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Insight Report

The Global Information Technology Report 2012

Living in a Hyperconnected World

Soumitra Dutta and Beñat Bilbao-Osorio, editors

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The Global Information Technology Report 2012 is a special project within the framework of the World Economic Forum's Centre for Global Competitiveness and Performance and the Industry Partnership Programme for Information Technology and Telecommunications Industries. It is the result of a collaboration between the World Economic Forum and INSEAD.

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World Economic Forum
Geneva

ISBN-10: 92-95044-33-9
ISBN-13: 978-92-95044-33-3

This book is printed on paper suitable for recycling and made from fully managed and sustained forest sources.

Printed and bound in Switzerland by SRO-Kundig, Geneva.

Visit *The Global Information Technology Report* page at **www.weforum.org/gitr**

A special thank you to Hope Steele for her excellent editing work and Neil Weinberg for his superb graphic design and layout.

The terms *country* and *nation* as used in this *Report* do not in all cases refer to a territorial entity that is a state as understood by international law and practice. The terms cover well-defined, geographically self-contained economic areas that may not be states but for which statistical data are maintained on a separate and independent basis.

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Preface

ROBERT GREENHILL
Chief Business Officer, World Economic Forum

Over the past decade, the world has become increasingly hyperconnected. We live in an environment where the Internet and its associated services are accessible and immediate, where people and businesses can communicate with each other instantly, and where machines are equally interconnected with each other. This hyperconnectivity is deeply redefining relationships between individuals, consumers and enterprises, and citizens and governments; it is introducing new opportunities but also new challenges and risks in terms of individual rights and privacy, security, cybercrime, the flow of personal data, and access to information. As a result, our economies and societies will undergo fundamental transformations.

Mastering and leveraging these transformations to maximize the positive impacts and increase resilience against the risks that ICT can bring to the economy, society, environment, and healthcare are crucial for boosting economic competitiveness and well-being. The present edition of *The Global Information Technology Report* (GITR) analyzes in detail the main drivers and impacts of this ICT-enabled hyperconnected world and contributes to the work of the World Economic Forum's recently launched Hyperconnected World Initiative, which establishes a holistic means of understanding the systemic nature of change in a hyperconnected world.

The GITR series has been published by the World Economic Forum in partnership with INSEAD since 2002, accompanying and monitoring ICT advances over the last decade as well as raising awareness of the importance of ICT diffusion and usage for long-term competitiveness and societal well-being. Through the lens of the Networked Readiness Index (NRI), the driving factors and impacts of networked readiness and ICT leveraging have been identified, highlighting the joint responsibility of all social actors—individuals, businesses, and governments. Over time, the series has become one of the most respected studies of its kind. It has been extensively used by policymakers and relevant stakeholders as a unique tool to identify strengths on which to build and weaknesses that need to be addressed in national strategies for enhanced networked readiness.

The Global Information Technology Report 2012 features the latest results of the NRI, offering an overview of the current state of ICT readiness in the world. This year's coverage includes a record number of 142 economies from both the developing and developed world, accounting for over 98 percent of global GDP. A number of essays and case studies on living in a hyperconnected world as well as policy case studies on developing ICT are featured in the *Report,* together with a comprehensive data section—including detailed profiles for each economy covered and data tables with global rankings for the NRI's 53 indicators.

We would like to convey our sincere gratitude to the industry and international organizations' experts who contributed outstanding chapters exploring the drivers and impacts of living in hyperconnected world to this *Report,* as well as to policy analysts for providing their valuable insights in the policy case studies. We especially wish to thank the editors of the *Report,* Soumitra Dutta at INSEAD and Beñat Bilbao-Osorio at the World Economic Forum, for their leadership in this project, together with the other members of the GITR team: Roberto Crotti, Thierry Geiger, Danil Kerimi, and Derek O'Halloran. Appreciation also goes to Alan Marcus, Head of Information Technology and Telecommunications Industries, and Jennifer Blanke, Head of the Centre for Global Competitiveness and Performance, as well as her team: Ciara Browne, Margareta Drzeniek Hanouz, Tania Gutknecht, Caroline Ko, and Cecilia Serin. Last but not least, we would like to express our gratitude to our network of 150 Partner Institutes around the world and to all the business executives who participated in our Executive Opinion Survey. Without their valuable input, the production of this *Report* would not have been possible.

Foreword

CESARE MAINARDI
Chief Executive Officer, Booz & Company

In 2001, when the World Economic Forum first published *The Global Information and Technology Report* (GITR), the dot-com bubble had just burst; there were fewer than 20 million mobile phone users in all of Africa; and Apple Inc.'s product line was confined to Macintosh computers. That *Report* presented an optimistic view of the future, highlighting the transformational potential of information and communication technologies (ICT) in advancing the progress of global society and business. In the decade that followed, Booz & Company has witnessed firsthand the realization of that potential in its work with clients and communities worldwide and through its long-standing involvement with the GITR. Today there are more than 500 million mobile phone subscribers in Africa, and Apple is the world's largest company in market capitalization, producing iPhones, iPods, and iPads along with Mac computers. Despite the strides the sector has made since the technology bust in 2001, however, we believe we are only just beginning to feel the impact of digitization—the mass adoption by consumers, businesses, and governments of smart and connected ICT.

Success in the digitization world—where competitors from Shenzhen to Schengen can emerge seemingly overnight—requires policymakers and business leaders to go back to the drawing board to identify and build "right-to-win" capabilities in their spheres of influence. Digitization is more than a matter of access. Our recent research shows that digitization *multiplies* the impact of connectivity, creating substantial incremental value in terms not only of job creation and economic growth, but also of societal well-being and government transparency. Today, more than 70 percent of the world's citizens live in societies that have just begun their digitization journeys. As the individuals and enterprises in these societies continue to progress in developing their own digitization capabilities, they will only increase and accelerate these economic and social benefits.

The primary beneficiaries will be those who adapt their legacy capabilities and assets and fully exploit the potential of these new ICT technologies. Policymakers, who for years focused on ensuring affordable access to networks, now need to adopt a broader ecosystem perspective to shape and implement their national digitization agendas. Enterprises across sectors need to reassess the models that enable them to continue growing or even to stay in business, given the emergence of nimble digital competitors. Individuals need to reassess the skills they need to cultivate if they are to thrive in an environment of global labor pools and tenuous competitive advantage.

At Booz & Company, we believe in the power and potential of digitization to help solve the economic and societal challenges of tomorrow. Digitization enables people with good ideas to efficiently and effectively connect and learn from each other's successes and failures in building scalable solutions and enduring capabilities. We are honored to contribute to *The Global Information Technology Report 2012* and look forward to helping policymakers and business leaders realize the promise of ICT captured in these pages.

Foreword

SUN YAFANG
Chairwoman, Huawei Technologies

The global economy has been turbulent during the last several years, and governments and enterprises are doing everything possible to inject momentum and effectuate sustainable growth. Although we still face serious challenges as we step into 2012, the impact of information and communication technologies (ICT) on each industry has become more far reaching as its transformational effects spread to several sectors of the economy and society via innovations, the emergence of new industries, and the advent of the era of hyperconnectivity. We are convinced that in this new era of hyperconnectivity, ICT will begin a bold new chapter and will be closely linked to continued economic growth worldwide. More importantly, ICT will significantly reduce geographic or other limitations, allowing people around the globe to communicate and share information and ideas freely. In this integrated and interwoven world, ICT will contribute greatly to a variety of fields such as medical care and environmental protection. ICT and relevant technological innovations will propel global economic growth further than ever before.

The convergence of information technology (IT) and communications technology (CT) will be an important part of these technological innovations. All countries have come to realize that an integrated ICT industry will enhance the competitiveness and creativity of their economies and fuel the sustainable growth of the global economy. Countries everywhere—from Europe, Africa, and Asia to the United States and China—have been unveiling their innovative strategies for the ICT industry. These strategies are intended to make the industry an "enabler" of future economic growth. Converged ICT technologies will bring dramatic changes to our lives.

For individuals, smart devices and cloud services will have far-reaching effects and become an essential part of daily life and work. Ubiquitous super-broadband will make almost everything faster and better while delivering an improved user experience. Subscribers will not have to wait to stream or download videos, pictures, or other data files from the network. The benefits will also make people's lives much more convenient as ICT technologies are applied to building e-government models and improving e-commerce, e-learning, and online medical services, as well as other web-based intelligent services.

For enterprises, applying ICT technologies to their operations will significantly improve their operational efficiency. In an increasingly flat world, the potential customer base for many enterprises is extremely broad and the environments in which they operate are very complex. These enterprises will inevitably confront declines in efficiency and increases in costs. Innovative ICT technologies can help solve these issues: cloud computing can reduce the costs for information-based enterprise operations, and the Internet of Things can deliver smarter management systems.

Following improvements in broadband, current IT systems are migrating from fairly independent platforms to collaboration across a wide range of arenas, and the standardization capabilities in the CT industry have the potential to improve interoperability in IT. The deepening convergence between IT and CT will therefore become a major trend and one of the main driving forces behind the rapid development of the ICT industry. That said, there are obstacles to this integration, including insufficient openness in the ICT industry; a lack of unified technical standards; and a lack of connection among cloud computing, telecommunications networks (the pipe), and smart devices. Overcoming these obstacles and unifying ICT's technical standards is a top priority if we are to improve interoperability within the industry.

Research has shown that the ICT industry contributes 25 percent of the European Union's growth in GDP and 40 percent of its productivity growth. Within the ICT domain, considering the value of cloud computing alone, the aggregate sum is forecasted to exceed US$1 trillion in Europe by 2020. We have every reason to be excited and confident about the future of the ICT industry.

Huawei is honored to sponsor this *Report.* We believe that the valuable studies presented here will help accelerate convergence in the ICT industry and allow it to play a vital role in the growth of the global economy.

Executive Summary

SOUMITRA DUTTA, INSEAD
BEÑAT BILBAO-OSORIO, World Economic Forum

Last year, the *Global Information Technology Report* (GITR) series celebrated its 10th anniversary. The World Economic Forum, in collaboration with INSEAD, initially began this project to explore the impact of information and communication technologies (ICT) on productivity and development as a component of the Forum's research on competitiveness. To this end, over the past decade the Networked Readiness Index (NRI) has been measuring the degree to which economies across the world leverage ICT for enhanced competitiveness. During this period, it has been helping policymakers and relevant stakeholders to track their economies' strengths and weaknesses as well as their progress over time. In addition, it has identified best practices in networked readiness and designed roadmaps and strategies for establishing optimal ICT diffusion to boost competiveness.

Since 2002, the networked readiness framework has remained stable, aside from some minor adjustments at the variable level to better reflect the dynamic trends in the technology landscape. This has allowed for meaningful comparisons across time and created a valuable database of technology metrics. However, the ICT industry has changed dramatically since 2002 and its effects are increasingly transforming our economies and societies.

More precisely, over the past decade, the world has become increasingly "hyperconnected." We live in an environment where the Internet and its associated services are accessible and immediate, where people and businesses can communicate with each other instantly, and where machines are equally interconnected with each other. The exponential growth of mobile devices, big data, and social media are all drivers of this process of hyperconnectivity. Consequently, we are beginning to see fundamental transformations in society. Hyperconnectivity is redefining relationships between individuals, consumers and enterprises, and citizens and the state. It is introducing new opportunities to increase productivity and well-being by redefining the way business is done, generating new products and services, and improving the way public services are delivered. However, hyperconnectivity can also bring about new challenges and risks in terms of security, cybercrime, privacy, the flow of personal data, individual rights, and access to information.

Traditional organizations and industry infrastructures are also facing challenges as industries converge. This will inevitably have consequences for policy and regulation because regulators will have to mediate the blurring lines between sectors and industries, and will be obligated to oversee more facets of each interaction in a pervasive way. For example, in terms of security and surveillance, hyperconnectivity is transforming the way people, objects, and even animals are being monitored. Experts also predict it will have an impact on inventory, transport and fleet management, wireless payments, navigation tools, and so on. The impact of ICT on different facets of life and work is growing.

In this context, the way we monitor, measure, and benchmark the deployment and impacts of ICT must evolve to take into account the rapid changes and consequences of living in a hyperconnected world. Reflecting on this imperative of adaptation, a comprehensive review process of the NRI framework has been undertaken, guided by a process of high-level consultations with academic experts, policymakers, and representatives of the ICT industry. The results of this new framework are presented for the first time in this edition of the *Report.*

The *Report* series is the result of a long-standing partnership between the World Economic Forum (the Forum) and INSEAD, aimed at identifying, measuring, and benchmarking the drivers of national capacity to leverage ICT to boost competitiveness and well-being and their impacts. The *Report* is composed of four thematic parts. Part 1 describes the conceptual framework and relates the findings of the NRI 2012. In addition, Part 1 features selected expert contributions on the general theme of hyperconnectivity. Part 2 includes two case studies showing the efforts that two countries, Azerbaijan and Mauritius, are making to develop ICT and fully leverage their potential benefits. Part 3 comprises detailed profiles for the 142 economies covered in this year's *Report,* providing a thorough picture of each economy's current networked readiness landscape and allowing for international comparisons of specific variables or components of the NRI. Part 4 includes data tables for each of the 53 variables composing the NRI, with rankings for the economies covered as well as

technical notes and sources for the quantitative variables used.

PART 1: THE CURRENT NETWORKED READINESS DESCRIBING A HYPERCONNECTED WORLD

Part 1 presents the latest findings of the NRI, offering a comprehensive assessment of the present state of networked readiness in the world. A number of expert contributions that consider the drivers and impacts of hyperconnectivity on individuals, businesses, and governments are included. These relate to (1) the convergence of information technologies and communication technologies; (2) issues in a hyperconnected world, with a specific focus on the role of regulation; (3) network neutrality; (4) the increasing importance of mobile broadband to empower individuals; (5) the cost of broadband; (6) the role of in-memory technology and analytics to harness the power of big data; (7) the role of real-time analytics to make good sense of big data; (8) the value of digital traces for commercial strategy and public policy; (9) the promise and perils of hyperconnectivity for organizations and societies; (10) maximizing the impact of digitization; and (11) the effect of technology in education.

Insight from the NRI 2012 on the world's networked readiness

Chapter 1.1, "The Networked Readiness Index 2012: Benchmarking ICT Progress and Impacts for the Next Decade" by Soumitra Dutta of INSEAD and Beñat Bilbao-Osorio and Thierry Geiger of the World Economic Forum, presents the latest findings of the NRI, putting them into a regional and income-group context while also looking at regional differences.

This year, echoing the rapid changes and consequences of living in a hyperconnected world, the framework we use to measure and benchmark networked readiness has evolved. Following a two-year review process that involved high-level consultations with academic experts, policymakers, and representatives of the ICT industry, the World Economic Forum, in partnership with INSEAD, has undertaken a review to ensure that the framework continues to remain relevant and at the forefront of measuring and benchmarking the role of ICT for competitiveness and well-being for the next decade.

The evolved framework is inspired by five underlying principles:

- Measuring the economic and social impacts of ICT is crucial.
- An enabling environment determines the capacity of an economy and society to benefit from the use of ICT.
- ICT readiness and usage remain key drivers and preconditions for obtaining any impacts.
- All factors interact and co-evolve within an ICT ecosystem.
- The framework should provide clear policy orientations and identify public-private partnership opportunities.

As a result, the framework gauges:

- the friendliness of a country's market and regulatory framework in supporting high levels of ICT uptake;
- the degree of a society's preparation to make good use of an affordable ICT infrastructure;
- the efforts of the main social agents—that is, individuals, business, and government—to increase their capacity to use ICT as well as their actual use of ICT in their day-to-day activities; and
- the broad economic and social impacts accruing from ICT and the transformation of a country toward an ICT- and technology-savvy economy and society.

As in previous editions, the NRI is composed of a mixture of quantitative data collected by international organizations—such as International Telecommunication Union (ITU), the United Nations, and the World Bank—and survey data from the Executive Opinion Survey (the Survey), conducted annually by the Forum in each of the economies covered by the *Report.* The NRI 2012 covers a record number of 142 economies from both the developed and developing world, accounting for over 98 percent of world GDP.

In terms of the result, the top 10 of the NRI is made up exclusively of advanced economies. That group is dominated by the Nordics, with Sweden, Finland, Denmark, and Norway featuring in the top 7, and Iceland coming in at a not-so-distant 15th place. All members of the top 10 are relatively close to each other, and they tend to do well across all pillars.

Sweden's performance is remarkable in every aspect. The country leads four of the 10 pillars of the NRI, namely infrastructure and digital content, individual usage, business usage, and economic impacts; and appears in the top 10 of a further five, while in the last pillar, skills, it ranks a very solid 12th. Second to Sweden, Singapore leads the group of the Asian Tigers, ahead of Taiwan, China (11th), Korea, Rep. (12th), and Hong Kong SAR (13th), which stand at the doorway of the top 10. Compared with Sweden, Singapore's performance is nearly as impressive. The city state leads the political and regulatory environment pillar and the business and innovation environment pillar, and is among the top 10 of five more pillars. It tops the impact component, thanks to the 2nd and 3rd rank earned in the economic impacts pillar and social impacts pillar, respectively.

At 8th place overall, the United States delivers a strong performance. The country boasts an environment that is generally conducive to leveraging ICT successfully. Yet the political and regulatory framework (21st) presents some impediments, including the poor functioning of the law-making institutions and regulation that remains

burdensome in several aspects. The business and innovation environment is more propitious (8th). In terms of readiness, the country can rely on a very good (6th) and affordable (10th) ICT infrastructure.

Overall, Europe remains at the forefront of the efforts to leverage ICT to transform its economy and society. Seven European counties are positioned in the top 10 of our rankings, with the Nordic countries, including Sweden at the very top, leading the way. Notwithstanding the overall strength of Europe as a whole, there are important disparities within the region. Four broadly defined groups of countries sharing different ICT development paths and facing different challenges to further leverage ICT can be identified: the Nordic countries, advanced economies of Western Europe, Southern Europe, and Central and Eastern Europe.

The Nordic countries are the most successful in the world at leveraging ICT. They have fully integrated ICT in their competitiveness strategies to boost innovation and ICT is present everywhere and in all areas of society, such as education and healthcare. In Western Europe, besides Switzerland (5th), the Netherlands (6th), and the United Kingdom (10th), five other advanced economies—Germany (16th), Austria (19th), Luxembourg (21st), Belgium (22nd), and France (23rd)—attain high positions, ranging from 16th to 23rd place. Overall, the countries exhibit fairly well developed conditions for ICT, but not to the extent of the Nordic countries.

All four of the European Union's southern countries—Portugal, Spain, Italy, and Greece—are still lagging behind in terms of ICT uptake and impacts vis-á-vis the rest of Western European economies. In general, despite acceptable levels of ICT infrastructure development, the traditional lag in poorly performing educational and innovation systems does not allow these countries to benefit to the same extent in the potential economic impacts accruing from ICT.

Central and Eastern Europe presents a mixed picture in terms of ICT development and uptake. While some large countries in Central Europe share similar characteristics, others confront specific challenges that influence their capacity to take advantage of the potential of ICT. The Czech Republic, Hungary, Poland, the Slovak Republic, and to a lesser extent, Romania and Bulgaria (in 42nd, 43rd, 49th, 64th, 67th, and 70th place, respectively) have managed to develop their ICT infrastructures fairly well, although the high costs of accessing it—especially in the Czech Republic and Slovak Republic (93rd and 104th, respectively)—affects the actual uptake capacity of large shares of the population.

Kazakhstan, the Russian Federation, and Azerbaijan are the best performers among the Commonwealth of Independent States (CIS), achieving 55th, 56th, and 61st position, respectively. All three countries count on affordable access to ICT infrastructure, although the development of this infrastructure is superior in the case of the Russian Federation (40th, compared with 71st and 72nd for Kazakhstan and Azerbaijan). However, the vision and commitment of the government to boost ICT as a driver of economic growth is lower in Russia, and in all three cases the innovation system that underwent a deep restructuring after the collapse of Communism has not yet been fully reorganized or redeveloped.

Asia and the Pacific region is home to some of the world's wealthiest, most innovative and digitized nations in the world and also to some of its poorest, least-connected countries. Six economies besides Singapore feature among the top 20, namely Taiwan, China (11th), Korea, Rep. (12th), Hong Kong SAR (13th), New Zealand (14th), Australia (17th), and Japan (18th). At 51st place, China leads the BRICS, the group of large emerging economies. Yet the country faces important challenges ahead that must be met to more fully adopt and leverage ICT. China's institutional framework and especially its business environment present a number of shortcomings that stifle entrepreneurship and innovation.

Latin America and the Caribbean continues to suffer from an important lag in adopting ICT and technology more broadly. This is reflected in the rankings, as no country manages to reach the top 30 and only a handful of small economies manage to be included among the top 50—the exceptions are Barbados, Puerto Rico, Chile, and Uruguay. Although the region is vast and heterogeneous, three shared reasons for this lag can be identified: an insufficient investment in developing the ICT infrastructure; a weak skill base in the population, the result of poor educational systems that hinder society's capacity to make an effective use of these technologies; and unfavorable business conditions that do not support the spur of entrepreneurship and innovation. Addressing these weaknesses will be crucial for improving the region's competitiveness and shifting its economies toward more knowledge-based activities.

The level of ICT readiness in sub-Saharan Africa is still very low, with most countries evidencing strong lags in connectivity because of an insufficient development of ICT infrastructure, which remains too costly. Low levels of skills that do not allow for an efficient use of the available technology add to the challenges these countries face if they are to increase ICT uptake. Moreover, most countries still suffer from poor framework conditions for business activity that, coupled with the above-explained weaknesses, result in poor economic impacts that hinder the much-needed transformation of the region toward less resource-extraction-oriented activities and higher-value-added production. Nine out of the last 10 countries in our sample belong to the region and the results evidence the digital divide the region suffers vis-á-vis more developed regions.

There are large differences across the Middle East and North Africa, with countries grouping around three subregions: Israel and the Gulf Cooperation Council states; the Levantine nations; and, finally, the countries in North Africa. While Israel and most of the Gulf Cooperation Council states seem to have embraced ICT uptake and have started to gain from the associated benefits, countries in the former two groups still suffer from important weaknesses that hinder their capacity to fully leverage the use of ICT to increase competitiveness and accelerate the positive social impacts that are associated with technology.

An analysis of regional differences in leveraging ICT for competitiveness and well-being is also included in the chapter.

The Convergence of Information and Communication Technologies Gains Momentum

The convergence of information technology (IT) and communications technology (CT) is driven by several factors, including the proliferation of web-enabled mobile devices that allow access to cloud computing services. A discussion of the trends in ICT convergence, which are taking place at three levels of technology innovation—cloud, pipe, and device—and the adaptations that industry is making to deliver enriched user experiences across industries and the private sector is presented in Chapter 1.2., by Ivan Huang, Roc Guo, Harry Xie, and Zhengxian Wu of Huawei Technologies.

Cloud computing services provide a catalyst for ICT convergence. Telecommunications carriers will gradually move IT systems and Internet data centers into the cloud, and telecommunications and IT industries will develop uniform standards to facilitate rapid cloud development. As a result, CT is transforming from voice-services to services supported by integrated mobile networks, and IT is evolving from traditional data centers to cloud computing. Likewise, the "pipes" of the telecommunications industry (fixed and mobile telecommunications networks) are converging along with the evolution to flexible and cost-effective all-IP networks. The addition of optical network technology will ensure the increased transmission speed needed for the high bandwidth transmissions of the future. In addition, the close integration of smart devices with the cloud will change the way consumers use their home devices (television sets, smartphones, and personal computers or PCs) and blur the boundaries between formerly separate industries.

ICT convergence significantly impacts consumers, industries, and governments. For consumers, the integration of smart devices with peripheral devices, ubiquitous networks, and robust cloud data centers is changing experiences involving entertainment, travel, healthcare, and shopping. For industry, ICT convergence extends employee productivity with collaborative tools, reduces travel expense with videoconferencing, and enables customized products to develop across many industries.

As the chapter points out, governments can encourage ICT convergence in three key ways. They can reform policies and regulations to encourage competition and remove barriers to investment; they can offer financial incentives to firms that deploy ICT services; and they can directly invest in ICT infrastructure and services. By taking these steps, governments can facilitate the technological innovation required for ICT convergence and meet market demands.

Emerging Issues for our Hyperconnected World

Chapter 1.3, contributed by International Telecommunication Union (ITU), considers the growth and expansion of our hyperconnected world as well as some of the issues associated with it. Our future hyperconnected world will build on the functionality made possible by converged next-generation networks (NGN) and open access networks, but extends the concept of NGN in several ways—through embedded ambient intelligence, automated machine-to-machine traffic, and the sheer size and scale of the Internet of Things. In practice, we should be able to enjoy super-fast connectivity on the move, always-on, roaming seamlessly from network to network, wherever we go—anywhere, anytime, via any device.

In this chapter, Phillippa Biggs and her co-authors explore some of the consequences and issues that may arise through embedding ICTs and connectivity into mobile devices and everyday objects. From technological advances and growth in connection speeds to an explosion in data traffic and a more extensive role for regulators, this chapter provides an overview of some of the major trends shaping the hyperconnected world of converged ICTs. Given the predicted massive expansion of data traffic, the chapter highlights the importance of traffic prioritization and the different approaches possible to the net neutrality debate. It concludes that regulators and policymakers have a vital role to play at this point in time in establishing the mores and norms for the online world—in what is and is not acceptable, and in developing principles and best practices going forward, so that the risks and opportunities of our hyperconnected world are managed appropriately to protect both consumers and citizens.

Network Neutrality: An Opportunity to Create a Sustainable Industry Model

Network neutrality is the principle that inhibits telecommunications network operators from discriminating among different kinds of Internet content, applications, and services traveling across their networks. In Chapter 1.4, authors Scott Beardsley, Yavuz Demirci, Luis Enriquez, Mehmet Guvendi, Stagg Newman, Sergio Sandoval, Malin Strandell-Jansson, Oleg Timchenko, and

Wim Torfs of McKinsey & Company consider the debate surrounding this issue. Advocates of network neutrality argue that the principle underpins the Internet's explosive growth: if any and every kind of content, service, and application can be distributed over the Internet, then there is no limit to the innovations that Internet companies will invent for consumers to choose from. But network neutrality has, arguably, become the victim of its own success. Internet traffic has grown faster than network operators' related revenues and they are now struggling to invest in the new network infrastructure needed to support more Internet traffic.

Not surprisingly, network operators are also trying to manage traffic volumes. Some are even deploying sophisticated network management technologies, such as deep packet inspection, which examine the nature and content of the traffic to identify possible sources of harm to network performance and also to protect the networks and consumers from increasingly sophisticated attacks and abuse. But as soon as network operators start scrutinizing the content of Internet traffic, edge players (providers of content, applications, and services as well as aggregators) worry that network neutrality may be infringed, limiting their will to innovate. Both consumers and regulators also worry about maintaining the confidentiality of consumer data.

Mobile Broadband: Redefining Internet Access and Empowering Individuals

With more than 6 billion connections worldwide and US$1.3 trillion in annual revenue, mobile telephony has become the largest ICT in history. Mobile connects four times as many people as landline telephony because of its better reach, convenience, and functionality, as well as its lower costs. Mobile telephony also surpasses the landline Internet by more than 3.5 billion users, while driving economic growth and important societal benefits, as documented in the World Economic Forum's *Global Information Technology Report 2008–2009: Mobility in a Networked World* and other research.

While the global scale of mobile telephony and its economic impacts are well understood by ICT industry participants and governments today, the authors of Chapter 1.5, William Bold and William Davidson of Qualcomm, envision that mobile broadband—with its ability to connect people to the Internet in an ultra-personal and pervasive manner—will have a far greater impact.

Mobile broadband, or high-speed access to the Internet and other data services over mobile networks, is already changing the way people across the globe access the Internet. It promises to drive even stronger economic growth than mobile telephony alone and to fundamentally change the way in which we live, learn, work, and collaborate. This in turn is driving seismic shifts across the communications and computing industries. Perhaps most importantly, it provides unprecedented opportunities to empower individuals across all socioeconomic classes.

The authors present this view within the framework of two fundamental shifts, or tipping points, and related trends that underscore how mobile broadband is changing the way people access the Internet and, in turn, how the Internet itself is changing. They explore the transformative opportunities these shifts create in areas such as healthcare and education, as well as some key steps stakeholders can take to both enable and take advantage of these new possibilities.

Reaching the Third Billion: Arriving at Affordable Broadband to Stimulate Economic Transformation in Emerging Markets

In Chapter 1.6, authors Chris S. Thomas and Frederico Carvalho of Intel Corporation present an analysis of the background to the current issues affecting network operators' revenue and capacity as well as measures so far taken by the industry to address them, and discuss current regulatory positions on network neutrality. The authors then propose a set of aims that all industry players—network operators, companies offering Internet services and applications, and regulators—can pursue that will balance growing industry revenues to fund infrastructure investment with safeguarding network neutrality, and so release the next wave of services and applications over the Internet, with all the economic and societal benefits they promise.

Direct correlations can be made between the affordability of broadband connectivity and an individual's or country's ability to successfully transform itself through the utilization of ICT capabilities.

The chapter outlines several examples of countries arriving at affordable broadband programs, and considers the bundling of total computing and connectivity packages. Many creative and successful strategies are being employed to extend the reach and impact of technology by driving broader Internet access, affordability, and awareness, ultimately accelerating the use of technology to improve national competitiveness and GDP as well as individual livelihoods.

Advocating reaching more people by paying less for less, these strategies are employed in many different countries with the aim of closing the affordability gap. Business and deployment strategies similar to those of the pre-paid mobile phone market that enabled its successful reach to the majority of the world population are then encouraged.

The chapter provides a number of examples that highlight an informed leadership emerging in the form of national broadband strategies, programs, and incentives; new private and nationalized telecommunications offerings and programs; vendor bundles; and financing options as well as the cooperation of development

organizations and funds. By implementing different ICT programs with more affordable broadband, countries are providing impacts through levels of computing and Internet accessible to a much higher percentage of the population.

Harnessing the Power of Big Data in Real Time through In-Memory Technology and Analytics

Chapter 1.7, by SAP AG, considers the power and the complications presented by the enormous quantity of data that can now be experienced as overwhelming. The world today is flooded with data from multiple sources such as corporate databases, sensor networks, and the Internet—and the trend is increasing. In the face of this rising tide of data, organizations are finding it difficult to keep up.

Since the 1960s, many companies have used computers to manage their business—to determine such things as how much cash is available, how much debt is outstanding, what the risks are for certain ventures, and so on. Complex software programs called enterprise resource planning (ERP) systems have been created to manage and provide insights into the daily operations of a company. However, increasing data volumes have led to a problem. By the turn of the 21st century, large organizations were no longer always able to access the information they required in a timely manner. There were just too many data to analyze.

As the chapter points out, at the heart of any enterprise application is the database management system, responsible for storing the myriad of data generated by the day-to-day operations of a business. Today, enterprise data are split into separate databases for performance reasons. Analytical data reside in data or business warehouses, synchronized periodically with transactional ERP systems. This separation makes real-time reporting on current data impossible.

Multi-core CPUs, large main memories, cheaper and more powerful hardware, and cloud computing are now laying the foundation for the transition of enterprises away from this restrictive model. New database systems called *in-memory technology* can execute fast, flexible analyses in real time to facilitate decision making for top managers and other users. These can now accelerate business processes by a factor of up to 1,000.

The use of in-memory technology marks an inflection point for enterprise applications. The availability and capacity per dollar of main memory have increased markedly in the last few years, leading to a rethinking of how mass data should be stored.

The Wisdom of the Cloud: Hyperconnectivity, Big Data, and Real-Time Analytics

The exponential increases in data volumes—often referred to as *big data*—are increasingly driven by unprecedented hyperconnectivity and the rapid adoption of social media that present new opportunities for savvy organizations to capture "the wisdom of the cloud" and leverage the flood of unstructured data that is being created.

Using case studies, in Chapter 1.8 Mikael Hagström and Neena Gill of SAS discuss the implications of these trends in re-engineering the healthcare industry, transforming the public sector, and creating new and intelligent intersections between businesses and consumer that allow for fluid dialogue. The chapter explains how, in healthcare, researchers can share results with one another to tap their collective knowledge, clinicians can improve their ability to manage disease outbreaks, and hospitals can improve patient safety. In the public sector, the "civic long tail" is making it easier for people to voice their views and connect with like-minded citizens. Government can use these data to become more efficient and responsive. In the business world, companies are leveraging big data to improve their offers, respond to key influencers, reduce churn, manage risks, strengthen brands, get to know their customers, and more.

On the Value of Digital Traces for Commercial Strategy and Public Policy: Telecommunications Data as a Case Study

At a time when governments and corporations are looking to target policy, strategy, and investment so as to reduce costs and improve impact measurement, the potential value of real-time data and, in particular, a real-time census is becoming increasingly clear. Digital data from large-volume transactional sources such as credit cards and telecommunications, as well as health and other administrative systems, offers the timeliness and scalability required for such applications, and it promises to transform the way that policymakers and strategic planners see the social, environmental, and economic context of their work.

Eventually, historical approaches to the classification and characterization of households and places—such as though lifestyle segmentation and geodemographics—may be replaced with novel real-time, adaptive systems based on up-to-the-minute spatially referenced (geo-coded) data. In Chapter 1.9, authors Rob Claxton, Jon Reades, and Ben Anderson use telecommunications data—coupled with the network-oriented methods of an emerging computational social science—as a lens through which to examine society and the knowledge economy. The authors present results from four studies that offer a taste of the ways in which this type of data can be used to expand our understanding of social and economic activity.

They begin with a study of regions, comparing the "geographies of talk" with existing administrative units; then they consider the ways in which social networks reflect underlying problems of access to opportunity

before turning to access of a different sort, using indicators of globalization within Britain's most competitive industries. Finally, the authors conclude with early work on real-time data-driven household classification systems and a discussion of the implications for government and corporations.

The Promise and Peril of Hyperconnectivity for Organizations and Societies

Hyperconnectivity is a relatively new term that was coined in response to the rapid availability and broad assimilation of entirely new ways to communicate. Hyperconnectivity refers not only to the means of communication and interaction, but also to the impact this phenomenon has on both personal and organizational behavior.

Hyperconnectivity results from a combination of broadband expansion, the proliferation of mobile devices and wireless access, the dominance of social media in daily life and, most recently, the use of the cloud for data and applications access. Hyperconnected communication includes not only people-to-people formats (as individuals and as members of groups and using a vast array of media), but also communication between people and machines and between machines themselves without any direct human involvement.

In a short period of time, the hyperconnectivity phenomenon has had a notable impact on society, which authors John Fredette, Revital Marom, Kurt Steinert, and Louis Witters of Alcatel-Lucent explore in Chapter 1.10. For institutions and organizations, research reveals hyperconnectivity's influence on the nature of work practices, functions, and missions. Hyperconnectivity breaks down the boundaries of both time and space. It brings people (and things) together from anywhere and at anytime. Its impact is both ubiquitous and unceasing. Thanks in part to hyperconnectivity we now live in a world of neo-urbanization, where the distinctions between rural and urban are decreasing. Hyperconnectivity has also given rise to a globalized "168" world (24 × 7 = 168), where the work day continues around the clock.

On a societal level, the impact of hyperconnectivity can be readily discerned in neo-urbanization, government, education, healthcare, business, workforces, and sustainability.

The authors point out that hyperconnectivity has rapidly become an influential aspect of contemporary life. There is great potential for it to be used to improve the quality of life on a global basis, thus providing heretofore unforeseen opportunity. There is also the possibility that hyperconnectivity could remain a key differentiator between the haves and the have nots. Public-private alliances appear to be the best model to get optimum value from hyperconnectivity. To embrace an alliance model, both public and private organizations need to accept that a hyperconnected public is certain to be better informed, more easily aligned, and more responsive than ever before; this can have both positive and negative consequences.

Maximizing the Impact of Digitization

Policymakers today face a different environment for information and communications technology (ICT) than the one for which they designed policies. ICT technologies are far more pervasive than they were previously: more people today have access to a cell phone than to electricity, powering exponential growth in global data generation. With ICT access approaching ubiquity, policymakers' next challenge is to ensure that individuals, businesses, and governments are making the best possible use of networks and applications. Countries that have achieved advanced levels of digitization—the mass adoption of connected digital technologies and applications by consumers, enterprises, and governments—have realized significant benefits in their economies, their societies, and the functioning of their public sectors.

The authors of Chapter 1.11—Karim Sabbagh, Roman Friedrich, Bahjat El-Darwiche, Milind Singh, and Sandeep Ganediwalla of Booz & Company and Raul Katz of Telecom Advisory Services LLC—note that previous attempts to measure the impact of ICT have focused primarily on assessing the economic effects of widespread access to either wireless or broadband technologies. But in developing a comprehensive methodology to measure the impact of digitization, Booz & Company found greater benefits linked to growing usage of digital technologies and applications rather than access alone. Benefits are not just economic, but social and political. Digitization offers incremental economic growth: countries at the most advanced stage of digitization derive 20 percent more in economic benefits than those at the initial stage. Digitization also has a proven impact on reducing unemployment, improving quality of life, and boosting citizens' access to public services. Finally, digitization allows governments to operate with greater transparency and efficiency.

The chapter concludes that policymakers have an important role to play in ensuring that their countries are progressing toward advanced stages of digitization. They need to acknowledge where they currently stand, and recognize the benefits of digitization. Finally, they need to shift focus away from access and set into motion programs and plans that focus on the widespread adoption and usage of technology. That includes elevating digitization on the national agenda, including the systematic planning and tracking of their efforts; evolving sector governance structure; adopting an ecosystem perspective; enabling competition; and stimulating demand.

Trusting the Unknown: The Effects of Technology Use in Education

Governments have been investing in educational technology since the early 1980s. The devices, services, and applications are constantly evolving, as is the nature of the school and classroom arrangements aimed at making the most out of those technologies. The increasing emphasis on personal ubiquitous access to connectivity, for communication or information purposes, coupled with the evolution of technology and lower prices represent additional factors that contribute to modify the context in which investment decisions about educational technology—the so-called technology policies in education—have to be made.

When reviewing these policies, one of the most striking findings is how little is known about the effects of technology use on the quality of school education, and more specifically which particular uses of technology can result in better student performance. If a good evidence-supported knowledge base existed in this domain, then the analysis of these effects, and the factors that determine or condition them, could be used to unveil what works and why. But in the absence of hard evidence, the evaluation of these policies remains an almost impossible endeavor and the whole issue of how policy decisions are made remains open.

In Chapter 1.12, author Francesc Pedró from UNESCO addresses two particular questions. First is the question of what is currently known in this area and what are the limitations of the existing knowledge base—with the paradox that developing countries, which make comparatively bigger efforts in this domain, lag behind also in terms of knowledge base. Second is the issue of what elements are missing, and how the important methodological challenges required to gather those elements could be addressed.

PART 2: CASE STUDIES OF LEVERAGING ICT FOR COMPETITIVENESS AND WELL-BEING

Part 2 presents deep-dive studies of selected national experiences of leveraging ICT or developing the sector, showcasing the main challenges faced and the articulation of strategies to overcome them. In this edition, the cases of Azerbaijan and Mauritius are presented.

Big Ambitions in a Rapidly Changing World: Azerbaijan

The Republic of Azerbaijan is leveraging its position as an oil and gas center and developing strong regional ties, while also promoting economic diversity. Development of the ICT sector is expected to play a crucial role in this policy as a result of its considerable impact on the country's socioeconomic life in recent years.

In Chapter 2.1, authors Rasim Aliguliyev of the Information Technology Institute, Azerbaijan National Academy of Sciences, and Galib Gurbanov of the Azerbaijan Internet Society note that Azerbaijan has been successful in implementing the following policy actions: (1) maintaining compliance of domestic legislation with relevant international standards and requirements of the World Trade Organization, (2) attracting new telecommunications operators to the market and establishing sound competitive environment for market participants, (3) ensuring effective and fair use of limited number and frequency resources, and (4) regulating interconnection issues and ensuring implementation of advanced licensing.

However, there are still some serious challenges that need to be addressed. Individual and business technological readiness, industry-university cooperation, and the accompanying institutional framework are all areas that will require further improvement to boost ICT impacts for competitiveness. In addition, the government will also need to improve the quality, relevance, and usefulness of its websites as well as its willingness to provide online information and participatory tools and services to the people, where country still lags behind.

Domestic and regional ICT projects carried out in accordance with the government programs and strategies, as well as the sectorial growth rate and evaluations by international experts, allow the expectation that Azerbaijan's ICT sector will catch up with oil revenues by 2025, and the country will become a regional ICT hub.

The Making of a Digital Nation: Toward i-Mauritius

Globally, the past few years have been marked by profound geopolitical changes against a backdrop of unabated financial turmoil. The credit crunch has irrevocably altered consumer behaviors, which in turn challenged many business processes and models. In this context, the ICT sector has been recognized as one of the most resilient sectors of many world economies. In fact, the foresightedness of the Government of Mauritius in developing its ICT sector as a strong pillar of the Mauritian economy has been handsomely rewarded by the double-digit growth that the sector has recently experienced.

In Chapter 2.2, authors Krishna Oolun of the Information & Communications Technologies Authority, Suraj Ramgolam of the National Computer Board, and Vasenden Dorasami of the Ministry of Information and Communication Technology present the state of the ICT/business process outsourcing in Mauritius through illustrative indicators. The chapter also describes the main challenges the country has faced in making the ICT sector what it is today, particularly because ICT is not only a sector/industry in its own right but also a vital support for almost all industries that contribute to the national wealth. In addition, the authors demonstrate how the adoption of a coherent policy-orientation approach and a sound governance structure that steers the implementation process, underpinned by various national ICT strategic plans over the last 15 years, has

resulted in widespread adoption of ICT by its citizens. This has led to an all-inclusive information society where the digital divide has been effectively bridged in terms of the key performance indicators set under the Millennium Development Goals.

Finally, the chapter focuses on the way forward for Mauritius and its ICT sector against the backdrop that presented earlier, particularly the anticipated euro crisis within the European market (see http://www.ft.com/intl/indepth/euro-in-crisis), which is Mauritius's major trading partner.

PARTS 3 AND 4: COUNTRY/ECONOMY PROFILES AND DATA PRESENTATION

Parts 3 and 4 feature comprehensive profiles for each of the 142 economies covered in this year's *Report* and data tables for each of the 53 variables composing the NRI, with global rankings. Each part begins with a description of how to interpret the data provided.

Technical notes and sources, included at the end of Part 4, provide additional insight and information on the definitions and sources of specific quantitative non-Survey data variables included in the NRI computation this year.

The Networked Readiness Index Rankings

The Networked Readiness Index 2012

Rank	Country/Economy	Score
1	Sweden	5.94
2	Singapore	5.86
3	Finland	5.81
4	Denmark	5.70
5	Switzerland	5.61
6	Netherlands	5.60
7	Norway	5.59
8	United States	5.56
9	Canada	5.51
10	United Kingdom	5.50
11	Taiwan, China	5.48
12	Korea, Rep.	5.47
13	Hong Kong SAR	5.46
14	New Zealand	5.36
15	Iceland	5.33
16	Germany	5.32
17	Australia	5.29
18	Japan	5.25
19	Austria	5.25
20	Israel	5.24
21	Luxembourg	5.22
22	Belgium	5.13
23	France	5.12
24	Estonia	5.09
25	Ireland	5.02
26	Malta	4.91
27	Bahrain	4.90
28	Qatar	4.81
29	Malaysia	4.80
30	United Arab Emirates	4.77
31	Lithuania	4.66
32	Cyprus	4.66
33	Portugal	4.63
34	Saudi Arabia	4.62
35	Barbados	4.61
36	Puerto Rico	4.59
37	Slovenia	4.58
38	Spain	4.54
39	Chile	4.44
40	Oman	4.35
41	Latvia	4.35
42	Czech Republic	4.33
43	Hungary	4.30
44	Uruguay	4.28
45	Croatia	4.22
46	Montenegro	4.22
47	Jordan	4.17
48	Italy	4.17
49	Poland	4.16
50	Tunisia	4.12
51	China	4.11
52	Turkey	4.07
53	Mauritius	4.06
54	Brunei Darussalam	4.04
55	Kazakhstan	4.03
56	Russian Federation	4.02
57	Panama	4.01
58	Costa Rica	4.00
59	Greece	3.99
60	Trinidad and Tobago	3.98
61	Azerbaijan	3.95
62	Kuwait	3.95
63	Mongolia	3.95
64	Slovak Republic	3.94
65	Brazil	3.92
66	Macedonia, FYR	3.91
67	Romania	3.90
68	Albania	3.89
69	India	3.89
70	Bulgaria	3.89
71	Sri Lanka	3.88
72	South Africa	3.87
73	Colombia	3.87
74	Jamaica	3.86
75	Ukraine	3.85
76	Mexico	3.82
77	Thailand	3.78
78	Moldova	3.78
79	Egypt	3.77
80	Indonesia	3.75
81	Cape Verde	3.71
82	Rwanda	3.70
83	Vietnam	3.70
84	Bosnia and Herzegovina	3.65
85	Serbia	3.64
86	Philippines	3.64
87	Dominican Republic	3.60
88	Georgia	3.60
89	Botswana	3.58
90	Guyana	3.58
91	Morocco	3.56
92	Argentina	3.52
93	Kenya	3.51
94	Armenia	3.49
95	Lebanon	3.49
96	Ecuador	3.46
97	Ghana	3.44
98	Guatemala	3.43
99	Honduras	3.43
100	Senegal	3.42
101	Gambia, The	3.41
102	Pakistan	3.39
103	El Salvador	3.38
104	Iran, Islamic Rep.	3.36
105	Namibia	3.35
106	Peru	3.34
107	Venezuela	3.32
108	Cambodia	3.32
109	Zambia	3.26
110	Uganda	3.25
111	Paraguay	3.25
112	Nigeria	3.22
113	Bangladesh	3.20
114	Tajikistan	3.19
115	Kyrgyz Republic	3.13
116	Malawi	3.05
117	Benin	3.05
118	Algeria	3.01
119	Belize	3.01
120	Mozambique	2.99
121	Suriname	2.99
122	Côte d'Ivoire	2.98
123	Tanzania	2.95
124	Zimbabwe	2.94
125	Cameroon	2.93
126	Mali	2.93
127	Bolivia	2.92
128	Nepal	2.92
129	Syria	2.85
130	Ethiopia	2.85
131	Nicaragua	2.84
132	Timor-Leste	2.84
133	Lesotho	2.78
134	Madagascar	2.73
135	Burkina Faso	2.72
136	Swaziland	2.70
137	Burundi	2.57
138	Chad	2.55
139	Mauritania	2.55
140	Angola	2.49
141	Yemen	2.41
142	Haiti	2.27

Part 1

The Current Networked Readiness Describing a Hyperconnected World

CHAPTER 1.1

The Networked Readiness Index 2012: Benchmarking ICT Progress and Impacts for the Next Decade

SOUMITRA DUTTA, INSEAD
BEÑAT BILBAO-OSORIO, World Economic Forum
THIERRY GEIGER, World Economic Forum

Last year, the *Global Information Technology Report* (GITR) series celebrated its 10th anniversary. The World Economic Forum, in collaboration with INSEAD, initially began this project to explore the impact of information and communication technologies (ICT) on productivity and development, as a component of the Forum's research on competitiveness. To this end, over the past decade the Networked Readiness Index (NRI) has been measuring the degree to which economies across the world leverage ICT for enhanced competitiveness. During this period, it has been helping policymakers and relevant stakeholders to track their economies' strengths and weaknesses as well as their progress over time. In addition, it has identified best practices in networked readiness and designed roadmaps and strategies for establishing optimal ICT diffusion to boost competiveness.

Since 2002, the networked readiness framework has remained stable, aside from some minor adjustments at the variable level to better reflect the dynamic trends in the technology landscape. This has allowed for meaningful comparisons across time and created a valuable database of technology metrics. However, the ICT industry has changed dramatically since 2002 and its effects are increasingly transforming our economies and societies.

More precisely, over the past decade, the world has become increasingly "hyperconnected." We live in an environment where the Internet and its associated services are accessible and immediate, where people and businesses can communicate with each other instantly, and where machines are equally interconnected with each other. The exponential growth of mobile devices, big data, and social media are all drivers of this process of hyperconnectivity. Gartner reported that worldwide sales of mobile devices reached 440.5 million units alone in the third quarter of 2011, while smartphone sales increased by 42 percent from the previous year.[1] Ericsson estimates that there will be more than 50 billion connected devices in the world by 2020.[2] Even emerging markets are joining the trend, as mobile penetration increases (after Asia, in 2011 Africa became the second-largest mobile market in the world),[3] and fixed broadband prices in developing countries dropped by over 50 percent in the last two years.[4] This trend is expected to accelerate in the current decade. The topic of hyperconnectivity therefore is appropriate as the main theme of this year's *Report.*

The multitude of connected devices consequently gives rise to the escalating growth of data and data traffic. According to the International Data Corporation (IDC), the amount of data transmitted worldwide surpassed one zettabyte for the first time in 2010.[5] The digital universe is now expected to double every two years.[6] Growing numbers of connected devices have also widened the gateway to online social networks. Facebook boasts more than 800 million active users in 2011,[7] while

Box 1: Main changes in the NRI framework

In order to ensure that the Networked Readiness Index (NRI) framework remains aligned with the latest changes in the ICT industry and responds better to policy needs, the present edition of the GITR presents an evolved NRI that aims at measuring and benchmarking ICT progress and impacts for the next decade. This box highlights the main changes introduced in this framework this year. These are:

1. **Introducing an ICT impact subindex:** To emphasize their importance, we have included a fourth subindex measuring the impacts of ICT on both the economy and society. Although measuring ICT impacts is a complex task, this subindex captures some of the broader economic and social impacts accruing from ICT. In the near future, as richer datasets become available, we hope to be able to cover a wider range of impacts and include such areas as the environment, energy, and health.
2. **Redefining the pillars in the readiness subindex:** We have chosen to redefine the pillars within the readiness subindex to focus on infrastructure, affordability, and skills. We believe these new categories are aligned with key policy action areas that affect all actors within an economy and measure the overall preparedness of a country to use ICT. In this sense, when a government improves the ICT infrastructure or provides greater investment in skills upgrade, everyone—individuals and public- and private-sector organizations—benefit from it.
3. **Restructuring the pillars in the environment subindex:** The pillars within the environment subindex have been modified to reflect the importance of having an overall framework that is not only conducive to ICT and technology uptake, but that also acts as a catalyst for innovation and entrepreneurship rather than acting as a filter. The previous pillars included political and regulatory environment, market environment, and infrastructure. The revised pillars include political and regulatory environment and the business and innovation environment. The latter reflects the growing role of an innovation- and entrepreneurial-friendly environment for enabling ICT economic transformational impacts to accrue.
4. **Separating usage from impacts in the usage subindex:** The original distribution of pillars within the usage subindex is maintained according to economic agent (e.g., individuals, business, and government). This allows for in-depth analysis about the role and uptake efforts of specific agents in a society. However, all ICT impact–related variables have been regrouped under the newly created impact subindex.
5. **Updating and rationalizing the selection of variables:** In order to take into account the rapid changes in the ICT industry, several outdated variables (e.g., number of telephone lines) have been dropped and new and more relevant variables have been included (e.g., mobile broadband Internet subscriptions). Moreover, several variables that captured similar concepts have been eliminated to obtain a more balanced picture of the underlying factors defining networked readiness.

Google Plus surpassed 40 million users in less than six months (it took Facebook three years to reach the 25 million mark).[8] Other factors, identified by Cisco—such as the growth of high-speed broadband penetration, the expansion of digital screen surface area and resolution, the proliferation of networked-enabled devices, and the increase in power and speed of computer devices—have also contributed to the world's hyperconnected state.[9]

As a result, we are beginning to see fundamental transformations in society. Hyperconnectivity is redefining relationships between individuals, consumers and enterprises, and citizens and the state. It is introducing new opportunities to increase productivity and well-being by redefining the way business is done, generating new products and services, and improving the way public services are delivered. However, hyperconnectivity can also bring about new challenges and risks in terms of security, cybercrime, privacy, the flow of personal data, individual rights, and access to information. Traditional organizations and industry infrastructures are also facing challenges as industries converge. This will inevitably have consequences for policy and regulation because regulators will have to mediate the blurring lines between sectors and industries and will be obligated to oversee more facets in a pervasive way. For example, in terms of security and surveillance, hyperconnectivity is transforming the way people, objects, and even animals are being monitored. Experts also predict that it will have an impact on inventory, transport and fleet management, wireless payments, navigation tools, and so on. The impact of ICT in different facets of life and work is growing.

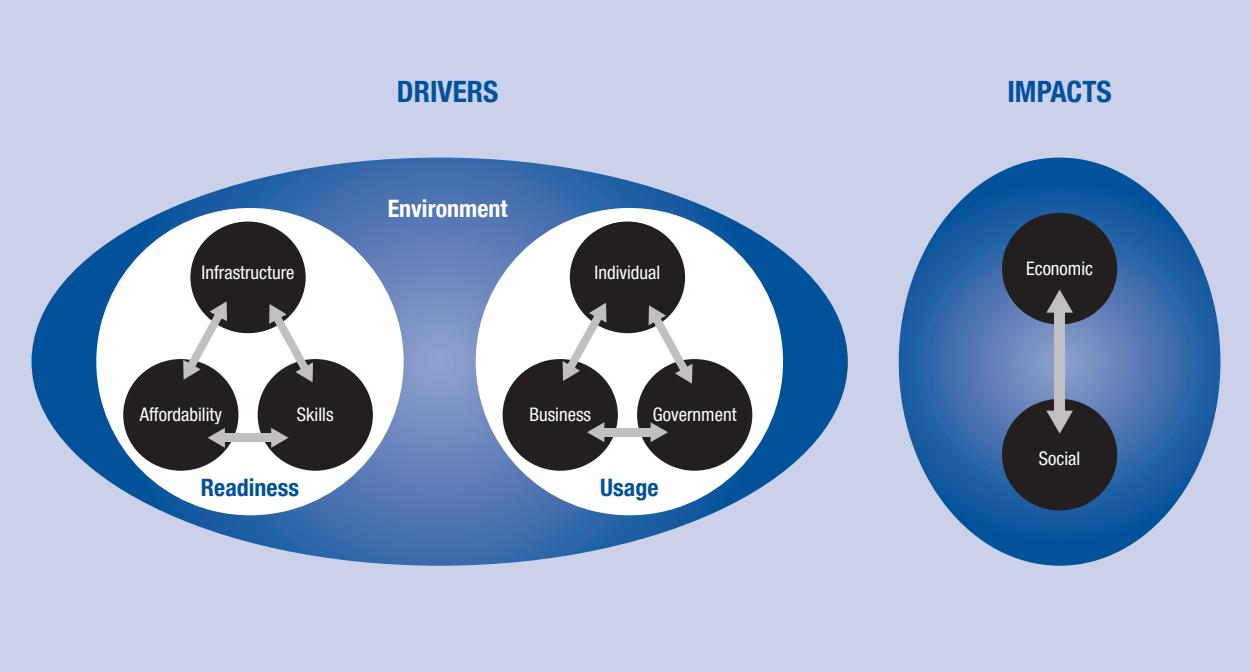
In this context, the way we monitor, measure, and benchmark the deployment and impacts of ICT must evolve to take into account the rapid changes and consequences of living in a hyperconnected world. Reflecting on this imperative of adaptation, a comprehensive review process of the NRI framework has been undertaken, guided by a process of high-level consultations with academic experts, policymakers, and representatives of the ICT industry. The results of this new framework are presented for the first time in this edition of the *Report.*

More precisely, this chapter presents the evolution of the framework and methodology underpinning the NRI. In addition, highlights of the 2012 rankings for a record 142 economies are also presented.

THE EVOLVING NETWORKED READINESS FRAMEWORK: FROM ICT ACCESS TO ICT IMPACTS

Over the last decade, several attempts have been made to assess ICT developments. Appendix B includes a historical overview of the efforts made by various organizations to measure and benchmark ICT developments. One of the most authoritative exercises has been the NRI, which has been adopted by several governments as a valuable tool for assessing and leveraging technology

Figure 1: The evolved Networked Readiness Index framework



for competitiveness and development. Its success emphasizes the importance of continuing to adapt its framework in alignment with the changing landscape of technology and the new opportunities it introduces (Box 1).

As has been noted in the past two editions of this *Report,* the ICT industry has changed rapidly over the past decade. More powerful technologies, new mechanisms of accessing ICT and integrating it in multiple devices (e.g., through mobile broadband), and new ways of producing digital content (e.g., via social networks) have been developed, radically changing the industry and accelerating the convergence among the ICT, telecommunications, and media industries. Moreover, the many manifestations of ICT have become truly ubiquitous. Economic structures and the ways economic activities are organized have been rapidly transformed by new ICT-based or enabled business practices, generating sharp productivity gains. Society, and the way citizens interact among themselves and with governments, has also changed thanks to ICT. New modes of engagement between governments and citizens, not only in the shape of new ways of delivering public services but also in terms of redefining governance mechanisms and social engagement, have appeared.

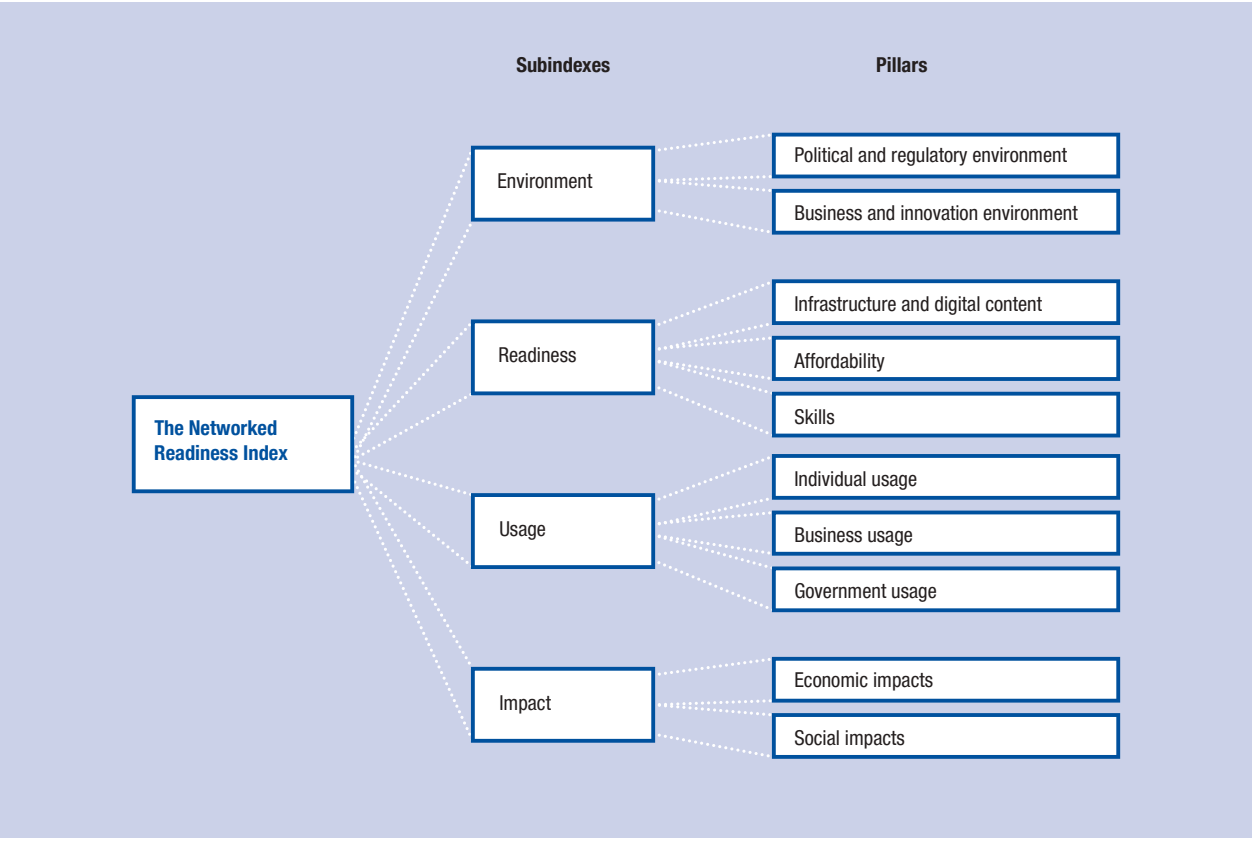
Consequently, much of the policy attention paid to ICT has also shifted. Because ICT has become increasingly omnipresent and almost universal in today's world, the focus has moved from one of how to provide access to one of how to make the best use of ICT in order to improve business innovation, governance, citizens' political participation, and social cohesion.

As described above, although the NRI has benefited from minor adjustments both in its variables—to better reflect the dynamic trends in the technology landscape—and in the methodology employed to compute the rankings, it has remained essentially stable since 2002. However, over the past two years a review of the framework has been undertaken to make certain not only that it continues to effectively capture the main drivers of ICT readiness but also that it increasingly incorporates data on ICT impacts. The objective of this process is to ensure that the framework remains relevant and at the forefront of measuring and benchmarking the role of ICT for competitiveness and well-being for the next decade.

As a result of the efforts of the past two years, in this edition of the *Report* a new framework is being introduced (Figure 1). This evolved framework is inspired by five underlying principles:

1. **Measuring the economic and social impacts of ICT is crucial.** The NRI must include aspects of the way ICT is transforming the economy and society. In the economy, the development of the ICT industry has become increasingly important and now accounts for a significant share of value-added and employment. In addition, ICT interacts closely with many other sectors, thus enabling *innovations* to accrue and affecting the overall productivity of a country. Moreover, the impacts of ICT are also evident in the development of *new skills* that are important in knowledge-based, information-rich societies and that are crucial for employment. In society, ICT empowers citizens to participate more actively and steadily in social and political debates, and to obtain better and faster services—for example, financial services—that

Figure 2: The evolved Networked Readiness Index structure



have an important impact on the quality of life and can potentially transform the quality and outcomes of important services such as education or health.

2. **An enabling environment determines the capacity of an economy and society to benefit from the use of ICT.** The success of a country in leveraging ICT and achieving the desired economic and social benefits will depend on its overall environment—including market conditions, the regulatory framework, and innovation-prone conditions—to boost innovation and entrepreneurship.

3. **ICT readiness and usage remain key drivers and preconditions for obtaining any impacts.** Despite ICT becoming increasingly universal, the question of access and usage remains important—especially for developing countries, given their need to narrow the digital divide. Even within developed nations, the need to provide high-speed broadband to all segments of the population has acquired importance in recent years. The NRI should include aspects related to access and usage covering not only affordable ICT infrastructure but also digital resources, including software, and the development of skills. Moreover, ICT impacts can arise only if ICT is widely used by all key actors—*individuals, businesses,* and *governments.* It is a society-wide effort. Those actors demonstrating better preparedness and greater interest are likely to use ICT more and more effectively, contributing to a greater impact on competitiveness and development.

4. **All factors interact and co-evolve within an ICT ecosystem.** Those societies that count on better-prepared actors and an enabling environment are more likely to benefit from higher rates of ICT use and impacts. At the same time, those societies that benefit from higher rates of ICT use and positive impacts will, in turn, be more likely to benefit from a push on the part of the different stakeholders to be better prepared and keep improving the framework conditions that will allow for more and stronger benefits to accrue. As a result, a virtuous circle starts where improvements in one area affect and drive improvements in other areas. Conversely, lags in one particular factor also affect the evolution of the other factors.

5. **The framework should provide clear policy orientations and identify public-private partnership opportunities.** The NRI should clearly facilitate the identification of areas where policy intervention—through investment, including public-private partnerships; smart regulation; or the provision of incentives—could boost the impacts of ICT. This is important because the development and general uptake of ICT depends on the capacity of a country to provide an institutional framework with reliable and efficient rules and regulations; favorable business conditions for the birth and growth of new (social and commercial) enterprises; an innovation-prone environment,

capable of developing and absorbing new knowledge; and an ICT-friendly government policy.

ELEMENTS OF THE NETWORKED READINESS INDEX

The networked readiness framework translates into the NRI, comprising four subindexes that measure the environment for ICT; the readiness of a society to use ICT; the actual usage of all main stakeholders; and, finally, the impacts that ICT generates in the economy and society. The three first subindexes can be regarded as the drivers that condition the results of the fourth subindex—that is, ICT impacts. These four subindexes are divided into 10 pillars and 53 variables according to the following structure (see also Figure 2):

A. Environment subindex
1. Political and regulatory environment
2. Business and innovation environment

B. Readiness subindex
3. Infrastructure and digital content
4. Affordability
5. Skills

C. Usage subindex
6. Individual usage
7. Business usage
8. Government usage

D. Impact subindex
9. Economic impacts
10. Social impacts

The final NRI score is a simple average of the four composing subindex scores, while each subindex's score is a simple average of those of the composing pillars. In doing this, we assume that all Index subindexes give a similar contribution to national networked readiness. Appendix A at the end of this chapter includes detailed information on the composition and computation of the NRI 2012.

A brief description of the different composing elements (at the subindex and pillar level) follows.

Environment subindex

The environment subindex gauges the friendliness of a country's market and regulatory framework in supporting high levels of ICT uptake and the development of entrepreneurship and innovation-prone conditions. A supportive environment is necessary to maximize the potential impacts of ICT in boosting competitiveness and well-being. It includes a total of 18 variables distributed into two pillars.

The *political and regulatory environment pillar* (nine variables) assesses the extent to which the national legal framework facilitates ICT penetration and the safe development of business activities, taking into account general features of the regulatory environment (including the protection afforded to property rights, the independence of the judiciary, and the efficiency of the law-making process) as well as more ICT-specific dimensions (the passing of laws relating ICT and software piracy rates).

The *business and innovation environment pillar* (nine variables) gauges the quality of the business framework conditions to boost entrepreneurship, taking into account dimensions related to the ease of doing business (including the presence of red tape and excessive fiscal charges). This pillar also measures the presence of conditions that allow innovation to flourish by including variables on the overall availability of technology, the demand conditions for innovative products (as proxied by the development of government procurement of advanced technology products), the availability of venture capital for financing innovation-related projects, and the presence of a skillful labor force.

Readiness subindex

The readiness subindex, with a total of 12 variables, measures the degree to which a society is prepared to make good use of an affordable ICT infrastructure and digital content.

The *infrastructure and digital content pillar* (five variables) captures the development of ICT infrastructure (including the mobile network coverage, international Internet bandwidth, secure Internet servers, and electricity production) as well as the accessibility of digital content.

The *affordability pillar* (three variables) assesses the cost of accessing ICT, either via mobile telephony or fixed broadband Internet, as well as the level of competition in the Internet and telephony sectors that determine this cost.

The *skills pillar* (four variables) gauges the ability of a society to make effective use of ICT thanks to the existence of basic educational skills captured by the quality of the educational system, the level of adult literacy, and the rate of secondary education enrollment.

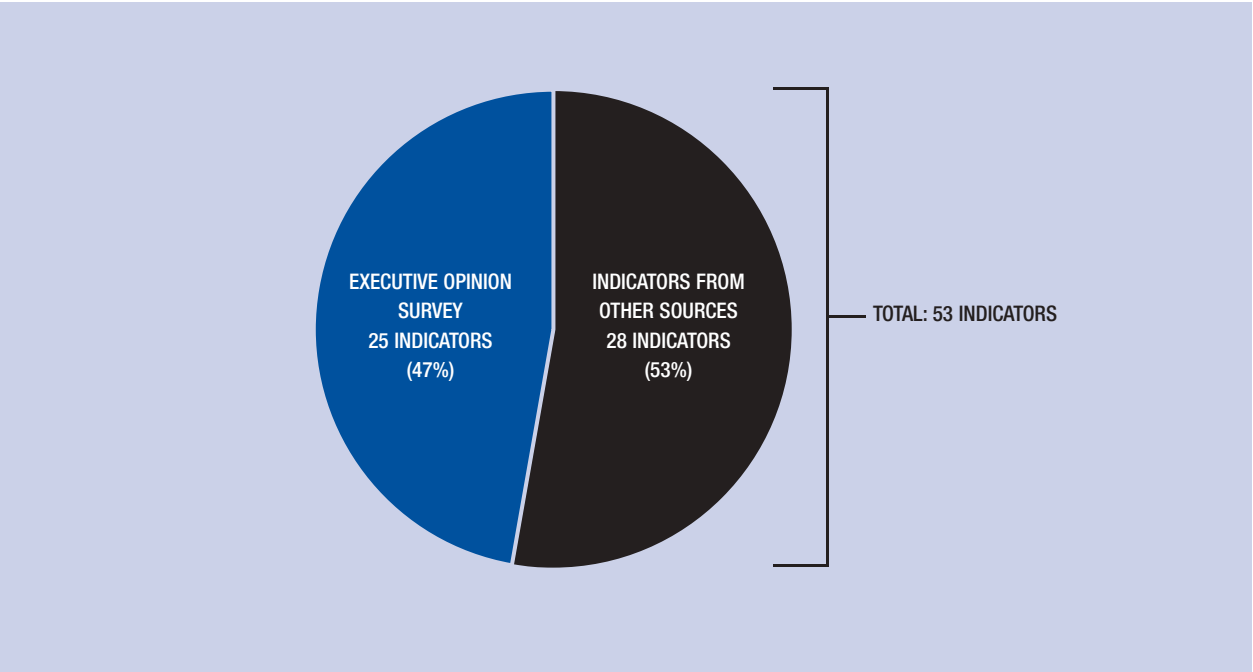
Usage subindex

The usage subindex assesses the individual efforts of the main social agents—that is, individuals, business, and government—to increase their capacity to use ICT, as well as their actual use in their day-to-day activities with other agents. It includes 15 variables.

The *individual usage pillar* (seven variables) measures ICT penetration and diffusion at the individual level, using indicators such as the number of mobile phone subscriptions, individuals using the Internet, households with a personal computer (PC), households with Internet access, both fixed and mobile broadband subscriptions, and the use of social networks.

The *business usage pillar* (five variables) captures the extent of business Internet use as well as the efforts of the firms in an economy to integrate ICT into an internal, technology-savvy, innovation-conducive environment

Figure 3: Breakdown of indicators used in the Networked Readiness Index 2012 by data source



that generates productivity gains. Consequently, this pillar measures the firm's technology absorption capacity as well as its overall capacity to innovate and the production of technology novelties measured by the number of PCT patent applications. It also measures the extent of staff training available, which indicates the extent to which management and employees are better capable of identifying and developing business innovations.

The *government usage pillar* (three variables) provides insights into the importance that governments place on carrying out ICT policies for competitiveness and the well-being of their citizens, the efforts they make to implement their visions for ICT development, and the number of government services they provide online.

Impact subindex

The impact subindex gauges the broad economic and social impacts accruing from ICT to boost competitiveness and well-being and that reflect the transformations toward an ICT- and technology-savvy economy and society. It includes a total of eight variables.

The *economic impacts pillar* measures the effect of ICT on competitiveness thanks to the generation of technological and non-technological innovations in the shape of patents, new products or processes, and organizational practices. In addition, it also measures the overall shift of an economy toward more knowledge-intensive activities.

The *social impacts pillar* aims at assessing the ICT-driven improvements in well-being thanks to its impacts on the environment, education, energy consumption, health progress, or more-active civil participation. At the moment, because of data limitations, this pillar focuses on measuring the extent to which governments are becoming more efficient in the use of ICT and providing increasing online services to their citizens, and thus improving their e-participation. It also assess the extent to which ICT is present in education, as a proxy for the potential benefits that are associated with the use of ICT in education.

In general, measuring the impacts of ICT is a complex task and the development of rigorous quantitative data to do so is still in its infancy.[10] As a result, many of the dimensions where ICT is producing important impacts—especially when these impacts are not translated into commercial activities, such as the environment of health—cannot be covered yet. Therefore this subindex should be regarded as a work in progress that will evolve to accommodate new data on many of these dimensions as they become available.

COMPUTATION METHODOLOGY AND DATA

In order to capture as comprehensively as possible all relevant dimensions of societies' networked readiness, the NRI 2012 is composed of a mixture of quantitative and survey data, as shown in Figure 3.

Of the 53 variables composing the NRI, 28—or 53 percent—are quantitative data, collected primarily by international organizations such as International Telecommunication Union (ITU), the World Bank, and the United Nations. International sources ensure the validation and comparability of data across countries. In addition, some other quantitative data come from private enterprises—such as Informa, in the case of mobile

broadband penetration—that are leaders in collecting commercial ICT data.

The remaining 25 variables capture aspects that are more qualitative in nature or for which internationally comparable quantitative data are not available for a large enough number of countries, but that nonetheless are crucial to fully measure national networked readiness. These data come from the Executive Opinion Survey (the Survey), which the Forum administers annually to over 15,000 business leaders in all economies included in the *Report.*[11] The Survey represents a unique source of insight on many important dimensions of an enabling environment, such as the effectiveness of law-making bodies and the intensity of local competition; on dimensions of ICT readiness, such as the quality of the educational system and accessibility to digital content; on ICT usage, such as capacity to innovate and the importance of government vision for ICT; and finally on impact, such as ICT impacts on developing new products and services and improving access to basic services.

The NRI's coverage every year is determined by the Survey coverage and quantitative data availability. This year the *Report* includes 142 economies, three more than in the past edition. Three new countries are included for the first time: Belize, Haiti, and Yemen, while Suriname has been reinstated. Libya had to be dropped for lack of Survey data because of the events that took place in the country last spring.

More details on variables included in the Index and their computation can be found in Appendix A at the end of this chapter and in the Technical Notes and Sources section at the end of the *Report.*

THE CURRENT NETWORKED READINESS LANDSCAPE: INSIGHTS FROM THE NRI 2012

This section provides an overview of the networked readiness landscape of the world as assessed by the NRI 2012. It highlights the top 10 performers and the main regional results for Europe and the Commonwealth of Independent States, Asia and the Pacific, Latin America and the Caribbean, sub-Saharan Africa, and the Middle East and North Africa. Tables 1 through 5 report the 2012 rankings for the overall NRI, its four subindexes, and its ten pillars. In addition, the Country/Economy Profiles and Data Table sections at the end of the *Report* present the detailed results for the 142 economies covered by the study and the 53 indicators composing the NRI. To complement the analysis of the 2012 results, Box 2 depicts a comparative study of networked readiness across and within different world regions (see also Figure 4) and Box 3 presents the correlation between ICT drivers, calculated as the average of the environment, readiness, and usage subindexes and ICT impacts.

TOP 10

The top 10 of the NRI is made up exclusively of advanced economies. That group is dominated by the Nordics, with Sweden, Finland, Denmark, and Norway featuring in the top 7, and Iceland coming in at a not-so-distant 15th place. All members of the top 10 are relatively close to each other, and they tend to do well across all pillars, with some noticeable exceptions mentioned below.

Sweden's performance is remarkable in every aspect. The country leads four of the 10 pillars of the

Box 2: Charting the digital divide

This brief comparative analysis confirms the existence of a global digital divide. Broadly defined, the *digital divide* refers to inequalities between the advanced economies and the rest of the world in terms of access and use of information and communication technologies (ICT), and thus its economic and social impacts. The Networked Readiness Index (NRI) framework and rankings aim to shed light on the reasons behind the persistence and depth of this gap, through a holistic analysis of a country's digital ecosystem.

Figure A plots the average score of selected country groups in the 10 pillars of the NRI and reveals the depth of the digital divide.[1] The advanced economies lead the emerging countries by a significant margin in each category. The gap is the widest with sub-Saharan Africa, and smaller with Developing Asia and with Latin America and the Caribbean.

The divide is particularly deep in terms of infrastructure quality and digital content accessibility. In sub-Saharan Africa, the shortcomings in terms of skills and affordability—two critical areas of ICT readiness—are just as serious. This poor preparedness in turn contributes to explaining the region's dismal performance in terms of usage. Sub-Saharan Africa remains by far the world's least-connected region. Despite mobile telephony becoming almost commonplace in the region, with 49 subscriptions per 100 population, access to other technologies remains the privilege of a few.[2] For instance, only 13 percent of individuals in sub-Saharan Africa use the Internet, 8 percent of households in the region own a personal computer (PC), and less than 4 percent have access to the Internet at home. By comparison, in Developing Asia 20 percent of individuals use the Internet, 22 percent of households own a PC, and 14 percent have access to the Internet at home. In terms of differences across developing regions, Developing Asia and Latin America and the Caribbean are very close in most dimensions. Exceptions are found in the affordability pillar and government usage pillar—that is, the leadership role that governments undertake to develop and leverage ICT in society, where the former outperforms the latter. In fact, Developing Asia has almost closed the gap with advanced economies in this latter dimension.

Group averages often conceal wide disparities within a group of countries. Although the dominance of advanced economies in the NRI is uncontested, Figure B shows the profound diversity within the group. The performance of the Nordics, led by Sweden, and of the Asian Tigers, led by Singapore, offers a stark contrast to the picture drawn by Southern and Eastern European economies.[3] The average performance of Greece, Italy, Portugal, and Spain, grouped under Southern Europe for the purpose of this analysis, is significantly below that of the Nordic countries. The chasm turns cavernous when considering specific dimensions of the NRI. That is the case in the business usage pillar, where the gap between Southern Europe and the Nordics is comparable to that between Developing Asia and advanced economies.

Similarly, Figure C illustrates the existence of a digital divide within the Middle East and North Africa (MENA) region, where the Gulf Cooperation Council (GCC) countries stand out remarkably.[4] Five of the GCC member countries place between the 27th (Bahrain) and 40th (Oman) ranks. Most of their governments have embraced ambitious digital strategies coupled with pro-business reforms and massive infrastructure developments as part of their efforts to attract foreign investors and to diversify their economies. This big government-led push is reflected in the strong performance achieved in several dimensions of the NRI where the government plays a critical role, including the creation of an environment and legal framework conducive to business and innovation, skills, and usage of ICT by the government. In those pillars, the GCC average score tends to be very close to the average of advanced economies. The rest of MENA presents a much bleaker picture, with Syria (129th), Mauritania (139th), and Yemen (141st) ranking among the worst-performing countries globally.

Figure 4 in this chapter complements the present analysis. It visualizes on a map the NRI score of the 142 economies covered by the study. The areas of the 10 best-performing countries are shaded dark red, whereas the worst-performing economies appear in dark blue. The orange color identifies economies with a fairly high degree of networked readiness, which, however, does not match that of the top-performing economies. This group of 15 notably includes several economies in Western Europe and all advanced economies in Asia and the Pacific except Singapore, which belongs to the red category. The brown shading is used for countries that are only partly leveraging ICT for enhancing their competitiveness and well-being. This is the case for several countries in Southern and Eastern Europe, Central Asia, and MENA. Indeed, the patchwork of colors in Europe reflects its huge diversity. Finally, blue shadings designate countries that present major weaknesses in various dimensions of the NRI. The impacts of ICT therefore remain very limited, and minimal in the case of dark blue shaded countries. Africa is overwhelmingly blue, and exclusively of the darkest shade in the western part of the continent.

Notes

1 In this box, all cited scores are expressed on a 1-to-7 scale, unless noted otherwise. When referring to a group, scores correspond to simple averages. Refer to Table 1 for the classification of economies by groups.

2 Figures cited in this paragraph are weighted average rates for 2010 computed using data from International Telecommunication Union's *World Telecommunication Indicators 2011 Database* (December 2011 update).

3 The Nordics group comprises Denmark, Finland, Iceland, Norway, and Sweden. The Asian Tigers group comprises Honk Kong SAR, Korea, Singapore, and Taiwan, China.

4 The Gulf Cooperation Council comprises Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates.

(Cont'd.)

Box 2: Charting the digital divide *(cont'd.)*

Figure A: Performance in the NRI: Advanced economies and selected emerging regions

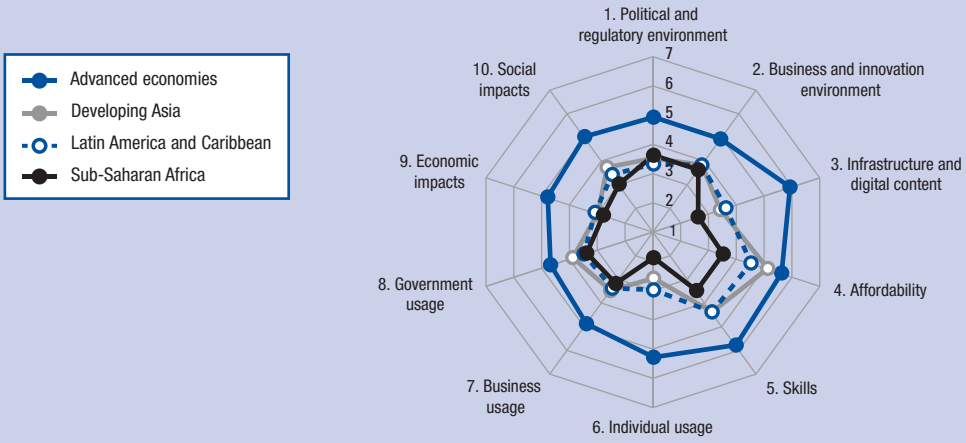


Figure B: Performance in the NRI: Advanced economies, selected subgroups

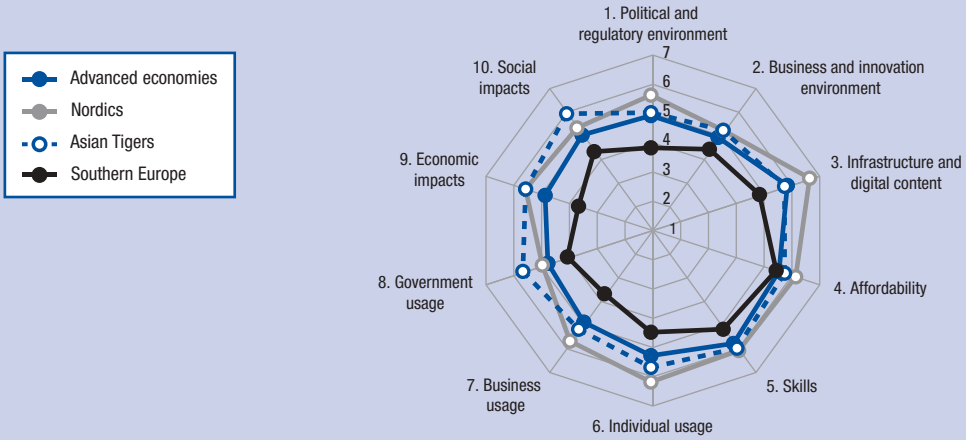


Figure C: Performance in the NRI: Advanced economies, Middle East and North Africa and Gulf Cooperation Council states

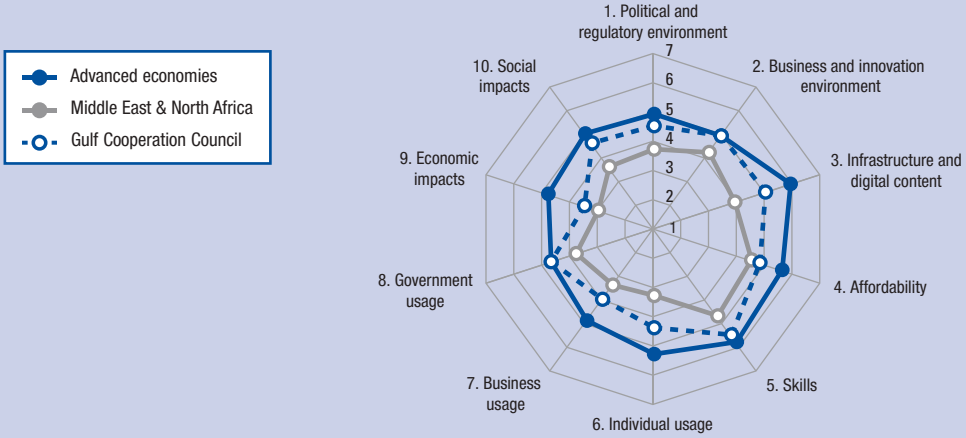


Table 1: The Networked Readiness Index 2012

Rank	Country/Economy	Score	Group*
1	Sweden	5.94	ADV
2	Singapore	5.86	ADV
3	Finland	5.81	ADV
4	Denmark	5.70	ADV
5	Switzerland	5.61	ADV
6	Netherlands	5.60	ADV
7	Norway	5.59	ADV
8	United States	5.56	ADV
9	Canada	5.51	ADV
10	United Kingdom	5.50	ADV
11	Taiwan, China	5.48	ADV
12	Korea, Rep.	5.47	ADV
13	Hong Kong SAR	5.46	ADV
14	New Zealand	5.36	ADV
15	Iceland	5.33	ADV
16	Germany	5.32	ADV
17	Australia	5.29	ADV
18	Japan	5.25	ADV
19	Austria	5.25	ADV
20	Israel	5.24	ADV
21	Luxembourg	5.22	ADV
22	Belgium	5.13	ADV
23	France	5.12	ADV
24	Estonia	5.09	ADV
25	Ireland	5.02	ADV
26	Malta	4.91	ADV
27	Bahrain	4.90	MENA
28	Qatar	4.81	MENA
29	Malaysia	4.80	DEVASIA
30	United Arab Emirates	4.77	MENA
31	Lithuania	4.66	CEE
32	Cyprus	4.66	ADV
33	Portugal	4.63	ADV
34	Saudi Arabia	4.62	MENA
35	Barbados	4.61	LATAM
36	Puerto Rico	4.59	ADV
37	Slovenia	4.58	ADV
38	Spain	4.54	ADV
39	Chile	4.44	LATAM
40	Oman	4.35	MENA
41	Latvia	4.35	CEE
42	Czech Republic	4.33	ADV
43	Hungary	4.30	CEE
44	Uruguay	4.28	LATAM
45	Croatia	4.22	CEE
46	Montenegro	4.22	CEE
47	Jordan	4.17	MENA
48	Italy	4.17	ADV
49	Poland	4.16	CEE
50	Tunisia	4.12	MENA
51	China	4.11	DEVASIA
52	Turkey	4.07	CEE
53	Mauritius	4.06	SSA
54	Brunei Darussalam	4.04	DEVASIA
55	Kazakhstan	4.03	CIS
56	Russian Federation	4.02	CIS
57	Panama	4.01	LATAM
58	Costa Rica	4.00	LATAM
59	Greece	3.99	ADV
60	Trinidad and Tobago	3.98	LATAM
61	Azerbaijan	3.95	CIS
62	Kuwait	3.95	MENA
63	Mongolia	3.95	CIS
64	Slovak Republic	3.94	ADV
65	Brazil	3.92	LATAM
66	Macedonia, FYR	3.91	CEE
67	Romania	3.90	CEE
68	Albania	3.89	CEE
69	India	3.89	DEVASIA
70	Bulgaria	3.89	CEE
71	Sri Lanka	3.88	DEVASIA
72	South Africa	3.87	SSA
73	Colombia	3.87	LATAM
74	Jamaica	3.86	LATAM
75	Ukraine	3.85	CIS
76	Mexico	3.82	LATAM
77	Thailand	3.78	DEVASIA
78	Moldova	3.78	CIS
79	Egypt	3.77	MENA
80	Indonesia	3.75	DEVASIA
81	Cape Verde	3.71	SSA
82	Rwanda	3.70	SSA
83	Vietnam	3.70	DEVASIA
84	Bosnia and Herzegovina	3.65	CEE
85	Serbia	3.64	CEE
86	Philippines	3.64	DEVASIA
87	Dominican Republic	3.60	LATAM
88	Georgia	3.60	CIS
89	Botswana	3.58	SSA
90	Guyana	3.58	LATAM
91	Morocco	3.56	MENA
92	Argentina	3.52	LATAM
93	Kenya	3.51	SSA
94	Armenia	3.49	CIS
95	Lebanon	3.49	MENA
96	Ecuador	3.46	LATAM
97	Ghana	3.44	SSA
98	Guatemala	3.43	LATAM
99	Honduras	3.43	LATAM
100	Senegal	3.42	SSA
101	Gambia, The	3.41	SSA
102	Pakistan	3.39	DEVASIA
103	El Salvador	3.38	LATAM
104	Iran, Islamic Rep.	3.36	MENA
105	Namibia	3.35	SSA
106	Peru	3.34	LATAM
107	Venezuela	3.32	LATAM
108	Cambodia	3.32	DEVASIA
109	Zambia	3.26	SSA
110	Uganda	3.25	SSA
111	Paraguay	3.25	LATAM
112	Nigeria	3.22	SSA
113	Bangladesh	3.20	DEVASIA
114	Tajikistan	3.19	CIS
115	Kyrgyz Republic	3.13	CIS
116	Malawi	3.05	SSA
117	Benin	3.05	SSA
118	Algeria	3.01	MENA
119	Belize	3.01	LATAM
120	Mozambique	2.99	SSA
121	Suriname	2.99	LATAM
122	Côte d'Ivoire	2.98	SSA
123	Tanzania	2.95	SSA
124	Zimbabwe	2.94	SSA
125	Cameroon	2.93	SSA
126	Mali	2.93	SSA
127	Bolivia	2.92	LATAM
128	Nepal	2.92	DEVASIA
129	Syria	2.85	MENA
130	Ethiopia	2.85	SSA
131	Nicaragua	2.84	LATAM
132	Timor-Leste	2.84	DEVASIA
133	Lesotho	2.78	SSA
134	Madagascar	2.73	SSA
135	Burkina Faso	2.72	SSA
136	Swaziland	2.70	SSA
137	Burundi	2.57	SSA
138	Chad	2.55	SSA
139	Mauritania	2.55	MENA
140	Angola	2.49	SSA
141	Yemen	2.41	MENA
142	Haiti	2.27	LATAM

Note: Group classification follows the International Monetary Fund's classification (situation as of September 2011).
* Groups: ADV = Advanced economies; CEE = Central and Eastern Europe; CIS = Commonwealth of Independent States and Mongolia; DEVASIA = Developing Asia; LATAM = Latin America and the Caribbean; MENA = Middle East and North Africa; SSA = Sub-Saharan Africa.

Table 2: Environment subindex and pillars

ENVIRONMENT SUBINDEX			Political and regulatory environment		Business and innovation environment	
Rank	Country/Economy	Score	Rank	Score	Rank	Score
1	Singapore	5.73	1	5.96	1	5.51
2	Finland	5.56	4	5.80	4	5.32
3	Sweden	5.51	2	5.86	11	5.15
4	New Zealand	5.48	3	5.84	14	5.12
5	Denmark	5.44	6	5.63	7	5.24
6	Switzerland	5.37	7	5.61	13	5.13
7	Hong Kong SAR	5.34	15	5.32	3	5.36
8	Canada	5.33	12	5.36	5	5.30
9	Netherlands	5.33	8	5.55	17	5.10
10	Norway	5.32	9	5.53	16	5.12
11	United Kingdom	5.28	10	5.51	20	5.05
12	Australia	5.28	11	5.48	18	5.07
13	Luxembourg	5.27	5	5.79	27	4.75
14	United States	5.11	21	4.99	9	5.22
15	Qatar	5.10	27	4.82	2	5.37
16	Iceland	5.02	22	4.98	19	5.06
17	Saudi Arabia	5.00	29	4.75	8	5.24
18	Germany	4.99	13	5.34	32	4.63
19	Israel	4.98	28	4.79	10	5.16
20	Ireland	4.95	18	5.16	28	4.75
21	Austria	4.93	14	5.33	37	4.53
22	Belgium	4.93	26	4.84	21	5.01
23	Malaysia	4.92	24	4.87	24	4.97
24	Taiwan, China	4.88	37	4.47	6	5.28
25	France	4.87	17	5.17	33	4.57
26	Japan	4.85	16	5.18	39	4.53
27	Bahrain	4.84	35	4.53	12	5.14
28	United Arab Emirates	4.83	31	4.66	22	5.00
29	Barbados	4.82	20	5.09	35	4.55
30	Chile	4.72	38	4.45	23	4.99
31	Cyprus	4.69	36	4.53	25	4.86
32	Estonia	4.69	25	4.85	36	4.54
33	Rwanda	4.66	19	5.10	57	4.22
34	South Africa	4.65	23	4.92	50	4.37
35	Korea, Rep.	4.63	43	4.14	15	5.12
36	Oman	4.63	34	4.59	31	4.67
37	Malta	4.60	30	4.68	41	4.51
38	Portugal	4.47	42	4.20	29	4.74
39	Puerto Rico	4.42	41	4.33	40	4.52
40	Spain	4.39	44	4.12	30	4.67
41	Mauritius	4.38	39	4.36	46	4.40
42	Slovenia	4.34	57	3.88	26	4.81
43	Uruguay	4.22	50	4.01	45	4.42
44	Namibia	4.22	33	4.60	87	3.83
45	Hungary	4.19	45	4.10	52	4.27
46	Lithuania	4.17	53	3.95	49	4.39
47	Montenegro	4.17	61	3.80	38	4.53
48	Jordan	4.16	58	3.87	43	4.45
49	Latvia	4.14	59	3.87	44	4.42
50	Czech Republic	4.11	51	4.00	59	4.21
51	Zambia	4.10	70	3.66	34	4.55
52	Botswana	4.10	40	4.33	79	3.88
53	Turkey	4.06	62	3.80	51	4.33
54	Gambia, The	4.06	32	4.61	117	3.51
55	Tunisia	4.02	49	4.02	67	4.03
56	Kuwait	3.99	60	3.81	61	4.17
57	Brunei Darussalam	3.99	48	4.03	76	3.95
58	Poland	3.98	66	3.75	58	4.22
59	Thailand	3.96	69	3.67	54	4.24
60	Macedonia, FYR	3.95	83	3.51	47	4.40
61	Panama	3.95	84	3.51	48	4.39
62	Jamaica	3.93	56	3.91	75	3.95
63	Ghana	3.89	55	3.94	82	3.85
64	China	3.88	46	4.07	105	3.69
65	Cape Verde	3.88	54	3.95	90	3.80
66	Morocco	3.86	68	3.68	66	4.04
67	Slovak Republic	3.86	74	3.63	65	4.09
68	Croatia	3.85	80	3.53	62	4.17
69	Greece	3.85	87	3.49	60	4.21
70	Malawi	3.80	47	4.05	114	3.56
71	Sri Lanka	3.79	64	3.75	85	3.84
72	Indonesia	3.79	88	3.48	64	4.09
73	Bulgaria	3.78	99	3.30	53	4.27
74	Georgia	3.77	98	3.31	55	4.23
75	Italy	3.75	85	3.50	70	3.99
76	Trinidad and Tobago	3.73	90	3.48	72	3.99
77	Azerbaijan	3.73	75	3.60	80	3.86
78	India	3.72	71	3.65	91	3.80
79	Mexico	3.72	86	3.50	77	3.94
80	Iran, Islamic Rep.	3.71	78	3.57	81	3.85
81	Kazakhstan	3.70	92	3.42	71	3.99
82	Albania	3.70	89	3.48	78	3.92
83	Romania	3.69	95	3.37	68	4.02
84	Ethiopia	3.69	72	3.64	99	3.75
85	Egypt	3.68	76	3.59	94	3.76
86	Guyana	3.67	81	3.52	88	3.81
87	Tajikistan	3.67	52	3.97	128	3.36
88	Senegal	3.66	106	3.18	63	4.15
89	Cambodia	3.66	73	3.64	106	3.69
90	Costa Rica	3.66	67	3.70	108	3.62
91	Uganda	3.64	63	3.78	120	3.50
92	Lebanon	3.64	129	2.78	42	4.50
93	Peru	3.64	114	3.05	56	4.23
94	Colombia	3.63	82	3.51	95	3.76
95	Mongolia	3.59	105	3.18	69	4.01
96	Vietnam	3.58	79	3.55	109	3.62
97	Dominican Republic	3.58	104	3.19	73	3.98
98	Nigeria	3.58	91	3.45	104	3.71
99	Kenya	3.55	94	3.38	101	3.73
100	Russian Federation	3.54	102	3.24	83	3.84
101	Brazil	3.52	77	3.59	121	3.46
102	Tanzania	3.51	65	3.75	129	3.28
103	El Salvador	3.46	121	2.97	74	3.96
104	Mali	3.45	93	3.39	118	3.51
105	Serbia	3.45	113	3.05	84	3.84
106	Moldova	3.45	109	3.08	89	3.81
107	Honduras	3.44	100	3.28	112	3.60
108	Mozambique	3.43	97	3.34	116	3.52
109	Bosnia and Herzegovina	3.43	108	3.10	97	3.75
110	Armenia	3.42	112	3.06	93	3.77
111	Philippines	3.42	107	3.15	107	3.69
112	Pakistan	3.42	110	3.08	96	3.76
113	Burkina Faso	3.40	96	3.36	123	3.45
114	Benin	3.35	101	3.27	124	3.43
115	Syria	3.33	126	2.88	92	3.79
116	Guatemala	3.32	128	2.81	86	3.84
117	Ukraine	3.31	125	2.88	98	3.75
118	Cameroon	3.30	119	2.98	111	3.61
119	Ecuador	3.30	120	2.98	110	3.62
120	Lesotho	3.28	115	3.03	115	3.54
121	Belize	3.26	116	3.03	119	3.50
122	Argentina	3.26	122	2.94	113	3.57
123	Bangladesh	3.24	130	2.75	100	3.73
124	Madagascar	3.20	134	2.68	103	3.72
125	Nepal	3.19	123	2.93	122	3.46
126	Paraguay	3.18	138	2.63	102	3.72
127	Zimbabwe	3.13	111	3.06	132	3.21
128	Swaziland	3.09	103	3.21	136	2.96
129	Timor-Leste	3.08	124	2.90	130	3.27
130	Côte d'Ivoire	3.03	135	2.68	127	3.38
131	Suriname	3.02	137	2.64	126	3.40
132	Kyrgyz Republic	2.99	131	2.73	131	3.25
133	Bolivia	2.98	118	2.99	135	2.98
134	Yemen	2.86	142	2.31	125	3.42
135	Mauritania	2.85	117	3.01	140	2.69
136	Algeria	2.83	132	2.70	137	2.96
137	Nicaragua	2.82	136	2.66	134	2.99
138	Venezuela	2.78	139	2.45	133	3.12
139	Chad	2.68	127	2.82	142	2.54
140	Burundi	2.63	141	2.33	138	2.93
141	Angola	2.63	133	2.69	141	2.57
142	Haiti	2.62	140	2.38	139	2.86

Table 3: Readiness subindex and pillars

READINESS SUBINDEX			Infrastructure and digital content		Affordability		Skills	
Rank	Country/Economy	Score	Rank	Score	Rank	Score	Rank	Score
1	Iceland	6.52	2	6.89	4	6.48	7	6.18
2	Finland	6.50	5	6.82	16	6.17	1	6.51
3	Sweden	6.44	1	6.90	7	6.38	12	6.03
4	Canada	6.35	3	6.84	21	6.03	5	6.19
5	United States	6.26	6	6.80	10	6.34	32	5.65
6	Norway	6.17	4	6.83	20	6.04	34	5.65
7	Switzerland	6.13	8	6.49	48	5.55	4	6.34
8	Singapore	6.06	20	5.88	29	5.84	2	6.46
9	Denmark	6.04	15	6.07	18	6.13	14	5.93
10	Austria	5.99	12	6.20	24	5.99	24	5.79
11	Netherlands	5.98	10	6.26	47	5.57	8	6.12
12	New Zealand	5.96	9	6.40	63	5.31	6	6.18
13	United Kingdom	5.96	11	6.21	27	5.85	21	5.81
14	Taiwan, China	5.95	19	5.92	30	5.83	9	6.11
15	Cyprus	5.93	23	5.71	14	6.21	17	5.85
16	Hong Kong SAR	5.90	28	5.48	5	6.40	23	5.81
17	Germany	5.88	14	6.09	38	5.72	20	5.82
18	Ireland	5.86	17	6.02	44	5.64	15	5.92
19	Luxembourg	5.86	13	6.17	36	5.74	31	5.66
20	Belgium	5.83	21	5.80	68	5.25	3	6.42
21	Malta	5.73	16	6.05	65	5.29	19	5.83
22	Lithuania	5.69	35	5.00	6	6.40	30	5.67
23	Estonia	5.67	24	5.69	54	5.48	18	5.83
24	Korea, Rep.	5.64	18	5.98	70	5.22	27	5.72
25	Bahrain	5.54	31	5.20	31	5.83	36	5.60
26	Australia	5.53	7	6.60	100	3.97	11	6.03
27	Japan	5.52	22	5.72	78	5.03	22	5.81
28	France	5.51	30	5.42	69	5.24	16	5.88
29	Latvia	5.44	47	4.68	13	6.23	43	5.40
30	Slovenia	5.43	29	5.43	71	5.20	29	5.67
31	Croatia	5.41	45	4.72	19	6.08	42	5.43
32	Russian Federation	5.41	40	4.84	17	6.16	53	5.22
33	Ukraine	5.34	74	3.76	2	6.76	39	5.51
34	Israel	5.32	38	4.86	32	5.81	48	5.29
35	Italy	5.30	43	4.78	28	5.85	51	5.28
36	United Arab Emirates	5.29	25	5.65	92	4.70	38	5.53
37	Portugal	5.28	34	5.02	40	5.70	59	5.12
38	Poland	5.25	41	4.78	50	5.53	41	5.43
39	Puerto Rico	5.24	53	4.55	11	6.33	78	4.84
40	Mongolia	5.22	64	4.22	3	6.52	71	4.92
41	Moldova	5.22	63	4.26	8	6.36	65	5.03
42	Romania	5.19	51	4.56	37	5.73	46	5.30
43	Trinidad and Tobago	5.19	44	4.73	64	5.30	37	5.53
44	Greece	5.17	42	4.78	49	5.54	55	5.19
45	Czech Republic	5.16	26	5.49	93	4.65	44	5.34
46	Saudi Arabia	5.14	36	4.99	85	4.81	35	5.61
47	Jordan	5.10	79	3.66	9	6.35	49	5.29
48	Kuwait	5.09	37	4.93	62	5.32	66	5.02
49	Hungary	5.08	61	4.32	55	5.47	40	5.46
50	Bosnia and Herzegovina	5.07	62	4.26	45	5.64	45	5.30
51	Barbados	5.06	33	5.13	102	3.97	10	6.09
52	Kazakhstan	5.06	71	3.88	15	6.18	60	5.12
53	Montenegro	5.05	46	4.68	87	4.80	28	5.68
54	Costa Rica	5.05	77	3.68	35	5.76	26	5.72
55	Malaysia	5.03	65	4.12	41	5.69	47	5.29
56	Spain	4.99	32	5.17	90	4.73	64	5.07
57	Serbia	4.97	56	4.40	59	5.39	61	5.11
58	Mauritius	4.95	73	3.78	23	6.00	63	5.08
59	Qatar	4.93	27	5.48	111	3.33	13	5.98
60	Turkey	4.86	52	4.55	53	5.48	92	4.54
61	Azerbaijan	4.86	72	3.78	25	5.98	82	4.81
62	Jamaica	4.82	54	4.46	61	5.35	90	4.65
63	Uruguay	4.81	49	4.65	83	4.92	76	4.87
64	India	4.79	100	3.16	1	6.94	100	4.27
65	Albania	4.78	75	3.74	57	5.43	56	5.18
66	China	4.78	87	3.49	42	5.67	57	5.18
67	Sri Lanka	4.78	102	3.12	22	6.02	54	5.20
68	Tunisia	4.76	70	3.91	73	5.16	52	5.22
69	Panama	4.74	55	4.43	39	5.72	102	4.09
70	Oman	4.74	69	3.99	82	4.94	50	5.28
71	Chile	4.71	50	4.59	89	4.74	83	4.79
72	Brazil	4.66	68	4.00	67	5.27	86	4.72
73	Bulgaria	4.65	39	4.86	98	4.12	70	4.98
74	Indonesia	4.63	103	3.11	34	5.78	69	4.99
75	Thailand	4.58	107	3.06	33	5.80	74	4.87
76	Mexico	4.57	81	3.62	52	5.50	91	4.59
77	Philippines	4.57	80	3.66	72	5.18	77	4.86
78	Macedonia, FYR	4.55	59	4.36	96	4.29	68	5.00
79	Egypt	4.54	89	3.43	12	6.30	108	3.87
80	Venezuela	4.47	83	3.54	60	5.37	93	4.52
81	Guyana	4.44	92	3.35	66	5.28	88	4.68
82	Paraguay	4.44	67	4.01	56	5.44	109	3.86
83	Slovak Republic	4.43	57	4.38	104	3.91	67	5.01
84	Argentina	4.38	58	4.37	103	3.93	80	4.83
85	Colombia	4.37	88	3.47	95	4.49	58	5.15
86	Vietnam	4.36	101	3.12	76	5.07	73	4.89
87	Brunei Darussalam	4.34	48	4.66	135	2.58	25	5.78
88	Algeria	4.33	105	3.08	51	5.52	97	4.40
89	Lebanon	4.31	95	3.22	99	4.06	33	5.65
90	Armenia	4.26	85	3.52	97	4.19	62	5.09
91	Ecuador	4.25	90	3.37	81	4.95	96	4.42
92	Dominican Republic	4.18	84	3.54	75	5.12	107	3.87
93	Georgia	4.15	60	4.34	116	3.27	79	4.83
94	South Africa	4.13	82	3.58	94	4.55	101	4.26
95	Cape Verde	4.12	117	2.78	86	4.81	84	4.76
96	Honduras	4.05	96	3.22	80	5.01	105	3.92
97	Pakistan	4.03	108	3.05	26	5.91	129	3.13
98	Botswana	4.00	93	3.27	101	3.97	85	4.75
99	Ghana	4.00	124	2.62	46	5.57	112	3.79
100	Morocco	3.97	94	3.25	77	5.06	119	3.62
101	Kyrgyz Republic	3.93	98	3.21	106	3.70	75	4.87
102	El Salvador	3.92	104	3.11	84	4.86	113	3.79
103	Bangladesh	3.87	114	2.87	58	5.41	125	3.32
104	Iran, Islamic Rep.	3.75	99	3.16	114	3.27	81	4.82
105	Guatemala	3.75	110	3.03	91	4.71	122	3.49
106	Cambodia	3.74	66	4.07	110	3.34	111	3.82
107	Uganda	3.74	118	2.78	79	5.03	124	3.41
108	Kenya	3.68	112	2.90	109	3.43	87	4.70
109	Burundi	3.54	131	2.28	43	5.66	135	2.68
110	Zimbabwe	3.50	126	2.51	107	3.59	98	4.39
111	Nepal	3.47	135	2.05	74	5.14	128	3.22
112	Belize	3.39	78	3.66	131	2.83	116	3.67
113	Namibia	3.37	97	3.21	126	2.91	104	3.99
114	Suriname	3.36	130	2.37	120	3.04	89	4.68
115	Tajikistan	3.28	138	1.94	122	3.00	72	4.90
116	Zambia	3.28	120	2.73	115	3.27	110	3.83
117	Timor-Leste	3.26	76	3.73	113	3.28	133	2.77
118	Senegal	3.20	109	3.04	112	3.32	127	3.24
119	Nicaragua	3.19	91	3.37	134	2.60	120	3.61
120	Rwanda	3.19	113	2.89	119	3.05	118	3.64
121	Côte d'Ivoire	3.15	106	3.08	108	3.49	131	2.87
122	Bolivia	3.11	129	2.40	136	2.44	95	4.49
123	Nigeria	3.09	119	2.75	118	3.08	123	3.44
124	Swaziland	3.04	122	2.68	137	2.40	103	4.04
125	Tanzania	3.03	125	2.54	128	2.88	117	3.67
126	Gambia, The	3.01	115	2.82	133	2.62	121	3.61
127	Lesotho	3.00	133	2.13	123	2.98	106	3.90
128	Benin	2.99	116	2.80	125	2.91	126	3.25
129	Peru	2.96	86	3.52	141	1.00	99	4.37
130	Chad	2.94	141	1.77	88	4.76	140	2.30
131	Cameroon	2.94	132	2.21	129	2.87	114	3.74
132	Malawi	2.86	123	2.68	138	2.21	115	3.70
133	Syria	2.86	111	2.98	140	1.11	94	4.50
134	Mozambique	2.84	136	2.05	105	3.77	134	2.69
135	Madagascar	2.77	134	2.11	117	3.10	130	3.10
136	Yemen	2.71	121	2.69	127	2.90	136	2.53
137	Mauritania	2.58	128	2.42	124	2.93	139	2.41
138	Ethiopia	2.50	140	1.86	132	2.80	132	2.86
139	Angola	2.49	137	1.98	121	3.04	137	2.46
140	Mali	2.31	139	1.86	130	2.87	141	2.22
141	Burkina Faso	2.14	127	2.45	139	1.83	142	2.13
142	Haiti	1.97	142	1.50	n/a	n/a	138	2.44

Table 4: Usage subindex and pillars

USAGE SUBINDEX			Individual usage		Business usage		Governent usage	
Rank	Country/Economy	Score	Rank	Score	Rank	Score	Rank	Score
1	Sweden	5.92	1	6.33	1	6.22	10	5.21
2	Korea, Rep.	5.84	2	6.27	12	5.36	1	5.90
3	Denmark	5.77	4	6.22	4	5.96	12	5.15
4	Finland	5.66	5	6.15	5	5.96	17	4.88
5	Singapore	5.60	10	5.79	14	5.25	2	5.78
6	Norway	5.59	3	6.23	9	5.46	13	5.08
7	Switzerland	5.54	6	5.95	2	6.13	35	4.55
8	Japan	5.51	13	5.61	3	6.09	21	4.83
9	Netherlands	5.46	11	5.78	8	5.75	19	4.84
10	United States	5.45	18	5.37	10	5.45	5	5.52
11	United Kingdom	5.41	8	5.88	16	5.09	7	5.27
12	Israel	5.36	15	5.53	7	5.80	24	4.74
13	Germany	5.33	14	5.53	6	5.86	30	4.61
14	Taiwan, China	5.31	28	4.92	13	5.31	3	5.70
15	Luxembourg	5.26	7	5.91	18	5.03	20	4.83
16	Hong Kong SAR	5.22	12	5.64	20	4.99	15	5.03
17	Australia	5.19	16	5.48	22	4.82	8	5.26
18	Canada	5.11	20	5.29	23	4.78	9	5.24
19	Iceland	5.10	9	5.83	15	5.11	42	4.35
20	Austria	5.07	17	5.37	11	5.39	39	4.43
21	France	5.06	21	5.27	17	5.07	18	4.86
22	New Zealand	5.04	19	5.34	24	4.73	14	5.04
23	Belgium	4.91	23	5.15	19	5.03	34	4.56
24	Estonia	4.80	22	5.17	28	4.35	16	4.89
25	Qatar	4.79	26	5.07	26	4.54	22	4.78
26	Bahrain	4.77	30	4.78	39	3.94	4	5.59
27	Malta	4.69	27	4.94	35	3.98	11	5.16
28	Ireland	4.66	25	5.08	25	4.66	47	4.26
29	Malaysia	4.60	47	4.01	27	4.43	6	5.35
30	United Arab Emirates	4.52	31	4.77	30	4.20	32	4.59
31	Portugal	4.47	35	4.67	36	3.98	23	4.75
32	Spain	4.34	34	4.70	40	3.89	40	4.43
33	Saudi Arabia	4.33	44	4.08	31	4.20	25	4.70
34	Barbados	4.30	24	5.08	41	3.88	61	3.94
35	Lithuania	4.28	32	4.76	38	3.94	49	4.13
36	Puerto Rico	4.26	53	3.86	21	4.84	54	4.07
37	Slovenia	4.24	33	4.76	32	4.15	69	3.81
38	Czech Republic	4.15	38	4.57	29	4.20	77	3.69
39	Chile	4.12	55	3.80	42	3.88	26	4.69
40	Oman	4.12	51	3.90	46	3.82	29	4.65
41	Brunei Darussalam	4.10	39	4.57	61	3.61	50	4.12
42	Hungary	4.06	41	4.53	54	3.70	60	3.95
43	Uruguay	4.01	48	3.98	64	3.55	36	4.49
44	Latvia	3.98	42	4.51	52	3.73	76	3.70
45	Italy	3.95	29	4.79	45	3.82	113	3.24
46	Cyprus	3.91	45	4.06	50	3.74	62	3.94
47	Croatia	3.90	36	4.58	79	3.48	82	3.64
48	Slovak Republic	3.89	37	4.58	55	3.67	100	3.42
49	Poland	3.88	40	4.55	58	3.65	99	3.43
50	Montenegro	3.84	50	3.91	70	3.51	53	4.09
51	China	3.82	82	2.92	37	3.97	33	4.58
52	Trinidad and Tobago	3.79	43	4.26	81	3.46	81	3.65
53	Tunisia	3.78	78	2.95	51	3.74	27	4.67
54	Brazil	3.78	66	3.34	33	4.04	59	3.97
55	Jordan	3.77	67	3.31	69	3.52	37	4.48
56	Panama	3.76	64	3.42	48	3.79	55	4.07
57	Azerbaijan	3.73	70	3.25	72	3.51	38	4.44
58	Colombia	3.72	76	2.99	71	3.51	28	4.65
59	Turkey	3.69	62	3.45	57	3.65	58	3.98
60	Russian Federation	3.69	52	3.90	83	3.43	71	3.73
61	Macedonia, FYR	3.68	46	4.03	113	3.12	63	3.90
62	Albania	3.66	59	3.58	74	3.51	64	3.90
63	Costa Rica	3.64	65	3.34	43	3.86	74	3.72
64	Mauritius	3.61	73	3.15	62	3.60	52	4.10
65	Kazakhstan	3.61	74	3.09	93	3.34	41	4.39
66	Greece	3.55	49	3.96	97	3.30	102	3.39
67	Kuwait	3.55	60	3.55	80	3.47	84	3.63
68	Bulgaria	3.54	56	3.79	101	3.23	87	3.60
69	Vietnam	3.52	80	2.94	78	3.48	48	4.14
70	Romania	3.50	54	3.80	91	3.34	105	3.36
71	Sri Lanka	3.47	107	2.24	44	3.84	43	4.32
72	Mexico	3.45	77	2.98	75	3.50	66	3.87
73	Morocco	3.44	69	3.25	92	3.34	70	3.75
74	Egypt	3.42	79	2.95	103	3.23	51	4.10
75	Mongolia	3.40	101	2.46	84	3.43	44	4.32
76	South Africa	3.38	96	2.57	34	4.01	89	3.55
77	Argentina	3.38	58	3.59	86	3.42	119	3.12
78	India	3.36	117	2.01	47	3.81	46	4.26
79	Jamaica	3.36	84	2.87	67	3.53	78	3.68
80	Cape Verde	3.35	94	2.61	110	3.16	45	4.29
81	Peru	3.34	85	2.87	85	3.43	73	3.72
82	Dominican Republic	3.33	87	2.78	95	3.33	65	3.88
83	Thailand	3.32	90	2.73	60	3.63	86	3.61
84	Ukraine	3.31	72	3.16	76	3.49	111	3.28
85	Indonesia	3.28	103	2.39	49	3.76	75	3.70
86	Philippines	3.28	95	2.61	63	3.58	79	3.66
87	Rwanda	3.28	133	1.69	66	3.53	31	4.61
88	Senegal	3.24	115	2.11	59	3.64	57	3.98
89	Armenia	3.24	75	3.04	104	3.21	95	3.47
90	Moldova	3.24	71	3.20	120	3.04	94	3.48
91	Kenya	3.23	109	2.19	56	3.65	67	3.87
92	Guyana	3.22	97	2.55	82	3.46	80	3.66
93	Serbia	3.22	57	3.68	133	2.79	115	3.20
94	Georgia	3.21	83	2.92	109	3.17	90	3.53
95	Gambia, The	3.19	110	2.17	65	3.54	68	3.85
96	Botswana	3.17	102	2.41	87	3.39	72	3.72
97	Ecuador	3.16	86	2.80	100	3.24	96	3.45
98	Honduras	3.16	93	2.63	73	3.51	107	3.33
99	Bosnia and Herzegovina	3.14	61	3.46	126	2.96	123	3.01
100	El Salvador	3.14	88	2.74	88	3.39	110	3.28
101	Guatemala	3.13	91	2.65	53	3.73	121	3.02
102	Suriname	3.11	63	3.45	102	3.23	133	2.66
103	Venezuela	3.05	81	2.94	117	3.09	117	3.13
104	Iran, Islamic Rep.	3.05	92	2.63	121	3.00	92	3.51
105	Lebanon	3.02	68	3.25	94	3.33	138	2.47
106	Namibia	3.01	111	2.16	68	3.53	108	3.33
107	Pakistan	3.00	104	2.32	96	3.30	103	3.39
108	Bangladesh	2.98	125	1.84	118	3.05	56	4.06
109	Nigeria	2.98	105	2.32	77	3.49	116	3.13
110	Côte d'Ivoire	2.92	113	2.12	105	3.20	97	3.44
111	Cambodia	2.92	126	1.82	89	3.37	88	3.57
112	Benin	2.89	112	2.12	106	3.18	104	3.37
113	Zambia	2.88	123	1.88	90	3.36	101	3.39
114	Ghana	2.86	116	2.01	99	3.25	109	3.32
115	Tajikistan	2.81	119	1.94	111	3.14	106	3.34
116	Syria	2.79	98	2.50	129	2.87	127	2.98
117	Uganda	2.78	135	1.67	108	3.17	93	3.50
118	Mali	2.77	129	1.72	124	2.97	83	3.63
119	Paraguay	2.77	100	2.50	116	3.09	131	2.72
120	Bolivia	2.75	108	2.22	123	2.98	120	3.05
121	Mozambique	2.73	138	1.58	115	3.09	91	3.51
122	Kyrgyz Republic	2.68	106	2.28	134	2.77	126	2.99
123	Belize	2.68	99	2.50	119	3.05	137	2.49
124	Tanzania	2.67	131	1.70	114	3.11	114	3.21
125	Zimbabwe	2.67	122	1.90	112	3.12	125	2.99
126	Cameroon	2.66	134	1.68	107	3.18	118	3.12
127	Algeria	2.66	89	2.74	140	2.60	135	2.64
128	Burkina Faso	2.62	139	1.56	131	2.86	98	3.43
129	Malawi	2.62	137	1.59	98	3.25	124	3.01
130	Angola	2.58	127	1.81	137	2.67	112	3.27
131	Timor-Leste	2.58	120	1.94	132	2.79	122	3.02
132	Nicaragua	2.57	118	2.01	122	3.00	132	2.70
133	Ethiopia	2.55	142	1.33	136	2.71	85	3.62
134	Lesotho	2.54	130	1.71	125	2.97	129	2.93
135	Nepal	2.48	136	1.62	130	2.86	128	2.95
136	Madagascar	2.46	132	1.69	128	2.91	130	2.78
137	Swaziland	2.41	114	2.11	127	2.91	140	2.21
138	Mauritania	2.35	124	1.84	141	2.57	136	2.63
139	Haiti	2.25	121	1.94	135	2.71	141	2.11
140	Chad	2.22	141	1.37	138	2.61	134	2.66
141	Yemen	2.16	128	1.80	139	2.61	142	2.07
142	Burundi	2.05	140	1.42	142	2.45	139	2.28

Table 5: Impact subindex and pillars

IMPACT SUBINDEX			Economic impacts		Social impacts	
Rank	Country/Economy	Score	Rank	Score	Rank	Score
1	Singapore	6.03	2	6.14	3	5.91
2	Sweden	5.90	1	6.15	6	5.64
3	Taiwan, China	5.78	7	5.61	2	5.95
4	Korea, Rep.	5.76	12	5.31	1	6.21
5	Netherlands	5.64	4	5.89	13	5.40
6	Denmark	5.53	8	5.48	7	5.58
7	Finland	5.50	5	5.84	18	5.17
8	United States	5.42	9	5.47	14	5.38
9	Switzerland	5.42	3	5.92	25	4.92
10	Hong Kong SAR	5.37	16	5.05	5	5.69
11	United Kingdom	5.35	14	5.18	9	5.52
12	Israel	5.29	6	5.70	28	4.88
13	Norway	5.28	11	5.33	17	5.24
14	Canada	5.23	17	5.02	11	5.45
15	Estonia	5.21	21	4.65	4	5.77
16	Australia	5.16	20	4.75	8	5.57
17	Japan	5.13	10	5.37	26	4.90
18	Germany	5.10	13	5.31	27	4.89
19	France	5.03	15	5.08	23	4.98
20	Austria	5.02	19	4.76	16	5.29
21	New Zealand	4.98	25	4.50	10	5.45
22	Belgium	4.86	22	4.65	20	5.08
23	Iceland	4.67	23	4.58	32	4.77
24	Malaysia	4.64	31	3.97	15	5.31
25	Malta	4.61	28	4.11	19	5.12
26	Ireland	4.58	18	4.82	41	4.34
27	Lithuania	4.52	30	4.07	24	4.96
28	Luxembourg	4.50	27	4.28	34	4.72
29	Puerto Rico	4.45	24	4.50	39	4.40
30	Bahrain	4.44	54	3.44	12	5.44
31	Spain	4.44	33	3.86	22	5.02
32	Qatar	4.43	34	3.81	21	5.05
33	United Arab Emirates	4.42	29	4.09	33	4.76
34	Slovenia	4.32	32	3.87	31	4.77
35	Portugal	4.30	37	3.74	29	4.87
36	Barbados	4.26	26	4.32	44	4.20
37	Chile	4.21	35	3.78	36	4.63
38	Cyprus	4.11	43	3.59	37	4.63
39	Uruguay	4.08	47	3.51	35	4.65
40	Saudi Arabia	4.01	40	3.64	40	4.37
41	China	3.96	79	3.15	30	4.77
42	Oman	3.92	55	3.44	38	4.41
43	Czech Republic	3.91	38	3.71	48	4.10
44	Tunisia	3.90	51	3.46	42	4.33
45	Hungary	3.87	44	3.56	45	4.18
46	Latvia	3.83	42	3.62	53	4.04
47	Montenegro	3.80	39	3.70	57	3.91
48	Colombia	3.76	58	3.36	47	4.15
49	Kazakhstan	3.73	80	3.15	43	4.31
50	Brunei Darussalam	3.73	64	3.28	46	4.18
51	Croatia	3.71	61	3.33	50	4.09
52	India	3.70	41	3.64	65	3.76
53	Brazil	3.70	52	3.46	54	3.93
54	Italy	3.68	36	3.74	74	3.62
55	Turkey	3.67	67	3.27	52	4.07
56	Rwanda	3.67	50	3.49	60	3.85
57	Jordan	3.66	70	3.23	49	4.10
58	Costa Rica	3.66	45	3.55	63	3.77
59	Kenya	3.59	56	3.41	64	3.77
60	Bulgaria	3.59	69	3.26	55	3.92
61	Panama	3.58	65	3.28	59	3.88
62	Mongolia	3.56	84	3.04	51	4.09
63	Slovak Republic	3.56	49	3.50	72	3.62
64	Senegal	3.56	46	3.53	79	3.58
65	Mexico	3.56	71	3.22	58	3.89
66	Poland	3.53	57	3.37	68	3.69
67	Guatemala	3.52	48	3.51	81	3.54
68	Cape Verde	3.50	74	3.20	62	3.79
69	Sri Lanka	3.49	63	3.30	70	3.68
70	Azerbaijan	3.48	68	3.27	67	3.70
71	Macedonia, FYR	3.45	87	2.99	56	3.91
72	Albania	3.44	75	3.18	69	3.69
73	Russian Federation	3.43	53	3.45	89	3.41
74	Egypt	3.43	62	3.33	83	3.52
75	Ukraine	3.42	66	3.28	80	3.56
76	Peru	3.41	72	3.22	75	3.61
77	Greece	3.40	73	3.21	77	3.59
78	Gambia, The	3.37	78	3.16	78	3.58
79	Vietnam	3.33	102	2.85	61	3.81
80	Dominican Republic	3.33	76	3.16	86	3.50
81	South Africa	3.32	59	3.36	98	3.29
82	Jamaica	3.32	81	3.13	84	3.51
83	Mauritius	3.29	83	3.06	82	3.53
84	Philippines	3.29	77	3.16	88	3.42
85	Thailand	3.28	96	2.93	71	3.64
86	Indonesia	3.28	106	2.84	66	3.72
87	Georgia	3.26	100	2.91	73	3.62
88	Nigeria	3.25	60	3.33	102	3.16
89	Moldova	3.21	91	2.98	87	3.44
90	Romania	3.21	98	2.92	85	3.50
91	Trinidad and Tobago	3.20	89	2.99	90	3.41
92	Mali	3.18	86	3.01	94	3.35
93	Kuwait	3.17	110	2.73	76	3.60
94	Pakistan	3.12	94	2.95	99	3.29
95	Ecuador	3.12	97	2.92	95	3.31
96	Argentina	3.07	82	3.07	108	3.08
97	Honduras	3.07	85	3.01	104	3.12
98	Botswana	3.06	113	2.70	91	3.41
99	Armenia	3.05	90	2.98	106	3.11
100	Ghana	3.02	88	2.99	111	3.04
101	Guyana	3.00	114	2.69	96	3.30
102	El Salvador	2.99	93	2.96	113	3.03
103	Tajikistan	2.99	115	2.69	97	3.30
104	Lebanon	2.99	92	2.97	114	3.00
105	Bosnia and Herzegovina	2.97	111	2.73	101	3.21
106	Benin	2.97	101	2.88	110	3.05
107	Venezuela	2.97	95	2.94	115	2.99
108	Mozambique	2.95	104	2.84	109	3.06
109	Morocco	2.94	127	2.49	92	3.40
110	Cambodia	2.94	126	2.52	93	3.36
111	Serbia	2.94	108	2.76	105	3.11
112	Malawi	2.94	99	2.91	117	2.96
113	Iran, Islamic Rep.	2.93	107	2.76	107	3.10
114	Kyrgyz Republic	2.91	120	2.59	100	3.24
115	Uganda	2.86	121	2.59	103	3.12
116	Bolivia	2.85	117	2.65	112	3.04
117	Cameroon	2.84	105	2.84	124	2.84
118	Côte d'Ivoire	2.81	103	2.84	125	2.78
119	Namibia	2.81	116	2.68	118	2.93
120	Nicaragua	2.78	118	2.63	119	2.93
121	Zambia	2.77	122	2.58	116	2.96
122	Burkina Faso	2.74	109	2.75	127	2.72
123	Belize	2.72	123	2.56	122	2.88
124	Bangladesh	2.72	125	2.53	120	2.91
125	Ethiopia	2.66	128	2.43	121	2.89
126	Paraguay	2.62	112	2.72	131	2.52
127	Tanzania	2.57	133	2.30	123	2.84
128	Nepal	2.54	132	2.33	126	2.75
129	Madagascar	2.47	134	2.29	128	2.66
130	Zimbabwe	2.44	124	2.55	137	2.34
131	Suriname	2.44	119	2.59	138	2.29
132	Syria	2.43	136	2.26	129	2.61
133	Timor-Leste	2.43	131	2.36	132	2.49
134	Mauritania	2.40	137	2.25	130	2.55
135	Chad	2.37	130	2.38	136	2.37
136	Lesotho	2.27	139	2.11	134	2.44
137	Angola	2.26	135	2.26	139	2.26
138	Haiti	2.25	129	2.42	140	2.08
139	Swaziland	2.24	142	2.01	133	2.47
140	Algeria	2.24	140	2.10	135	2.37
141	Burundi	2.07	138	2.19	141	1.95
142	Yemen	1.93	141	2.08	142	1.77

NRI, namely infrastructure and digital content, individual usage, business usage, and economic impacts; and in the remaining six pillars, it ranks no lower than 12th. Sweden has in place a virtuous circle. A conducive environment, combined with the highest degree of readiness and widespread use of ubiquitous technologies, maximize the economic and social impacts of ICT, create new business opportunities, foster innovation, and contribute to reinforce a knowledge-based economy. In this near-perfect assessment, only a handful of indicators call for attention: the typical corporate tax rate is fairly high at 53 percent of profits (114th), and two indicators reveal the length of certain administrative procedures, contrasting with the otherwise extremely efficient institutional framework. In addition, the government could certainly improve its online presence and its degree of interaction with the population, on which two measures Sweden earns a middling 0.53 and 0.49, respectively, on a 0-to-1 scale.

Second to Sweden, **Singapore** leads the group of the Asian Tigers, ahead of Taiwan, China (11th), Korea, Rep. (12th), and Hong Kong SAR (13th), which stand at the doorway of the top 10. Compared with Sweden, Singapore's performance is nearly as impressive. The city state leads the political and regulatory environment pillar and the business and innovation environment pillar, and is among the top 10 of five more pillars. It tops the impact subindex thanks to the 2nd and 3rd rank earned in the economic impacts pillar and social impacts pillar, respectively.

Third overall and second among the Nordics, **Finland** posts a strong performance across all pillars, earning the top spot in the skills pillar, placing in the top 10 of six others, and ranking no lower than 17th in the remaining three. The country's level of readiness is first rate, thanks to its world-class educational system, relatively inexpensive technologies, and excellent infrastructure. As a result, ICT is ubiquitous and uptake by the population is quasi universal. Over 80 percent of households own a PC (16th) and are connected to the Internet (13th). A staggering 87 percent (7th highest rate) of individuals are regular Internet users and mobile broadband Internet is already widespread, with 61 such subscriptions per 100 population. A conducive environment, a skilled population, and pervasive technology all contribute to making Finland one of the most prolific innovators in the world, ranking 3rd for the number of patent applications per capita. In this context, one would almost be concerned by the government's limited success in promoting (20th) and using ICT to engage with the population (30th).

As for the two Nordics preceding it, **Denmark**'s state of networked readiness is astounding (4th). The country ranks in the top 10 of six pillars and no lower than 18th in the remaining four. The environment is particularly conducive, be it the institutional and regulatory framework (6th) or the business context (7th). Individual and business usage is widespread. Denmark posts some of the world's highest per capita figures in terms of Internet users, fixed and mobile broadband Internet subscribers, and PCs. The use of virtual social networks is pervasive, as reflected in Denmark's score (6.6 out of 7) and rank (2nd, behind Iceland) in the associated indicator.

Switzerland rounds up the top 5. The country features in the top 10 of six pillars, and comes in at 4th place in the skills pillar. Boosted by the high degree of readiness and a propitious environment, the country boasts very high usage rates. It ranks 6th on the individual usage pillar, owing to very high penetration rates of mobile telephony, computers, Internet, and broadband Internet. Furthermore, it places 2nd in the business usage pillar, behind Sweden. ICT is having a very significant impact on the economy (3rd), leading to new services, products, and business models and fostering innovation. Its impact on society seems to be less marked (25th). This relates to the weakest aspect of Switzerland's performance, namely the modest engagement of its government in promoting and using ICT (35th). The country's performance is also affected by the costliness of ICT (48th) even when adjusting for purchasing power differentials.

The **Netherlands** (6th) delivers a strong performance. The affordability pillar represents the only real weakness in its assessment (47th). The country earns excellent marks in terms of ICT usage (9th). In particular, the Netherlands boasts the world's highest broadband Internet penetration rate with 40 subscriptions per 100 population, the second-highest percentage of computer ownership (92 percent of households), and third-highest percentage of individuals using the Internet (90.1 percent). The country's best rank is achieved in the economic impacts pillar (4th), thanks to the high share of knowledge-intensive jobs in the economy—almost 50 percent, the third highest in the world—and the country's knack for innovation, as reflected in the fifth-highest ratio of ICT-related patent applications per capita.

At 7th place, **Norway** does very well across the board. Yet its average performance in the skills pillar contrasts with that of the other Nordics, which all excel in this dimension, starting with Finland (1st). This turns out to be Norway's weakest performance among the 10 pillars (34th), owing to the relatively low assessment of its educational system. For the rest, the picture is mostly bright. Highlights include 3rd rank in the individual usage pillar. In particular, some 90 percent of households are equipped with a computer and have access to the Internet. Overall, 93 percent of the population use the Internet on a regular basis (the second-highest percentage after Iceland).

At 8th place overall, the **United States** delivers a strong performance. It features in the top 10 of six pillars,

yet fails to make the top 3 of any. Almost all dimensions of the NRI offer room for improvement. The country boasts an environment that is generally conducive for successfully leveraging ICT. Yet the political and regulatory framework (21st) presents some impediments, including the poor functioning of the law-making institutions and regulation that remains burdensome in several aspects. The business and innovation environment is more propitious (9th). In terms of readiness, the country can rely on a very good (6th) and affordable (10th) ICT infrastructure. In order to further boost readiness, efforts are needed to upgrade the skill set of its population (32nd). In terms of individual usage, the United States fails to play a leading role (18th) as usage, though high, is not as widespread as in several other countries, most noticeably the Nordics. For instance, whereas Sweden posts penetration rates of around 90 percent for Internet and PC ownership, the United States' rates do not exceed 75 percent. The picture in terms of business usage is brighter, thanks to the country's innovation capacity. However, once the champion of innovation, challenged only by Japan, for the past two decades the United States has been witnessing several Asian Tigers, the Nordics, Switzerland, and Israel emerging as innovation powerhouses. Indeed, when taking into account their size, some of these economies are actually more prolific than the United States as measured by the number of patent applications per population.

Canada ranks 9th overall, earning its best marks in the environment (8th) and readiness (4th) subindexes of the NRI, while lagging behind the best-performing countries in the usage (18th) and impacts (14th) subindexes. In particular, the country ranks 3rd for the quality of its infrastructure and accessibility of digital content, 5th in the business and innovation environment pillar, and 5th in the skills pillar. Despite their proximity in the NRI rankings—with a score difference of only 0.05—Canada and the United States present some disparities when considering the different subindexes. Whereas Canada offers a more conducive environment than the United States, it trails the latter in terms of business usage as well as economic impacts—one of the chief reasons for this is the superior innovation capacity of the United States.

Rounding up the top 10, the **United Kingdom** delivers a consistent, yet perfectible, performance in the NRI. The country obtains its best marks in the usage and impact subindexes. ICT is pervasive among the population at large and in the government. Yet in all these categories, the United Kingdom does not play a leading role as it is systematically outperformed by the Nordics, the Asian Tigers, or both. Finally, its business and innovation environment (20th) would benefit from reforms to further encourage entrepreneurship.

EUROPE AND THE COMMONWEALTH OF INDEPENDENT STATES (CIS)

Overall, Europe remains at the forefront of the efforts to leverage ICT to transform its economy and society. As previously presented, seven European countries are positioned in the top 10 of the NRI rankings, with the Nordic countries, including Sweden at the very top, leading the way. Notwithstanding this overall strength of Europe as a whole, there are important disparities within the region. Four broadly defined groups of countries sharing different ICT development paths and facing different challenges to further leverage ICT can be identified: the Nordic countries, advanced economies of Western Europe, Southern Europe, and Central and Eastern Europe.

As presented in the section above, the **Nordic countries,** together with Singapore, are the most successful in the world in leveraging ICT. They have fully integrated ICT in their competitiveness strategies to boost innovation, and ICT is present everywhere and in all areas of society, such as education and healthcare. The constant efforts to upgrade ICT infrastructure, coupled with world-class educational systems that specifically focus on developing ICT-related competencies, have resulted in very high rates of penetration. Moreover, the development of business-friendly environments and strong and well-rounded innovation systems conclude the virtuous circle that has led to an emergence of global players in high-tech and innovative products that have transformed these economies.

In **Western Europe,** besides Switzerland (5th), the Netherlands (6th), and the United Kingdom (10th), five other advanced economies attain high positions, ranging from 16th to 23rd place. Overall, these countries exhibit fairly well developed conditions for ICT, although not to the extent of the Nordic countries.

Germany, at 16th position, manages to achieve fairly good economic impacts (13th) thanks to its high level of ICT-related innovations and a robust innovation system led by the business community (6th). The country's well-developed ICT infrastructure (14th) and its high-quality educational system (17th), which provides the vast majority of the population with the required skills to effectively use ICT (20th), result in high levels of ICT usage by individuals (14th). Notwithstanding these clear strengths, further improvements could be achieved by rendering access to ICT, especially fixed broadband, more affordable (38th); also the government should recognize further the importance of ICT for the future economic and social development of the country (47th), in line with the Nordic experiences.

With a very similar profile, **Austria** is in 19th position in our rankings. Its very good ICT infrastructure development (12th), including access to digital content (4th) and the fact that virtually the entire population has the basic skills to utilize and access ICT (24th), result in very good

penetration rates by individuals (17th) and the business community (11th). Moreover, the successful integration of ICT in a well-performing innovation system results in positive economic impacts (19th) in terms of innovation and focus on knowledge-intensive activities. On a less positive note, the high tax rate (115th) and the cumbersome procedures to open new businesses (97th) can affect the spirit of entrepreneurship and hinder seizing new ICT-based business opportunities.

Luxembourg and **Belgium,** while placed very close to each other at 21st and 22nd place, respectively, present slightly different pictures in terms of ICT development. Although both countries benefit from a fairly well developed ICT infrastructure that facilitates a good uptake by individuals and businesses, Belgium benefits from a better-performing and more robust innovation and educational system that allows the country to obtain better economic impacts thanks to higher innovation rates. On the other hand, Luxembourg counts on more affordable access to ICT and a more entrepreneurial-prone environment with lower taxes.

France, in 23rd position, achieves a harmonious uptake of ICT by all agents in society, producing good economic results (15th) in terms of developing innovative products and services (6th) and granting a wide access to basic services (18th). Despite the high cost of mobile cellular rates (121st), ICT infrastructure is fairly well developed and the educational system has allowed the population to acquire a skill base to use ICT. In order to further boost entrepreneurship and innovation via the creation and development of new technology-based companies, the high corporate tax rate (127th) and the insufficient development of venture capital (36th) are areas that may require further attention.

All four of the **European Union's Southern countries**—Portugal, Spain, Italy, and Greece—are still lagging behind in terms of ICT uptake and impacts vis-á-vis the rest of the Western European economies. In general, despite acceptable levels of ICT infrastructure development, the traditional lag in poorly performing educational and innovation systems does not allow these countries to benefit to the same extent from the potential economic impacts accruing from ICT.

Portugal and **Spain,** in 33rd and 38th position, respectively, benefit from a fairly well developed ICT infrastructure as reflected by the international Internet bandwidth values, where Portugal ranks 7th and Spain 24th. However, the cost of accessing this infrastructure, especially in the case of Spain (90th), is still high and therefore the uptake rates by individuals and businesses in both countries still lag behind those of more advanced economies. Moreover, the poor quality of the educational system (76th and 98th, respectively) and the traditional lag in research and development and other related innovation investments—especially at the corporate level—do not allow these countries to fully leverage ICT and obtain the positive economic impacts of other advanced economies in the European Union.

Italy, in 48th position, presents a profile similar to those of Portugal and Spain, with a couple of singular characteristics that have relegated the country to this lower position. In addition to the underperformance of the educational and innovation systems, the first particular feature of the Italian case is the weak functioning of the political and regulatory environment (85th), which hinders the overall functioning of the economy. The second singular characteristic is that the government is clearly lagging behind in the effort to leverage ICT to boost competitiveness (113th). Addressing these weaknesses should be a priority not only to leverage the use of ICT, but to boost competitiveness more broadly.

Greece, at 59th place, depicts important weaknesses that hinder its capacity to take full advantage of its fairly good ICT infrastructure (42nd). Despite a good ICT penetration at the individual level (49th), both businesses (97th) and the government (102nd) have failed to recognize and fully integrate ICT in their activities. Moreover, in addition to the traditional severe lag in innovation, the convulsive political and regulatory environment (87th) is contributing to the country's inability to fully benefit from ICT, both economically (73rd) and socially (77th).

Central and Eastern Europe presents a mixed picture in terms of ICT development and uptake. While some large countries in Central Europe share similar characteristics, other countries are confronted with specific challenges that influence their capacity to take more or less advantage of the potential of ICT.

In the Baltic states, **Estonia,** in 24th place, following the example of the Nordic countries, has widely recognized the role that ICT can play to transform its economy and society. In general, a good ICT infrastructure development coupled with fairly well performing educational systems has resulted in good uptake rates by all agents in the region, especially in Estonia and to a lesser extent in **Latvia.** The government vision to develop the sector and spread its effects to all areas of the economy has been significantly important in Estonia (18th), while this has lagged behind a bit in both **Lithuania** (71st) and Latvia (103rd). As a result, Estonia is benefiting from important ICT-related impacts both in the economy and society (15th), while Lithuania (27th) and Latvia (46th) are not yet at that level.

Slovenia (37th) and **Croatia** (45th) have both managed to develop a fairly good ICT infrastructure that, coupled with high rates of adult literacy and secondary education enrollment, allows for important penetration rates (37th and 47th, respectively). Improving the quality of the educational system and strengthening the overall innovation system so that ICT investments can be fully integrated and yield better economic results remain an outstanding challenge, especially for Croatia. In contrast

with this rather good outlook, **Bosnia and Herzegovina** and **Serbia** are relegated to 84th and 85th position, respectively, in our rankings. These scores are the result not so much of the level of infrastructure development or the skill base of their populations, but of the actual ICT uptake, especially by the business community (126th and 133th, respectively) and the government (123rd and 115th, respectively). In addition, serious weaknesses in their innovation systems, which need to be restructured and expanded, hinder their capacity to leverage ICT for deeper economic and social impacts.

In Central Europe, the **Czech Republic, Hungary, Poland,** the **Slovak Republic,** and to a lesser extent **Romania** and **Bulgaria**—in 42nd, 43rd, 49th 64th, 67th, and 70th place, respectively—manage to develop their ICT infrastructures fairly well, although the high costs of accessing it, especially in the Czech Republic (93rd) and the Slovak Republic (104th), affects the actual uptake capacity of large shares of the population. The ICT development in these countries has been favored by their integration into the European Union and the positive actions carried out under the Digital Agenda initiative of the European Commission. However, their governments seem to lag behind in recognizing the importance of ICT and drawing a clear vision and development plan (ranking 106th, 95th, 116th, 107th, 117th, and 101st, respectively, on this indicator) for its expansion. Moreover, with the exception of the Czech Republic, important weaknesses in the overall innovation system, especially at the corporate level, hinder full leverage of ICT and therefore the economic transformation of these economies toward more knowledge-intensive activities. Finally, in the cases of Romania and Bulgaria, the overall political and regulatory environment (95th and 99th) also affects the development of privately led economic activity in general, and the birth and growth capacity of any innovation-related business in particular.

Turkey, in 52nd position, does not manage to enter into the top 50 economies that are best leveraging ICT to boost competitiveness and well-being. The population's insufficient level of skills (92nd), caused by its relatively low levels of secondary education enrollment (93rd) and the poor quality of the educational system (94th), hinder an effective ICT use of all the agents in the economy (59th). In order to further benefit from the positive impacts of ICT and move its economy toward more knowledge-intensive activities, an overall strengthening of the educational and innovation systems, with more and more efficient investments, will be crucial. These investments cannot be the exclusive responsibility of the government; the business community will have to contribute as well by fully recognizing the business opportunities that they can offer and how these affect their capacity to compete in an increasingly globalized market.

Kazakhstan, the **Russian Federation,** and **Azerbaijan** are the best performers among the CIS countries, at 55th, 56th, and 61st position, respectively. All three countries count on affordable access to ICT infrastructure, although the development of this infrastructure is superior in the case of the Russian Federation (40th, compared with 71st and 72nd for Kazakhstan and Azerbaijan). However, the vision and commitment of the government to boost ICT as a driver of economic growth is lower in Russia, and in all three cases the innovation system, which underwent deep restructuring after the collapse of Communism, has not yet been fully reorganized or redeveloped. The Russian Federation still maintains pockets of scientific excellence, but unfortunately they do not seem to spill over into the productive sector. This, coupled with a weak political and regulatory environment (92nd, 102th, and 75th for Kazakhstan, Russia, and Azerbaijan, respectively) and a somewhat entrepreneurship- and innovation-averse environment (71st, 83rd, and 80th, respectively) affect the capacity of all three countries to reap the full economic benefits associated with higher rates of technology development (80th, 53rd, and 68th, respectively). Moving forward, in addition to continuing to upgrade and develop their ICT infrastructure, all three countries should improve the quality of their educational systems and build effective innovation systems with the active participation of the private sector. Improvements in these three areas should go hand in hand with more and stronger economic impacts associated with higher rates of innovation and the development of more knowledge-intensive activities.

Despite benefiting from a relatively skillful population (39th), a considerable development of the innovation capacity of its firms (42nd), and one of the lowest access tariffs for ICT (2nd), **Ukraine** places only at 75th position. Its ICT infrastructure needs to be further developed. Moreover, the lack of a strong government vision to develop ICT coupled with unfavorable innovation conditions (98th) and weak legal foundations for economic activity (125th) are jeopardizing the country's great potential to benefit from stronger social and economic impacts (75th). Improvements in the framework conditions will be a prerequisite for the country to boost the economic benefits accruing from deeper levels of technological progress.

Georgia, Armenia, and especially **Tajikistan** and the **Kyrgyz Republic,** in 88th, 94th, 114th, and 115th position, respectively, close the regional rankings. Weaknesses in the development of ICT infrastructure, especially for the two Central Asian republics, coupled with the high costs of accessing it, result in a poor technology uptake by all agents. Unlike the cases of mineral-rich Kazakhstan and Azerbaijan, governments in these countries have not yet led the process of fully deploying ICT; this results in inevitable lower economic and social impacts.

ASIA AND THE PACIFIC

Asia and the Pacific region is home to some of the world's wealthiest, most innovative, and most digitized nations in the world and also to some of its poorest, least-connected countries.

The second of the Tigers, **Taiwan, China** comes in at 11th place overall. ICT has been at the core of the island's economic success since the early 1980s when it started moving up quickly the value chain, away from agriculture and low-end manufacturing, to become a major manufacturer of electronics and high-tech products and later an innovation hub. The government has been instrumental in this transformation. In the NRI, Taiwan, China ranks 3rd in the government usage pillar, 7th in the economic impacts pillar, and 2nd in the social impacts pillar. Yet, unlike Singapore and Hong Kong SAR, which feature prominently in this category, Taiwan, China suffers from weaknesses in its political and regulatory framework (37th). By contrast, its business and innovation environment are very favorable (6th).

For the **Republic of Korea** (12th), the regulatory framework also represents the main area of concern (43rd). The third-ranked Tiger earns low marks in areas related to the functioning of its public institutions. For the rest, the country's performance ranges from good to outstanding. It ranks 2nd to Sweden in terms of individual usage, with impressive penetration rates. In particular, Korea shows the way in terms of mobile broadband access, with close to 80 subscriptions per 100 inhabitants. At home, a staggering 97 percent of households have access to the Internet. Furthermore, Korea leads the government usage and social impacts pillars.

Hong Kong SAR (13th) delivers a consistent performance, although punctuated by fewer highlights than the other three Tigers. The territory appears in the top 10 of three pillars, ranking 3rd in the business and innovation environment pillar, and 5th in both the affordability pillar and the social impacts pillar. In addition, and unlike Korea and Taiwan, China, its economy is not innovation driven and relies more on trade and financial services. On the other hand, Hong Kong does not exhibit any major weaknesses in the NRI, its lowest pillar rank being a quite strong 28th in the infrastructure and digital content pillar. And when looking at individual indicators, one notices that Hong Kong has almost 200 mobile telephone subscriptions per 100 inhabitants, a world record. It also boasts the world's largest Internet bandwidth per user (780 kilobytes per second).

New Zealand (14th) offers one of the most conducive environments for the successful development and leveraging of ICT. Its public institutions are particularly well functioning and efficient (3rd). The country also boasts a high degree of readiness, thanks to the excellent skill base of the population (6th) and world-class infrastructure (9th). As for most advanced economies featuring high in the NRI, the affordability pillar is the only real weakness of New Zealand (63rd).

New Zealand's distant neighbor, **Australia,** ranks three notches behind at 17th position. Its institutional framework and business climate also offer a favorable context (12th in the environment subindex). The country's readiness would be excellent if not for its pricy ICT. Australia ranks 100th in the affordability pillar, at odds with its 7th rank in the infrastructure and digital content pillar and 11th in the skills pillar. The government's success at ICT promotion and usage is reflected in its good marks in the government usage (8th) and social impacts (8th) pillars.

One of the world most prominent innovation powerhouses, **Japan** ranks only 18th, owing to a number of important shortcomings in the environment subindex of the NRI, including red tape. The biggest competitive advantage of Japan is, without contest, its innovative and sophisticated business sector (3rd). Technology and innovation have greatly contributed to making Japan one of the most productive economies in the world. Beyond this economic impact, they have not had such a transformational impact on society at large (26th). A more supportive business environment and renewed commitment by the government to lead the digital revolution could usher in a new development model for Japan.

In 29th position, **Malaysia** is the top-ranked country from the Developing Asia region. Trying to emulate the success of Korea and other Asian Tigers, the Malaysian government has been pursuing a long-term plan with the ambition of achieving high-income status by the end of the decade, with ICT playing a critical role. Most government-related indicators reflect this commitment, and Malaysia ranks 6th in the government usage pillar—not too far behind three Asian Tigers. Businesses are quite aggressive at adopting technology and increasingly innovative. These government-led efforts seem to be starting to have a transformational impact on the economy (31st) and on society at large (15th). On a less positive note, Malaysia ranks an average 47th in the individual usage pillar.

More than 20 places separate Malaysia from **China,** the next-ranked Developing Asian country. At 51st, China leads the BRICS, the group of large emerging economies.[12] Yet this should offer little consolation in light of the important challenges ahead that must be met to more fully adopt and leverage ICT. China's institutional framework (46th) and especially its business environment (105th) present a number of shortcomings that stifle entrepreneurship and innovation, including excessive red tape and long administrative procedures, lofty taxation amounting to 64 percent of profits (124th), uncertain intellectual property protection—it is estimated that almost 80 percent of installed software in China is pirated—and limited or delayed availability of new technologies (100th). In terms of readiness, the country ranks a low 87th in the infrastructure and digital content pillar, mainly because of its underdeveloped Internet infrastructure. China gets

high marks in the cost measures (42nd, with a score of 5.7) and to some extent in the education-related variables, as reflected in the satisfactory score of 5.2 in the skills pillar. Looking at actual ICT usage, figures remain quite low in absolute terms but should be considered in light of the sheer size of the country. ICT usage by businesses is significant (37th). China is becoming more and more innovative and this in turn encourages further and quicker adoption of technologies. The government is placing great hopes in ICT as a catalyst for future growth, because more traditional sources of growth will dry up. The efforts of the government in promoting and using ICT are reflected in China's good showing in the government usage pillar (33rd). For the time being, the impact of ICT on the economy remains limited (79th in the economic impacts pillar).

Almost 20 ranks behind China, **India** at 69th place overall delivers a very mixed performance, with encouraging results in a few areas and a lot of room for improvement elsewhere, notably in the political and regulatory environment (71st) and the business and innovation environment (91st). Extensive red tape stands in the way of businesses and corporate tax is among the highest of all analyzed countries. For instance, it typically takes four years and 46 procedures to enforce a contract. Starting a business is longer and requires more paperwork than in most countries. Other variables in the environment subindex are better assessed, including the availability of new technologies (47th), the availability of venture capital (27th), the intensity of local competition (31st), and the quality of management schools (30th). One of the weakest aspects of India's performance lies in its low penetration of ICT. The country ranks 117th in the individual usage pillar. There are 61 mobile subscriptions for every100 population—a relatively low figure. A mere 7.5 percent of the population uses the Internet. Six percent of households own a PC and broadband Internet remains the privilege of a few, with less than one subscription per 100 population. Upgrading skills and infrastructure would contribute to increasing these figures. Already, fierce competition and innovations for the "bottom of the pyramid" have made India the leader in the affordability pillar, thus providing a significant boost to the country's readiness. Although penetration is still limited among the population at large, businesses are early and assiduous adopters of new technologies (47th). And the government is placing a great deal of emphasis on ICT as a way to address some of the country's most pressing issues, including job creation, corruption and red tape, and education. Whether this vision will translate into a transformation of the economy and society remains to be seen. But already ICT is having a—small—transformational impact on the economy, which is partly reflected in India's performance in the economic impacts pillar (41st).

Coming in at a low 77th rank, **Thailand** presents a number of shortcomings in all dimensions of the NRI. Thailand ranks in the top 50 of just one pillar, affordability (33rd), and as low as 107th in infrastructure and digital content. Indeed, there are only 2 indicators out of 53 in which the country ranks better than 50th: the number of procedures to start a business (28th) and mobile cellular tariffs (14th). ICT usage (83rd) remains scant by international standards. And, unlike other economies in the region, ICT development does not seem to be a priority for the government, witness Thailand's 86th rank on government usage.

Thailand is followed closely by three fellow Association of Southeast Asian Nation (ASEAN) members: **Indonesia** at 80th position, **Vietnam** at 83rd, and the **Philippines** at 86th. The performances of these four countries, which together are home to almost 500 million people, are remarkably similar across the different components of the Index, and disappointing, too. Some differences exist in the environment subindex and to some extent the readiness subindex. The environment is significantly more conducive in Thailand (59th) and Indonesia (72nd) than in Vietnam (96th) and the Philippines (111th). Using ICT is also much cheaper in Thailand and Indonesia. When it comes to ICT usage, all four countries display very limited uptake among the population, especially Indonesia (103rd) where the Internet, for instance, is used by less than 10 percent of the population. Businesses are generally prompter at adopting technology in Indonesia, but even then figures are low by international standards. As for the efforts of the respective governments in using and promoting ICT, they remain very timid, with the exception of Vietnam, which ranks 48th in government usage, while the others are found beyond the 70th mark. In light of the many shortcomings, the economic and social impacts of ICT in these countries are necessarily limited. No doubt these countries could learn from Singapore and Malaysia, two ASEAN members that have been very successful at leveraging ICT. This could be done in the context of the recently adopted ASEAN ICT Master Plan 2015.

LATIN AMERICA AND THE CARIBBEAN

Latin America and the Caribbean continues to suffer from an important lag in adopting ICT and technology more broadly. This is reflected in the rankings, as no country manages to reach the top 30 and only a handful of small economies manage to be included among the top 50—the exceptions are Barbados, Puerto Rico, Chile, and Uruguay. Although the region is vast and heterogeneous, three shared reasons for this lag can be identified: these countries all exhibit an insufficient investment in developing their ICT infrastructure, a weak skill base in the population because of poor educational systems that hinder society's capacity to make an effective use of these technologies, and unfavorable business

conditions that do not support the spur of entrepreneurship and innovation. Addressing these weaknesses will be crucial for improving the region's competitiveness and shifting its economies toward more knowledge-based activities.

Two small Caribbean islands top the regional rankings: **Barbados** in 35th place and **Puerto Rico** in 36th place. Both economies boast environments conducive for entrepreneurship and benefit from relatively robust ICT infrastructures, although mobile coverage in Puerto Rico (123rd) remains insufficient. In the case of Barbados, the strong skill base (10th) results in a large individual uptake of technology (24th) and offsets the high costs of using ICT (102nd). On the other hand, Puerto Rico needs to further develop the skills of its population (78th), which currently negatively affects the uptake of technology by individuals (53rd). In both cases, ICT development has been led mainly by the private sector, especially in the case of Puerto Rico (21st), as the governments in both islands have lagged behind in steering ICT progress (61st and 54th, respectively). Moving forward, Barbados would obtain higher economic impacts from its overall good ICT uptake should the private sector further improve its overall innovation capacity (91st). In the case of Puerto Rico, improvements in the performance of its educational system, especially in math- and science-related subjects (91st), would also allow a better integration of ICT in a more solid innovation system.

Chile, in 38th position, clearly depicts the strongest performance in Latin America. Benefiting from an entrepreneurial-friendly and well-functioning legal framework, recent efforts to improve the overall innovation system, while still insufficient, have paved the way for this top position within the region. Notwithstanding these important merits, the country still suffers from a series of weaknesses that do not allow it to benefit from the potential benefits of ICT and technology more broadly. Although its ICT infrastructure achieves good scores in certain dimensions, notably mobile network coverage (1st), the technological preparedness of the country is severely hindered by the excessive costs of accessing ICT (89th) and above all the poor quality of an educational system that requires improvement and that fails to provide the necessary skill base (83rd) to fully optimize the use of ICT. Therefore, despite the government-led effort to leverage ICT (26th) with one of the widest offerings of online services in the world (18th), the penetration rates in individual households (55th) still lags behind. In addition, the business community needs to invest in upgrading its capacity for innovation (62nd) in order to facilitate the achievement of further economic impacts and shift the national economy toward more knowledge-intensive, higher-value-added activities.

Close behind, **Uruguay,** at 44th place, is one of the leading countries in the region that has recognized the importance of ICT. This process has been led by the government (36th), which has made important efforts to build a good ICT infrastructure in the country (49th) and grant wide access to ICT to school pupils (11th) with its one computer per student policy. Despite these efforts, the technological readiness (63rd) of the country still needs improvement, especially in terms of raising the quality of the educational system that presently hinders the ability to seize the full benefits of the opportunities that ICT, and technology more broadly, can offer. Moreover, weaknesses in the innovation system, especially at the corporate level (65th), hamper the capacity of the country to move toward more knowledge-intensive activities (67th). Addressing these weaknesses would represent the next step to fully leveraging ICT deployment for competitiveness and social well-being.

Panama and **Costa Rica,** in 57th and 58th position, respectively, clearly stand out from the rest of the countries in Central America—a region that suffers overall from an important connectivity lag, a low skill base, and weaknesses in its business environment. Despite obtaining similar scores and levels of ICT usage (56th and 63rd, respectively), Panama and Costa Rica face different challenges to improving their level of preparedness to leverage ICT for competitiveness and well-being. In the case of Panama—while by regional standards the country benefits from a fairly good ICT infrastructure (55th), especially in terms of international Internet bandwidth (47th)—the very low skill base hinders its capacity to achieve higher ICT uptakes and stronger economic impacts (65th). Conversely, Costa Rica benefits from a strong skill base (26th) thanks to a well-performing educational system (23rd), but the country suffers from an ICT infrastructure lag (77th) that thwarts its ability to achieve higher ICT uptake rates. In both cases, improving their overall innovation systems would allow them to benefit further from the ICT efforts and contribute to shifting their economies toward more knowledge-intensive activities, especially in the case of Panama (84th).

Brazil, positioned narrowly above the middle range of our rankings at 65th place, benefits from strong levels of business ICT usage (33rd). These, combined with fairly advanced levels of technological capacity (31st) in particular segments of its industry, allows the country to achieve one of the strongest performances of ICT-enabled innovations in the region, both in terms of new products and services (29th) and more efficient processes (34th). Notwithstanding these strengths, its overall business environment with its burdensome procedures to create new businesses (138th) and its high tax rates (130th), in addition to its high mobile cellular tariffs (133rd) and poor skill availability (86th), hinder the potential of the Brazilian economy to fully benefit from ICT and shift toward more knowledge-based activities (76th) at a faster pace.

Colombia, at 73rd place, right below the median of our sample, presents a mixed picture in terms of ICT development and uptake. On the one hand, the government offers a large number of public services online (9th) and the information it provides through its websites encourages citizens' participation (26th). Moreover, Colombia benefits from a relatively skillful population (58th). On the other hand, the country still suffers from important challenges that hamper its capacity to leverage ICT to boost competitiveness and raise well-being. The lag in terms of ICT infrastructure and digital content (88th), coupled with unfavorable framework conditions for entrepreneurship and innovation (95th), result in a low ICT usage by businesses (71st). In addition, the uptake of ICT by individuals (76th) is still low, with less than 20 percent of the population accessing the Internet at home.

The lack of a holistic digital agenda, currently under debate, prevents **Mexico** from taking full advantage of ICT. At 76th position, the government of Mexico has made important efforts to increase the number of services online (38th) and boost the e-participation of citizens through useful, high-quality, and relevant websites (32nd) that provide information, thus enhancing public governance. However, the country still faces significant weaknesses. An insufficient development of ICT infrastructure (81st), especially in terms of international Internet bandwidth (87th), coupled with the high costs of telecommunications (100th) and poor educational standards (107th) negatively influence the effective and productive use of ICT by individuals (77th) and businesses (75th). Moreover, despite the recent improvements that facilitate entrepreneurship by reducing the number of procedures and time to open a business (42nd), the functioning of some public institutions and the development of a strong innovation system are still pending challenges to creating a conducive environment for higher ICT impacts (79th). Addressing these weaknesses in a holistic manner will determine the success of the country in benefitting from the opportunities that ICT has to offer.

Argentina, in 92nd position, benefits from a fairly well developed ICT infrastructure (58th), especially in terms of international Internet bandwidth (41st) and high levels of adult literacy (51st) that could pave the way to a high and effective ICT uptake by all members of society. However, while individuals reach acceptable usage rates (58th), businesses (86th) seem to lag behind, and the perception of the business community is that the government is not prioritizing the use of ICT sufficiently (134th). In order to further leverage ICT usage, reducing the high costs of accessing ICT (103rd) would be beneficial. In addition, addressing the enduring shortcomings in the political and regulatory environment (122nd) as well as in the framework conditions to boost entrepreneurship and innovation (113rd) would allow the country to increasingly shift its economy toward more knowledge-intensive, higher-value-added activities.

Despite the economic growth that **Peru** has experienced in the past year, at 106th place the country still lags significantly behind in terms of ICT. An insufficiently developed and expensive (141st) ICT infrastructure (86th) coupled with a low-quality educational system (128th) hinders the preparedness of Peru to make an effective use of ICT. As a result, the use of ICT by all three actors—individual, business, and government—is still low (81st), and despite relatively good framework conditions for entrepreneurship (56th), the potential economic impacts are not yet accruing.

Finally, **Venezuela** (107th), **Paraguay** (111th), **Bolivia** (127th), **Nicaragua** (131st), and, closing the rankings, **Haiti** (142nd) trail behind the rest of countries in the region. These countries continue to suffer from some worrisome connectivity weaknesses, both in terms of physical and human infrastructure, which—coupled with an innovation-adverse environment—result in poor leverage of ICT for boosting competitiveness and raising well-being.

SUB-SAHARAN AFRICA

The level of ICT readiness in sub-Saharan Africa is still very low, with most countries evidencing strong lags in connectivity because of an insufficient development of ICT infrastructure, which remains too costly. Low levels of skills that do not allow for an efficient use of the available technology add to the challenges these countries face if they are to increase ICT uptake. Moreover, most countries still suffer from poor framework conditions for business activity that, coupled with the above-explained weaknesses, result in poor economic impacts that hinder the much-needed transformation of the region toward less resource extraction–oriented activities and higher-value-added production. Nine out of the last 10 countries in our sample belong to the region and the results evidence the digital divide the region suffers vis-á-vis more developed regions.

Mauritius, in 53rd position, leads the regional classification and is the only economy in the top half of our rankings. By means of a process decisively led by the government that has identified ICT development as one of its three pillars for economic development,[13] the country has managed to create a fairly sophisticated enabling environment for ICT development (41st), with a stable political and regulatory framework (39th) and fairly good conditions for entrepreneurship and innovation (46th), although the rate of tertiary education enrollment is low (82nd). However, despite ICT infrastructure (73rd), which is still in need of improvement, becoming affordable (23rd), the level of uptake by businesses (62nd) and individuals (73rd) remains low. This, in turn, results in low economic (83rd) and social (82nd) impacts. Improving the overall skills (63rd) and the capacity to integrate ICT into a broader innovation system at the corporate level will be crucial for the country to benefit from the

transformational impacts of ICT and drive the national economy toward more value-added activities.

Despite counting on one of the most solid political and regulatory environments (23rd) and better framework conditions for entrepreneurship and innovation (50th) in the region, **South Africa,** at 72nd place, is not yet leveraging the potential benefits associated with ICT. Important shortcomings in terms of basic skills availability (94th) in large segments of the population and the high costs (94th) of accessing the insufficiently developed ICT infrastructure (82nd) result in poor rates of ICT usage (76th), despite efforts on the part of the business community to use ICT and integrate it in a broader, firm-based innovation system (34th). As a result, the economic impacts accruing from ICT are patchy (59th) and the social impacts disappointing (98th). Upgrading the overall skills at all layers of society and increasing efforts to build affordable infrastructure for all would allow the country to increase its ICT readiness and uptake and, in turn, spread its impacts across society.

Rwanda, in 82nd position, evidences important problems of connectivity associated with a poor deployment of an expensive (119th) ICT infrastructure (113th) and very low levels of basic skills (118th) that hinder the capacity of the population to make effective use of ICT. As a result, levels of ICT usage are very low, especially for individuals (133rd) and businesses (66th). Improving the ICT readiness of the country by developing the necessary infrastructure—which could be done through public-private partnerships—and enhancing the overall skills of the population would result in higher economic and social impacts, especially because the country counts on fairly favorable framework conditions, allowing these benefits to accrue.

Similar to Rwanda, **Kenya** and **Ghana,** in 93rd and 97th position, respectively, suffer from low levels of ICT readiness due to the underdevelopment of ICT infrastructure and the lack of a widespread skill base that would enable society to make an optimal use of technology. In the case of Kenya, as for Rwanda, in addition the cost of accessing these technologies is still high for a large share of the population (109th). As a result, both countries suffer from low ICT uptake rates by all agents, especially individuals, and hence the transformational impacts of ICT are low. Other countries in East Africa, such as **Zambia, Uganda,** and **Tanzania**—in 109th, 110th, and 123rd position, respectively—depict a similar profile and face similar challenges to boosting the development and uptake of ICT.

Finally, a last tier of countries in West and South Africa, including **Zimbabwe, Cameroon, Lesotho, Madagascar, Burkina Faso, Swaziland, Burundi, Chad, Mauritania, Angola,** and **Yemen**—ranging from 124th to 141st position—essentially close our rankings. All these countries suffer from severe weaknesses in all components of our Index, from poor connectivity caused by expensive and poor-quality ICT infrastructure to very low levels of basic skills and weak framework conditions for technology-rich activities to flourish. Not surprisingly, these countries also present the weakest results in terms of ICT impacts.

MIDDLE EAST AND NORTH AFRICA

Overall, there are large differences in ICT use and impacts across the region, with countries grouping around three subregions: Israel and the Gulf Cooperation Council states; the Levantine nations; and, finally, the countries in North Africa. While Israel and most of the Gulf Cooperation Council states seem to have embraced ICT uptake and have started to gain from the associated benefits, countries in the latter two groups still suffer from important weaknesses that hinder their capacity to fully leverage the use of ICT to increase competitiveness and accelerate the positive social impacts that are associated with technology.

Israel, in 20th position in the rankings, epitomizes the success of an economy that—despite not counting on vast endowments of natural resources—has succeed in securing a high level of development thanks to ICT and innovation. Ranked 6th in terms of economic impacts, with one of the highest rates of ICT PCT patent applications (3rd), the country has managed to create very favorable market conditions for entrepreneurship and innovation (10th), which has acted as a catalyst for the high ICT uptake and readiness of the business community (7th). Moving forward, the country could benefit even more should it be able to address some of its key infrastructure shortcomings, especially in terms of international Internet bandwidth (84th), and improve further the quality of its educational system (48th), especially in fields related to math and science (79th).

Leading the Arab World, **Bahrain,** in 27th place, as in the case of Israel, creates a fairly sophisticated enabling environment for entrepreneurship and innovation (11th) that, coupled with a good ICT readiness (25th) in terms of infrastructure, affordability, and overall skills, has brought the country to this good position. However, unlike Israel, this process has been led mainly by a strong commitment from the government (4th) that has not yet been followed by the rest of the agents with the same intensity, notably the business community (39th). As a result, the positive economic impacts reflecting higher rates of innovation and the shift toward more knowledge-based activities have not yet taken off (54th). Efforts to integrate ICT in a more general innovation ecosystem at the corporate level should help to boost the desired economic impacts of ICT and technology more broadly.

Closely following Bahrain, **Qatar** appears in 28th position. As in the case of Bahrain, the emirate has managed to create one of the best environments for entrepreneurship and innovation worldwide (2nd). This, coupled with the government's strong commitment to

boosting ICT-related infrastructure (27th) and spilling over the effects across the economy (34th) and society (21st), has allowed the country to rank in the top quarter of our sample. On a less positive note, the low levels of competition existing in the ICT and telecommunications sectors (122nd) are affecting the overall affordability of accessing ICT (111th), especially in terms of broadband (109th), hindering a wider diffusion and usage of ICT across the different agents in the country, such as broadband Internet subscriptions (57th).

The **United Arab Emirates,** at 30th place, presents a profile similar to neighboring Qatar's. With the government's strong commitment to develop and prioritize ICT (7th) as one of the key engines to diversify its still oil dependent economy, the country has managed to develop a good ICT-related infrastructure (25th) and a favorable framework for business and innovation (21st) that result in fairly good innovation rates in the form of both new products and services (15th) and new organizational models (21st). Notwithstanding these efforts, the country would benefit further from expanding its overall skill base, especially eradicating adult illiteracy (86th) and increasing tertiary education participation (86th). As in the case of Qatar, liberalizing the ICT and telecommunications markets (117th) would help reduce the high costs of accessing the Internet (94th).

Saudi Arabia, in 34th place, has equally recognized the importance of ICT as a key driver of its economic transformation. A committed and strong government-led effort (5th) to prioritize ICT (14th) coupled with a very favorable environment for business development (8th) has yielded fairly good results to get the country ready for the ICT revolution, especially in terms of infrastructure development (36th). However, as in the case of the United Arab Emirates and Qatar, boosting higher levels of competition to reduce the costs of communications (85th), improving the skill base by reducing adult illiteracy (98th), and increasing tertiary education participation (66th) should be the immediate priorities to further increase ICT uptake by all agents in the country.

Kuwait, in 62nd position, is the laggard in the region in terms of embracing ICT. Despite a fairly good ICT-related infrastructure development, the high costs of accessing it and the population's relatively low level of skills are affecting the ICT readiness of the country. As a result, Kuwait depicts fairly poor rates of ICT usage (67th) that, coupled with a less business friendly environment for entrepreneurship (56th) than other Gulf Cooperation Council states, result in low levels of ICT impacts (93rd).

Jordan, in 47th position, leads the ICT race by far in the group of Levantine states. Despite the need to improve its ICT infrastructure (79th), especially in terms of getting access to a wider international Internet bandwidth (92nd), the country—led by a strong commitment of the government (37th)—has managed to liberalize the markets and provide affordable access to ICT (9th) and improve its business and innovation environment (43rd), although some weaknesses remain. **Lebanon** and **Syria,** in 95th and 125th position, respectively, on the other hand, still suffer from important weaknesses in terms of ICT development that hinder their capacity to take full advantage of the benefits accruing from the deployment and use of these and other technologies.

Tunisia, ranked in 50th place, leads the rankings in North Africa. ICT development in the country has been led by a strong commitment of the government to boost ICT uptake. This commitment, coupled with a fairly good educational performance—despite a high rate of adult illiteracy (108th)—allows the country to position itself ahead its North African neighbors. Improving affordable (73rd) access to a more robust ICT infrastructure and digital content (70th) would help improve the still-low uptake of ICT by individuals (78th) and businesses (51st).

ICT development in **Egypt** has been traditionally led by the government that in the past years has made a strong effort to make ICT access affordable (12th) and enlarge the number of services it offers online (23rd). However, despite these efforts, neither the individuals (79th) nor especially the business community (103rd) have managed to match this effort, and as a result the country is placed at 79th place. Upgrading the ICT infrastructure (89th), developing more digital content in Arabic (100th), improving the general environment for entrepreneurship and innovation (94th), and enhancing the available skill base (108th) should be the four priorities for the country to encourage higher and more homogeneous usage rates and achieve increased positive impacts.

Morocco and **Algeria,** in 91st and 118th places, respectively, are lagging in benefiting from the transformational impacts of ICT, especially in the economy (127th and 140th). Low levels of ICT infrastructure development, coupled with insufficient available skills, translate to weak uptake rates of technology by all agents, especially the business community and individuals. In addition, in the case of Algeria, the very unfavorable business condition (137th) that acts as a filter for innovation hampers the capacity of already-scarce efforts to result in meaningful economic impacts. Addressing these weaknesses in a timely manner will be crucial for both countries to start shifting their national economies toward knowledge-richer and higher-productivity activities.

CONCLUSIONS

The rapid changes that the ICT industry has experienced in the last decade have brought about deep transformations in the way our economic activity and society are organized. We live in a hyperconnected world where the sense of immediateness and constant accessibility is redefining the relationships between and across individuals, businesses, and governments. Societies that recognize the potential opportunities that new technologies unveil will be better prepared to reap the potential

Box 3: Testing the robustness of the evolved NRI framework: The relationship between ICT drivers and ICT impacts

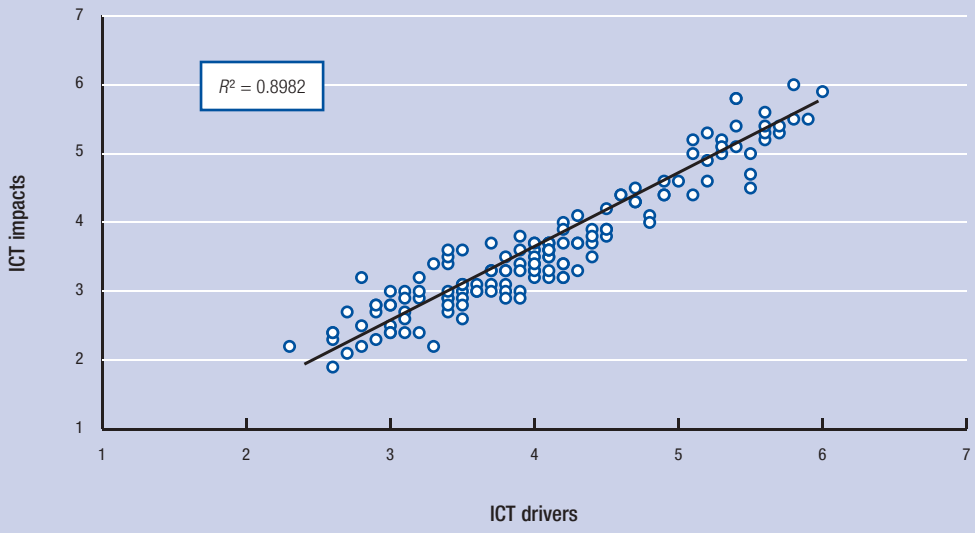
Any data-driven model that aims at capturing a complex process such as measuring the determinants of ICT uptake and its associated economic and social impacts can only be tentative. No quantitative analysis can fully take into account the richness and complexity of the relationships that exist between the underlying factors. Furthermore, in many cases the available data, especially for a large set of countries, are patchy and incomplete. Therefore, assessing the robustness of any model becomes crucial to ensure that it captures the right factors and the relationship between the determinants and the results of the analyzed phenomenon.

The present edition of *The Global Information Technology Report* introduces an evolved framework where, for the first time, the ICT economic and social impacts (ICT impacts) are explicitly and clearly differentiated from the three factors that drive these impacts (ICT drivers): an environment enabling a strong ICT uptake and favorable for economic and social impacts to accrue, a strong ICT readiness, and substantial ICT usage. As a result, the model allows—also for the first time—the ability to check on the relationship between the drivers of ICT on the one hand and their associated impacts on the other. In other words, it allows testing whether the framework is robust enough to identify and measure those factors that are relevant for achieving the desired ICT impacts, which is the end policy objective.

Running an econometric model to test the causality effect of each of the ICT drivers on the impacts in the NRI framework would be statistically difficult because of problems of multi-collinearity—that is, the values of the drivers are highly correlated with each other and therefore it is difficult to isolate unique effects—and also because of reverse causality—that is, the drivers affect the results of the impacts and vice versa. However, a simple correlation analysis could help us shed some light about the validity of the model.

Figure A presents this correlation analysis. As can be observed, the relationship between ICT drivers and impacts is very strong, with a correlation coefficient of 90 percent. This very high correlation, coupled with the practically nonexistent statistical outliers that largely divert from the relationship line, seems to corroborate the robustness of the NRI framework.

Figure A: Relationship between ICT drivers and impacts



Source: Authors' calculations.

benefits and weather the risks of these technologies. The potential benefits of ICT have been widely researched. Improvements in innovation performance and raises in productivity in those technology-savvy organizations have been widely documented. Moreover, improvements in people's well-being, thanks to new ICT-enabled products in healthcare or environmental solutions, are transforming the quality of life of many of our citizens.

The GITR series and the NRI in particular have contributed over the past decade to raise awareness about the determinants that drive the capacity of societies to transform and benefit from the multiple impacts that ICT can bring about. Moving forward, this new edition of the GITR continues to innovate and introduces an evolved framework that keeps abreast of the latest changes in the ICT industry and responds better to policy needs. While measuring ICT access remains important, especially for developing and emerging economies, the ubiquity of ICT in all areas of society has rendered the measuring and benchmarking of ICT impacts even more important.

An analysis of the ICT landscape thanks to the NRI results reveals that large differences across regions persist regarding the uptake and impacts of ICT. Despite the global economic convergence of the past decade, owing to the sharp economic growth of Southeast Asia, Latin America, and Africa on the one hand and to the stagnation of the advanced economies on the other, the digital divide seems to follow a different process. Advanced economies, especially the Nordic countries and the Asian Tigers, continue to dominate with well-rounded, society-wide strategies to fully leverage ICT. At the other end of the scale, sub-Saharan Africa continues to trail the rest of the world with important weaknesses, both in terms of preparedness caused by a low skill base and an environment that does not enable significant economic impacts to accrue. Latin America, despite the region's strong resilience in the face of the economic crisis, still lags behind, and the need to integrate ICT better in more robust innovation systems remains an important challenge looking forward. On a more positive note, some emerging economies in Asia seem to make good progress, inspired by the good practices of regional champions such as Korea and Singapore.

The GITR series and the NRI is proud to continue, with renewed energy, its task of providing an analytical framework that sheds light on national efforts to leverage ICT for increased competitiveness and well-being, creating a platform for multi-stakeholder interaction and action.

NOTES

1 Gartner 2011.

2 Ericsson 2011.

3 GSMA-Atkearney 2011, p. 4.

4 ITU 2011b.

5 IDC 2011.

6 IDC 2011.

7 Facebook Statistics, available at http://www.facebook.com/press/info.php?statistics (accessed December 21, 2011).

8 BT Online Bureau (November 8, 2011), available at http://businesstoday.intoday.in/story/google-plus-starts-service-for-businesses-brands/1/19906.html (accessed December 21, 2011).

9 Cisco 2010, p. 3.

10 The difficulty in the definition of impacts is one of the main handicaps, as ICT has proven transformational in many aspects of the economy and society, influencing not only the outcomes but also the process through which products and services are delivered. As a result, developing metrics to capture these dimensions is both difficult and costly, especially when it comes to covering a large number of emerging countries. In addition, even when impact areas can be defined, it is not always easy to trace back specific impacts to all their original sources. Often observed economic and social impacts are the result of a thick network of several interacting factors, where ICT is but one of them.

11 The NRI 2012 includes the results of the 2010 and 2011 Surveys. For more details on the Survey methodology, see Browne and Geiger 2010.

12 The BRICS are Brazil, the Russian Federation, India, China, and South Africa.

13 For an in-depth review of the policies carried out in Mauritius to develop the ICT sector, please refer to Part 2 of the *Report.*

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Appendix A: Structure and computation of the Networked Readiness Index 2012

This appendix presents the structure of the Networked Readiness Index 2012 (NRI). As explained in the chapter, the NRI framework separates environmental factors from ICT readiness, usage, and impact. That distinction is reflected in the NRI structure, which comprises four subindexes. Each subindex is in turn divided into a number of pillars, for a total of 10. The 53 individual indicators used in the computation of the NRI are distributed among the 10 pillars.

In the list below, the number preceding the period indicates the pillar to which the variable belongs (e.g., indicator 2.05 belongs to the 2nd pillar; indicator 8.03 belongs to the 8th pillar). The numbering of the indicators matches the numbering of the data tables at the end of the *Report*.

The computation of the NRI is based on successive aggregations of scores, from the indicator level (i.e., the most disaggregated level) to the overall NRI score (i.e., the highest level). Unless noted otherwise, we use an arithmetic mean to aggregate individual indicators within each pillar and also for higher aggregation levels (i.e., pillars and subindexes).[a]

Throughout the *Report*, scores in the various dimensions of the NRI pillars are reported with a precision of one or two decimal points. However, exact figures are used at every step of the computation of the NRI.

Variables that are derived from the World Economic Forum's Executive Opinion Survey (the Survey) are identified here by an asterisk (*). All the other indicators come from external sources, as described in the Technical Notes and Sources section at the end of the *Report*. These variables are transformed into a 1-to-7 scale in order to align them with the Survey's results. We apply a min-max transformation, which preserves the order of, and the relative distance between, scores.[b]

NETWORKED READINESS INDEX 2012

Networked Readiness Index = 1/4 Environment subindex
+ 1/4 Readiness subindex
+ 1/4 Usage subindex
+ 1/4 Impact subindex

ENVIRONMENT SUBINDEX

Environment subindex = 1/2 Political and regulatory environment
+ 1/2 Business and innovation environment

1st pillar: Political and regulatory environment

1.01 Effectiveness of law-making bodies*
1.02 Laws relating to ICT*
1.03 Judicial independence*
1.04 Efficiency of legal system in settling disputes*[c]
1.05 Efficiency of legal system in challenging regulations*[c]
1.06 Intellectual property protection*
1.07 Software piracy rate, % software installed
1.08 Number of procedures to enforce a contract[d]
1.09 Time to enforce a contract, days[d]

2nd pillar: Business and innovation environment

2.01 Availability of latest technologies*
2.02 Venture capital availability*
2.03 Total tax rate, % profits
2.04 Time required to start a business, days[e]
2.05 Number of procedures to start a business[e]
2.06 Intensity of local competition*
2.07 Tertiary education gross enrollment rate, %
2.08 Quality of management schools*
2.09 Government procurement of advanced technology products

READINESS SUBINDEX

Readiness subindex = 1/3 Infrastructure and digital content
+ 1/3 Affordability
+ 1/3 Skills

3rd pillar: Infrastructure and digital content

3.01 Electricity production, kWh/capita
3.02 Mobile network coverage rate, % population
3.03 International Internet bandwidth, kb/s per user
3.04 Secure Internet servers per million population
3.05 Accessibility of digital content*

4th pillar: Affordability[f]

4.01 Mobile cellular tariffs, PPP $/min.
4.02 Fixed broadband Internet tariffs, PPP $/month
4.03 Internet and telephony sectors competition index, 0–2 (best)

5th pillar: Skills

5.01 Quality of educational system*
5.02 Quality of math and science education*
5.03 Secondary education gross enrollment rate, %
5.04 Adult literacy rate, %

USAGE SUBINDEX

Usage subindex = 1/3 Individual usage
+ 1/3 Business usage
+ 1/3 Government usage

6th pillar: Individual usage

6.01 Mobile phone subscriptions per 100 population
6.02 Internet users per 100 population
6.03 Households with personal computer, %
6.04 Households with Internet access, %
6.05 Fixed broadband Internet subscriptions per 100 population
6.06 Mobile broadband Internet subscriptions per 100 population
6.07 Use of virtual social networks*

7th pillar: Business usage

7.01 Firm-level technology absorption*
7.02 Capacity for innovation*
7.03 PCT patent applications per million population
7.04 Extent of business Internet use*
7.05 Extent of staff training*

8th pillar: Government usage

8.01 Government prioritization of ICT*
8.02 Importance of ICT to government vision of the future*
8.03 Government Online Service Index, 0–1 (best)

IMPACT SUBINDEX

Impact subindex = 1/2 Economic impacts
+ 1/2 Social impacts

9th pillar: Economic impacts

9.01 Impact of ICT on new services and products*
9.02 PCT ICT patent applications per million population
9.03 Impact of ICT on new organizational models*
9.04 Employment in knowledge-intensive activities, % workforce

10th pillar: Social impacts

10.01 Impact of ICT on access to basic services*
10.02 Internet access in schools*
10.03 ICT use and government efficiency*
10.04 E-Participation Index, 0–1 (best)

NOTES

a Formally, for a category i composed of K indicators, we have:

$$\text{category}_i = \frac{\sum_{k=1}^{K} \text{indicator}_k}{K}$$

b Formally, we have:

$$6 \times \left(\frac{\text{country score} - \text{sample minimum}}{\text{sample maximum} - \text{sample minimum}} \right) + 1$$

The *sample minimum* and *sample maximum* are, respectively, the lowest and highest country scores in the sample of economies covered by the GCI. In some instances, adjustments were made to account for extreme outliers. For those indicators for which a higher value indicates a worse outcome (i.e., indicators 1.07, 1.08, 1.09, 2.03, 2.04, 2.05, 4.01, and 4.02), the transformation formula takes the following form, thus ensuring that 1 and 7 still corresponds to the worst and best possible outcomes, respectively:

$$-6 \times \left(\frac{\text{country score} - \text{sample minimum}}{\text{sample maximum} - \text{sample minimum}} \right) + 7$$

c For Indicators 1.04 and 1.05, the average of the respective normalized scores is used in the computation of the NRI.

d For Indicators 1.08 and 1.09, the average of the respective normalized scores is used in the computation of the NRI.

e For Indicators 2.04 and 2.05, the average of the respective normalized scores is used in the computation of the NRI.

f The affordability pillar is computed as follows: the average of the normalized scores of indicators 4.01 mobile cellular tariffs and 4.02 Fixed broadband Internet tariffs is multiplied by a *competition factor*, the value of which is derived from indicator 4.03 Internet and telephony sectors competition index. It corresponds to the score achieved by an economy on this indicator normalized on a scale from 0.75 (worst) to 1.00 (best), using the min-max transformation described above. A normalized score of 0.75 is assigned to an economy with a competition index score of 0, which means that a monopolistic situation prevails in the 19 categories of ICT services considered. A normalized score of 1.00 is assigned to an economy where all 19 categories are fully liberalized. Where data are missing for indicator 4.03 (i.e., Hong Kong SAR, Puerto Rico, and Timor-Leste), the score on the affordability pillar is simply the average of the normalized scores of indicators 4.01 and 4.02 is used. For example, Albania obtains a score of 1.69 on the competition index. This translates into a competition factor of 0.96, which multiplies 5.65, corresponding to the average of Albania's normalized scores on the two tariff measures. Albania's score on the affordability pillar therefore is 5.43.

Appendix B: Historical overview of the efforts to measure and benchmark ICT developments

The Networked Readiness Index (NRI) framework was first developed to make conceptual sense of the complex realities of information communication technologies (ICT) and to provide guidance to policymakers and civil society. When the original NRI framework was established in 2002, numerous attempts had already been made to measure comparative levels of ICT development in nations.[1]

The task of capturing a nation's competitiveness in a single index score was a significant challenge in 2002; it continues to present difficulties today. Since the development of the original framework, further efforts have been made and new models have emerged in the attempt to find effective measurements for assessing ICT development in economies. From a review of these models, as presented in Table B1, we found that the conceptual frameworks for measuring ICT have evolved in three stages and that previous works in this field could be grouped in three categories.

The first group includes frameworks that were developed prior to the original NRI framework, launched in 2002. Conceptual frameworks in measuring ICT competitiveness were then still in their infancy. Various organizations, such as the Computer Systems Policy Project (CSPP) and the Center for International Development (CID) at Harvard, worked out some of the first policymaking and evaluation tools for countries.[2]

The focus of these initial frameworks was on individual assessment and policy development around e-readiness and increasing Internet penetration rates: APEC's *e-Commerce Readiness Assessment Guide* (2002) and the Mosaic Group's *Framework for Assessing the Global Diffusion of the Internet* (2001) attempted to do this.[3] There were few ranking systems for comparative analysis of countries. Furthermore, because of the lack of or difficulty in obtaining data, low-income economies were often excluded from the analysis. In 2002, the NRI became the most comprehensive index for assessing and evaluating a large number of countries (82 economies) by taking into consideration the main stakeholders (individuals, businesses, and governments) in the development and use of ICT, as well as the general macroeconomic and regulatory environments in which these stakeholders play out their respective roles.[4]

Following the 2002 NRI, many more comparative analyses and country indexes emerged. Since the World Summits on the Information Society (in Geneva in 2003 and Tunis in 2005), a stronger sense of urgency in leveraging ICT for meeting the UN Millennium Development Goals emerged. This is reflected in the second group of frameworks, which widened their scope and included a broader range of countries, especially developing countries. Models such as International Telecommunication Union's Digital Opportunity Index and ICT Development Index (IDI) were developed in order to find opportunities to bridge the digital divide.[5] However, the increase in the number of countries analyzed often meant a reduction in the number of indicators used. This was the result of a lack of reliable data from numerous countries. Guidebooks and methodologies—such as the Organisation for Economic Co-operation and Development (OECD)'s *Guide to Measuring the Information Society* and the World Bank Institute's Knowledge Assessment Methodology[6]—have therefore been produced in an attempt to create worldwide standards in collecting data for measuring the state of ICT development.

Yet with time, as Internet penetration began to stabilize in several developed economies, the need for a broader and more comprehensive measurement of ICT (not just penetration and adoption rates) became apparent. The third group of work follows this focus in understanding the role of ICT in long-term economic and social growth and in fostering competitiveness. In addition to the NRI, the Economist's Intelligence Unit (EIU)'s Digital Economy Rankings—previously known as the E-readiness Rankings—and Waverman et al.'s *Connectivity Scorecards* have attempted to examine both countries' e-readiness and the challenges they will face in maximizing ICT use.[7] This underlines the growing shift toward measuring the impact of ICT in numerous dimensions.

In our analysis of past works to measure levels of ICT competitiveness we find that approaches vary significantly with the type of organizations by which they were developed, their aims and objectives, their methodology, and finally in the results they produced (see Table B2).

Table B1: Evolution of conceptual ICT frameworks, rankings, and indexes

Objective	Characteristics	Initiative and institution
Prior to the original NRI framework (2001)		
Measuring ICT competitiveness	Developed prior to the original NRI framework in 2002 Development of first policymaking and evaluation tools for countries Relatively few ranking systems for comparative analysis of countries Measure state of Internet acceptance (or e-readiness) in a country or community Measure the growth of Internet in the world	Readiness for Living in the Networked World, by the Computer Systems Policy Project (CSPP), 2000 Readiness for the Networked World: A Guide for Developing Countries, by the Center for International Development (CID) at Harvard University, 2000 International Survey of E-Commerce, by The World Information Technology and Service Alliance (WITSA), 2000 APEC e-Commerce Readiness Assessment Guide, by the Asian Pacific Economic Cooperation (APEC) Electronic Commerce Steering Group, 2000 A Framework for Assessing the Global Diffusion of the Internet, by The Mosaic Group, 2001 Ready? Net. Go!, by McConnell International, 2001
After the development of the NRI framework (2002–07)		
Leveraging ICT for development	Focus on bridging the digital divide and meeting the Millennium Development Goals Wider range of economies to include low-income countries Many self-assessment tools to help governments and policymakers assess their country's state Developed shortly before or after the World Summits on the Information Society (Geneva 2003, Tunis 2005)	2002 Global Technology Index, by Howard Rubin, Metricnet.com, 2002 The Knowledge Economy, the KAM Methodology and World Bank Operations, by Chen and Dalhman, World Bank Institute, 2005 Digital Opportunity Index (DOI), by ITU, 2006–07
More recent frameworks (after 2007)		
Understanding and measuring ICT in a broader sense	Overall increase of indicators as data become more available Stronger focus on business and social perspective and on developing more economic competitiveness among countries Attempts to include more measurements of the impact of ICT	ICT Development Index (IDI), by ITU, 2008–11 Guide to Measuring the Information Society, by the OECD, 2011 Digital Economy Rankings 2010-Beyond e-readiness, by the Economist Intelligence Unit, 2010 (previously the E-readiness Rankings) Connectivity Scorecard, by Waverman, Dasgupta and Rajala, 2008–11

Table B2: Key differences among approaches used to measure ICT

Type of organization	Private-sector organizations
	Government organizations
	Academic institutions
Objectives	Policymaking and evaluation tool for countries
	Measure state of Internet acceptance (or e-readiness) in a country or community
	Measure the growth of the Internet in the world and ICT impact
Methodology and data	Questionnaire-based data (based on opinions of key decision makers and leaders)
	Hard data–based, using sources such as the World Bank, Pyramid, ITU, and so on
	Individual country self-assessment tools and guides
Results	Comparative analysis of countries
	Identification of gaps and strong points within independent communities
	Stage of ICT development of a country determined
	Guidelines in data collection and methodology

The methodology used in research prior to the NRI has varied. Studies such as the APEC e-Commerce Readiness Assessment Guide and the Mosaic Group's Global Diffusion of the Internet rely on questionnaire-based data. Others, such as the work of the CID and the EIU, are a hybrid of survey questionnaires and hard data. The *Connectivity Scorecard* insists on using only hard data. The move to incorporate impact metrics is not new. Some of the older models, such as the CSPP and APEC models, are primarily readiness-based analyses. Reflecting the development of thought in this direction, agencies such as the EIU and the CID have incorporated selected impact metrics in their frameworks. ITU's ICT Digital Index and the EIU's Digital Economy Rankings have also included some indicators of impact. However, measurements of impacts in previous frameworks are very limited and finding suitable metrics remains a considerable challenge.

The results produced by the different tools fall primarily into four categories. The first category comprises those that look to provide a comparative analysis among the various countries (e.g., *Connectivity Scorecard,* ICT Digital Index, Digital Economy Rankings); the second is those designed to identify gaps and strong points of independent communities (e.g., McConnell's Ready? Net. Go! and the World Bank Institute's Knowledge Assessment Methodology); the third is the identification of the stage of development of a country (e.g., those of the CID and the CSPP); and the fourth consists of guidelines and methodology in collecting comparable and reliable data for a larger number of countries (e.g., the work of the OECD).

NOTES

1 See the Comparison of E-Readiness Assessment Models, October 2001, at http://www.bridges.org/e_readiness_assessment.

2 See CSPP 2000; CID 2000.

3 See APEC e-Commerce Readiness Initiative 2000; Wolcott et al. 2001.

4 Dutta and Jain 2003.

5 See ITU 2007, 2011a.

6 See OECD 2011; Chen and Dahlman 2005.

7 See EIU 2010; Waverman et al. 2010.

CHAPTER 1.2

The Convergence of Information and Communication Technologies Gains Momentum

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In the past few years, the boundaries between information technology (IT)—which refers to hardware and software used to store, retrieve, and process data—and communications technology (CT)—which includes electronic systems used for communication between individuals or groups—have become increasingly indistinguishable. The rapid convergence of IT and CT is taking place at three layers of technology innovation—cloud, pipe, and device—which are described in detail in this chapter. As a result of this convergence, industries are adapting and new industries are emerging to deliver enriched user experiences for consumers, enterprises, and the private sector.

Several factors are driving the convergence of IT and CT and, consequently, contributing to the integration and transformation of cloud, pipe, and device technologies (Figure 1). For example, as the mobile penetration rate nears 90 percent globally, more people are able to communicate with each other through mobile devices. Many of these devices can interconnect through cloud computing services when accessed via the Internet. Adding to this momentum are innovations in smartphones, which allow users to send and download music and images, to use the Internet to purchase products, and to pay retailers and financial institutions electronically. In addition, more than 50 countries have invested in national broadband projects that lay solid foundations for bandwidths adequate to drive ICT convergence.

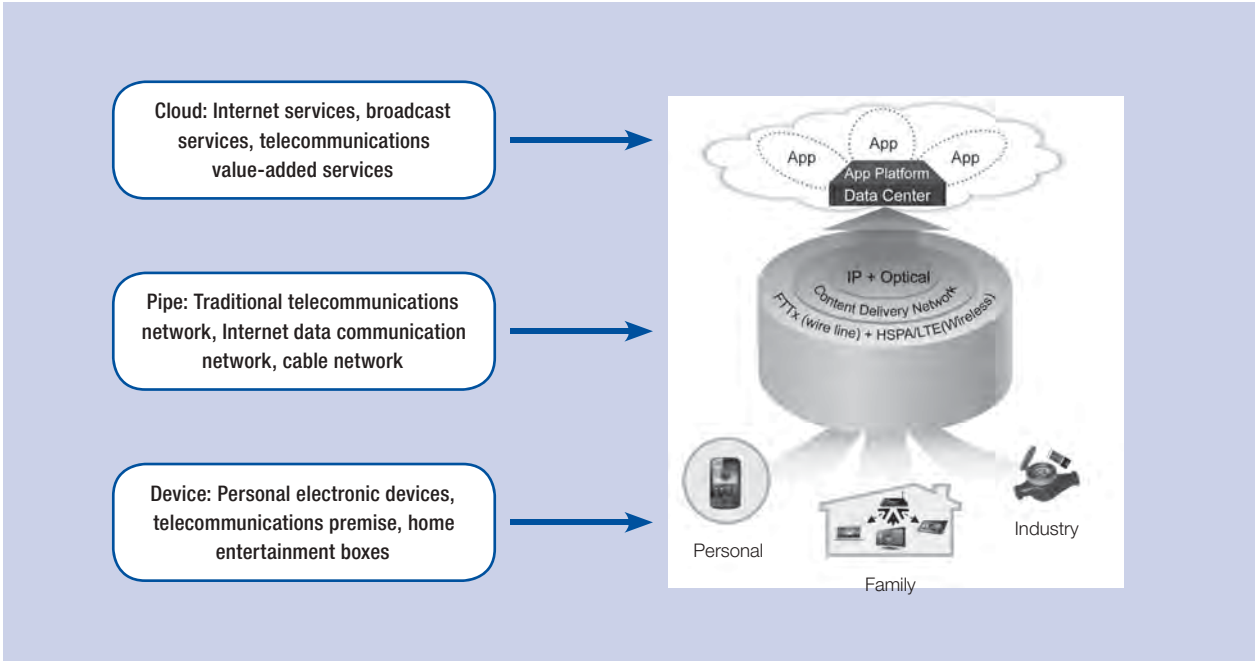
After years of evolution, Internet services, telecommunications value-added services, and even media services are converging for both consumers and industry. Services carried by optical networks and other modern wireless "pipes" are moving to the cloud, and both industries and consumers are utilizing those services through a variety of integrated smart devices.

THE CLOUD: A CATALYST FOR ICT CONVERGENCE

The IT and telecommunications industries will converge for cloud services. In addition to providing bandwidths for cloud services, telecommunications carriers will gradually move their IT systems, value-added services, and Internet data centers into the cloud to provide services to a variety of industries. To integrate their services successfully, telecommunications and IT industries will seek a common understanding on standards, interfaces, and security specifications. Most important will be the unification of industry standards. Uniform standards will significantly drive down the cost of the cloud, making interconnection a reality and facilitating its rapid development. Cloud services, such as e-government, e-education, and e-healthcare, will be able to better cater to the needs of governments, industries, and enterprises.

Although convergence presents many challenges to IT and CT, ICT convergence will strengthen both industries by accelerating the development of cloud computing services. As a groundbreaking business model and

Figure 1: ICT sector revenues and growth rate, US$ million



Source: Huawei Technologies.

an innovative technology, cloud computing is becoming a powerful catalyst in the restructuring and integration of IT and CT. Traditional IT and CT once tried to integrate with the Internet, but without the uniform standards that are required to enable cloud computing, the integration provided limited results. However, the current integration of the Internet with IT and CT is transforming both industries and enabling the development of next-generation technologies (Figure 2).

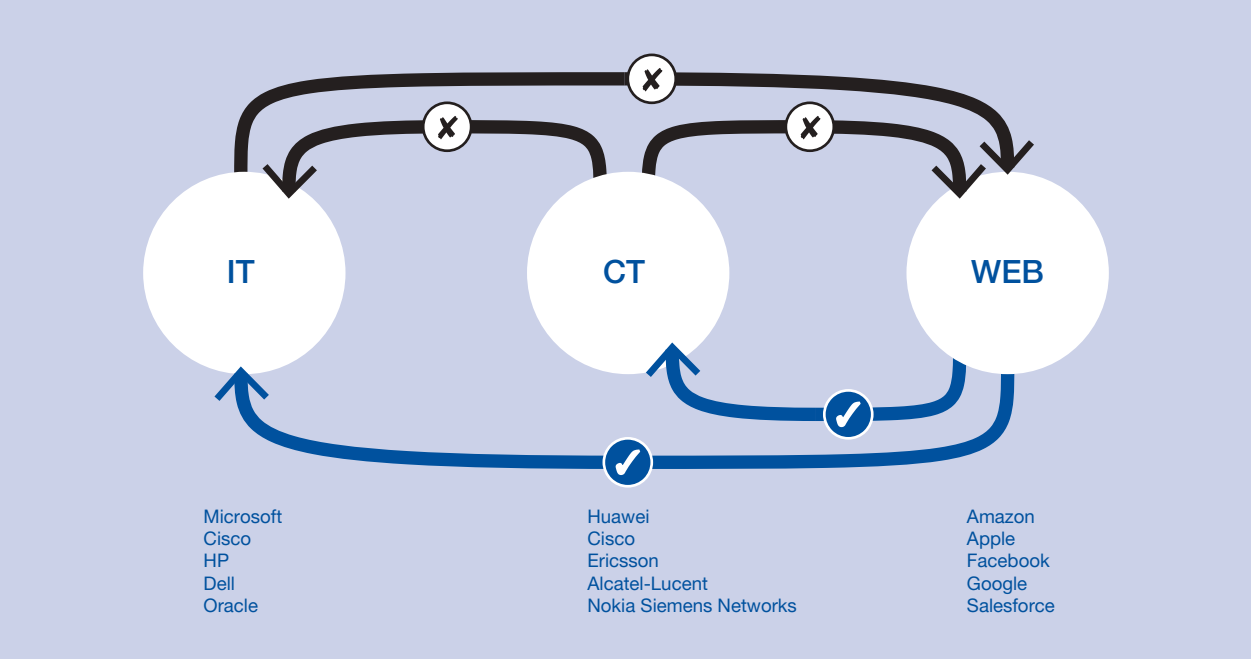
Traditional IT centers on data, whereas traditional CT centers on connection-based networks. Converged IT and CT produce ICT, which is the cornerstone of what we often refer to as *cloud computing,* a technology focused on interaction and collaboration between users and systems.

Before the transformation of CT into ICT, real-time voice services played a dominant role in CT. At that time, the telecommunications industry focused on finding solutions that empowered customers to roam with their mobile phones over a mobile network with acceptable price points for both the carrier and the subscriber. Since the transformation of CT into ICT, media services and breaking news are widely available via mobile networks and have replaced the previously dominant real-time voice services in CT. Today, the telecommunications industry focuses on the customer need for seamless services supported by integrated mobile networks (Figure 3). The very meaning of the word *pipes* has also changed. Although the term still refers to a data connection—with a pipe being analogous to bandwidth or throughput—it has evolved from a physical connection, such as a cable, to all–Internet protocol (all-IP) networks. Likewise, when telecommunications companies referred to *networks* in the past, they meant *connected networks.* Today, the same word also refers to data transmitted via ICT.

Just as traditional CT has changed since its transformation into ICT, IT is also rapidly evolving. In recent years, new IT enterprises in consumer markets have leveraged cloud computing's open and interconnected resources to aggressively challenge traditional IT in industry markets. A key challenge for traditional IT is its inability to keep pace with today's fast-paced industry markets. Traditional IT build-outs and management models face several inherent obstacles, including inflexibility, low resource utilization, high energy consumption, prolonged time frames for systems going live, and high software and management costs. Unlike the early days of IT, merely expanding hardware equipment is no longer sufficient to overcome these challenges.

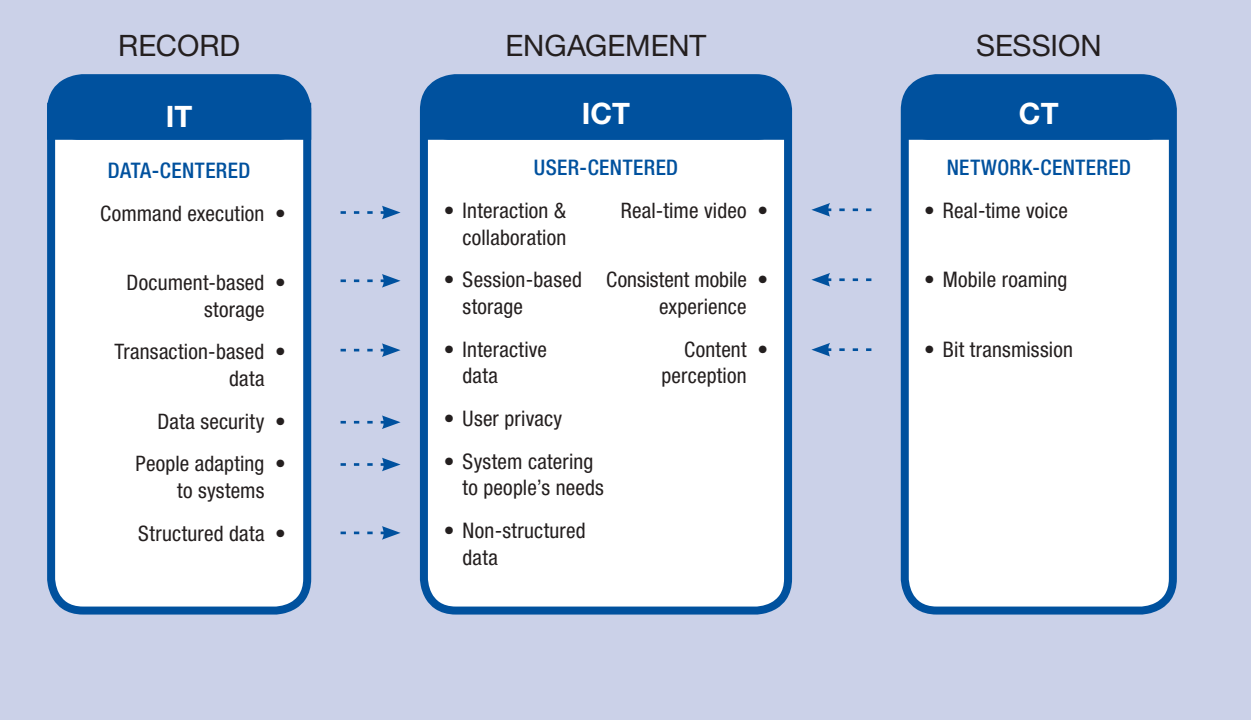
The evolution from traditional IT to ICT has significantly changed the IT landscape. For example, data centers based on document storage were once at the heart of traditional IT. In today's ICT era, cloud computing based on interactive sessions has replaced traditional data centers. Other aspects of traditional IT have also shifted. For example, although traditional IT was concerned with data security, today's ICT security focus has shifted to user privacy. Traditional IT also required people to adapt to systems, but today's systems are designed to cater to people's needs, instead of the other

Figure 2: The convergence of IT, CT, and web capabilities



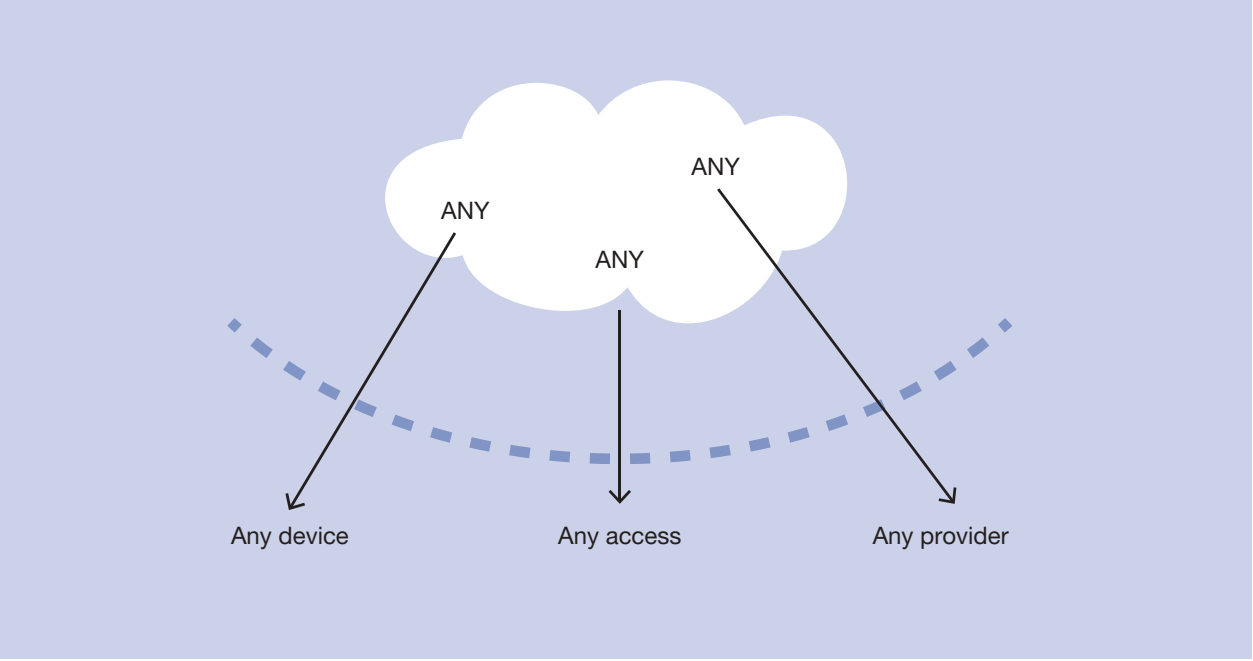
Source: Huawei Technologies.

Figure 3: Dynamic connections of ICT services



Source: Huawei Technologies.

Figure 4: Cloud computing from a user's perspective



Source: Huawei Technologies.

way around. Similarly, structural data were replaced as a main concern for traditional IT with ICT's large amounts of semi-structured or unstructured data.

Like traditional IT, the traditional CT industry needs to make further changes to realize the many benefits offered by ICT convergence. However, numerous business models, services, and individualized requirements emerging from the Internet are overwhelming today's communications industry. With the help of new technologies, this industry can continue to use its switching capabilities for a while longer. But if it does not keep pace with ICT convergence, traditional CT could find itself in the dark when it comes to communications control and monitoring. Alone, the communications industry is not knowledgeable enough about content exchange and does not know how to apply data control. In the era of ICT convergence, where cloud computing delivers data to any device anywhere, the pipes of the communications industry can no longer fully reflect its business value.

From a user's perspective, cloud computing blurs the lines between IT and CT to deliver superior and consistent experiences based on the ANY–ANY–ANY concept illustrated in Figure 4. The widespread use of smartphones and tablets has made user demand increasingly prominent for access from any device at any time using any service provider. Traditional IT or CT technologies alone cannot provide such an experience, which is why it is time to restructure these technologies.

Cloud computing has reshaped the IT industry. The new cloud model for computing storage and network resource management uses a distributed computing architecture to reshape the traditional single-server computing architecture. This new computing model adopts two key technologies—distribution and virtualization—to decouple software and service and help move data centers and services into the cloud. Resource sharing in the cloud increases the utilization and flexibility of resources, significantly accelerates service deployment, and improves processing capabilities.

Cloud computing also points CT in a new direction that goes beyond pipes to exploring the value of broadband for handling the large datasets that cloud computing can store and transmit. We think of the cloud as an information factory that is now overturning the traditional business models of software, hardware, and media to transform user focus from purchasing products to purchasing services. Not only is cloud computing desirable from a user's perspective, but it also enables IT and CT to enhance and transform each other (Box 1).

PIPE: IP+OPTICAL IS THE FUTURE OF PIPE INTEGRATION

For many years, telecommunications networks have been evolving into all-IP networks. This evolution has significantly reduced the cost of network operations (e.g., the cost of per-bit data transmission has dropped dramatically). All-IP networks have also accelerated the convergence of fixed with mobile telecommunications

networks. Currently, tremendous progress has been made in the all-IP model. The next objective is likely to be the IP+Optical network model.

On future networks, the majority of traffic will be video, which will increase the volume of data traffic dramatically. Optical technology will alleviate the pressure caused by large-capacity demands, whereas IP technology will make networks more flexible and ease interconnection. The IP+Optical model will significantly improve efficiency and reduce total cost of ownership. A joint article by BT and Huawei analyzing the economy of networks notes that when data traffic increases 6.5 times, the IP+Optical solution will reduce network construction costs by about 30 percent, diminish the area required for equipment rooms by 50 percent, and help decrease power consumption by about 55 percent.[1]

Cost is the primary driver for the convergence of multiple networks, including telecommunications networks, the Internet, broadcasting networks, and even electric power networks. For consumers, converging services have reduced charges and improved services. For carriers, IP technologies have lowered operating costs. As an example, look at the transmission networks of mobile carriers several years ago. At that time, mobile carriers often leased E1 channels, which are used to connect to medium and large companies, from fixed carriers for their mobile backhaul networks. Mobile carriers also employed non-IP technologies. As a result, they paid very high leasing fees. After IP backhaul technology was adopted, the cost to the carrier in many places went down by as much as 80 percent and the pressure from increased traffic was adequately addressed. More importantly, all-IP technologies have gradually standardized products and decreased network construction costs.

A seamless user experience is the second driver for the convergence of multiple networks. Separating networks from services leaves many users dissatisfied and leaves many carriers unable to address their own service convergence needs. The direction in which pipes develop has nothing to do with services, as all services can run in the same pipe. This means that networks of the future will become increasingly flattened and simplified.

Quality of service and quality of experience are the primary factors that need to be resolved in converged pipes, especially for converged Internet and traditional telecommunications networks. After the convergence of these two network types, multi-play carriers that combine mobility, video, Internet, and voice telephone services need to consider how to use carrier-class network capabilities to ensure a high quality of experience for these communications services, which traditionally required separate networks. The multi-play quality of experience solution must be end-to-end and must ultimately improve the consumer experience. This may mean end-to-end centralized strategy control centered on users and services at the network resource layer, or fast troubleshooting and self-healing capabilities at the network layer, or redundancy backup and hot swapping for key components at the equipment layer. In any case, multi-play carriers must ensure that consumers have a perfect carrier-class quality of experience while enjoying diversified multi-play services.

As Internet videos and Internet protocol television (IPTV) become popular, video services will constitute 90 percent or more of the services provided by future networks. Video usage, sharing, and storage trends will rapidly drive up traffic, which will place tremendous pressure on networks. A content distribution network (CDN) will effectively solve this problem. The Pareto principle (also known as the 80–20 rule) often applies when analyzing the proportion of traffic that users allocate to the contents they like. In other words, 80 percent of user traffic involves 20 percent of user content. Statistics show that 80 percent of peer-to-peer video content is transmitted via backbone networks. Therefore, many problems can be resolved if important video content is smartly cached via the CDN.

However, the CDN cannot resolve all problems. Gigantic data traffic makes it hard for some traditional technologies and architectures to sustain satellites, microwaves, and traditional routing architectures. The optical network will be an effective solution for large-capacity transmission. But the bearer mode adopted by traditional optical networks is too rigid to allow adequate flexibility in service provisioning and cross connections. Previously, Internet services used traditional Internet routers, which

Box 1: Cloud computing will reshape IT and CT

- IT and CT will enhance each other to produce a consistent experience across any device, any time, any where.
- The telecommunications and IT industries will integrate services and adopt common standards to:
  - drive down costs;
  - facilitate development; and
  - help cloud services cater to governments, industries, and enterprises.
- The IT computing model will change from a traditional single-server computing architecture to a distribution computing architecture that helps move data centers and services to the cloud.
- The CT model will shift from its focus on real-time voice services to accommodate increased multimedia content through integrated mobile networks and broadband.

Box 2: Converging pipes with IP+Optical networks

- IP technology:
  - makes networks more flexible and eases interconnection,
  - reduces the cost of network operations, and
  - accelerates convergence of fixed and mobile networks.
- Optical technology:
  - increases transmission speed for large-capacity transmissions (video), and
  - uses IP over DWDM to reduce operating and capital expenditures for high bandwidth transmissions.

were too flexible and reduced efficiency. If users clicked a movie link via the Internet, for example, the download often went through many routers. The IP+Optical model uses optical networking to reduce the number of hops for the routers and increase transmission speed. Therefore, the synergy of IP and optical networks has created a viable new solution.

From a service-bearing perspective, the IP+Optical model will make IP over dense wavelength division multiplexing (DWDM) a practical option for services requiring high bandwidths. In this way, data packages can be transmitted directly via relatively cheap optical networks, which will reduce the number of routers used and help conserve energy while also reducing the space required for equipment rooms. In addition, the combined effect of IP+Optical networks at the service protection, network management, and maintenance layers will make this solution highly feasible (Box 2).

THE DEVICE: SMART DEVICES WILL USE THE CLOUD TO EVOLVE INTO PERSONAL MEDIA CENTERS

Up to now, mobile phone usage has centered around conventional communications functions. This will change with the convergence of IT and CT services, which has been helped along by the wider use of smart devices. Since consumers are craving a variety of impressive applications, we believe that in the future smart devices will become deeply intertwined with the cloud to support popular services and applications. As the situation stands today, users often have a bad experience because of disconnects between devices and the cloud, dispersed applications, and unstable service quality. Closely interweaving devices with the cloud will give consumers a better user experience while also accelerating widespread use of industry applications.

Integration of home devices

Gradually, devices used inside and outside of the home are becoming increasingly integrated. Users who connect mobile phones, flat-panel television sets, and personal computers (PCs) with the Internet via broadband or Wi-Fi networks can better leverage the capabilities of each device to make phone calls, watch movies and television programs, play games, or access information online. Thanks to advancing ICT technologies, conventional television sets that once used analog signals now use digital signals. This transformation has turned television sets into smart devices that are able to serve as open platforms for smartphones and PCs. The large high-definition display on these smart television sets vividly projects the full complement of smart applications that users are running on mobiles phones and PCs.

Compared with using just a mobile phone or television set, integrated home devices deliver an enhanced user experience that is customized to the individual tastes of each member of the household. This integration allows users to enjoy a fuller and more animated experience when watching movies and television programs or playing games than they can have by merely watching a conventional television.

Integration of industry devices

Like home devices, industry devices are becoming integrated amid the widespread use of ICT technologies. The integration of industry devices promises to gradually disperse the boundaries between industries. Adding to this trend is the ever-growing convergence of multiple networks (including broadcasting networks, telecommunications networks, and the Internet). This convergence allows IT, television programming, the Internet of Things, gaming, and other technologies to be incorporated into each of the integrated devices.

With the advancement of telecommunications infrastructure networks and the arrival of the era of high-speed mobile communications, network-supported functions can become increasingly versatile. Consider an example from the automotive industry, which wants to cater to today's consumer demand for smarter vehicles. It is because of this demand that integrated automotive devices—including automotive global positioning systems (GPSs) and mobile communications devices—have been developed for consumer markets. Through integration, automotive devices can deliver more versatile and easily accessible functions. These functions may include navigation services provided by call centers that specialize in the automotive domain; automotive security services; and Internet-based provisioning of communications, entertainment, and lifestyle resources.

As mobile devices become integrated on a large scale, people require data both in higher frequency and in massive amounts. To keep up with this integration trend, cloud computing solutions are coming

into widespread use for more and more mobile devices (Box 3). With the help of cloud computing, users can acquire, store, and use data more efficiently and cost-effectively.

ICT CONVERGENCE IMPACTS CONSUMERS, INDUSTRIES, AND GOVERNMENTS

The rapid convergence of ICT has significant meaning for consumers, enterprises/industries, and governments. Consumers and enterprises are benefiting from this transformation, and governments are in a position to facilitate this transformation.

ICT convergence and consumers

The mobile Internet is one of the most important sectors of the ICT industry. In many places around the world, mobile Internet users (e.g., 3G, or third-generation, mobile phone subscribers) outnumber fixed Internet users (e.g., PC users). In Africa, for example, the number of mobile phone subscribers has exceeded 500 million, and there are far more users who access the Internet with their mobile phones than those who access the Internet with their PCs. In Japan, users of devices powered by mobile communications networks also outnumber PC users.

By taking advantage of burgeoning mobile communications networks in the United States, 58 percent of US adults are using mobile network applications, such as mobile email, image downloading, and map searching. Moreover, the increasing popularity of mobile phones and widespread network deployments have given rise to new businesses, such as mobile phone–based shopping and payment. About one-sixth of the population in Kenya uses mobile phone–based banking functions to get financial services. In China, 46 percent of mobile phone subscribers surveyed said that they have purchased something using the access services provided by their mobile phones.[2] The sky is the limit as we learn to leverage the full potential of integrated smart devices, the full complement of peripheral devices, ubiquitous networks, and robust cloud data centers.

Raising the levels of integration will allow users to easily upload documents, photos, songs, and videos recorded on their smart devices to the cloud or to freely download data from the cloud. Life becomes much more convenient with this type of cloud-powered accessibility and back-end backup. Users will also be able to access the network with their smart devices while on weekend getaways or extended road trips to directly view satellite maps and real-time traffic conditions, get recommendations from online friends about scenic spots and nearby restaurants, or easily reserve hotel rooms. In addition, users will be able to play content, such as music, stored in their smart devices on their automobile's sound system to make driving more enjoyable.

Box 3: The future of smart devices

- Smart devices will use the cloud to support popular services and applications.
- Interweaving devices with the cloud will offer a better user experience and accelerate the widespread use of industry applications:
  - Integration of home devices (mobile phones, flat-panel television sets, PCs) with the Internet delivers an enhanced, customized user experience.
  - Integration of industry devices and the convergence of multiple networks (broadcasting, telecommunications, Internet) are gradually merging the boundaries between industries.

Giving full play to the power of this integration will impact users in all aspects of their lives (Box 4). Consumers will be able to use smart devices to search for sales of their favorite clothes at nearby shopping malls; they will be able to improve their diets by using smart devices to check the calorie content of their favorite foods and decide whether they have the nutrition their bodies need.

Combining smart devices and peripheral devices leads to a smarter lifestyle. Linking a smartphone to a conventional television set through an interface device allows users to effortlessly transfer songs, photos, and videos stored in their smartphones to their television sets. This capability not only revolutionizes the functionality of a conventional television set, it gives users a fresh new experience.

Integrating smart devices with compatible medical peripheral devices creates mini smart medical devices. The peripheral devices capture basic vital signs—such as cardiopulmonary status, oxygen saturation, temperature, and pulse—while the built-in applications of the smart devices analyze these signs and then upload them to the cloud. By using smart devices this way, users can analyze their overall health locally and keep an eye on trends in their data. Health professionals can use these data to update personal health records stored in the cloud and to make suggestions for preventative care.

ICT convergence and enterprises/industries

One huge advantage that ICT convergence introduces is cloud computing for businesses, which allows employees to work anywhere that has network coverage rather than merely in their offices (Box 5). By connecting devices, such as mobile phones and PCs, to the cloud, employees can handle urgent tasks at home, on-the-go during business trips, or even on a beach during

Box 4: Implications of ICT convergence for consumers

Raising integration levels between smart devices, peripheral devices, ubiquitous networks, and robust cloud data centers allows consumers to:

- upload documents, photos, songs, and videos from smartphones to the cloud;
- download data from the cloud;
- use smart devices on trips to access maps and traffic reports or find hotel rooms;
- play content from smart devices on automobile devices for enjoyable driving;
- search for local sales;
- check calorie count of favorite foods;
- transfer songs, photos, and videos to television for a fresh experience; and
- track and analyze vital signs for better preventative healthcare.

vacation. The access to resources and the manageability of the deliverables are similar to being physically present in the office.

Another advantage of ICT convergence for enterprises is that employees can boost their production efficiency by leveraging collaborative tools that synchronously deliver intense functions, such as instant messaging, audio and video communications, data sharing, whiteboard sharing, and interactive polling. This applicability allows multinational enterprise teams to cooperate across geographic regions while slashing communications costs. Having virtual teams across the world that work as "one world, one team" is no longer just a dream.

In addition to location-independent accessibility and a boost in production efficiency, ICT convergence also provides high-definition videoconferencing solutions that enable attendees to meet with others in a virtual environment that simulates talking face to face. Attendees on both sides can see each other in real-life proportions and pick up on each other's facial expressions, body language, gestures, and even eye expressions. This functionality minimizes the need for senior management to travel frequently for meetings, which substantially decreases the time and cost for the enterprise.

ICT convergence promises positive impacts on product applications by allowing any industry a greater degree of customization. For example, education, medicine, finance, and government can all benefit from ICT convergence.

In traditional education, students trained primarily in physical classrooms. This method of education does not satisfy the constant need for new expertise that keeps people competitive in a knowledge-based economy. Among the drawbacks of traditional education methods are inadequacies in teaching resources, constraints on time and locations, repetition of effort, lack of consideration for individual learning modes, a potential for out-of-date knowledge, and an inability to meet stiff requirements for collective or off-the-job training. By capitalizing on such comprehensive technologies as cloud computing, cooperative communications, and high-definition videoconferencing, the modern distance education system turns small classrooms scattered around the world into one huge classroom or virtual community. Isolated schools can share resources, and numerous students can attain access to lessons taught by excellent teachers.

Another example of product advancement through ICT convergence comes from the medical industry. Healthcare opportunities vary significantly from one region to another around the world and are usually quite low in rural areas. ICT convergence can help people in less-developed areas gain access to superior healthcare resources. Once connected and linked up to converged networks, high-definition video equipment and medical apparatuses can transmit complete and vital data (such as onsite operation data, electrocardiogram data, monitoring equipment data, computed tomography data, and patient medical records) in real time to medical experts located hundreds or thousands of miles away. Medical experts can even diagnose patients by observing such visible indicators as skin tone and physique.

ICT convergence also offers financial institutions a competitive edge in attracting customers by presenting an alternative to waiting in long lines for banking services. Mobile banking systems and multifunctional self-service devices, which converge both IT and CT technologies, can extend the scope of banking services beyond business center networks and offer customized financial services 24/7.

Government agencies can use ICT convergence to build safer cities by fully leveraging smart monitoring devices, highly reliable transmission networks, large data storage capacity, and smart analytics. It is possible for government authorities to use a daily work platform to see how a city looks in real time and rapidly respond to various emergencies—including fires, car accidents, and floods—to minimize loss of life and financial loss.

ICT convergence and government policy

As the convergence of IT and CT gains momentum, so does the role of governments in facilitating the evolution of ICT. Governments can encourage ICT convergence in three key ways. First, they can reform policies and regulations to remove investment barriers and create a

level playing field for competitors. Next, they can offer financial incentives to firms that deploy advanced ICT services. Finally, they can support and accelerate ICT convergence by directly investing in infrastructure and services.

Responding with effective regulations

With ICT industries already subject to volatile technological and market changes, it is important for regulators of the telecommunications, IT, and broadcasting network industries to respond to changing conditions. By effectively enabling ICT convergence, government regulations can act as catalysts for network and economic development. For example, to build a national broadband network, government agencies need to provide adequate spectrum so the ICT industry can deploy mobile broadband networks that enable rural area residents to benefit from national initiatives. However, the spectrum in many countries is a scarce resource mainly used by the military, broadcasting, telecommunications, and IT industries. This lack of broadband spectrum availability restricts services, ICT convergence, and opportunities for economic development. One way to maximize this scarce resource is to allocate spectrum resources based on industry efficiency.

Switzerland's long-term evolution (LTE) auction provides an example of a regulatory action that drives network and economic development for multiple stakeholders. LTE is a wireless communication standard for high-speed data for mobile devices and data terminals. Switzerland offers an 800 MHz spectrum auction to encourage mobile telecommunications development as a universal access and service tool. The local regulator of this auction established the rule that the auction's winner would be responsible for providing mobile broadband services for rural residents. The regulator allocated the 800 MHz spectrum to the mobile industry for two reasons: the 800 MHz band helps mobile operators deploy LTE networks, and mobile technology is more efficient than IT or broadcast. By adding mechanisms to manage the radio-frequency spectrum, Switzerland helped accelerate ICT convergence for multiple stakeholders.

Several countries have reformed their policy and regulatory frameworks to enable convergence while simultaneously focusing on market forces. Kenya and Singapore, among others, have moved toward technology-neutral licensing regimes that allow service providers the flexibility to deploy the most efficient networks. Some countries—such as Malaysia, the Republic of Korea, and the United Kingdom—have restructured their entire legal and regulatory frameworks to align with convergence and allow multiple players without restriction. There is also an emerging trend in Finland, Japan, and Moldova that simplifies licensing for some services.

Box 5: Implications of ICT convergence for industry

- Extend employee productivity with location-independent access to resources.
- Boost production efficiency across dispersed teams with collaborative tools.
- Minimize executive travel with high-definition videoconferencing.
- Customize products for specific industries:
  - **Education industry:** Improve access to education with modern distance education systems.
  - **Medical industry:** Transmit real-time data and vital signs to distant medical experts for better healthcare access in less-developed areas.
  - **Finance Industry:** Attract customers with 24/7 customized financial services.
  - **Governments:** Build safer cities with monitoring devices, reliable transmission networks, large data storage capacity, and smart analytics.

Policymakers today have the opportunity to promote competition as they undertake policy reform. Creating a competitive market for a variety of different service providers has been recognized as the most effective means to drive growth and encourage efficiency in ICT while reducing prices and improving quality. One way governments can encourage new market entry and subsequent investment in ICT is to remove restrictions on foreign ownership of licenses. This is particularly true in developing countries, where capital availability may be limited. In fact, foreign license regulations can impede ICT convergence. For example, when the Spanish telephone company Telefónica attempted to acquire a stake in Brazil's pay television provider Way TV, regulatory approval took about six months because of foreign ownership issues.

Some countries are introducing new regulatory tools to encourage network investment by smaller market players. Ireland, for example, has found that rather than imposing national broadband rollout and coverage obligations on large-scale operators, it can achieve greater success by allowing wireless broadband providers to enter small local service areas. This has led to a significant rise in new broadband subscribers in non-urban areas.[3]

Traditionally, countries have been very protective of access to government land by private industry. By streamlining and standardizing the application process for access to pole attachments and railway, electrical grid, and road rights-of-way, governments can stimulate the development of broadband infrastructure.

Box 6: How governments can facilitate ICT convergence

- Reform policies to promote competition and remove investment barriers:
  - remove restrictions on foreign ownership of licenses;
  - adopt rules to provide for infrastructure sharing of towers, ducts, and support facilities;
  - add mechanisms for managing radio-frequency spectrum;
  - encourage wireless broadband providers to enter small local service areas;
  - streamline the process for accessing rights of way and pole attachments; and
  - monitor dominant operators.
- Provide government incentives to firms that deploy advanced ICT services, such as:
  - interest-free credit;
  - subsidies, attractive loans to compensate providers who deploy networks in unprofitable areas; and
  - preferential tax rates.
- Invest in infrastructure and services:
  - fund the construction of open-access fiber optic networks;
  - fund digital education initiatives;
  - include network conduits in road projects or incorporate cable arrays in new electrical grids; and
  - support local community initiatives to provide broadband access.

Offering financial incentives

In addition to reforming policies, governments can accelerate ICT convergence by providing incentives to firms that deploy advanced ICT services. The government of Japan, for example, provided interest-free credit, subsidies, preferential tax rates, competition-enhancing rules, and other measures to promote the deployment and use of fiber optic broadband networks.[4] This helped Japan lead the world in fiber optic home subscriptions, with more than 8 million homes connected in 2007.

In 2010, the European Commission (EC) exchanged its old regulatory framework for one that recognized the need to stimulate large-scale fiber investments differently.[5] In the new regulatory framework, governments are allowed to subsidize the rollout of fiber networks in rural and unprofitable areas, and operators can adapt pricing regimes to different market contexts in different geographical areas. The EC expects commercial players to invest in more densely populated urban areas and public authorities to support development in more rural areas. Government can help cut commercial costs by (1) mapping suitable infrastructure, (2) ensuring that civil engineering projects involve potential investors and exploit synergies among all network infrastructures, and (3) clearing rights of way.

Investing in infrastructure

Finally, some countries facilitate ICT convergence by directly investing in infrastructure and services. Government investment can provide a significant advantage during the early stages of convergence and serves to make the government's policy stance clear to stakeholders (Box 6). One study demonstrated that connecting homes with fiber optic networks is financially feasible in cities only if more than 25 percent of homes subscribe, mainly because of the high costs of deployment.[6] Direct investment in community initiatives to provide broadband access can help cities defray deployment costs and jumpstart development.

As part of their investment in ICT convergence, governments can lead the development of advanced networks or create an open-access infrastructure to attract private investment. By 2008, 65 percent of households in France had broadband service,[7] and multiple service providers had benefited from the unbundling of the incumbent France Telecom network. Now national and local governments are investing in the rollout of open-access fiber networks that private service providers will pay to use. Included in this plan are opening sewers and conduits to allow competitive service providers to lay their fiber optic cables within already-existing networks. According to one estimate, this will reduce costs of network deployment by up to 60 percent.[8]

In 2007, the Australian federal government initiated the National Secondary School Computer Fund to ensure that students in grades 9 through 12 had access to school computers.[9] Other initiatives by the Australian government include a commitment of A$81.9 million over three years to fund the Vocational Education Broadband Network, which will create a single high-speed broadband network for post-secondary school training and further education.

Direct government investment in ICT includes risks and challenges. For example, a government's preferential treatment of one or more service providers could distort the market and potentially reduce competition. To address this issue, the EC created rules requiring justification for state intervention and an analysis of the impact of aid on competition in the market. In areas where competing private operators are present, the EC can prohibit state investment if intervention could crowd out existing or future investments by market players.[10]

CONCLUSION

Several factors have contributed to the rapid convergence of IT and CT, including widespread mobile phone penetration, innovations in smart devices, and the advent of cloud computing. As ICT convergence gains momentum, multiple networks will continue to converge, using a combination of IP and optical technology to drive down costs and improve the user experience.

Technology innovations at the level of cloud, pipe, and device are stimulating new industries to meet the expectations of consumers and enterprises for integrated services. As ICT convergence advances, integrated smart devices will gain prominence in homes and enterprises. These devices will use the cloud to support popular services and applications. Consumers will interact with each other and access information in new ways, providing the impetus for new businesses such as mobile phone–based shopping and payment services. ICT convergence will free employees from the office setting and boost production efficiency with collaborative tools such as videoconferencing that allow widely dispersed employees to come together as a single team.

Governments can play a key role in facilitating ICT convergence by creating a framework that promotes competition and innovation. New policies and the removal of regulatory restrictions can help stakeholders of all sizes expand their opportunities while improving access to information for residents in remote regions. Beyond policy reform, governments can stimulate investments through financial incentives. They can even directly invest in infrastructure and services as a way to empower their citizens and remain competitive with other countries. This three-stage process—reform policies, provide incentives, invest in infrastructure and services—provides a roadmap to economic development by encouraging technological innovation and meeting market demand.

NOTES

1 He et al. 2009.

2 See the *ITU Statistics Newslog: Mobile Applications* at http://www.itu.int/ITU-D/ict/newslog/CategoryView,category,Mobile%2Bapplications.aspx.

3 ITU 2006.

4 Dow Jones International News 2000, available at www.dowjones.com.

5 Beardsley et al. 2011.

6 Sigurdsson 2007.

7 Paul Budde Communication, 2009, available at http://www.budde.com.au/.

8 Paul Budde Communication 2008.

9 See details about this program at http://www.deewr.gov.au/Schooling/DigitalEducationRevolution/ComputerFund/Pages/NationalSecondarySchoolComputerFundOverview.aspx.

10 Papadias et al. 2006, p. 13.

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CHAPTER 1.3

Emerging Issues for our Hyperconnected World

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The Internet is changing. From narrowband to broadband, from kilobits to gigabits, from talking people to talking things—our networked world is changing forever. In future, we shall no longer just be connected, we shall be hyperconnected: enjoying super-fast connectivity, always-on, on the move, roaming seamlessly from network to network, wherever we go—anywhere, anytime, via any device.

This vision of our future hyperconnected world builds on the connectivity and functionality made possible by converged next-generation networks (NGNs), but extends the concept of NGN in several ways—through embedded ambient intelligence, automated machine-to-machine (M2M) traffic, and the sheer size and scale of the "Internet of Things" (Figure 1). Today, connected humans are already in the minority of Internet users. According to industry forecasts, the number of networked devices overtook the global population in 2011 and will reach 15 billion connected devices as early as 2015 (Intel's projection in 2009),[1] or a milestone to be achieved as late as 2019 (Google's later forecast, made in 2011),[2] potentially exploding to 50 billion by 2020 (Ericsson's prediction, dating from 2010)[3]—by which time connected devices could outnumber connected people by a ratio of six to one, transforming our concept of the Internet forever. This chapter explores some of the technologies and standards necessary for realizing this vision of our hyperconnected world and its consequences for regulation.

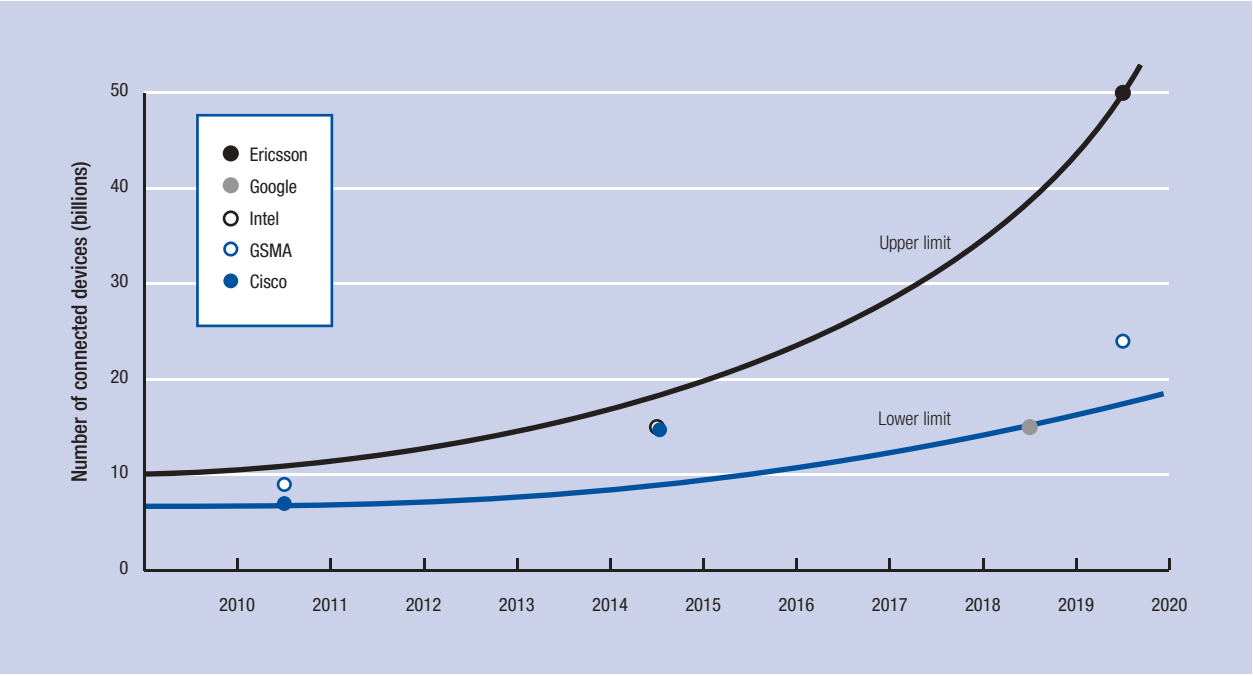
REALIZING OUR HYPERCONNECTED WORLD

The concept of a hyperconnected world embraces elements of the Internet of Things,[4] M2M,[5] ambient intelligence, embedded computing, and mesh networks.[6] Cisco identifies four key enablers of multi-tasking and passive networking, which it asserts comprise "the two key pillars of hyperconnectivity": [7] (1) the growing penetration of high-speed broadband; (2) the expansion of digital screen surface area and resolution; (3) the proliferation of network-enabled devices; and (4) increases in the power and speed of computing devices.

In the *ITU Internet Report* on the Internet of Things, ITU notes that the development of the Internet of Things and the hyperconnected world encompasses a set of technological developments in different fields—wireless and mobile connectivity, miniaturization, nanotechnology, radio-frequency identification (RFID), and smart technologies.[8] Although the Global System for Mobile Communications (GSM) is currently the most widely used technology for M2M, the World Bank suggests that Wi-Fi is likely to play an important role in the future Internet of Things,[9] with Wi-Fi chips embedded in portable computers and smartphones able to operate on a

This chapter reflects the views of its authors only and in no way reflects the views of ITU or its membership.

Figure 1: Projected estimates of the number of Internet-connected devices



Sources: Compiled by ITU, for Intel: Higgenbotham, 2009; for Ericsson: Higgenbotham, 2010; for Google: Malas, 2011; for Cisco: Cisco, 2010; for GSMA: Mobile World Live, 2011.

license-exempt (unlicensed) basis,[10] and with the majority of upgrade costs lying with consumers rather than with the operators. Reportedly one in ten people around the world now use Wi-Fi.[11] Advances in these technologies, taken together, will help realize a miniaturized, embedded, automated Internet of connected devices communicating constantly and effortlessly (Figure 2).

Applications of the Internet of Things are far-reaching, especially when combined with other technologies such as sensor technologies, nanotechnology, or payment systems in the retail sector. Traditional appliances and devices—such as home appliances, vehicles, energy meters, and vending machines—are now entering the network. Perhaps future directions for our hyperconnected future are most readily illustrated with some practical examples.

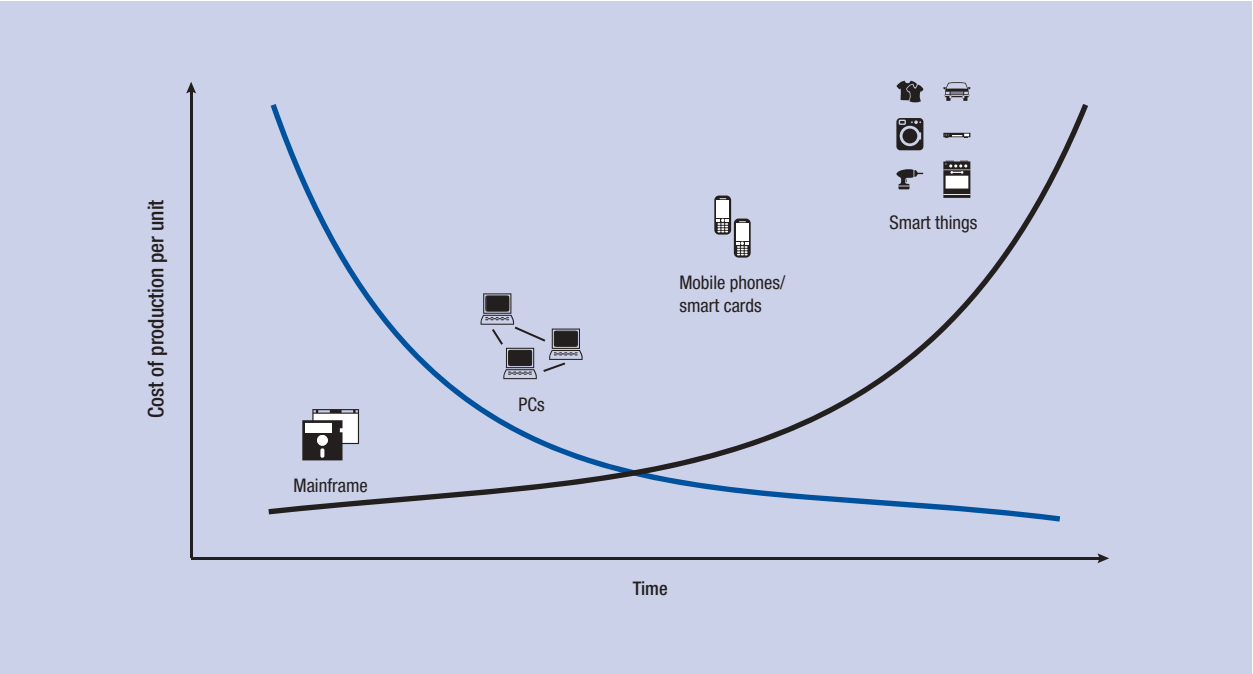
In security and surveillance, commercial security cameras, nannycams, and petcams could transform the way in which objects and premises—as well as people, patients, and pets—are monitored. In the medical and healthcare sector, connecting up patients is being prioritized alongside connecting up digital health records that are accessible by different specialists, pharmacies, or associated health establishments. In the inventory, transport, and fleet management sectors, tracking and status applications are paramount for monitoring the location, status, and condition of stock and food shipments.

Another significant growth area is retail. Besides the integration of mobile banking services or credit card services into mobile phones, various wireless payment and special "contactless" technologies have been developed, which can now be embedded into mobile handsets.[12] For example, mobile operators in Japan and the Republic of Korea have integrated special circuit chips installed into mobile phones to provide payment systems for a number of years now.[13] Some phones also have near field communications (NFC) chips that can be programmed to transfer small sums of money to contactless cash registers.[14]

EXPLOSIVE GROWTH OF DATA

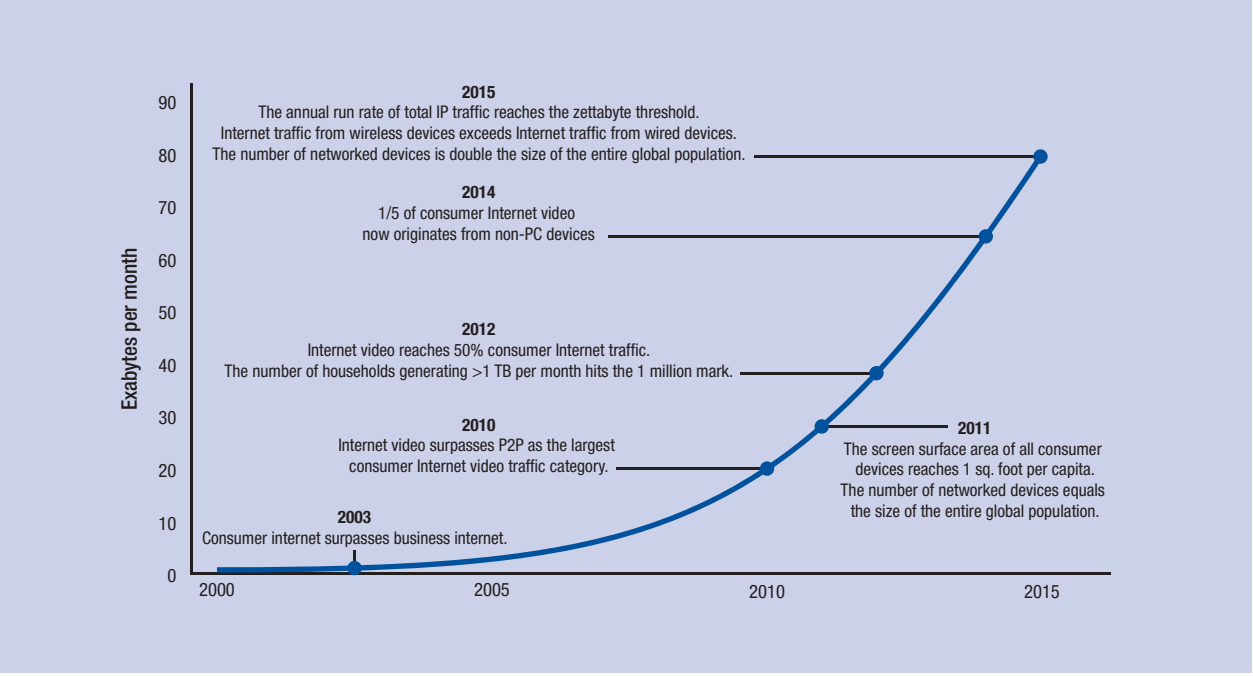
It is no longer the device or the connection that is most important—the data themselves are the new currency of our networked future. Data are now growing exponentially (Figure 3), with both stored and transmitted data showing strong expansion. According to some estimates, more data were created between 2008 and 2011 than in all history prior to 2008. The research consultancy IDC considers that, in 2010, the amount of data transmitted around the world exceeded 1 zettabyte for the first time, while estimating that the size of the digital universe now doubles every two years.[15] Cisco is not so sure, and predicts that annual global IP traffic will only reach the zettabyte threshold (966 exabytes, or nearly 1 zettabyte) in 2015 (Figure 3).[16] Of note, Cisco projects that traffic from wireless devices will exceed Internet traffic from wired devices by 2015—in the hands of end-users, the future Internet looks wireless, mobile,

Figure 2: Miniaturizing and multiplying: Getting smaller and more numerous



Source: ITU, 2005a.

Figure 3: Explosive growth in data



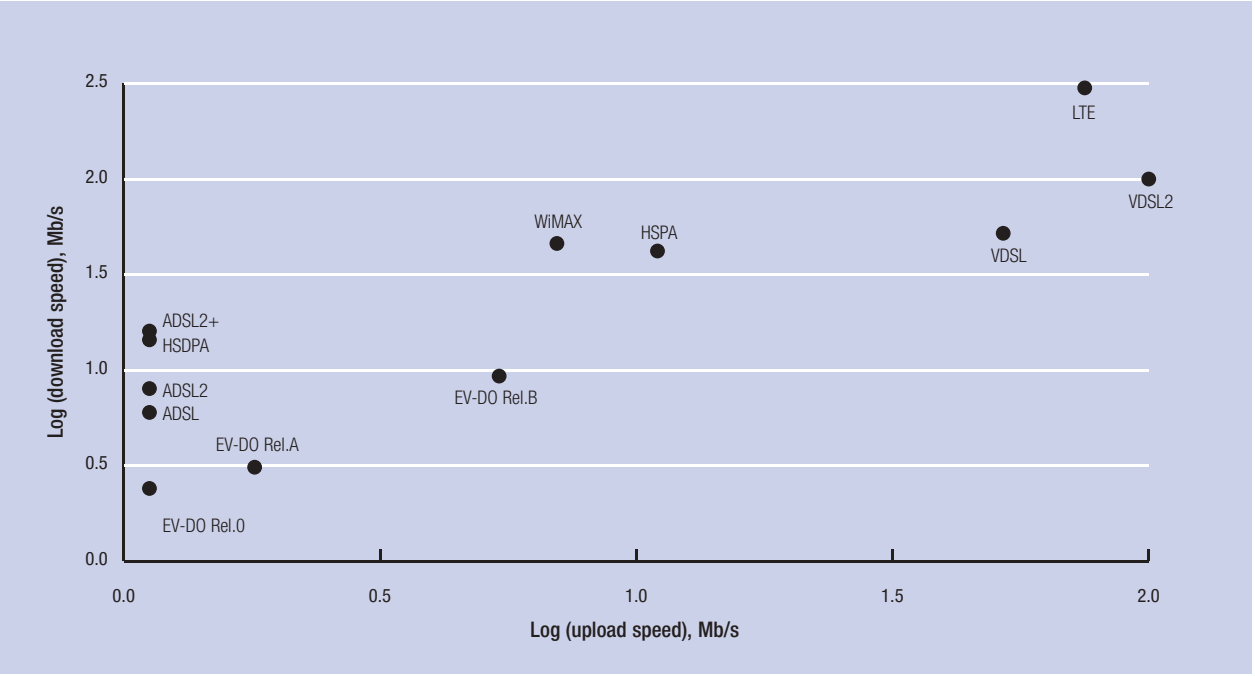
Source: Cisco, 2011.

and portable, even if fiber networks remain essential in the transport layer of the Internet to accommodate such growth in data.

Factors driving this growth in data include the greater availability of hardware, falling marginal costs of digital reproduction (which are now close to zero), automation, and easier digital delivery, with digital assets enjoying an extended lifespan online.[17]

In fact, unless investment in networks can keep up, we risk being overwhelmed by a data deluge: as one leading industry executive puts it, the current generation is the first generation where more data are not

Figure 4: Growth in theoretical throughput speeds and capacity, Mb/s



Source: ITU, with representative speeds cited from various sources: ITU (http://www.itu.int/dms_pub/itu-t/oth/1D/01/T1D010000040003PDFE.pdf); GSMA (www.gsmamobilebroadband.com/about/); Cisco (Pinola and Pentikousis 2008).
Notes: Throughput speeds converted using log to the base 10. ADSL = Asymmetric Digital Subscriber Line, several versions; EV-DO = Evolution Data Only, several releases; HSDPA = High-Speed Downlink Packet Access; HSPA = High-Speed Packet Access; LTE = Long-Term Evolution; VDSL = Very-High-Bit-Rate Digital Subscriber Line; WiMAX = Worldwide Interoperability for Microwave Access.

necessarily good.[18] In any case, it is clear that significant new investments are needed in many forms of information infrastructure. For example, Gartner predicts that global hardware spending on data centers (including servers, storage, and enterprise data center networking equipment) will surpass US$126.2 billion in 2015, up from US$87.8 billion in 2010.[19]

Given such rapid growth in data traffic, in order to continue providing adequate levels of quality of service, telecommunications operators and service providers are adopting more stringent network management practices that include data restrictions, traffic throttling, filtering, and/or the use of data caps or thresholds. Once the cap is exceeded, a subscriber must purchase additional download volumes, or their access speed is reduced or service terminated for that month. Such practices have influenced debates over "net neutrality." These issues are increasingly likely to come to the fore if data traffic continues to grow at current rates.

Along with network and infrastructure investments, networked technologies are evolving rapidly to accommodate such massive growth in data. The most obvious development is perhaps in speed, with fixed fiber-to-the-home now capable of up to 100 Mb/s for consumers and up to 1 Gb/s for business. High-capacity wireless technologies have historically managed to achieve data rates and capacities of up to a tenth of the fastest equivalent wireline technology, with the latest data rates for LTE amounting to some 5–12 Mb/s download, and some 2–5 Mb/s upload. Its theoretical maximum download speeds are much higher, at 300 Mb/s download and upload speeds of 75 Mb/s (Figure 4).

However, measuring technological progress in terms of speed and data capacity alone is too simplistic—technological progress is transforming the way we live.

REGULATORY CONSEQUENCES

The impact of the Internet of Things promises to be more pervasive and far-reaching than merely convenient wireless payment systems, smart gadgets, and Internet-enabled devices (Box 1). The embedded Internet will blur boundaries between economies, societies, and industries. Many industries (including energy, transport, financial services, healthcare, and media) now rely on integrated information technology (IT) systems and infrastructure to monitor, control, manage, and deliver their services. Integrating Internet connectivity into devices and things opens up new risks that information will be unintentionally put into the hands of people who should not have access to it. These risks—as well as opportunities—arise in determining who exactly knows what, who can access what, and who can communicate with which device, as well as the dissemination and use of different data across different sectors. This section goes on to review the changing role of regulators, as well as some of the key regulatory consequences of a hyperconnected

ICT environment in open access and infrastructure-sharing, technical numbering and address issues, switching and roaming requirements, and net neutrality.

The changing role of regulators

Perhaps the greatest overall impact of the hyperconnected world lies in transforming the role of regulators in a converged telecommunication environment. Establishing a separate telecommunication/ICT regulator has been the basis of the sector reform process in many countries. By the end of 2011, 158 separate regulators had been established worldwide, in around four-fifths of all countries around the globe. Every year, ITU hosts a Global Symposium for Regulators (GSR) to debate the issues transforming the ICT environment and to consider their impact on the regulatory environment, and publishes the outcomes of the GSR in the form of best practice guidelines.[20]

In recognition of the technological convergence taking place between infrastructure and content, many telecommunication regulators are now moving to adopt growing responsibilities over the regulation and monitoring of content and broadcasting (Figure 5). Some other countries have also moved to expand the mandate of the regulator to include information technology, broadcasting content, and/or spectrum management.

In 2010, 16 percent of all telecommunication/ICT regulators worldwide included regulation over broadcasting content within their mandate (with a few sharing that responsibility with a ministry). Although Internet content is not regulated in more than 44 percent of countries worldwide, regulation of Internet content lies within the mandate of some 13 percent of telecommunication/ICT regulators. Thirty percent of regulators include IT in their mandate; they share this responsibility with the ministry or other government bodies in 12 percent of these cases.[21]

As the Internet becomes embedded in many more everyday objects, some observers suggest that the role of ICT regulators in a converged ICT environment will be far more pervasive and touch on many more facets of our hyperconnected lives than just competitive market structure, network interconnection, pricing, and consumer protection. The advent of high-speed networks and new kinds of content creates an important leadership role for government policymakers and ICT regulators in stimulating the demand for broadband and in promoting investment in infrastructure.[22] In fact, ICT regulators may become indirectly involved in many more spheres of influence, reflecting the involvement of ICT infrastructure and services in many aspects of our daily lives.

Open access and infrastructure sharing

Open access approaches and infrastructure sharing are likely to be the foundations for future network growth.[23] Various different approaches have been adopted by national governments. A number of countries (e.g., Australia, Malaysia, Qatar, and Singapore) have embarked on the creation of entirely new national broadband networks (NBNs), which deploy fiber optic technology throughout the core network and, crucially, in the access networks that extend to end-customers. Investments in these networks are huge (e.g., Australia's NBN will cost $A 43 billion, or US$45 billion), which has led to the re-nationalization of infrastructure in some countries in order to obtain economies of scale and preferential government borrowing rates.

Other countries (e.g., in Europe) are trying to work within existing regulatory frameworks to find means of improving investment incentives for network operators while maintaining competitive supply.[24] These strategies involve lightening the regulatory requirements on dominant operators (or those with significant market power) as a support or reward for the development of ubiquitous broadband networks.

Developing countries that lack the public funds to support a full NBN, as well as those with no existing privately owned fixed network infrastructure, can pursue various hybrid solutions (e.g., Tanzania and Mozambique). These initiatives usually involve public investment (typically in the form of low-interest loans) in a fiber backbone network, coupled with various forms of support and encouragement for privately funded access networks using a range of technologies (such as W-CDMA or Wideband Code Division Multiple Access

Box 1: Contactless payments: Near field communication payments in Turkey

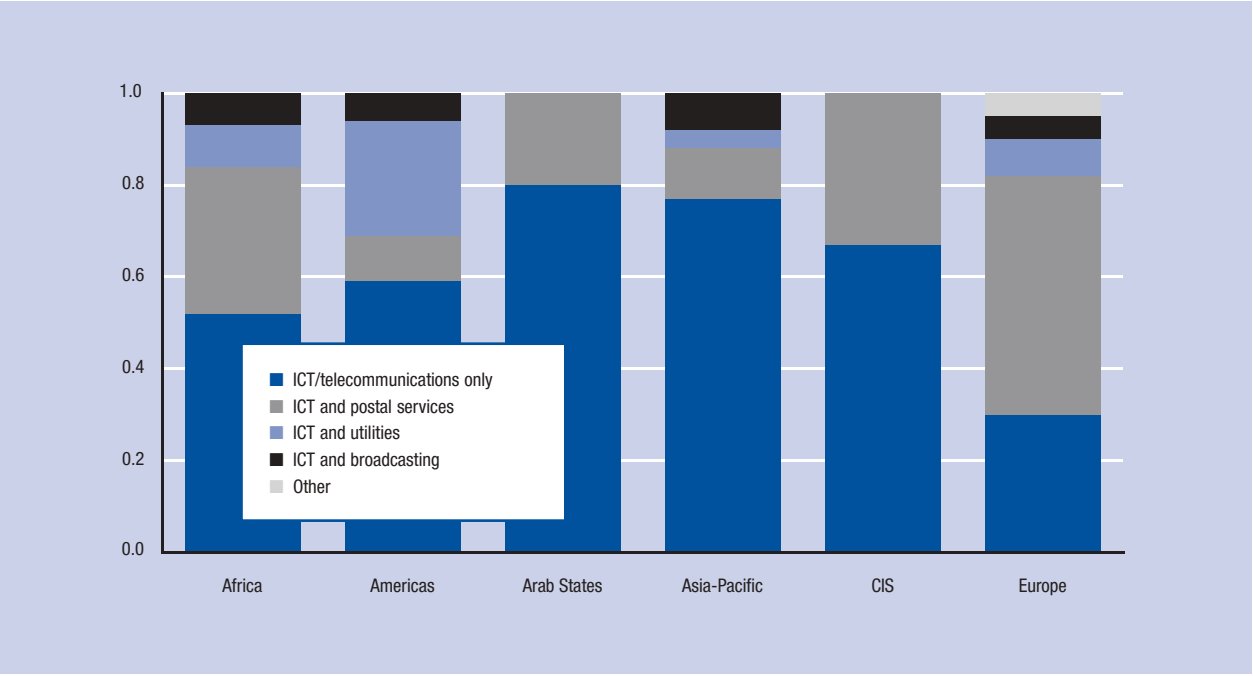
The World Bank's *ICT 4 Development Report 2012* (forthcoming) underlines the notion that growth in mobile money systems is built on a complex ecosystem spanning the mobile, retail, and financial sectors that are comprised of banks, mobile operators, the retail sector, policymakers, regulators, and consumers.

This is a point illustrated by the growth of near field communication (NFC) in Turkey. Turkish banks have embraced NFC enthusiastically as a form of wireless payment. With support from the Ministry and the Government of Turkey, and in conjunction with retailers, Turkish banks and mobile operators have promoted NFC as a quick, easy, and convenient way to pay for purchases. Operators and banks have launched consumer awareness campaigns to promote the advantages of this form of payment. They have been rewarded by consumer enthusiasm for the new technology, which has been deployed in many modern commercial shopping centers in large Turkish towns. It remains to be seen whether the success of NFC in Turkey can be replicated to the same extent elsewhere.

Source

World Bank, forthcoming; BBC 2011.

Figure 5: Converged regulation: The mandates of regulators, 2010



Source: ITU World Telecommunication/ICT Regulatory Database; ITU, Forthcoming.

Evaluation; HSDPA, or High-Speed Downlink Packet Access; and WiMAX, or Worldwide Interoperability for Microwave Access, for example).

Whichever strategy is adopted, open access usually means that all suppliers, whether in horizontal or vertical markets, are able to obtain access to the new network facilities on fair and equivalent terms. The definition of open access varies from country to country, depending on the regulatory model adopted; the terms and conditions of access clearly vary. Nevertheless, open access is essential to avoid monopolistic frameworks and is generally required wherever there are economic bottlenecks preventing competitive supply. However, open access is progressively less important moving up the infrastructure layers, provided that it is available at the lower layers and there is sufficient incentive in its regulation to encourage investment in infrastructure.[25]

Numbering and addressing issues

Given the massive growth forecast for connected devices, numbering and addressing issues could become a major concern in providing all these network-enabled devices with their own addresses. In a future where many consumer equipment and electronic devices will need connectivity and hence their own identifiers (although not necessarily their own Internet addresses), some stakeholders envisage a need for greater and better numbering resources (others argue that this is not a problem at present, as most M2M applications currently use GSM).

Potential shortages in address space through full allocation (but not necessarily use) of Internet Protocol version 4 (IPv4) addresses (for example, triggered by the allocation of the two last blocks of remaining IPv4 address space on February 1, 2011) could be averted in the long run by the transition to Internet Protocol version 6 (IPv6).[26] Introducing IPv6 will take the address space from around 4 billion (2^{32} or 4,294,967,296 addresses) to 128-bit addresses, so the new address space supports 2^{128} or a total of 3.4×10^{38} addresses, enough for a trillion tags to be assigned every day for a trillion years. Opinions are divided about how much of a problem shortages in IPv4 address space are likely to pose. Some observers see this as a major issue that requires transition to IPv6 as a matter of urgency; others argue that greater use of network address translation (NATing) and more efficient use of IPv4 address space (e.g., such as recovering unused IPv4 addresses) will permit continued expansion of the IPv4 space, including for mobile devices.[27]

However, some countries and some regulators are not yet making adequate investments in capacity building or preparedness for the IPv6 transition, while mobile networks may not yet be IPv6-enabled (and they are unlikely to be so for some time yet). According to Detecon, this could amount to the digital equivalent of a fault line running through the future Internet of Things, between its wireline and wireless halves. Detecon identifies four possible options for resolving this issue: (1) extending the

existing mobile numbering range; (2) using a new mobile numbering range; (3) using an international mobile numbering range; and (4) using internal network numbers.[28]

Significant issues surround access and digital identity management more broadly. Today's secure numbering system means that, bar an erroneous wrong number, callers can be relatively confident that a message left on an answering machine should reach the intended recipient. In connecting up objects such as webcams, we may be confident we have accessed the right webcam to monitor our children at school or doing their homework at home remotely, but who else may also be able to access it?

Switching and roaming issues

Various issues arise with regard to switching and roaming. With regard to switching, M2M applications are often bound to a mobile operator for the device lifetime, mainly because: (1) M2M terminals are currently mainly based on GSM technology; (2) only operators can get E.212 (or international mobile subscriber identity—IMSI) numbers; and (3) regulators do not require the portability of IMSIs. This means that the mobile operator is at an advantage when clients want to negotiate a switch from one operator to another, or even in negotiating new rates. For large numbers of devices distributed all over a country (region or continent), switching subscriber identity module (SIM) cards to migrate devices from one mobile operator to another is simply not an option (Box 2).

With regard to roaming, many M2M applications (e.g., wireless payment systems) rely on full international mobile coverage. Providers cannot always negotiate competitive regional or global roaming solutions (for both the M2M application provider and the mobile operator) and often use intermediaries. This leaves intermediaries in a stronger negotiating position (regarding rates, etc.) than either the M2M application provider or mobile operator. There is a potential role for regulators here in considering whether intervention is necessary, and potentially in negotiating roaming requirements and rate interventions.

Net neutrality

Given the explosive growth in data, regulators are likely to become increasing concerned with traffic management practices. The ITU *GSR11 Discussion Paper* "Open Access and Regulation in the Digital Economy" identifies the main aspects of net neutrality as traffic management, transparency, non-discrimination, and potential differentiation between price and quality of service in traffic management.[29] Currently, many regulators are launching public consultations and investigations into traffic throttling practices, but many have stopped short of intervening, with most regulators content to call for greater transparency and disclosure in the industry's best interests to safeguard consumers. For example, the European Commission (EC) policy on net neutrality published in April 2011, *The Open Internet and Net Neutrality in Europe,*[30] calls for greater disclosure of traffic management practices to ensure that consumers are well informed (Table 1). The EC recognizes that traffic management is necessary to ensure the smooth flow of Internet traffic, particularly when there is network congestion—which looks increasingly likely to arise, given current growth rates in data traffic.

With regard to data, the assets at risk in a smart society include not only the networks, but also data and information assets (including customer identities and records). For example, the Ponemon Institute estimates that the cost of a data breach rose from US$6.8 million in 2009 to US$7.2 million in 2010, with the average cost per compromised record in 2010 reaching US$214,[31] up 5 percent from US$204 in 2009.[32] Information will be abundant and everywhere, but can we learn to live with such abundance—are we information-rich or information-overloaded? If we can learn to live with the data deluge, the prospects of personalized services tailored to customers and their search behavior offer tantalizing possibilities.

It is not just data breaches that are of concern: the data we willingly give away about ourselves are of equal concern in the web that never forgets—where instant status updates, sharing via retweets, and cascading distribution of information in online feeds are common. The speed with which we work and communicate is accelerating, while the scale and distribution of our

Box 2: M2M applications in the Netherlands

In 2010, Logica was commissioned by the Dutch Ministry of Economic Affairs to examine the technical solutions to the problem of migrating M2M providers for clients with large numbers of M2M devices. This poses a major logistical problem, where the thousands or tens of thousands of M2M devices are distributed all over the country, sometimes in hard-to-reach places.

After extensive study, Logica concluded that number portability does not work for SIM cards, because the first five or six digits of an IMSI number (which conforms to ITU numbering standard E.212) are operator-specific, so in order to change operators, the IMSI numbers would have to change. Logica suggests that remotely updating IMSI numbers on SIM cards is another technical possibility, but there are no standardized solutions for this, only proprietary ones.[1] Instead, Logica identified a regulatory solution whereby large-scale M2M deployments could use their own SIM cards carrying their own IMSI and cryptographic parameters, so it is no longer necessary to change the data on the SIM-card, the solution used by some Mobile Virtual Network Operators (MVNOs) today.

Source

van der Berg, 2010.

Table 1: Status of net neutrality initiatives in selected countries

Stage in process	Position along the spectrum (least to most stringent)	Country
No consultation	Considered net neutrality, but found no problems requiring a consultation and subsequent rule; will continue to monitor	Denmark Germany Ireland Portugal
	Non-binding neutrality guidelines	Norway
In consultation stage	Information gathering on current practices to potentially establish rules	Italy
	Transparency/disclosure rules proposed, but no traffic management	United Kingdom
	Transparency/disclosure rules and traffic management/ non-discrimination rules proposed	Brazil Sweden
Rules/legislation adopted	Transparency/disclosure rules but no traffic management/ non-discrimination rules	European Commission
	Transparency/disclosure rules and traffic management/ non-discrimination rules	Canada Chile France Netherlands United States

Source: Telecommunications Management Group, Inc., quoted in World Bank and infoDev, 2011.

real-time communications are growing. It seems unlikely that separate models of regulation for telecommunication and data protection can be sustained in our converged era—how can regulation evolve to keep up? The debacle over the launch of Google Buzz and ongoing concerns over privacy settings on Facebook are already highlighting gaps in a converged regulatory environment.

STANDARDS AND INTEROPERABILITY IN A NETWORKED WORLD

In a hyperconnected world of so many networked devices, identification, interoperability, performance standards, and communication protocols are clearly essential to ensuring that different devices and systems can communicate across different networks.

The Internet of Things will contain billions of objects that must be uniquely identified, a challenge for which there is, so far at least, no internationally agreed solution. A unique identification scheme is probably the biggest challenge of the Internet of Things. Some identification schemes for identifying objects are based on bar codes. Other schemes are under development to address the needs of specific applications. ITU has launched an Internet of Things Global Standards Initiative, enabling experts to come together physically to conduct standards-based development work. For example, ITU-T Study Groups 11 and 13 are studying architectures and testing requirements for networks using tag-based identification, while ITU-T Study Group 17 is studying the security and privacy of tag-based identification mechanisms.

One of the biggest issues in identity management today is that identifiers used in one network might not be understandable or usable in another network. In the Internet of Things, consumers are likely to want to use different objects across multiple kinds of heterogeneous networks, which will need the identities of things to be "federated" or capable of being translated accurately and recognized by different networks.

The solution to this challenge does not necessarily involve a single global identity for a device on a network. Rather, a "zoo" or collection of associated identities—as exists today—may continue. For example, in some domains, an identity may be just an email address. In other areas, such as social networks, an identity is far more complex and more loaded. It may include a real name and links to other people. Some identities may be created temporarily (such as those used for tracking people at a conference, for example, or those used for contractors working within companies). Mapping identities like these together to make them interoperable, while accommodating privacy and security concerns, is a vital part of identity management.

Indeed, connecting up many different kinds of object to the Internet may present one of the greatest standardization challenges yet. Sectors likely to be touched by the need for standardization include e-health, e-government, automotive, geo-information, remote sensing, home networking (including home automation), e-commerce, and even the mitigation of climate change.

As with any new area of standardization, one of the first important steps is to agree the scope of the work

and standard terminology, so experts from across different disciplines can all use the same language. ITU's Internet of Things Global Standards Initiative aims to develop a work plan for Internet of Things standardization and the detailed standards or Recommendations necessary for the deployment of the Internet of Things on a global scale, taking into account the work done in other standards development organizations in areas such as M2M, network aspects of identification (NID), ubiquitous sensor networks (USN), machine-oriented communication, and the web of things, among other areas.

CONCLUSIONS

We are moving toward an era of an embedded, ubiquitous, and invisible Internet. A hyperconnected world of communicating devices has consequences for us all in the way we live, as more and more of the everyday real world around us becomes reflected online. Status updates, location updates, changes in status or conditions: these will all become part either of what we know, or of what is known—or knowable—about us.

The outcome for our hyperconnected world might not necessarily be Big Brother, but it might not be far off either. Regulators and policymakers have a vital role to play at this point in time in establishing the *mores* and norms for the online world—in what is and is not acceptable and in developing principles and best practices going forward, so that the risks and opportunities of our hyperconnected world are managed appropriately to protect both consumers and citizens.

NOTES

1 Higgenbotham 2009.

2 Malas 2011.

3 Higgenbotham 2010.

4 The concept of the Internet of Things was first referred to by Mark Weiser in his 1991 paper, "The Computer for the 21st Century." ITU has adopted the following working definition of the *Internet of Things* (as of August 2011): "In a broad perspective, the IoT can be perceived as a vision with technological and societal implications. From the perspective of technical standardization, the IoT can be viewed as a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on, existing and evolving, interoperable information and communication technologies. Through the exploitation of identification, data capture, processing and communication capabilities, the IoT makes full use of things to offer services to all kinds of applications, whilst maintaining the required privacy."

5 ITU has recently established a new Focus Group on M2M service layer aspects at its TSAG. See ITU 2012; ITU-T. N.D.

6 ITU describes mesh networks as "A way to route data, voice and instructions between nodes. It allows for continuous connections and reconfiguration around blocked paths by 'hopping' from node to node until a connection can be established" in the glossary of ITU-D's *Trends in Telecommunication Reform 2009.* See ITU-D 2009.

7 Cisco 2010, p. 3.

8 ITU 2005a, 2005b.

9 World Bank and infoDev 2011.

10 ITU has designated the 2450 MHz and 5800 MHz bands for industrial, scientific, and medical (ISM) applications that "must accept harmful interferences." This is often interpreted to mean that they are considered unregulated. See *Frequently Asked Questions* on the ITU-R website, available at http://www.itu.int/ITU-R/terrestrial/faq/index.html.

11 Wi-Fi Alliance N.D.

12 World Bank, Mobile Trends report, forthcoming, written by Michael Minges.

13 Terri and Hayashi 2007.

14 Perez 2011.

15 IDC 2011.

16 Cisco 2011.

17 See Denton 2011.

18 *Google Think Quarterly* 2011.

19 Telecompaper 2011.

20 See ITU's regulatory website, http://www.itu.int/ITU-D/treg/index.html, for details of the latest Global Symposium for Regulators, GSR-2011 (http://www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR11/index.html), as well as previous GSR events, http://www.itu.int/ITU-D/treg/Events/Seminars/GSR/index.html.

21 ITU 2011a.

22 ITU 2011b.

23 This section is extracted from Rogerson 2011.

24 Rogerson 2011.

25 Rogerson 2011. D. Rogerson, taken from his speech at the GSR 2011.

26 See, for example, Middleton 2011.

27 See, for example, Arbor Net's discussion of IPv6 in relation to World IPv6 Day sponsored by the Internet Society (ISOC) in Malan 2011.

28 Detecon presentation on M2M, "Machine-to-Machine Communications (M2M) Creating a business enabling environment for one of the most promising growth markets." Personal communication.

29 Rogerson 2011.

30 European Commission 2011.

31 Messmer 2011.

32 Messmer 2010.

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CHAPTER 1.4

Network Neutrality: An Opportunity to Create a Sustainable Industry Model

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Network neutrality is the principle that inhibits telecommunications network operators from discriminating among different kinds of Internet content, applications, and services traveling across their networks. Advocates of network neutrality argue that the principle underpins the Internet's explosive growth: if any and every kind of content, service, and application can be distributed over the Internet, then there is no limit to the innovations that Internet companies will invent for consumers to choose from. But network neutrality has, arguably, become the victim of its own success. Internet traffic has grown faster than network operators' related revenues, and they are now struggling to invest in the new network infrastructure needed to support more Internet traffic.

Not surprisingly, network operators are also trying to manage traffic volumes. Some are even deploying sophisticated network management technologies, such as *deep packet inspection,* which examine the nature and content of the traffic to identify possible sources of harm to network performance and also to protect the networks and consumers from increasingly sophisticated attacks and abuse. But as soon as network operators start scrutinizing the content of Internet traffic, edge players—providers of content, applications, and services as well as aggregators—worry that network neutrality may be infringed, limiting their will to innovate. Both consumers and regulators also worry about maintaining the confidentiality of consumer data.

At the same time, major edge players are building their own Internet traffic "pipes" or using the dedicated content distribution networks (CDNs) of companies to preempt possible network capacity constraints and avoid the performance limitations related to the speed of transmission and delay if their traffic traverses the traditional backbone of the public Internet. By by-passing the backbone of the public Internet, the edge players ensure that the immense volume of traffic they generate reaches consumers' Internet service providers (ISPs) at top speeds. In fact, the majority of the traffic destined for residential end users from edge players now flows over these specialized backbone networks. This situation can be seen as putting a different kind of strain on net neutrality: smaller edge players, unable to make similar investments, may not be able to match the larger players' performance, though whether this represents discrimination or simply a competitive disadvantage is open to debate. Policymakers can argue that even though small edge players may not be disadvantaged, network neutrality regulations need not extend to the backbone providers, including the CDNs, because backbone transport in almost all countries operates in a competitive

The views expressed in this article correspond to those of the authors and not those of McKinsey & Company.

market. Moreover, the development of CDNs and private backbone transport has greatly benefitted the evolution of the Internet by the flow of new private capital that has greatly increased both performance and capacity.

However, the evolution of the backbone of the Internet from traditional Internet protocol (IP) interconnections to specialized networks to provide higher performance foreshadows the critical net neutrality issues vis-á-vis access networks with which policymakers must wrestle. The edge players that offer services demanding high performance or capacity such as video-rich content, gaming, and two-way multimedia conferencing will increasingly want differentiated service from where their traffic enters the access network to the end user in order to provide high-quality service. Unlike the competitive backbone market between edge providers and Internet access providers, access providers are positioned in the network where they do have unique market power since each end user typically is connected to only one access provider. Access providers need to invest capital to provide the differentiated services and increased capacity needed by edge players and end users. But the access providers will not invest this capital if they cannot earn reasonable returns. However, offering such differentiated services between edge players and end customers may be a departure from the pure "best effort" open-access principles of the Internet.

This is definitely a very complex picture for the telecommunications industry, and involves multiple angles. From an economic perspective, it is a debate on how to finance the new wave of infrastructure investments and who would incur the costs—for example, should edge players contribute? From a regulatory perspective, it involves complex regulatory issues covering both traffic and access management. Although network neutrality appears mainly as a discussion of traffic regulation, since it is closely related to capital expenditure funding decisions, there is also a strong link to access regulation. Thus, one cannot assess the network neutrality rules in any given country without understanding the status of that country's access regulation. Despite all these complexities, we believe, as we show in this chapter, there are some key industry messages that are starting to become clearer:

- Network neutrality is not an immediate major issue in the fixed-line industry. Despite decreasing numbers of fixed lines and revenues, the fixed-line sector has managed to successfully increase average revenues per line from its conventional, mainly copper-based access network in the past few years by successfully rebalancing in spite of the impact of applications such as voice over Internet protocol (VoIP). The issue in the fixed-line sector, however, is how to increase investments in fiber optic networks—particularly access—that are under current regulatory constraints. Once these networks are in place, capacity constraints will not have as great an effect on the content going through them.
- Network neutrality does matter for the mobile industry. Increasing capacity demands caused by new and heavy applications and an inability to re-price its services have meant that the industry will be under great pressure to deliver the future investments that are required for growth. We believe this industry, unlike the fixed-line industry, will constantly require network upgrades to keep up with capacity. Over-the-top (OTT) players (e.g., Skype, Netflix) also offer a fundamental challenge to mobile players because VoIP- and IP-based messaging applications have cannibalized traditional revenues.
- Traffic management issues will affect small edge players that leverage the "public Internet" to provide their services more than large edge players that more and more frequently use the competitive CDNs networks to provision their services.
- Network neutrality poses large risks for telecommunications operators, consumer privacy, and even—potentially—national security in general in the form of disclosure, adjudication, and discrimination.
- Regulators are caught in the middle of these complex and quickly evolving developments, and have largely been opting for a cautious approach.

This chapter sets out the background of the current issues affecting network operators' revenue and capacity as well as measures taken thus far by the industry to address those issues, and discusses current regulatory positions on network neutrality. It then proposes a set of aims that all industry players—network operators, companies offering Internet services and applications, and regulators—can pursue that will balance growing industry revenues to fund infrastructure investment with safeguarding network neutrality, and so release the next wave of services and applications over the Internet, with all the economic and societal benefits they promise.

THE INTERNET'S SUCCESS IS STRETCHING NETWORKS' CAPACITY AND REVENUES

The principles of an open Internet based on network neutrality developed at a time when facility-based Internet service providers could meet the demands of Internet traffic without straining their capital expenditure budgets. Similarly, Internet services and applications did not challenge the core revenue streams of the companies providing the Internet's physical transport infrastructure. Today the industry is quite different: explosive growth in Internet traffic has put operators under intense pressure to increase communications network capacity. This is expensive: estimates for upgrading fixed infrastructure to next-generation network in the EU-15 countries range between €200 billion and €250 billion. At the same time, operators are facing downward pressure on their revenues and profits, particularly from services offered "over-the-top" of the Internet by edge players,

making further investment at current levels of price and cash flow both difficult and unattractive.

Internet traffic has grown by 13,000 percent, or 63 percent a year, in the Organisation for Economic Co-operation and Development (OECD) countries over the past decade. It now dominates traffic on wireline networks, where it continues to grow at a compound annual growth rate of 40 percent.[1] Internet traffic will soon dominate wireless networks too: wireless Internet traffic is expanding in developed countries by 100 percent a year or more. Recent proliferation in movie-streaming services and connected home gaming systems is accelerating consumer demand for more bandwidth. These video-oriented applications represented more than 37 percent of total global consumer Internet traffic in 2010.

However, at the same time, some OTT Internet applications—such as VoIP—are eroding operators' existing revenue streams and cash flows. Although content providers continue to grow their businesses quite rapidly, McKinsey analysis in North America suggests that traditional telecommunications industry players, both mobile and fixed, lost around US$30 billion of revenue between 2005 and 2010 to OTT applications that substitute for existing revenue streams.

REGULATORY RESPONSES CONCERNING NETWORK NEUTRALITY

So far, we have seen how rapid and profound changes in the Internet landscape appear to be straining the principle of network neutrality. Telecommunications regulators around the world take a variety of approaches to the issue, which is appropriate given the variety of interests at stake. These stakeholders include the content providers and aggregators, who fiercely support the open Internet; telecommunications executives, who argue that more beneficiaries of an expanding Internet—such as Internet search engines, video content providers, and social networks—must share more of the heavy burden of network capacity expansion; and consumer advocates, who call for more privacy protection and transparency.

Examining the main regulatory approaches to network neutrality followed in the United States, the European Union, and Asia reveals some positions that will need to be refined to enable the successful co-existence of telecommunications operators and content providers. Current regulations tend to equate protecting network neutrality on its own as the best means of promoting competition in the provision of Internet infrastructure and services. But this approach bears the risk of some unfortunate unintended consequences.

The US approach

The US regulator, the Federal Communications Commission (FCC), has cautiously promulgated the following network neutrality principles:

- **Transparency:** Telecommunications operators must disclose their network management practices, performance characteristics, and terms and conditions in a clear way so that consumers and edge providers can make appropriate informed decisions.
- **No blocking:** Fixed operators may not block lawful content, applications, services, or non-harmful devices. In the same manner, mobile broadband providers may not block lawful websites or block applications that compete with their voice or video telephony services.
- **No unreasonable discrimination:** Fixed broadband providers may not unreasonably discriminate in transmitting network traffic as long as it is lawful.

The US approach recognizes that translating these principles into practice is challenging, to say the least, for the rapidly evolving Internet industry. Therefore the FCC encourages the industry to follow these principles while inviting potential aggrieved parties to file complaints, allowing a "case law" to develop that will inform more detailed regulations in the future. Despite their caution, the rules are already being challenged in the courts by Verizon and other service providers. The challengers argue that market forces are working fine on the Internet: there is no need for more regulation since existing anti-trust laws provide sufficient protections.

While assessing the status of regulations in the United States, one should keep in mind that the country has two competing fixed-infrastructure operators and the US regulatory authorities relieved network operators of the obligation to unbundle their networks. Together these give some immunity to operators, especially to fixed-line players, against the potential side effects of network neutrality regulation.

The EU approach

The European Union (EU) follows a "flexible in principle yet cautious" approach in its initial policies regarding network neutrality, which were adopted in April 2011. These policies enshrine the following principles:

- **Reasonable network management allowed:** Both fixed-line and mobile operators are allowed to manage traffic on their networks.
- **Transparency:** Consumers and content providers should be notified of network management policies.
- **Minimum quality requirements:** National regulatory authorities can impose "minimum quality requirements" for network transmission services concerning both performance and content to ensure that end users have access to comprehensive, comparable, and user-friendly information.
- **Close scrutiny:** The European Commission will keep a close eye on the behavior of operators to see whether they are complying with these principles. The Body of European Regulators (BEREC) is currently finalizing a report on their compliance so far,

which will inform further EU policies, if necessary, on network neutrality.

Individual countries in the European Union are interpreting the principles in different ways. For instance, the Netherlands has recently passed a law strictly enforcing network neutrality and forbidding any blocking of Internet services, the use of deep packet inspection to track customer behavior, and any other filtering or manipulation of network traffic. Italy, in contrast, takes a more laissez-faire approach. Its government has set up a regulatory roundtable including industry executives to review the topic in greater detail, from which no firm conclusions have yet emerged.

At the EU level, however, current thinking tends toward using network neutrality as a tool to promote competition among Internet providers. The EU Commissioner for the Digital Agenda, Neelie Kroes, stated recently that "If measures to enhance competition are not enough to bring Internet providers to offer real consumer choice, I'm ready to prohibit the blocking of lawful services or applications."[2]

The Asian approach

In Asia, some regulators take the view that network neutrality should be maintained by market power and anti-competition rules, allowing more flexibility in Internet markets.

For example, in Hong Kong, the Office of the Telecommunications Authority (OFTA) issued a discussion paper on net neutrality in April 2009 setting out its view that net neutrality mainly concerns anti-competitive and discriminatory conduct. OFTA believes that its existing regulations addressing market power issues and discriminatory activities are adequate to safeguard against anti-competitive and discriminatory actions that threaten net neutrality.

Implications of imposing net neutrality

Implementing policies to protect net neutrality, without making any other changes in the current Internet environment, risks triggering a number of unintended consequences concerning disclosure, adjudication, and discrimination.

- **Disclosure:** Will carriers that disclose their network management practices to satisfy transparency rules enable "the bad guys" to hack into their network, jeopardizing privacy of information or even national security? If so, who will be liable—the regulator, the carriers, or someone else? And will disclosing performance characteristics entail disclosing sensitive competitive information?
- **Adjudication:** First, who will determine what is a non-harmful device and how? To illustrate, a "chatty" wireless device that powers down frequently to save battery life can cause heavy signaling congestion on a 3G network, denying other users access. Can a carrier prohibit such a device for being "harmful"? And will a carrier be allowed to require device manufacturers to test devices for compliance in the carrier's own laboratories, to protect its network from harm? Second, who determines what is lawful concerning content and network practice and performance?
- **Discrimination:** Will a policy of no unreasonable discrimination inhibit investment in additional capacity and/or services and/or applications? Consider the extreme case, promoted by some consumer advocates, in which operators are allowed no price discrimination between different types of content and no usage-based pricing. For operators to meet the likely volume of demand for new services or applications fostered by such a non-discriminatory business model would require massive new capital investment with a high risk of no or negative return on investment, which rational operators would be unlikely to make.

THE INDUSTRY RESPONSE

Pressures on the physical capacity of the public Internet have prompted operators to look for ways to prioritize traffic. They have also prompted some larger edge providers to invest in their own high-speed Internet infrastructure or use content distribution networks. Both responses raise questions concerning network neutrality.

To make further capacity investments, telecommunications operators and edge providers alike need robust income streams and manageable investment costs. One priority for the industry therefore must be to enable both mobile and fixed-line operators to migrate to more sustainable business models. In this shifting competitive context, fixed-line players have made some progress on re-pricing, while mobile players are still behind, particularly in the European Union. Both fixed-line and mobile players need to work with regulators to develop policy that balances the need for growing revenues to fund investment with network neutrality. In particular, given the current dynamics of the industry, policy concerning revenue must recognize the critical need to stimulate investment in the network infrastructure.

Different types of capacity investment for different parts of the Internet

Physically, the Internet today comprises a network of IP-enabled networks in three parts that require different types of investment to increase capacity: backbone networks interconnecting all the Internet access networks; fixed high-speed Internet access links—using digital subscriber line (DSL), fiber, cable coax, or fixed-wireless technology—connecting individual residential or business customers to the backbone networks; and mobile access links that do the same for customers—via a second-, third-, or fourth-generation (2G, 3G, or 4G) cellular infrastructure.

Fixed-line operators need to make a major capital investment to add each new customer—the fixed access

line. However, once in place, this line needs no further investment whatever the customer's level of usage, unless the customer wants much higher speeds. A mobile operator's principal capital investment is its radio access network. But as mobile customers increase their usage, the operator must invest in extending the radio access network's capacity, both in radio frequency (RF) interface and backhaul, in order to maintain performance.

Both fixed and mobile access links are supported by backbone networks. But using the public IP network of networks' backbone can impede edge players' performance and add extra costs. Major edge players—the content providers and the service and applications providers—need to achieve higher levels of performance more cost effectively than public IP backbone networks can support. So they either build their own high-speed fiber networks to connect directly to fixed and mobile Internet access providers or use CDNs, whose specialty is providing backbone pipes.

Progress toward sustainable business models

Huge increases in consumers' bandwidth requirements coupled with the loss of traditional voice revenues to VoIP services have prompted both fixed-line and mobile operators to protect revenues by re-pricing services. Although fixed-line players have so far done a better job of maintaining average-revenue-per-user metrics, among mobile operators a structural mismatch has emerged between mobile broadband pricing and bandwidth consumption (Figure 1). Some regulators around the world are also adopting measures encouraging operators to invest in network capacity, for instance, by allowing pricing flexibility or offering direct subsidies. Meanwhile, edge players are advancing in building their own Internet backbones, trying to by-pass network capacity constraints and increase quality of service. However, this creates challenges for the business models of smaller edge players.

Re-pricing to increase resilience

Fixed-line players are generally doing better than mobile access providers at charging more for faster connections. In Sweden, for example, the whole market has succeeded in migrating customers from slower-speed asymmetric digital subscriber line (ADSL) packages to higher-speed connections over time. Sweden's telecommunications operators even managed to increase prices from 2009 to 2010, because consumers are recognizing the advantages of faster connections and will pay for them (Figure 2).

Re-pricing in fixed-line operators: However, fixed-line operators following the kind of re-pricing approach adopted in Sweden will not generate the amount of money they need to upgrade their telecommunications networks to meet future demand. Pressure to invest in fiber optic lines is rising: our analysis of current bandwidth usage patterns across Europe indicates that average households are on course to push the limits of bandwidth that can be delivered by copper wires by 2015. We estimate that upgrading the fixed-line telecommunications networks to fiber across the EU-15 is likely to cost between €200 billion and €250 billion, as noted above. Fixed-line network operators are unlikely to make this long-term investment with no expectation of meeting or exceeding their cost of capital. They need to cultivate a supportive regulatory environment, just as regulators need to develop careful strategies promoting infrastructure investment by operators, to enable the next wave of Internet use.

Re-pricing in mobile operators: Over the past four years, as people have used more mobile data services and therefore greater bandwidth, the unlimited data plans offered by some mobile carriers have begun to erode customer value. Unlimited data plans are effective tools for acquiring customers but unsustainable in the long term, since the performance of radio access networks, which account for the vast bulk of mobile operators' capital expenditure, is very sensitive to increased demand. In many mobile markets, data traffic is growing at a compound annual growth rate of 80–150 percent with the explosion of smart phones, tablets, dongles, and new video applications.

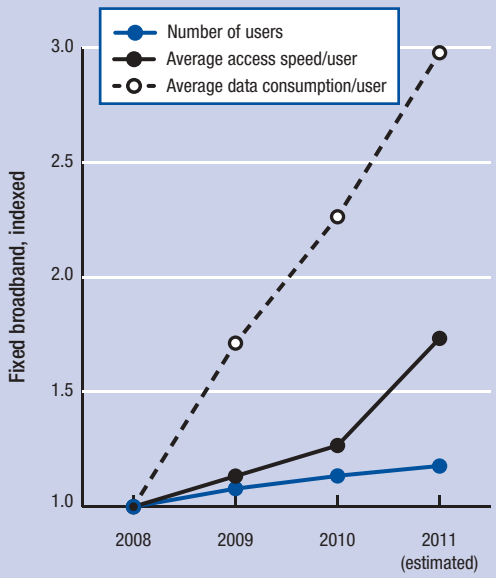
Mobile operators in some markets are managing to re-price. For example, in the United States operators have introduced tiered pricing for mobile data and moved to fixed monthly voice plans. Customers who use more bandwidth pay for the privilege. In Russia, one company offers pricing bands for data dongles, with users paying a fee proportional to usage. In Germany, an operator sells data plans as bolt-ons (or add-ons) to voice services, allowing customers to purchase blocks of mobile bandwidth each month. There are other models mobile operators can follow to rebalance their prices as a competitive reaction toward the shifting of their traditional services to IP. One option is for operators to bundle mobile voice service with different mobile data packages that, if priced correctly, can preserve their mobile average revenue per user (ARPU) levels and offset the risk of losing existing voice and short message service (SMS) revenues. Another more familiar option could be to mimic most fixed-line players and introduce access fees while significantly reducing pricing based on usage. This method worked well for fixed-line players, where prices of fixed-line calls converged to termination rates, or zero in the case of a full VoIP call, a trend that may easily occur with mobile pricing as well.

Financing the new wave of infrastructure investments

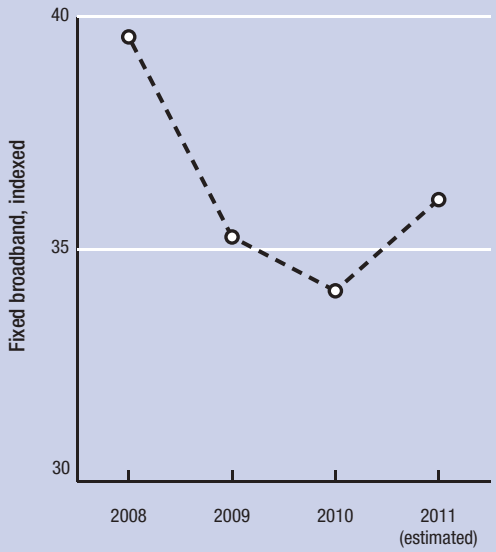
The new wave of infrastructure will require different types of investment incentives for fixed-line and mobile operators.

Figure 1: Fixed-line vs. mobile: ARPU levels and consumption growth

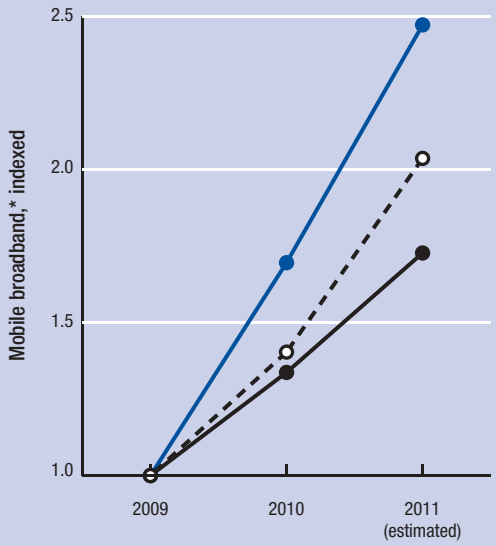
1a: Data consumption vs. access speed: Fixed broadband



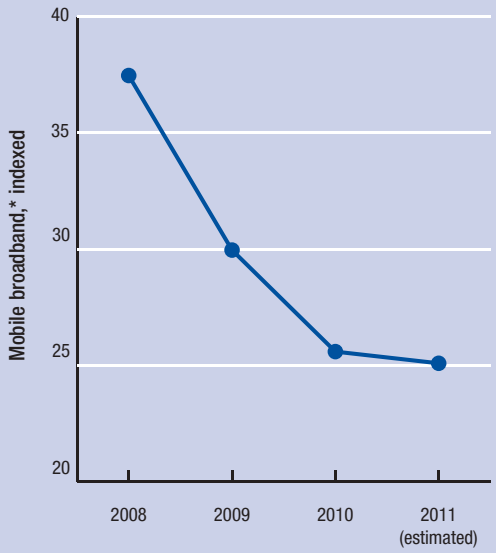
1c: Pricing schemes: Fixed broadband ARPU, Western Europe



1b: Data consumption vs. access speed: Mobile broadband

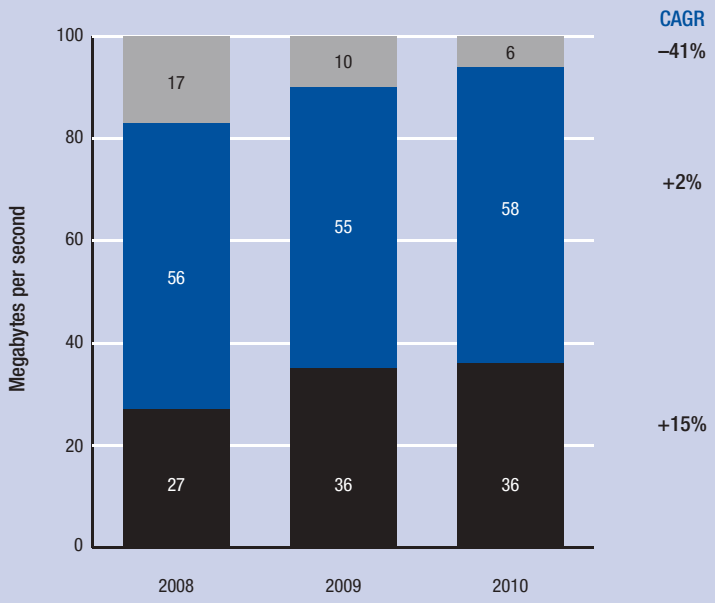


1d: Pricing schemes: Mobile broadband ARPU, Western Europe



Source: McKinsey & Company analysis.
Notes: ARPU = Average revenue per user. The vertical axes used indexed units, which means that different metrics are converted to a common scale starting at one.
* Small and big screen users

Figure 2: Access-speed pricing and the fixed-investment case: The shift of fixed customers from low-speed packages to higher-priced high-speed packages



Prices of different speeds (Telia ADSL), Swedish kroner

Speed	2008	2009	2010
2 Mb/s	264	249	257
> 8 Mb/s	314	299	314
> 20 Mb/s	364	349	364

Note: Inflation rate: –0.3 percent in 2009; 1.3 percent in 2010.

Source: McKinsey & Company analysis.
Notes: Data in this figure are from Sweden. These prices do not include inflation, but that is so low that the effect can be dismissed.

Fixed investment incentives: Studying markets that have already invested in fiber networks on a significant scale reveals two regulatory models that seem successful: one laissez-faire and one based on subsidies.

- **Laissez-faire model:** This model, followed in the United States, encourages operators' infrastructure investments by guaranteeing them attractive financial returns by relieving them of the obligation to unbundle their networks. In essence, this model provides regulatory certainty that benefits from investing in fiber infrastructure can be captured by those making the investment. This seems to be one reason why Verizon has invested more than US$18 billion in the last five years in a fiber-to-the-home network that currently covers 14.5 million residences in the United States. However, the model does not incentivize operators to roll out infrastructure in unprofitable areas and may need in future to be complemented by some sort of subsidy model. Moreover, the United States is unusual in that the majority of fixed-line Internet access is provided by cable operators that can increase capacity at a small fraction of the investment needed by telecommunications operators, which use DSL infrastructure, to do the same.
- **Subsidy model:** This is used mostly in Asian countries such as Singapore, Malaysia, and, to some extent, Japan, to promote broadband access for all. It offers network operators either indirect subsidies, through tax incentives, or direct subsidies for deploying fiber networks. Some countries—for example, Australia and New Zealand—have gone further and separated out a neutral (government-owned) entity from the incumbent's network through which to channel the public infrastructure investments. This entity then provides wholesale Internet access pipes at regulated prices to retail Internet service providers, and functions like any other regulated utility.

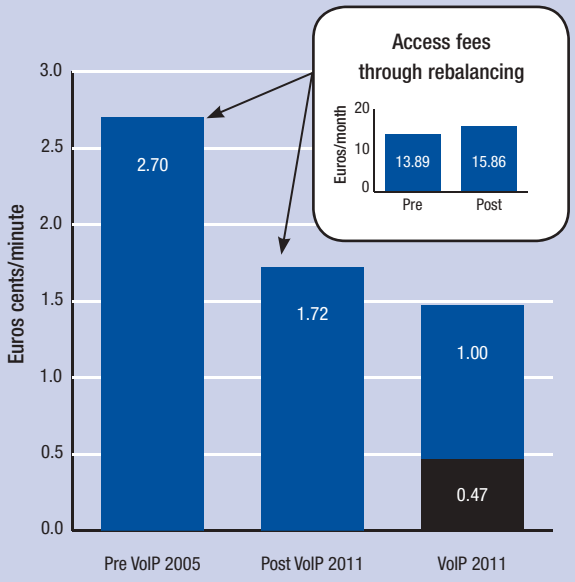
Mobile investment incentives: Regulators control many aspects of mobile networks that affect costs and returns from their network investments, and can therefore make investment more attractive. For example, regulators can allow operators to share parts of their networks and so lower their costs. They can also set economically viable network coverage requirements, make more spectrum available at an affordable cost, and maintain a reasonable degree of competition in the mobile arena through licensing and access regulations. The appropriateness of such measures will vary from market to market. At a minimum, regulations need to give mobile operators the freedom to re-price (Figure 3).

Contribution from edge players

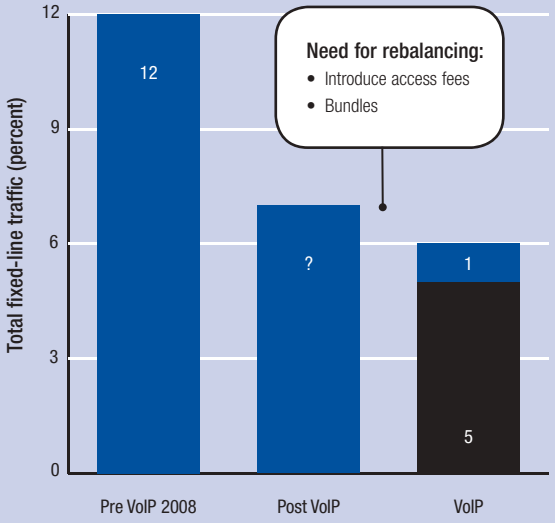
The continued explosive growth in Internet applications and services and the traffic they generate has forced important changes in the architecture of the Internet. Major edge players today, as noted above, are already addressing physical Internet capacity constraints and performance limitations by investing in private backbone networks or by using CDNs, which transport content from the edge to the destination Internet access providers. As a result, consumers are enjoying better performance and lower costs for many Internet applications

Figure 3: Re-pricing: Fixed-line industry after VoIP and mobile industry

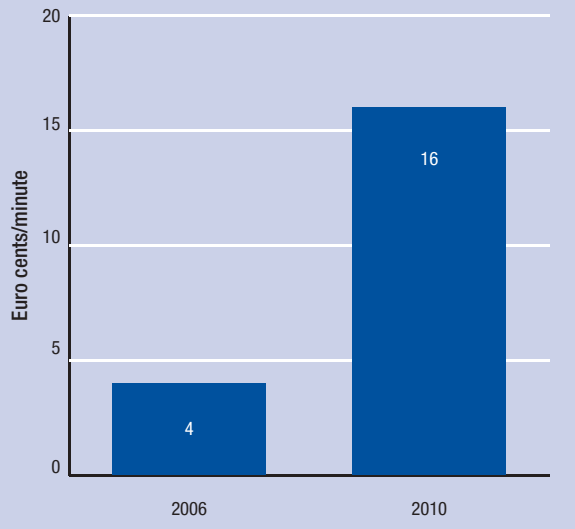
3a: Price rebalancing: PSTN international call access fees, EU average



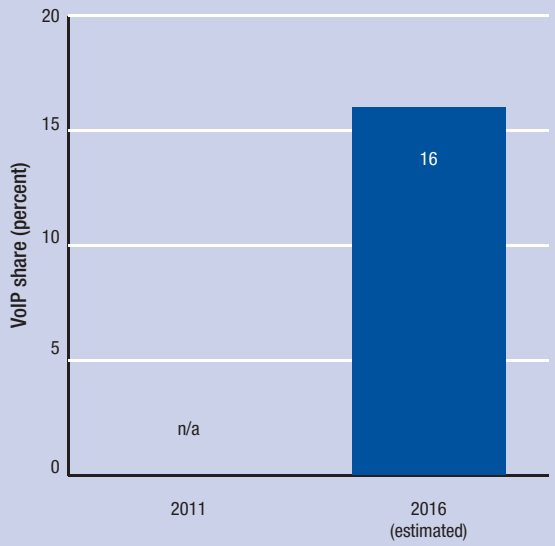
3b: Mobile voice pricing, euro cents/minute



3c: Fixed-line traffic: Share of VoIP, percent



3d: Mobile traffic: Share of VoIP, percent



Source: McKinsey & Company analysis.
Note: PSTN = Public switched telephone network; black bars indicate the cost of VoIP (termination fee).

and services. Some consumer advocacy groups believe this development may skew net neutrality and harm smaller edge players, but it could also simply reflect a legitimate scale advantage achieved by larger players, which ultimately benefits consumers.

The complexity of the network neutrality pricing issues among Internet access and backbone providers and the edge players that generate the traffic is illustrated by recent discussions about the peering and transit agreement that determines the pricing of Internet traffic exchanged between the companies. Internet peering and transit agreements are signed between ISPs—both access and backbone providers—and determine payments for Internet traffic exchange. Traditionally, smaller players pay larger players to transport their traffic, and players of equal size exchange traffic without charging each other fees. However, the recent increase in video downloads is creating an asymmetric flow of traffic between backbone companies using CDN technology and Internet access providers, and creating new disputes with requests for regulators to intervene. Whether this development undermines principles of net neutrality is the subject of much industry discussion. Thus far, however, the FCC, for example, has not regulated peering and transit agreements: it considers these to be business contracts between private parties and has declined to get involved in commercial disputes.

We believe the way to resolve such debates is to foster collaboration between edge players and access providers and thus create a win-win solution.

A COLLABORATIVE SOLUTION?

To prevent regulators from implementing policies that could discourage investment or have other unintended consequences, we believe that network operators; the major content, service, and application providers; and regulators need to come together to develop mutually beneficial solutions on net neutrality. If operators are allowed to manage traffic transparently while at the same time all industry actors collaborate to create conditions enabling further investment in network infrastructure, then the Internet can move into its next wave of growth. Principles that could assist in this endeavor include:

- **Allow operators to manage traffic with high levels of transparency toward customers.** First, network owners should be allowed to manage traffic on their networks so as to protect networks from harm and handle congestion effectively, but they must be more transparent about network management, service levels, and all relevant terms and conditions for consumers. Operators' policies concerning data collection, retention, and privacy should also be transparent. Future innovation and growth in Internet services and applications depend on preserving both openness and support for privacy on the Internet.
- **Incentivize investments by lowering input costs and/or providing favorable regulatory environment:**
  - **Make more inputs available at lower cost.** Given the need for increased massive expansion of the Internet, regulators should consider implementing approaches that lower the cost of inputs controlled by government policies, such as the cost of spectrum and rights of way. In addition, regulators should exercise their power to make more of these critical inputs available. For example, governments could ensure that construction companies dig trenches for installing fiber cables when they build or restore highways, or that government-owned roofs can be used for cell towers. Allowing site sharing is another means of increasing network capacity. Such measures will allow operators to expand their networks faster and at lower cost. The appropriateness of these measures will vary from market to market.
  - **Allow operators pricing flexibility.** Operators need to price services flexibly to achieve the levels of cash flow that will allow them to make the infrastructure investments required to meet surging demand. Regulators should create a favorable environment supporting infrastructure investments, such as granting regulatory holidays to fiber investments.
  - **Allow operators to provide differentiated services to edge players that share the same physical infrastructure.** These services will provide edge players with additional higher performance to support new innovation. Operators will be able to recoup their investment in improved performance and capacity from both traditional Internet access revenues and new differentiated services, thus being able to earn a return on investment that justifies continued investment. Operators must offer these services in a transparent, non-discriminatory manner.
- **Require operators to provide a high-quality best-effort service with minimal speeds.** This service is the baseline service that provides global interconnectivity and open access. This baseline provides for the continued innovation that has fueled the spectacular growth in Internet services and applications.

A formal net neutrality policy with these principles in place would be a win-win outcome: operators would be encouraged to invest in their networks, Internet players would be free to innovate and deliver services to a global user base, and governments would benefit from the impact of upgraded networks on the economy and society in general. Negotiating rules based on these principles will not be easy, however. For instance, achieving transparency without triggering any of the unintended consequences outlined above will take thoughtful discussion among all the parties involved. But countries that succeed will foster a continued virtuous cycle of investment,

innovation, and demand for new services and applications that will bring benefits to their consumers and across their information and communications sectors.

NOTES

1 Global Internet Traffic database; OECD – Cisco – 1984–2009.

2 Kroes 2011.

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CHAPTER 1.5

Mobile Broadband: Redefining Internet Access and Empowering Individuals

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With more than 6 billion connections worldwide and US$1.3 trillion in annual revenue,[1] mobile telephony has become the largest information and communication technology (ICT) in history. Mobile connects four times as many people as landline telephony because of its better reach, convenience, and functionality and its lower costs.[2] Mobile telephony also surpasses the landline Internet by more than 3.5 billion users,[3] while driving economic growth and important societal benefits, as documented in the World Economic Forum's *Global Information Technology Report 2008–2009: Mobility in a Networked World* and other research.

While the global scale of mobile telephony and its economic impacts are well understood by ICT industry participants and governments today, we envision that mobile broadband—with its ability to connect people to the Internet in an ultra-personal and pervasive manner—will have a far greater impact.

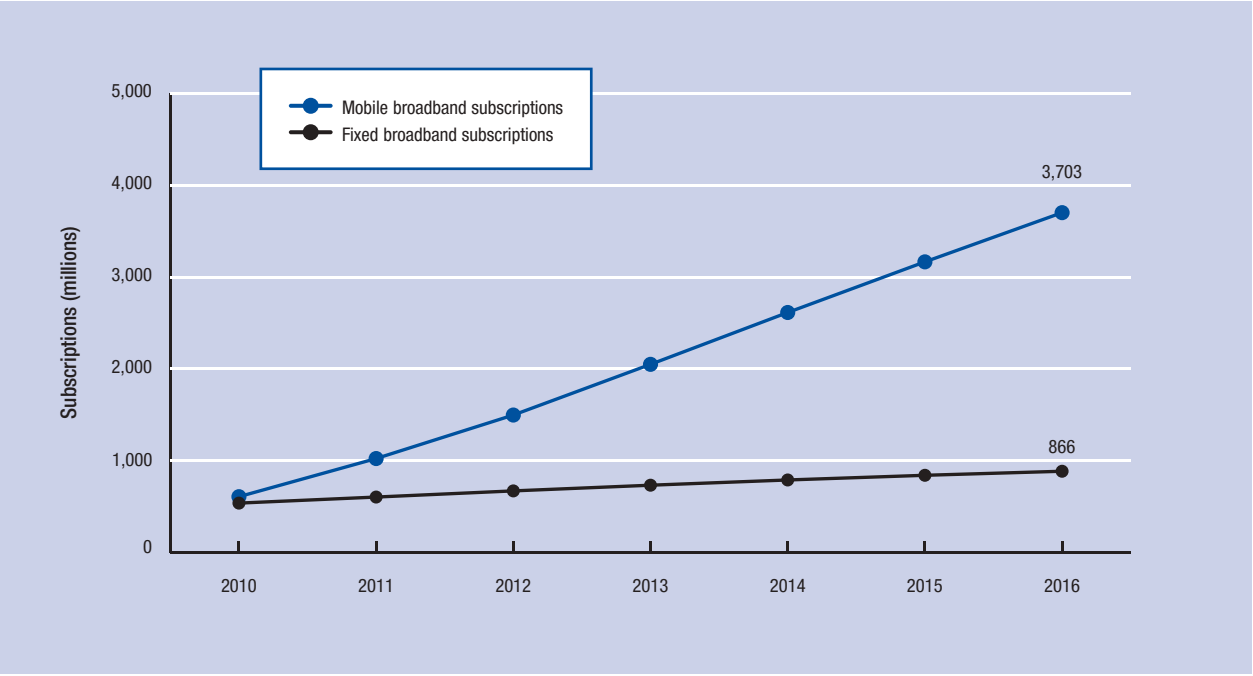
Mobile broadband, or high-speed access to the Internet and other data services over mobile networks, is already changing the way people across the globe access the Internet. It promises to drive even stronger economic growth than mobile telephony alone and to fundamentally change the way in which we live, learn, work, and collaborate. This in turn is driving seismic shifts across the communications and computing industries. Perhaps most importantly, it provides unprecedented opportunities to empower individuals across all socioeconomic classes.

In this chapter, we will discuss this view within the framework of two fundamental shifts, or tipping points, and related trends that underscore how mobile broadband is changing the way people access the Internet and, in turn, how the Internet itself is changing. We will also explore some of the transformative opportunities these shifts create in areas such as healthcare and education, as well as some key steps stakeholders can take to both enable and take advantage of these new possibilities.

TIPPING POINT: MOBILE BECOMES THE PRIMARY WAY PEOPLE ACCESS THE INTERNET

Not only has mobile broadband emerged over the past decade to meaningfully extend the reach of the Internet, it has actually become the primary method of access for people around the world. By the end of 2010, the number of broadband Internet subscriptions over mobile technologies surpassed the number of broadband subscriptions over fixed technologies (see Figure 1). This tipping point indicates that mobile is the first, and perhaps only, way people in emerging regions access the Internet. But it also substantiates the notion that the Internet itself is shifting from a desktop experience to an "on-the-go" experience for developing and developed nations alike. This shift provides unprecedented opportunities and benefits that will be explored in this chapter.

Figure 1: Global broadband subscriptions: Mobile at 80 percent by 2016



Sources: Industry analyst firm forecasts. For mobile broadband subscriptions: HSPA, EV-DO, TD-SCDMA, and LTE subscribers: Wireless Intelligence Database, February 2012; for WiMax: ABI Database, February 2012; for fixed broadband subscriptions: Informa Telecoms & Media (WBIS) Database, February 2012.
Note: Mobile broadband technologies include EV-DO, HSPA, TD-SCDMA, LTE, WiMax, and their respective evolutions.

Before discussing some of the underlying trends that have driven mobile broadband's dramatic growth, we provide a more detailed definition of mobile broadband and review its key enabling technologies.

Mobile technologies deliver true broadband rates

For the purposes of this chapter, *mobile broadband* is defined as any mobile (or cellular) technology that delivers minimum data rates in the hundreds of kilobits per second (kb/s) to end users and peak rates in the Megabits per second (Mb/s). This aligns well with definitions offered by the GSM Association and other industry bodies, as well as the 256 kb/s minimum data rate set out by International Telecommunication Union (ITU) to qualify fixed broadband services. In more practical terms, once mobile technologies were capable of delivering these minimum rates, all major notebook manufacturers decided to embed them in their products. In short, these minimum rates represent the starting point for delivering meaningful mobile broadband experiences.

Today, newer third-generation (3G) and fourth-generation (4G) mobile technologies easily surpass these minimums and provide the majority of mobile broadband connections worldwide. Key 3G and 4G technologies include HSPA,[4] EV-DO,[5] LTE,[6] and their evolutions. The latest HSPA+ and LTE commercial deployments now support peak data rates greater than 42 Mb/s, with typical user rates registering well above 1 Mb/s.

The wide majority of mobile operators have launched 3G services; a significant number are launching 4G services. As of January 2012, more than 451 operators had launched commercial HSPA networks, 270 had launched EV-DO networks, and 49 had launched LTE networks.[7] Combined, these networks serve more than 1 billion mobile broadband subscribers globally.[8]

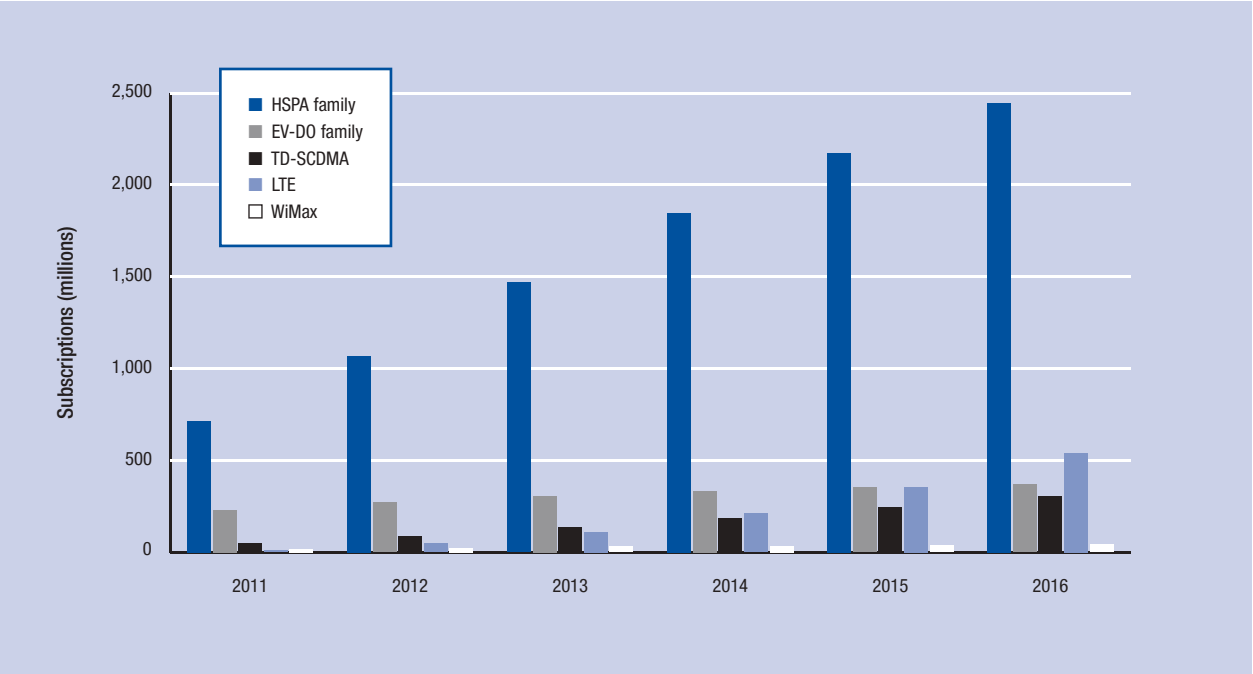
Forecasts are even more telling. By 2016, more than 80 percent of broadband connections will be mobile.[9] And with an estimated 1 million connections being added every day, 3G is fueling most of them (see Figure 2).

Data traffic surpasses voice over mobile networks

The rapid emergence of mobile broadband is tied to the global scale, interoperability, and ongoing investments made by mobile operators and an ecosystem of companies that are working to further technological innovations. Large-scale mobile networks were initially deployed for voice services. Operators have since been reinvesting revenues from their voice services to upgrade their networks, which now also form the backbone for delivering advanced mobile broadband services.

Accordingly, mobile network traffic has been shifting from voice to data, and in December 2009, data traffic exceeded the volume of voice calls across the world's mobile networks for the first time.[10] Global mobile data traffic continues to grow at a staggering rate. It more than doubled in 2010,[11] achieving volumes three

Figure 2: Growth in mobile broadband subscriptions fueled by 3G



Sources: Subscriptions for HSPA, EV-DO, TD-SCDMA, and LTE technologies: Wireless Intelligence Database, February 2012; subscriptions for WiMax: ABI Database, February 2012.
Note: Mobile broadband subscriptions are expected to grow at approximately 29 percent CAGR from 2011 to 2016, led by 3G and its evolution.

times larger than all the data traffic generated by the entire global Internet (both fixed and mobile) in 2000.[12] As mobile broadband networks are increasingly able to deliver rich Internet access and data services, mobile data traffic will continue its phenomenal growth. In 2014, *monthly* mobile data traffic is predicted to exceed mobile data traffic for all of 2008.[13] Overall, mobile data traffic is expected to grow 10 to 12 times between 2010 and 2015.[14]

Operators have a number of tools to help them meet this rapidly growing data demand. They are acquiring spectrum in new bands, migrating subscribers to the most efficient 3G and 4G technologies, employing technologies that reduce interference, and they are also deploying smaller cells that can more dynamically supply capacity to users in specific locations.

Mobile drives broadband Internet access in emerging regions

Mobile broadband growth is particularly accelerating in emerging countries, rising from 61 percent of all broadband connections in these regions in 2011 to 84 percent in 2016 (see Table 1). At this pace, emerging regions will surpass the developed world in terms of the number of mobile broadband connections in first half of 2013.

Unlike fixed broadband services, which have limited reach and high capital expenditures—particularly when compared with the available consumer spending in many emerging regions—mobile broadband offerings provide significant economies of scale and a more affordable means of reaching mass markets.

Table 1: Broadband connections in emerging regions

	2011 Connections (millions)	2016 Connections (millions)
Mobile broadband in emerging regions	415	2,366
Total broadband in emerging regions	676	2,826
Mobile broadband (as a % of total)	61%	84%

Sources: Mobile broadband: Wireless Intelligence Database, February 2012; fixed broadband: Informa Telecoms & Media (WBIS) Database, February 2012.

While mobile broadband services provide better reach and lower costs, personal computer (PC) penetration remains quite low in most emerging regions. Mobile broadband–enabled PCs (either through USB modems or embedded notebook solutions) have been successful in the market, but smartphones will have far greater impact, providing the first and primary way that people access the Internet in many regions.

In India, for example, mobile broadband became available in late 2009. Less than 18 months later, the number of subscriptions over mobile broadband networks surpassed the number of fixed broadband subscriptions. Usage has been with mobile devices rather than PCs.

Box 1: Mobile broadband and healthcare: Providing access to information for South African nurses

In South Africa, healthcare providers are challenged to deliver adequate care to large populations, especially those with infectious diseases. Providing healthcare to the poorest populations increasingly falls on the nurses.

Many nurses in South Africa lack Internet access. They are unable to share information with the global health community on rare and complex medical cases, keep abreast of the latest information on epidemics, or obtain information in real time for patient evaluation.

The Mobile Health Information System (MHIS) project leveraged 3G wireless technology to enable nurses to provide better care. The MHIS began as a collaborative effort involving the Eastern Cape Department of Health, Port Elizabeth Hospital Complex (PEHC), MTN-South Africa, and the Nelson Mandela Metropolitan University. The pilot phase provided nurses at PEHC with smartphones that were pre-loaded with a library of pertinent resources, enabling the nurses to access locally relevant, reliable, and accurate clinical information at the point of care.

Nurses integrated the smartphones into their daily activities. They reported using the newly accessible information to update their clinical knowledge, diagnose and treat and provide accurate information to patients, teach students, and share information with colleagues.

Rochelle Gelandt is a registered nurse at Livingstone Hospital Wellness Clinic, a comprehensive care and management facility for adults and children infected with HIV/AIDS. "I found the device most valuable when we did not have a doctor for months at a time in our clinic," she said.

"As some of the clients have chronic conditions such as hypertension, diabetes and epilepsy, I used the device to check if prescribed chronic medication is not contraindicated (causing adverse side-effect or risk due to precondition) when using ARVs (antiretroviral drugs). On many occasions I have had to advocate for patients regarding drugs prescribed by our doctor who was new to the HIV program."[1]

Note

1 Interview with nurses in the Eastern Cape in the fall of 2010. See also WIPO 2011.http://www.wipo.int/wipo_magazine/en/2011/03/article_0004.html.

Source

Qualcomm Wireless Reach™ Project, available at http://www.qualcomm.com/citizenship/wireless-reach/projects/health-care.

Mobile broadband delivers economic impact

Growth of mobile broadband services affects the economic activity of wireless operators, their suppliers, and the workers they employ. It also influences the economic activity of organizations, households, and individuals who use the new networks as well as the overall economic competitiveness of countries.

Although systematic correlations between more traditional mobile telephony and GDP levels across geographies have been made by the World Bank and others, mobile broadband has grown so quickly that these same measures are not yet widely available. There is, however, a small sampling of country-specific studies that find strong, positive economic impacts.

Studies assessing the direct and indirect impact of mobile broadband in economies such as India; South Africa; Nigeria; Taiwan, China; and the United States show that a 10 percent increase in mobile broadband penetration is likely to yield an impact of between 1 and 1.8 percent in GDP.[15]

More specifically, Analysys Mason estimates that for India, every 10 percent increase in mobile broadband penetration will generate incremental revenue growth of 1,622 billion Indian rupees, or 1.1 percent of the entire Indian GDP. This impact is forecasted to build to 1.5 percent of Indian GDP in 2015, based on 12.5 percent mobile broadband penetration that year.[16] A 2009 LECG study found that an investment of US$20 billion in 3G networks over the next five years will benefit India's economy by more than US$70 billion and create up to 14 million jobs.[17]

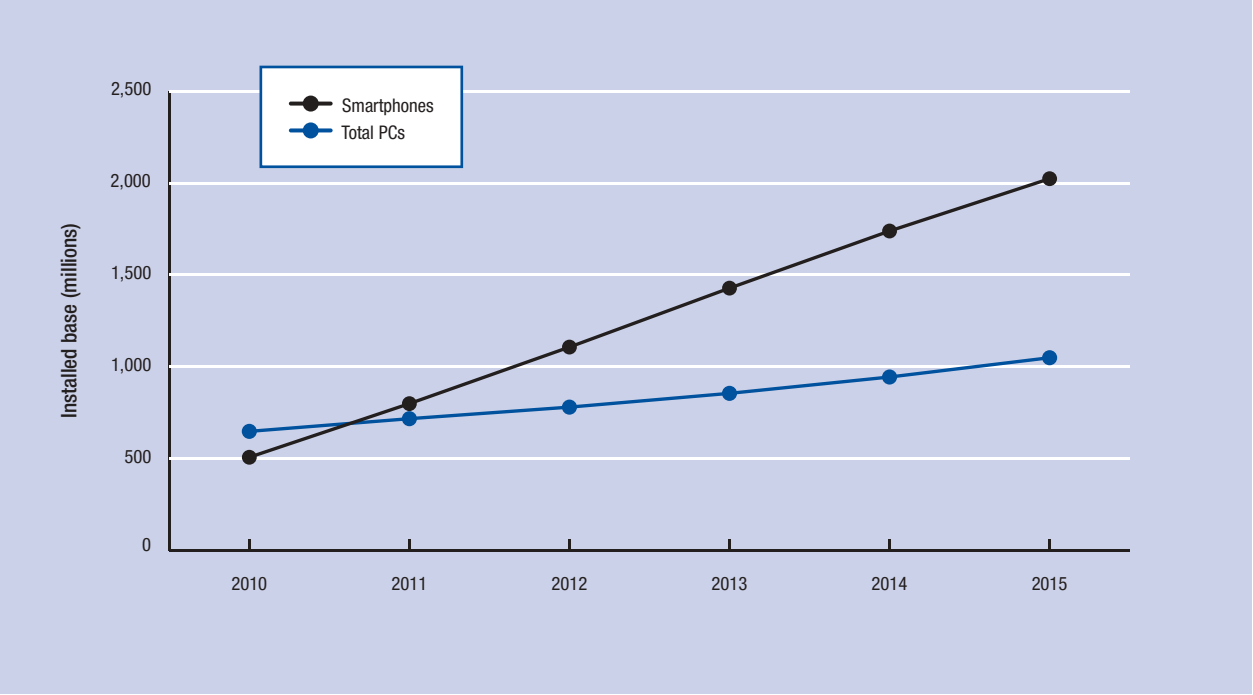
Similar assessments have produced analogous findings for other countries. In South Africa, mobile broadband and related industries could generate about 28,000 new jobs and 1.8 percent of GDP by 2015 if sufficient spectrum is allocated.[18] In Nigeria, mobile broadband could contribute over 1 percent of GDP (and 1.7 percent of non-oil GDP) in 2015, supporting diversification of the country's economy.[19]

The positive economic impact is not limited to emerging regions. In Taiwan, China, a developed region that is core to the manufacturing of computing and consumer electronics, mobile broadband technologies are predicted to contribute US$11.6 billion to the economy by 2015, an equivalent of 1.8 percent of GDP.[20] Furthermore, a recent Deloitte study focused on the United States identified a GDP growth opportunity of US$73 billion to $151 billion and an estimated 371,000 to 771,000 new jobs as a result of 4G technologies.[21]

These figures compare quite favorably with the economic impacts associated separately with mobile telephony and fixed Internet penetration. According to the World Bank, a 10 percent increase in mobile phone penetration correlates to a 0.8 percent increase of per capita GDP, while a 10 percent increase in Internet penetration increases per capita GDP by 1.4 percent in developing countries.[22]

We have discussed how mobile broadband has emerged as the primary way in which the world

Figure 3: Smartphones: The newest wave of computing



Source: Strategy Analytics, September 2011; December 2011.
Notes: *Smartphones installed base* is the total number of functioning and active cellular handsets with a high-level operating system at year's end. *Total PCs* include only IP-network enabled desktop, notebook, and netbook PCs and exclude PCs without connectivity.

accesses the Internet, how it is becoming the first and only Internet experience in emerging regions, and how it drives potential economic impacts. Mobile broadband is also driving the rapid growth of smartphones and other mobile broadband devices, as evidenced in the next tipping point.

TIPPING POINT: MOBILE BECOMES THE LEADING COMPUTING PLATFORM

The global scale and rapid growth of mobile broadband is driving another important trend within the mobile space: the emergence of mobile computing. Smartphones represent the newest wave of mobile phones and now comprise the largest segment of mobile broadband shipments. The installed base of smartphones exceeded that of PCs in 2011 and is growing more than three times faster than PCs.[23] Looking forward, approximately 4 billion smartphones are expected to ship between 2011 and 2015,[24] clearly establishing them as the most pervasive computing and Internet access device today and in the future (see Figure 3).

Today's smartphones deliver increasingly rich experiences, including full web browsing and computing capabilities, high-definition video, 3D gaming that rivals fixed game consoles, access to social networks, and many other compelling services. They are our most personal device since they are always on, always connected, and are always with us. They offer all-day battery life and, with GPS and other proximity technologies integrated inside, are location-aware and able to deliver a compelling array of new personalized services that build on these capabilities.

In many respects, today's smartphones are more powerful computers than PCs were just a few years ago. The computational power of smartphones has increased exponentially over the past decade. In the early 2000s, mobile phones ran in the tens of MHz in terms of processing power. In 2008, they surpassed 1 GHz (1,000 MHz) for the first time. Solutions on the near horizon will support dual- and quad-core processors with clock cycles up to 2.5 GHz—more powerful than many notebooks in use today. These processors, built with mobile in mind, are also driving today's tablet computers and other forms of consumer computing devices.

Smartphones already play an important role in providing access to the Internet. In the United States, more than one-quarter of mobile phone owners use their smartphones rather than a PC to access the Internet.[25] The success of smartphones extends beyond developed regions. In Brazil, for example, the smartphone's share in monthly 3G handset sales rose from 45 percent in May 2010 to 76 percent in May 2011—tripling in terms of unit volumes during the same period.[26]

A pilot project in South Africa (see Box 1) demonstrates how smartphones and mobile broadband technologies can be leveraged by nurses to improve access to healthcare within underserved communities.

Merging the best of both the computing and mobile worlds, advanced smartphones and tablets represent a new, highly personalized, rich computing experience

Box 2: Mobile broadband and healthcare: Detecting cardiovascular diseases in China

According to the World Health Organization, chronic diseases such as cardiovascular diseases (CVDs) place a grave economic burden on countries. In fact, China will lose US$558 billion between 2005 and 2015 in national income as a result of heart disease, stroke and diabetes.[1]

CVD is the leading cause of death in China, claiming about 3 million lives a year.[2] A pilot project involving Life Care Networks and the Community Health Association of China uses mobile broadband technologies to address the prevention and care of CVDs in underserved communities.

China's Wireless Heart Health project is deploying a 3G-enabled cardiovascular screening and monitoring system among resource-scarce community health clinics. The system includes smartphones with built-in electrocardiogram (ECG) sensors. The smartphones send patient heart data to cardiac specialists at a 24-hour call center in Beijing. As part of the service, doctors can provide real-time feedback to their patients via text or phone call.

This project demonstrates how 3G mobile broadband can extend the reach of specialized physicians into underserved areas and enable community health clinics to treat more patients effectively.

Notes

1 WHO 2005.

2 China National Center for Cardiovascular Diseases 2010.

Source

Qualcomm Wireless Reach™ Project, available at http://www.qualcomm.com/citizenship/wireless-reach/projects/health-care.

that we take with us wherever we go. This is driving both consumer demand and important shifts within the industry. Technology companies previously associated with PCs and fixed Internet experiences—such as Amazon, Apple, Facebook, Google, and Microsoft—are now focused heavily on mobile. A few points help illustrate the strength of this focus:

- Smartphones and tablets are driving two-thirds of semiconductor industry revenue growth through 2013, according to Gartner.[27]
- According to Facebook, more than 250 million people actively use Facebook through mobile devices and are twice as active on Facebook as non-mobile users.[28]
- Google reported that mobile access of Google Maps was higher than desktop usage for the first time during the 2010 Christmas holiday season.[29]
- In addition, Gartner reported in May 2011 that total downloads of mobile applications reached 8 billion in 2010 and should surpass 100 billion by 2015.[30]
- Microsoft's next PC operating system, Windows 8, is being designed to run on processors using ARM Holdings–based architecture, which are found in nearly every smartphone today.

We have discussed two fundamental tipping points to help underscore our view on mobile broadband and its growing impact: first, the emergence of its networks and services as the primary way we access the Internet; and second, the rise of its devices, specifically smartphones, as our primary computing platform. These factors in turn are redefining the way we interact with the Internet, with each other, and with the world around us. We now bring the Internet with us wherever we go rather than go to a place to access it. We now have real-time access, all the time. And because smartphones are our most personal device, they provide us highly personalized experiences, tailored to our needs and interests.

But the benefits delivered through these tipping points can become truly transformational once we examine what they can do to reshape areas such as healthcare, education, and, more generally, the empowerment of individuals.

THE TRANSFORMATIVE EFFECT OF MOBILE BROADBAND: THE POTENTIAL TO IMPROVE SOCIETIES AND EMPOWER INDIVIDUALS

Mobile broadband has the potential to impact important aspects of societies such as healthcare, education, and different socioeconomic groups. Combine this with highly personalized and pervasive experiences enabled by mobile smartphones and other always-on, always-connected devices, and the opportunity exists to empower individuals in transformative ways that were hard to imagine even just a few years ago.

Transforming access to healthcare

Within the healthcare sector, mobile broadband technologies can improve access to health services, enhance self-care, address rising costs, increase productivity, and help address the increasing demands of chronic disease and an aging population.

Mobile health solutions—whether used to automate electronic health records or treat chronic diseases—enable governments to more easily, quickly, and cost-effectively bring the benefits associated with access to comprehensive healthcare services to their citizens (see Box 2).

Mobile remote monitoring devices and services that transmit information about the condition of patients and applications that remind patients when to take their medications will allow many more people to lead healthier, more independent lives. A recent McKinsey study for the GSM Association estimated that remote monitoring through mobile devices can save US$175 billion to $200 billion in annual healthcare costs for managing chronic diseases in OECD and BRIC countries alone.[31] Accordingly, a recent Juniper Research study forecasted

remote patient monitoring using mobile networks to be a US$1.9 billion market by 2014.[32]

These solutions improve the reach, productivity, and outcomes within the healthcare sector. But more importantly, mobile broadband can empower people to participate more actively in understanding and managing their own health and wellness, and thus improving the quality of their lives. Better health education and information, real-time measurements of vitals through sensors, and closed-loop communications between patients and healthcare professionals can be achieved in a more proactive, preventive, and personalized manner.

Transforming education

Mobile broadband is also changing the way people learn and share information. While the use of always-on, always-connected mobile devices is providing access to resources previously not available to students in the developing world, it also transforms educational methods to improve educational outcomes in the developed world (see Box 3).

Empowering socioeconomic groups

There is evidence that socioeconomic groups are also empowered by mobile broadband. According to an August 2011 Pew Internet report on smartphones in America, 78 percent of under-30, non-white, low-income, and less-educated smartphone owners use their phones to access the Internet; and 38 percent of them use their handsets as their primary means of doing so. These rates are notably higher than in the average population.[33]

And in developing regions where people who lack Internet access are cut off from educational tools, access to mobile broadband helps them develop the skills to compete in the 21st century and provide new economic opportunities. A project in Indonesia (see Box 4) shows how mobile broadband economically empowers the underserved—particularly women.

Although mobile phone ownership has soared in recent years, there are 300 million fewer female than male subscribers. This means a woman is 21 percent less likely to own a phone than her male counterpart. The figure rises to 23 percent in Africa, 24 percent in the Middle East, and 37 percent in South Asia.[34]

Mobile phone ownership benefits women with improved access to educational, healthcare, and business opportunities. Women surveyed in low- and middle-income countries said they believe that owning a mobile phone helps them lead more secure, connected, and productive lives. Up to 41 percent of respondents said they increased their incomes or professional opportunities because of their mobile phones.[35]

In order to bridge the digital divide, governments and institutions have traditionally focused on fostering fixed Internet connections. However, mobile broadband provides a more pervasive, personal, and cost-efficient

Box 3: Mobile broadband and education: Improving educational outcomes for at-risk students in the United States

Smartphones and mobile broadband connectivity are creating new ways for at-risk students in North Carolina to learn mathematics.

Project K-Nect was launched in 2008 to determine whether smartphones with digital algebra I content and 24/7 connectivity could improve educational outcomes of students who scored poorly in math.

Qualifying students received 3G-enabled smartphones to wirelessly connect to supplemental math content aligned with their teachers' lesson plans, relevant web-based resources, and online collaboration tools. The devices also enabled students to communicate with their teachers and engage in peer learning.

As schools educate the next generation of society, mobile technology provides students a more efficient and convenient way to engage with their learning materials and each other 24/7. Mobile devices provide unprecedented access to learning resources, peers, and advisors—inside and outside the classroom, regardless of their location—at school, on the bus, or at home.

For four years running, Project K-Nect students have continued to outperform their peers, with students participating in Project K-Nect increased their proficiency rates by at least 30 percent on the State of North Carolina's End of Course exam, compared with classes not in Project K-Nect but taught by the same teacher.[1] Of those students, 50 percent reported a greater interest in attending college and one-third reported a greater interest in pursuing a degree and a career that uses their math skills.

Based on positive results from Project K-Nect, the Department of Defense Education Activity granted a participating school district $2.5 million to expand the reach of mobile learning to all algebra I students in Onslow County, North Carolina. In 2011, the US Federal Communications Commission chose Project K-Nect as one of 20 pilot projects to demonstrate the use of off-campus broadband as part of their Learning On-The-Go wireless pilot project. Today, Project K-Nect has expanded to three states and now reaches more than 4,500 students in grades 8 through 12.

Project K-Nect leverages the full capability of mobile broadband technologies and devices to help transform learning. The global reach of mobile broadband and the growing proliferation of smartphones will enable educational innovations using mobile devices for learning to expand to other countries.

Note

1 Project K-Nect Evaluation Report July 2007, available at http://www.tomorrow.org/docs/Project_k-Nect_Evaluationreport_Final_Jul7.pdf.

Source

Qualcomm Wireless Reach™: Project, available at http://www.qualcomm.com/citizenship/wireless-reach/projects/education.

Box 4: Mobile broadband and gender parity: Giving female entrepreneurs new tools for success

In Indonesia, the world's fourth most populous nation, underserved residents—many of whom are women—use mobile technology to access unique business opportunities and gain the skills needed to lift themselves out of poverty.

The Grameen Foundation, along with partners from private and public sectors and its Application Laboratory (AppLab) initiative, is establishing a multi-tier suite of data services that use existing SMS technology and increasingly available 3G technologies built on a mobile platform.

Designed to increase incomes of the nation's poor, these services can be accessed through two distribution channels:

- Village Phone Operators (VPOs), a social network of women entrepreneurs who own and operate mobile micro-franchise businesses, and
- commercially available phones available in collaboration with Bakrie Telecom.

For example, AppLab's Jual Pulsa (Top Up) application allows the poor to become entrepreneurs by selling airtime to customers. The Info Kerja (Day Job Search) application connects the poor to job opportunities, thus increasing the chances of stable income for their families.

As of January 2012, over 10,000 entrepreneurs have served more than 1 million unique customers. An estimated 47 percent of the entrepreneurs who stay in the portfolio for more than four months have moved above the poverty line, which the World Bank defines as US$2.50 per day. Currently, more than 83 percent of the businesses are owned by women and 100 percent are profitable.

Source

Qualcomm Wireless Reach™ Project, available at: http://www.qualcomm.com/citizenship/wireless-reach/projects/entrepreneurship#indonesia---village-phone.

way to connect the unconnected. Smartphones, in particular, allow people to take matters into their own hands and find effective ways to engage the knowledge economy.[36]

THE PATH FORWARD

To ensure the ongoing success of mobile broadband and its economic and societal benefits, governments and other stakeholders around the world have an important role in ensuring the availability of the tools and incentives that are needed to spur innovation, new technologies, and new products:

- Spectrum is crucial for mobile communications. Its allocation is a key area where cooperation between governments and industry is critical. Although the latest mobile broadband technologies use spectrum much more efficiently than their predecessors, they are approaching the theoretical limits of spectral efficiency. This, combined with the phenomenal growth in mobile broadband, is resulting in a new challenge to find additional spectrum to support the tremendous growth in data usage. The benefits of mobile broadband depend upon the availability of adequate and appropriate spectrum that is harmonized to the greatest extent possible across borders. Industry must continue to innovate and find more effective ways to utilize spectrum while governments need to allocate and assign spectrum to the highest-value use, such as for commercial mobile broadband. Close cooperation between governments and industry is critical to finding solutions that will ensure that advanced services can continue to grow.
- A core driver of innovation and growth within the mobile broadband sector is the commitment by public and private institutions to establish and invest in the infrastructure and technological capacity required to meet the demand of the various services described in this chapter. Today, mobile phones and services provide greater quality, reliability, and functionality than ever before. And they do this often at a price that is lower than that of earlier, less-advanced, wireless technologies introduced just a few years ago.

  This could not have been realized without large investments in research and development and an intellectual property system that ensures protection of those inventions. Government policy and funding can play an important role in the early successes of the mobile broadband industry by providing incentives to spur innovation, technologies, and new products and by establishing a system that is able to examine, evaluate, and respond to these fast-moving market dynamics in a timely manner that leads to the development of high-quality inventions.

  It is important that policymakers take into account innovative technology opportunities when developing regulations and avoid arbitrarily stifling market opportunities that have great promise for providing societal, environmental, and economic value. Moreover, these policies must maintain technology neutrality to ensure an open and dynamic environment for innovation.

To better account for the full impact that mobile broadband is having around the world, we also propose that the 2012 and future *Global Information Technology Report*s (GITRs) include two additional Network Readiness Index (NRI) indicators at the country and global level:

- A mobile broadband connectivity metric, as part of the overall broadband Internet access indicators, that will help us more fully understand how many people in a given country are accessing the Internet and participating in the networked society. Current GITR metrics reflect only fixed Internet connections.
- A separate personal Internet connectivity metric that more precisely measures how many people are experiencing the new, hyperconnected Internet through personal devices that are always with us and always connected to real-time services deliver-

Box 5: Three examples of public-private collaborations using mobile broadband

This box provides examples of broadband solutions from three very different parts of the world.

Wireless Wireless Access for Health in the Philippines

In Tarlac Province in the Philippines, a project that began in 2009 has been implemented in 16 rural health units in order to reduce the time required for reporting and to improve access to accurate and timely patient information. The Wireless Access for Health project is made possible through collaboration between the Philippines Department of Health, the provincial government of Tarlac, Philippine universities, and private industry.[1] It uses 3G to build on and strengthen an existing electronic medical records system developed by the University of the Philippines, Manila. As of December 2011, approximately 150,000 patient consultations have been recorded through the program, patient care has improved, and patient visits are more efficient. Patient information is now fed electronically into the Philippine Field Health Service Information System—the government's major resource for managing public health data in order to collate reports for policy planning and analysis, which had traditionally taken a year to compile. Meanwhile, the recording of clinic-level information is enabling the health units to manage drug supplies and identify human resource needs, while municipal-, district-, regional-, and provincial-level information is helping to identify disease outbreaks and inform decision makers about the most efficient allocation of resources. Because of the success of the pilot project, the Tarlac provincial government has committed staff and financial resources to replicate the project in all 38 health clinics in the province; the pilot will serve as a model for other health units across the country.

National Broadband Plan in the United States

In the United States, the Federal Communication Commission's (FCC) National Broadband Plan provided a comprehensive analysis of the ways in which broadband in general and mobile broadband in particular has the potential to change many facets of American life, including healthcare, energy consumption, public safety, and education. The FCC has begun implementing one important aspect of its plan to support the use of mobile broadband for primary and secondary school students. Since passage of the Telecommunications Act of 1996, the FCC's e-rate program has been used to wire schools for fixed broadband and to fund wireless use on school grounds. As a result, the FCC has begun to extend this program to subsidize mobile broadband off school grounds to provide students with 24/7 connectivity. The E-rate Deployed Ubiquitously 2011 Pilot Program (EDU2011) is enabling 35,000 students at 14 schools in 20 states to get low-cost mobile broadband connectivity when they are away from school to support anywhere, anytime learning. EDU2011 is an important step toward achieving 21st century primary and secondary education in the United States through the use of mobile broadband connectivity, devices, and software learning applications offered by the mobile communications industry.

Connected Brazil

In Brazil, the telecommunications sector government agencies have a long-standing and active engagement with industry, utilizing mechanisms such as public consultations and keeping an ongoing dialogue on key issues. The Ministry of Communications and ANATEL, the National Telecommunications Agency, are very active in key international policy and regulatory organizations that are working to address mobile communications. By including industry in the decision-making process, the results better reflect the needs of both the government's objectives and the private sector's interests. ANATEL is an example of a regulator that has proactively taken steps to manage spectrum in order to maximize frequency harmonization at the international level and leverage economies of scale. In addition, some of the objectives of Brazil's National Broadband Program (PNBL), Connected Brazil, are to create opportunities, speed up economic and social development, promote social inclusion, reduce social and regional differences, and promote job creation and capacity building for the population to use information technologies.[2] The Connected Brazil Forum is composed of almost 60 institutions from diverse sectors, public and private, and directly linked with broadband program goals. Mobile communications will play a pivotal role in fulfilling PNBL's theme of a "fast Internet for all of Brazil" and aid in accelerating mobile broadband access and adoption, increasing local applications development, and decreasing device and service costs.

Notes

1 Qualcomm Wireless Reach™ Project: Health Care: Philippines – Wireless Access for Health, available at http://www.qualcomm.com/citizenship/wireless-reach/projects/health-care#philippines.

2 PNBL (Plana Nacional de Banda Larga): Brasil Conectado, available at http://www4.planalto.gov.br/brasilconectado/pnbl/.

ing social and environmental information about the world around us.

CONCLUSION

For people in many parts of the world, mobile broadband offers the first-ever means of accessing the Internet. And for many, particularly in emerging regions, mobile broadband will likely be their *only* means of access. At the same time, it is rapidly becoming integral to modern life for people in more developed countries, continually opening up new Internet experiences and unlocking new opportunities. In short, mobile broadband has become a force for change across all socioeconomic levels and in every corner of the globe. In many profound ways, this technology is an economic development tool for the 21st century.

While mobile broadband leverages the ubiquitous nature and scale of mobile telephony, it is positioned for a far greater impact if challenges such as securing appropriate spectrum and establishing policies and

systems that encourage and protect technical innovation are addressed. And, for reasons discussed in this chapter, it will also likely have far greater impact than the traditional Internet does today.

We have already begun to see the benefits of public and private collaborations that utilize mobile broadband solutions to bring services to citizens (Box 5).

Mobile broadband not only allows people to connect to one other, but it also provides unprecedented access to highly personalized Internet and computing experiences. There is significant opportunity on the horizon for many more people to participate in those experiences and benefit from those opportunities. Mobile broadband uniquely provides this potential to empower individuals across the world as never before.

NOTES

1 Chetan Sharma Consulting 2011.

2 ITU 2011.

3 Internet World Stats: Usage and Population Statistics. March 31, 2011, available at http://www.internetworldstats.com/.

4 HSPA refers to high-speed packet access, standardized by 3GPP as an evolution of UMTS/WCDMA networks.

5 EV-DO refers to evolution-data optimized, standardized by 3GPP2 for CDMA2000 networks.

6 LTE refers to long-term evolution, standardized by 3GPP and deployed by both UMTS/WCDMA and CDMA2000 operators.

7 See CDMA Development Group (CDG), available at http://www.cdg.org/resources/cdma_stats.asp, and Global Mobile Suppliers Association (GSA), available at http://www.gsacom.com/news/gsa_fastfacts.php4 (accessed January 2012).

8 Wireless Intelligence database, Q4 2011, available at https://www.wirelessintelligence.com/home/.

9 Wireless Intelligence database, February 2012, available at http://www.wirelessintelligence.com/analysis/.

10 Ericsson 2010.

11 Strategy Analytics Quarterly Research: Mobile Broadband Trends Q2 2011 (Prepared for Qualcomm), Strategy Analytics, July 2011.

12 Cisco 2011.

13 ABI Research 2009.

14 Strategy Analytics, July 2011.

15 See notes 16–21.

16 Analysys Mason 2010a.

17 LECG 2009.

18 Analysys Mason 2010b.

19 Analysys Mason 2011a.

20 Analysys Mason 2011b.

21 Deloitte 2011.

22 Qiang et al. 2009.

23 Strategy Analytics, September 2011 and December 2011.

24 This figure is the average of data on worldwide mobile devices for 2008–15, from Gartner, 2011a, *Q3 Smartphone Forecast Database;* Strategy Analytics, 2011, *Quarterly Forecast Database;* and IDC, 2011, *Quarterly Forecast Database.*

25 Pew Internet, survey sample of 2,277 people, July 2011.

26 See GfK Retail and Technology, July 2011, available at www.gfkrt.com.

27 Gartner 2011b.

28 Digital Stats 2011.

29 See http://www.bgr.com/2011/03/13/google-vp-marissa-mayer-dishes-google-mobile-stats-150m-mobile-users/, March 2011.

30 Gartner 2011c.

31 McKinsey & Company and GSMA 2010. OECD countries are those in the Organisation for Economic Co-operation and Development; the BRIC countries are Brazil, the Russian Federation, India, and China.

32 Juniper Research Press Release, April 13, 2011.

33 Pew Research Center 2011.

34 GSMA et al. 2010.

35 GSMA et al. 2010.

36 Hood 2011.

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Qualcomm Wireless Reach™. Project: Entrepreneurship: Indonesia Mobile Microfinancing. Available at http://www.qualcomm.com/about/citizenship/wireless-reach/projects/entrepreneurship#indonesia---village-phone.

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CHAPTER 1.6

Reaching the Third Billion: Arriving at Affordable Broadband to Stimulate Economic Transformation in Emerging Markets

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Direct correlations can be made between the affordability of broadband connectivity and the ability of an individual or country to successfully transform itself through the utilization of ICT capabilities. Advocating reaching more people by paying "less for less," strategies employed in many different countries aim to close the affordability gap. In short, these countries are employing business and deployment strategies similar to those of the prepaid mobile phone market that enabled it to successfully reach the majority of the world's population.

An International Telecommunication Union (ITU) study recently indicated that Internet users have now surpassed the 2 billion mark worldwide.[1] This is significant because access to the Internet is clearly a major enabler of economic growth. Accessing information and education, facilitating the creation and reach of businesses, streamlining the costs of engaging with governments, and obtaining healthcare are all cited as benefits of access to the Internet.

As we celebrate the progress and begin to experience the individual, economic, and social transformation of surpassing 2 billion Internet users, we turn our attention to the more than 70 percent of the world's population yet to experience the benefits derived from broadband Internet access. How do we accelerate access as we move toward reaching the next billion users?

As with many things related to technology and communication, reaching the third billion is centered on the three major pillars of access, affordability, and awareness. Each country and situation calls for the development of unique, creative programs that can address these three elements successfully and meet the challenges of extending the reach and impact of broadband services.

THE IMPORTANCE OF INTERNET ACCESS: THE TIME FOR BROADBAND

In the past decade, almost 75 percent of the world's population has obtained an unprecedented level of basic connectivity through the almost viral proliferation of mobile phone technology.[2] Fueling the vibrant images of mobile phones sold in rural marketplaces—alongside fruits, vegetables, and other necessities—has been the communication industry's ability to reach new customers with creative and affordable service options. The most notable of these has been the prepaid phone service. In developing countries, prepaid voice services are the choice of most people,[3] reaching up to 97 percent of the users in Africa—allowing virtually everyone to choose the level of communication they can afford while avoiding an ongoing commitment.

This ubiquity of affordable telecommunications has led to a wave of new and innovative services that go well beyond staying in touch with family or friends. Affordable voice and text connections have become business and economic enablers.

Table 1: Broadband speed comparisons: Time needed to download content at different connection speeds

Content	256 kilobits per second (kb/s)	2 megabits per second (Mb/s)	10 megabits per second (Mb/s)	100 megabits per second (Mb/s)
Google home pages (160 kb)	5 seconds	1 second	Instant	Instant
Music track (5 MB)	2 minutes, 36 seconds	20 seconds	4 seconds	Instant
Video clip (20 MB)	10 minutes, 25 seconds	1 minute, 20 seconds	16 seconds	2 seconds
CD / low-quality movie (200 MB)	6 hours, 4 minutes, 35 seconds	46 minutes, 40 seconds	9 minutes, 20 seconds	56 seconds
DVD / high-quality movie (4 GB)	34 hours, 43 minutes, 20 seconds	4 hours, 26 minutes, 40 seconds	53 minutes, 20 seconds	5 minutes, 20 seconds

Source: ITU calculations with rounded values.

Although the world has reason to marvel at the benefits achieved with this first wave of wireless communication options, a second wave is hovering in the wings, waiting to become a driver of even greater economic impact. In this second wave, broadband technologies are extending the opportunities offered by data communications. It is easy to visualize the music, video, and multimedia experiences extended by broadband communications along with the business and economic opportunities that broadband makes possible. This makes encouraging the rapid proliferation and adoption of broadband crucial to those attempting to enter a local, national, or global market.

This was clearly stated in a World Bank study:

> Over the past decade, developing countries have seen rapid but uneven growth in information and communication technologies (ICT) access and use. Progress has been noteworthy in mobile telephony, where the gap between developing and developed countries is narrowing rapidly. . . . But outside mobile telephony, there are large and widening gaps in high-speed Internet access and Broadband connectivity, the development of local information technology (IT) industries, and of ICT applications; that is, the diffusion and use of ICT in business, services, and government—the areas where ICT can deliver the largest developmental impacts.[4]

Those charged with promoting the benefits of ICT and broadband can draw upon many examples. Research and implementations around the world have repeatedly shown that ICT investments can have a positive impact on jobs, productivity, GDP growth, and innovation. The demonstrated effects of investment in the ICT infrastructure include:

1. the creation of high-skilled, high-paying jobs;
2. improved international competitiveness;
3. a spillover effect, which can create opportunities in many other industries;
4. a better quality of life through enhanced education, healthcare, and so on; and
5. stronger and more competitive small and medium businesses.

US Federal Communications Commission (FCC) Chairman Julius Genachowski highlights the impact of these effects, as reported in a recent Reuters article:

> No infrastructure matters more for job creation and economic growth in the 21st century than broadband internet. . . . While the new "hyperconnected world" means some 20th century jobs may never return, Genachowski said studies show that broadband-related industries create 2.6 jobs for [every] one lost. He pointed to Facebook, which employs 2,600 people but has led to the creation of another 182,000 jobs. . . . And while eBay and Amazon employ 50,000 people, they provide a sales platform for up to 1 million entrepreneurs.[5]

Most countries are increasingly working hard to help their citizens adopt technology to improve their nation's competitiveness. We consider several of these national efforts here.

Table 2: Data usage comparisons

Type of traffic	ENTRY-LEVEL USER 300 megabytes	STANDARD BUSINESS 1 gigabyte	HEAVY BUSINESS AND LEARNING 2 gigabites	PERSONAL MEDIA USER 5 gigabytes
Basic email (20,000)	1,400 emails	2,500 emails	4,000 emails	2,000 emails
• With attachment (300,000)	• 100 emails	• 200 emails	• 300 emails	• 500 emails
• With photo (1 MB)	• 40 emails	• 100 emails	• 100 emails	• 300 emails
Web pages (300,000)	1,500 pages	2,000 pages	2,700 pages	5,500 pages
Social media with photos (500,000)	20	n/a	400 posts	10,000 posts
Streaming video (60 seconds = 3 MB)	n/a	1 hour	4 hours	10 hours
Application/game (download = 15 MB)	n/a	n/a	n/a	10 applications, 20 games
Music download	n/a	n/a	n/a	50 songs

Source: Example workloads are derived from AT&T workload data.
Notes: Data refer to the number of emails, web pages, and so on that a user "consumes" per month. n/a = nonapplicable.

In 2010, the Malaysian government spearheaded activities aimed at reaching 50 percent of households with personal computers (PCs) and Internet access. They are utilizing Universal Service Funds to subsidize 1 million netbooks for students and connectable rural low-income families and to establish projects to improve broadband coverage across specific underserved areas of the country.[6] The program at launch targeted a 1 percent rise in GDP and the creation of 135,000 jobs.

Perhaps the most prominent government-driven program for broadband Internet access is Australia's National Broadband Network (NBN) project. Here the government has recognized the economic potential of high-speed Internet connectivity and is engaged in a project (costing 43 billion Australian dollars) to bring 100 Mb/s fiber to every Australian home and business. The program emphasized the inclusion of the country's more rural regions to ensure that all citizens have comparable access to the network. This forward-looking project recognizes the ever-increasing importance of connectivity to national competitiveness.

A recent article in telecoms.com highlighted research released by Arthur D. Little, Chalmers University of Technology, and Ericsson that shows that doubling broadband speed can yield growth in excess of 0.3 percent GDP and quadrupling broadband speed can yield 0.6 percent growth in GDP. [7] They credit the positive effects of the increased speed to automated and simplified processes, increased productivity, and better access to basic services such as education and healthcare. The study also showed that for every 10 percent increase in broadband penetration, a country's GDP increases by 1 percent.

The anticipated traffic of a truly connected society will continue to require higher bandwidths. As noted in the Cisco© Visual Networking Index, "In 2010, 3 million tablets were connected to the mobile network, and each tablet generated 5 times more traffic than the average smart phone. In 2010, mobile data traffic per tablet was 405 MB per month, compared to 79 MB per month per smart phone. There were 94 million laptops on the mobile network in 2010, and each laptop generated 22 times more traffic than the average smart phone" and 515 times the traffic of a regular "not so smart" phone.[8]

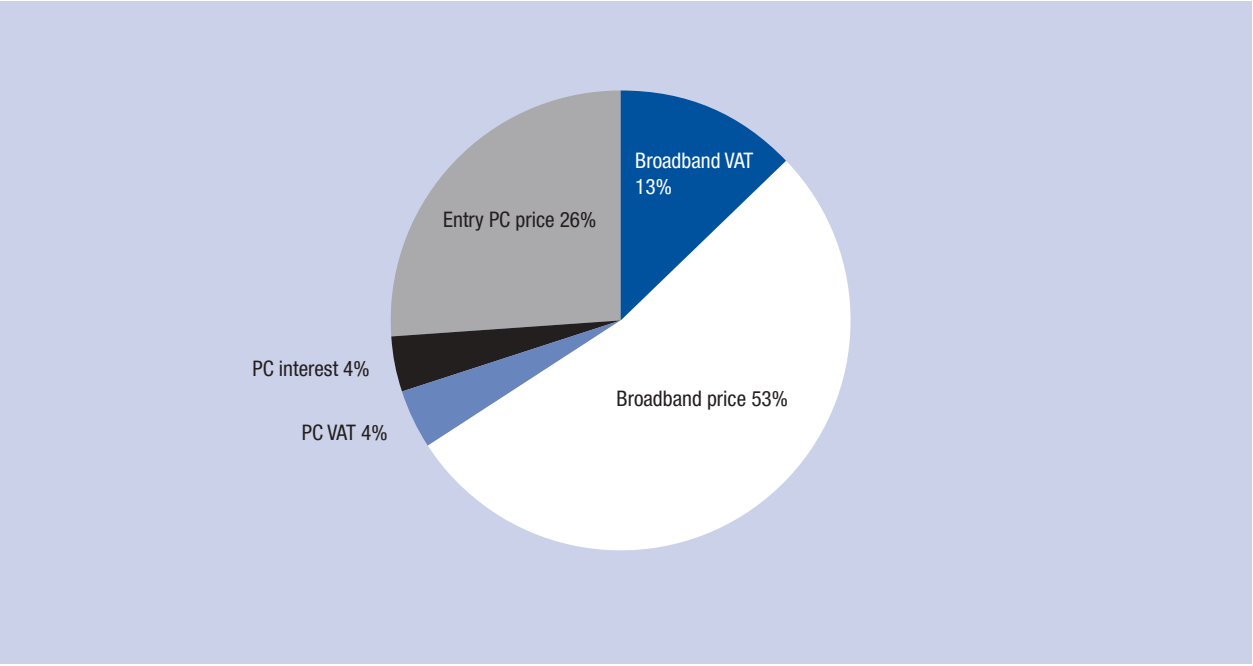
Table 1 provides some clarity on what different throughputs could mean in terms of the user experience (wait time).

It is important to determine what size is required for a data plan to be adequate for an individual to be able to participate in global and/or local business environments. The AT&T calculator helps calculate how much service is needed based on expected utilization (see Table 2).[9]

The example workloads in Table 2 indicate what might be possible at different download quantities. It is important to note that a satisfactory level of communication can be obtained from lower-volume data plans. Heavier use of richer media is, however, relegated to higher-volume plans.

Around the world, countries have been recognizing the need for high-speed Internet to be available to every

Figure 1: Average personal computer plus broadband solution costs, BRIC+TIM countries



Source: ITU, 2010a.
Note: Data projected for next four years (based on current day).

citizen, even in the most remote areas. They are deploying internal fiber networks, licensing spectrum, and using Universal Service Funds and other financial vehicles to support the efforts of providing affordable ubiquitous Internet access to their constituents. Like the progress experienced with the innovative use of voice and text services enabling supply lines with previously unobtainable knowledge, affordable broadband connections are fast becoming the business and economic enablers that make possible business and customer service opportunities previously too difficult to coordinate.

AFFORDABILITY: MAKING THE EXPENSIVE AFFORDABLE TO THE NEXT WAVE OF USERS

Recent studies published by ITU reveal that broadband penetration is directly related to its cost, relative to an average family income, as well as to the availability of products and services that accommodate the general population's purchasing ability.[10] For example, as the annual cost of broadband drops below 3 percent of a family's annual income, its use begins to increase dramatically. For developed countries, this relative cost has already been achieved, but for at least 34 countries worldwide, the cost of broadband remains higher than the average annual family income and thus it remains entirely out of reach.

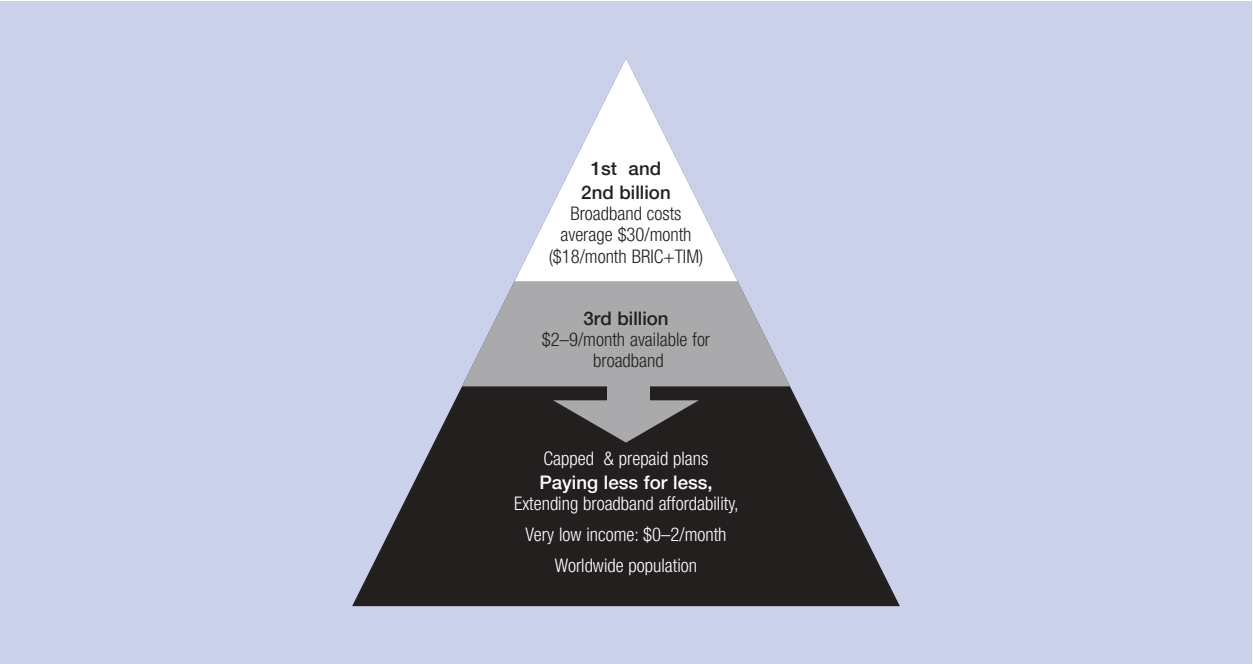
Extending the penetration of broadband to reach the next billion users becomes more complex because the ability of people in developing countries to afford more advanced technology and communications lessens dramatically. Of the approximately 5 billion people worldwide who remain without broadband access, the third billion represents those poised or preparing to achieve an income level capable of technology consumption. The challenge becomes one of establishing viable models that make this possible.

Affordable broadband programs are starting to emerge in countries such as Sri Lanka and India, with service providers offering connectivity solutions starting as low as US$2 per month. This level of affordability is making it possible for people to step up their learning, skills preparation, and service delivery levels by opening up their access to a larger quantity of Internet services and PC applications. Internet access services, coupled with computing devices that can range from entry-level netbooks to higher-performing laptops, are having a positive impact in these communities while providing choice. Many of the offerings are linked to financing options that further reduce the entry barriers to lower-income Internet entrants.

Those working hard to bridge the digital divide have tried to reduce these costs and barriers to entry for new users. Significant focus is put on the cost of specific Internet access devices, especially PCs, but looking into the total cost of ownership for a citizen of the rapidly developing economies—BRIC+TIM countries[11]—(Figure 1) shows that most of the family / individual income invested in getting connected to the Internet is actually spent on connectivity.

Some governments have realized that incentivizing technology adoption is much more lucrative than overtaxing the initial technology purchase. This realization has resulted in reducing the cost of devices through

Figure 2: Three percent of family income: Entry point for broadband adoption



Source: Intel calculations based on Euromonitor statistical data and Intel field intelligence.

subsidies and reducing or removing some of the taxes such as import duties and value-added tax (VAT).

For instance, Turkey's temporary VAT reductions have proven very effective in this regard.[12] By examining its economic data,[13] the Turkish government determined that a reduction on the VAT on PCs would have significant benefit. TUBISAD, a local nongovernmental organization, pointed out an important reason for the government to expand its consideration to the ICT industry: on average, in Turkey it takes US$61,000 to create a new job in a traditional sector such as the auto industry, compared with just US$5,000 for a new job in the ICT sector. Turkey's ICT economic model projected that:[14]

1. a 10 percentage point reduction on VAT would increase PC sales by 10.3 percent;
2. the tax reduction program has a net present value of US$279 million over a five-year period;
3. the VAT reduction would lead to an additional 14,000 to 15,000 jobs in PC manufacturing and retailing industries over a five-year period, and
4. each dollar lost on VAT revenue returns US$1.31 to the government in other taxes.

In the end, the Turkish government provided US$100 million in financial support to small and medium businesses for ICT purchases, in addition to reducing the VAT on PCs from 18 percent to 8 percent for three months. In the three months after the VAT was reduced, the benefits predicted by the ICT economic model were evident, and included:

1. increased nominal tax revenue for the government;
2. increased demand for ICT-related purchases caused by a favorable public response to the VAT reductions; and
3. greater local PC production, which increased 4.3 percent in April 2009.

Shortly after the initial three-month period expired, the policy's success convinced the government to extend the VAT reduction an additional three months.

Turkey's ICT economic model is now being used to evaluate other stimulus-program options such as providing cash rebates to first-time PC buyers and subsidizing the cost of broadband for PCs purchased by teachers.

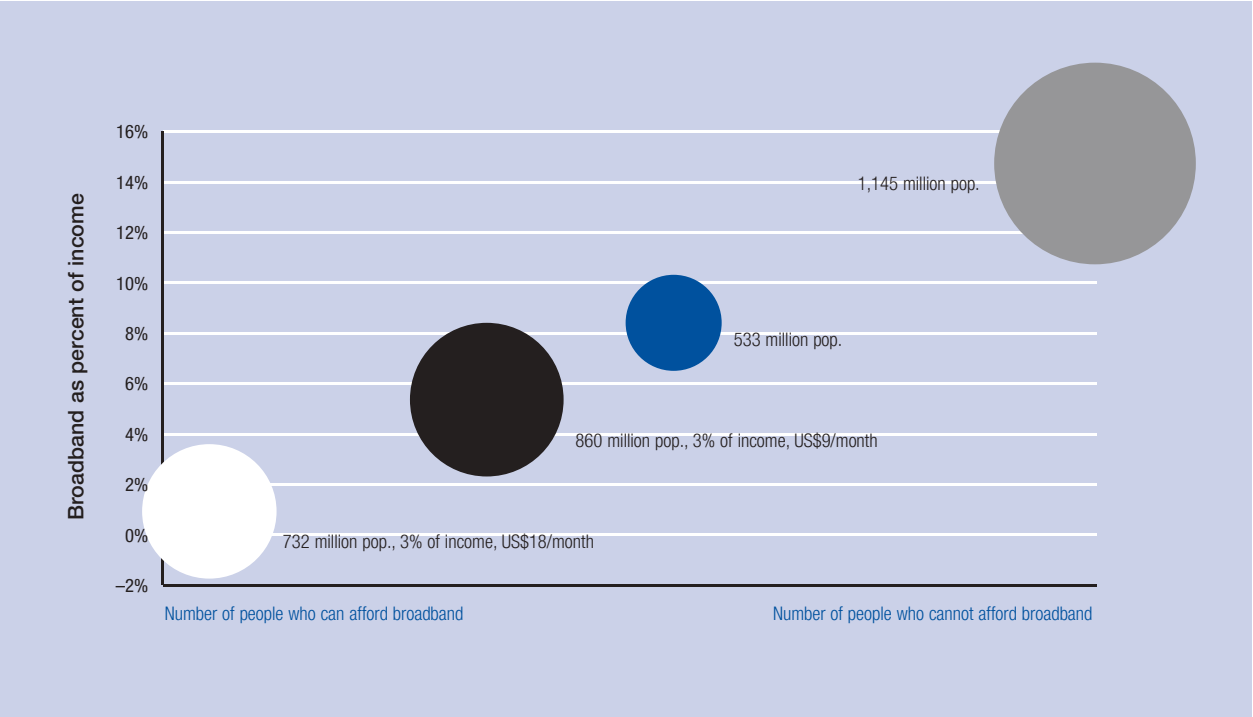
IS AFFORDABLE BROADBAND INTERNET ACCESS A VIABLE BUSINESS?

Frequently, employing successful models for increasing broadband utilization requires identifying how to maintain telecommunications service provider solvency while adding a large volume of new users.

As noted earlier, broadband becomes affordable to a substantially larger percentage of the population when it approaches 3 percent of annual family income. A large percentage of developing and emerging nations find themselves in between (Figure 2).

As seen in Figure 3 and Table 3, Brazil, Russia, India, China, Turkey, Indonesia, and Mexico (BRIC+TIM countries) could grow their available market by 860 million people by reducing the cost of entry for broadband

Figure 3: Affordability levels



Source: Intel calculations based on Euromonitor statistical data and Intel field intelligence.
Note: BRIC+TIM countries have 50 percent of the world's population; 80 percent of those in BRIC+TIM countries cannot afford broadband at the 3 percent GNI PPP income threshold.

Table 3: Affordability levels

Broadband as a percent of GNI PPP per capita	Population that can afford (millions)	Percent of population
< 3	731,911	22.38
>3 – <6	860,138	26.30
> 6 – < 10	533,277	16.31
> 10 – < 40	1,145,132	35.01
	3,270,458*	

Source: Intel calculations based on Euromonitor statistical data and Intel field intelligence.
Note: BRIC+TIM countries have 50 percent of the world's population; 80 percent of those in BRIC+TIM countries cannot afford broadband at the 3 percent GNI PPP income threshold.

by about 50 percent. Short of dropping prices, lower-cost and lower-speed or prepaid data packages can allow broadband providers to find new avenues to new customers by reducing the barrier to broadband adoption.

From a business perspective, a high-level calculation can approximate the potential business opportunity for a whole industry in terms of revenue and GDP growth: 1 billion new users × US$10/month x 12 months can represent up to US$120 billion revenue per year of opportunity over the course of the next several years.

Well-managed use of prepaid and capped offerings is enabling people to benefit from Internet access at lower speeds and cost entry points. Creative approaches to obtaining large quantities of data—such as pre-loading content on devices, utilizing free public Internet access, and transporting data via USB storage and other portable memory devices—can facilitate using lower speeds and cost entry point plans with experiences, learning content, and applications comparable to higher bandwidth options.

Telecommunications companies, governments, and vendors of technology are starting to understand the opportunities of reaching the third billion. Affordable data plans are beginning to emerge. Affordable connectivity bundled with computers, software, and content are being offered by several service providers around the world. Government-sponsored programs to equip educators, students, and lower-income families are also becoming a priority for many countries.

To take the example of Kenya, family income levels mean that only about 7 percent of the population can afford a service that offers uncapped monthly broadband access for US$20 per month. A prepaid broadband access service capped at 200 MB of data for US$5, however, could be within the reach of more than 60 percent of the Kenyan population. Realizing these affordability levels, Safaricom, the largest Internet service provider in Kenya, launched a segmented prepaid broadband offer in the end of 2009 targeted at different income levels. With most new broadband users also needing to acquire a PC, the PC market grew in the country as

well: in 2010, the Kenyan PC market grew more than 100 percent (compared with 2009) versus an average PC market growth in Africa of only 3 percent, according to International Data Corporation (IDC) period Q1'10–Q1'11.

In Egypt the telecommunications provider Mobinil is currently offering a netbook with six months of Internet access for US$300.[15] The broadband service is capped at 110 MB per month, at which time the high-speed service degrades. The service can be upgraded at various increments to a high-speed data package of 1.5 gigabytes (GB) for approximately US$8.50, so a large majority of the population can thus afford to be connected.

In many cases, although affordable offerings become available, those who could benefit most are not aware of this opportunity. The challenge becomes finding new ways to reach the new customers with new value propositions.

AWARENESS: PROMOTING BROADBAND ACCESS

Making new customers aware of the value and availability of broadband services can be difficult, and different approaches are being deployed by service providers to reach customers. Government programs as well as private ones are helping telecommunications providers and other technology vendors reach beyond their traditional marketing and sales promotions.

Learning from modeling and other economic data, many countries—including Australia, Brazil, Portugal, and Turkey—have made strategic investments in the ICT industry. These investments are designed to create new jobs, increase revenue for the government, and provide more stable overall economies.

In 2007, the government in Portugal launched a national program called Magalhães (Magellan) to provide subsidized laptops with 3G connectivity to all secondary students and teachers in the country using funds from the auction of 3G licenses. In 2008 this initiative was extended to primary school students, and it reached more than 1.3 million students and teachers over a period of three years. The cost of broadband was as low as 5 euros for 2 GB of data per month (with a 36-month contract) and laptops including an external 3G USB modem, commonly known as 3G USB dongle, would cost a maximum of 150 euros.[16] This program was widely marketed and publicized both by the government and private partners, thus ensuring that the entire society was aware of the program, its benefits, and the conditions under which one is eligible. The outcome was clear: two years after the start of the program, most of the students and teachers in Portugal had acquired their own laptops.

Vietnam's PC for Life program provides a good example of an extensive public-private partnership where a well-articulated communications campaign is reaching a large proportion of the population.[17] The government teamed up with telecommunications companies, computer vendors, content providers (including those providing English-learning software), and bank financing options, combining these various functions into multiple waves of programs. The fixed broadband packages from VNPT, which is running the program, include free installation; special pricing for students and teachers starts at US$4.30/month instead of the standard US$10/month. The Vietnamese mobile operator Viettel is offering a 3G data plan starting at US$6/month for unlimited data as well as a free service capped at 500 MB for students aged 14 to 22. The bundles offer choices of entry-level and higher-end laptops and netbook devices as well as add-ons from a variety of companies. The program has a strong national marketing campaign complete with songs and icons. Consistent with participants in other programs that provide several options, those offered different choices by Vietnam's PC for Life program typically stretch to try to buy the best capabilities they can afford.

Argentina's Conectar Egualdad program has chosen a different approach and is actively promoting the nation's rollout of PCs in their schools.[18] The nation is in the middle of a massive rollout of 3 million computers with the aim of providing a computer for all secondary school students and teachers. They have established a website and links through social networking sites that enable all citizens to watch and experience the rollout: http://www.conectarigualdad.gob.ar/. The program has established technology as part of the country's educational system, and includes courses, teacher training, learning content, and services as well as security. The computers can function both at school and outside the classroom. Broadband connectivity is provided in the schools.

Many other countries are starting to follow suit, identifying the results they want to achieve by including broadband in their ICT investment. The most successful programs clearly define their objectives and broadly communicate their existence to civil society.

THE EXAMPLE OF SRI LANKA

To illustrate what such a program could look like, we look at Sri Lanka's stated objectives, extracted directly from the *Information and Communication Technology Plan for Sri Lanka 2011–2016:*[19]

> The following economic and social targets will mainly be focused at in the initial stage:
>
> a. Drive ICT industry up to the level of US$1.0 billion industry by 2016 (US$2.0 billion industry by 2020)
>
> b. Create 100,000 new employment related to ICT industry and ICT enabled industries by 2016 (250,000 new employment by 2020)
>
> c. Increase level of ICT literacy up to 75% by 2016

d. Facilitate the use of ICT by citizens for fulfilling the needs of everyday life

e. Promote ICT education and Human Resources Development and ensure quality and standard of ICT education and training

f. Ensure availability of high quality and standard ICT Hardware and use of quality and legitimate software

g. Increase availability and use of high speed Broadband and network connectivity for economic and social activities

h. Strengthen the legal framework, provide secure environment for use of ICT and control computer crimes

Further, the Government has realized that the promotion of ICT usage in all business and industries would result in significant enhancement of the competitiveness of Sri Lanka over the other countries in the region. Presently, there are internationally accepted indexes set out by agencies functioning under the United Nations and other reputed global institutions to measure the relative advantages of a country over other courtiers of the world. Rising up in the ladder of indexes is one of the best approaches to attract more investments which would pave the way for more employment opportunities, better quality of life and finally rapid economic growth of the country. Therefore, it is expected to achieve minimum 20–30% growth related to the following globally accepted indexes during the next six years by injecting ICT into business, industry and the public sector.

a. eGovernment Readiness Index (Rank: 111 out of 192 countries in 2010)

b. Network Readiness Index (Rank: 72 out of 133 countries in 2009-10)

c. Global Competiveness Index (Rank: 62 out of 139 countries in 2010-11)

d. Ease of Doing Business Index (Rank: 102 out of 183 countries in 2010-11)

The process of implementation of the plan will be fundamentally based on Government's leadership, commitment of resources and smart partnerships. Furthermore, it is essential to have the collaboration of citizens, Government and the private sector to achieve the objectives of this plan.

The Sri Lankan plan has its roots in several successful years of proactive stimulus. Since 2009, the country has reduced its taxation of ICT products and services. As a consequence, broadband adoption has been growing at a rate of 100 percent year over year. In practical terms, the number of people capable of affording broadband went from approximately 3.5 million to over 13 million in 18 months. The availability of prepaid offerings that cost approximately US$2 per 300 MB was a principal method of making broadband more affordable.

Different countries have different priorities; some governments have decided to focus on specific segments of the population, such as teachers or students. All programs, however, employ one or more of the access, affordability, and awareness catalysts mentioned previously to establish their momentum. We consider two additional examples to see how this comes together.

Through South Africa's Teacher Laptop Initiative, a program managed by the country's Education Labour Relations Council, "Qualifying teachers will receive a monthly allowance of 130 South African Rands (R130.00) (taxable) and are required to fund the difference between the allowance (R130.00) and the monthly repayments of the package. Most of the packages from the provisionally accredited suppliers cost between R250.00 and R390.00 per month. The repayments are spread over a period of five years. The packages consist of appropriate hardware with prescribed minimum specifications, school administration, national curriculum and other software, as well as Internet connectivity, insurance, and finance. . . ."[20]

In Kenya, according to the country's ICT Board, "The laptop initiative is funded by the World Bank and implemented by The Kenya ICT Board under the Kenya Transparency and Communications Infrastructure Project (TCIP), as part of a component to implement the Computers for the Communities Initiative. This laptop initiative is known as 'Wezesha'; a Swahili word that means 'to enable'. . . . The incentive per registered student will be approximately fifteen (15%) and thirty three (33%) percent of the actual price of a laptop, depending on whether the student will prefer a lower-end or higher-end model."[21]

CONCLUSION

We can enjoy and applaud the success of some of the programs noted above for reaching a significant percentage of their country's population. However, many countries have yet to incorporate affordable broadband strategies as part of their national growth plans, and many telecommunications companies have not yet realized the potential of establishing new program offerings that can significantly extend their business by reaching a much broader customer base.

Exploring programs that actively address the issue of broadband adoption as an enabler of national progress, we find three principal mechanisms or channels that prove consistently useful:

1. telecommunications providers willing to package and market prepaid and subscription (post-paid) broadband offerings with limited speed or data packages at a lower cost;
2. an excited local ecosystem offering creative, affordable bundles and/or financing; and
3. government and regulatory incentives, sponsorship, and alignment to national broadband and overall ICT objectives.

The third billion represents the next wave of the world's population that is close to being able to afford Internet connectivity through a PC. Creative approaches to making technology and connectivity solutions affordable and accessible are starting to facilitate these people's capacity to contribute to and benefit from economic growth.

Fortunately, those tasked with improving the market penetration of broadband can benefit from the success of prepaid voice services. Utilizing the same, or similar, business models, government and private industry leaders are starting to see the value, as well as the necessity, of finding ways to bring more and more of the population into the information age. Developing programs that reduce the cost of access through tax reductions, prepaid services, creative financing, and entry-level offerings that approach 3 percent of a family's annual income can have a tremendous impact, more than doubling the population contributing to the economy by utilizing and innovating with ICT.

NOTES

1 ITU 2010a.

2 ITU 2010a.

3 Wireless Intelligence 2011.

4 IEG 2011.

5 Voskamp 2011.

6 *Universal Service Funds,* also called *Universal Service Access Funds,* are the funds that governments collect as a tax from telecommunications operators to whom they have allocated spectrum, with the goal of making supporting investments in infrastructure and access to voice and data in the parts of the country where commercial operators would not be able to justify a sustainable business model.

7 Middleton 2011.

8 Cisco 2011.

9 See http://www.att.com/standalone/data-calculator/.

10 ITU 2010a.

11 BRIC+TIM is the acronym that represents Brazil, Russia, India, China plus Turkey, Indonesia, Mexico.

12 Intel 2009a.

13 Today's Zaman 2009.

14 Intel 2009b.

15 See the company's promotional website at http://www.mobinil.com/whatsnew/BuySamsungnetbookN150withMobinilUSBmodem.aspx.

16 Information about the Portuguese Magalhães program is available at www.e-escola.pt.

17 Information about the Vietnamese PC for Life program is available at http://www.pcguide.vn/pc4life/.

18 Information about Argentina's Conectar Egualdad program is available at http://www.conectarigualdad.gob.ar/.

19 Ministry of Telecommunication and Information Technology (Sri Lanka) 2011.

20 Information about this program is available at http://www.teacher-laptop.co.za/#.

21 Kenya ICT Board 2010.

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CHAPTER 1.7

Harnessing the Power of Big Data in Real Time through In-Memory Technology and Analytics

SAP AG

Companies today have more data on hand than they have ever had before. It is estimated that an average Fortune 500 company has between seven and ten years worth of customer data—data that are often underutilized. In addition, the volume of these data has been growing tremendously. A recent study by the *Economist* estimated that humans created about 150 exabytes of information in the year 2005;[1] in 2011, this is projected to be 1,200 exabytes. Similarly, the research firm IDC estimates that digital content is doubling every 18 months.[2] Gartner projects that, in the future, as much as 80 percent of enterprise data will be unstructured, spanning both traditional and non-traditional sources.[3]

THE EMERGENCE OF BIG DATA

The massive explosion in data is creating manageability issues for companies around the world, particularly in the context of mergers and acquisitions. For some specialized applications, such as telecommunications call data records, data can quadruple in 18 months. At the same time, tighter regulations involving the tracking of financial transactions and customer data have expanded the responsibility of businesses so that they must maintain these data and their accessibility for years on end. Meeting these data-volume challenges can be costly, as companies must purchase and maintain hardware to handle the load. Multiple data warehouses and transaction systems add up to a high total cost of ownership and require constant oversight.

So what are companies to do with the huge amount of data, often called *big data*? As many a shrewd executive realizes, there could be a real business advantage to gaining some quick insight on this issue and moving ahead of competitors.

Until recent advances—such as in-memory technology, which we will address later in this chapter—this was easier said than done. Physical limits of computing—the speed of accessing data from relational databases, processing instructions, and so on—meant that a complex calculation or search of data could not be accomplished in real time. At best, such an operation would take a few hours; at worst, it would take a few days.

Around the world today, there is an overwhelming demand for tools that could help organizations access, analyze, govern, and share information. Big data are everywhere, and, as mentioned, they are mostly unstructured data outside the database. Gartner's 2011 Hype Cycle predicts that big data are maturing quickly and rising to the peak of "inflated expectations."[4] Big data dictate a need for advanced information management and processing. Speed is a key requirement, but speed

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alone is not useful without context. Companies not only want faster access to their data, they also want to understand quickly what the information means and what they can do with it.

Ultimately, the goal for the technology providers of any business is to create a true, real-time enterprise where new insights in big data can be made available at the speed of thought to improve decision making, accelerate performance, and improve productivity and efficiency.

The challenges

Intimately linked to the growth of big data are such technology trends as the growth of mobile technology and wireless devices, the emergence of self-service channels, the wide adoption of cloud-based services, and the expansion of social networking and remote collaboration.

But even before big data assumed their present volume, there was business analytics: the analysis of business data to gain insight. This has been around for at least the last 15 years. Originally called "decision support," its name evolved into "business intelligence" (BI). Over the years, technologies such as business reporting, self-service BI, BI dashboards, budgeting, planning, data integration, and others were consolidated into larger enterprise portfolios offered by software vendors such as SAP. In effect, business users got a taste of the insight they could get from data—but that worked only until the recent explosion of data volumes, preventing any real-time analysis.

We now look a little more closely at the challenges of organizing big data and the demands of the marketplace. Corporate users—typically business analysts—want to be able to run reports themselves instead of through their information technology (IT) departments. They also want to be able to customize their requests, and they want analytic solutions that are easy to use and accessible without the extensive involvement of IT, since users feel that a reliance on IT dramatically slows down their work day.

Users also want data visualization, since it seems now more than ever that organizations and consumers expect high-impact visualizations associated with data—not only in the form of charts, graphs, and heat maps, but also in forms customizable to design preferences. Information design also goes beyond merely displaying the data in graphic form; it includes contextualizing the data with other sources and content to ensure they are relevant in a real-world context and to ensure also that they are updated in real time.

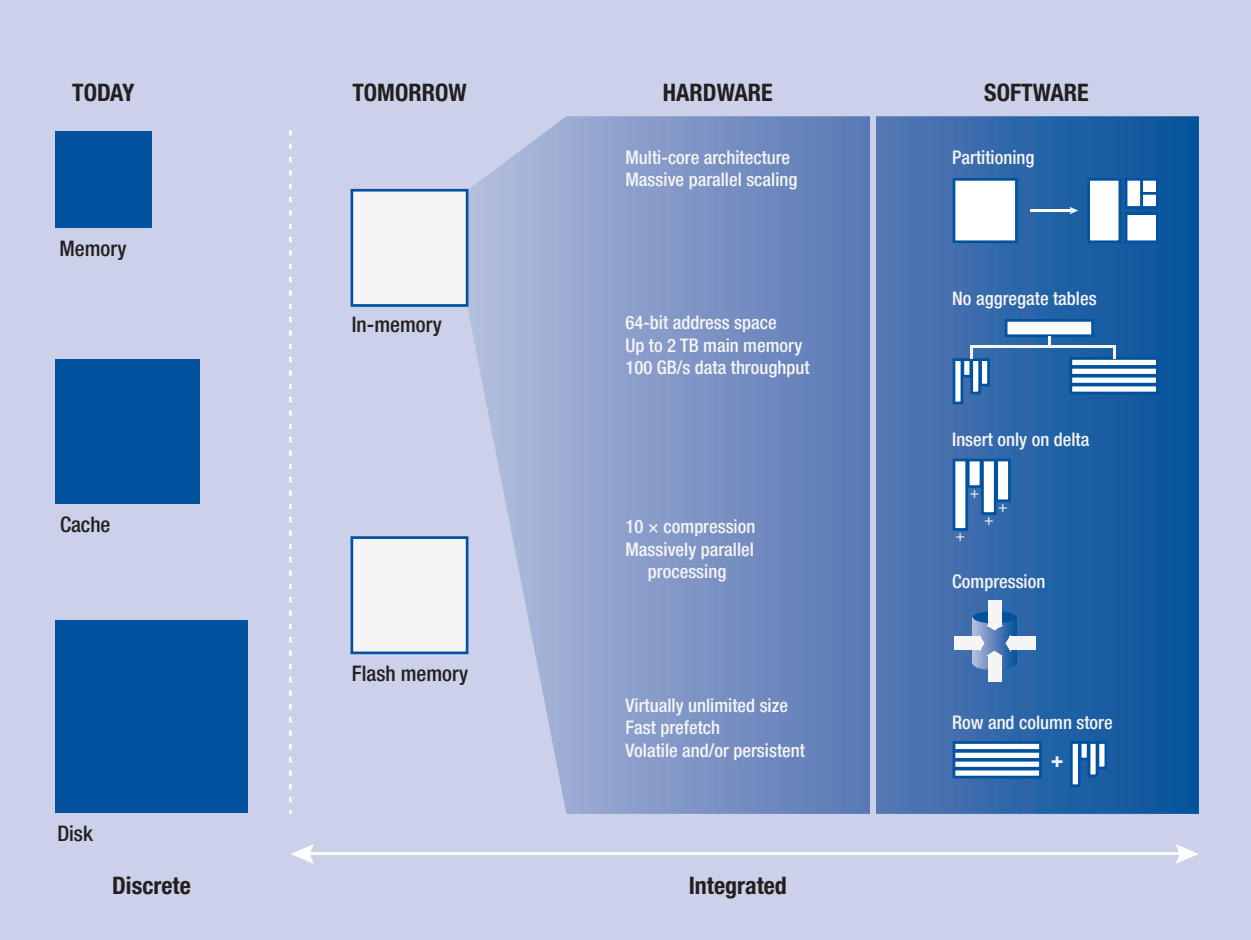
Data points and clear answers are valuable, but today's analytics must go beyond data input and output and maintain relevance to the real world. This means transforming the data into actionable information by coupling them with appropriate additional data from social media analysis, geolocation, customer relationship management systems, and so on. "Contextual engagement" employs feedback data from users and consumers to prioritize the information that a specific user considers most important, cutting through extraneous information and permitting smarter decisions to be made. Providing proper context is becoming more feasible with access to new data sources, such as social media and location and time information, as well as sources that may not be proprietary but may still prove useful (e.g., cell phone information, publically available government data, event streams, images).

Users also want to analyze the information that is coming through social media. There is, of course, the analysis of unstructured text from blogs, Facebook, Twitter, and other websites—an activity presently dominated by small start-up vendors rather than big players. There is also the application of social media–like functionality and processes to team sharing in a business context (e.g., StreamWork, Chatter). For example, many influencers—industry and business analysts—describe "crowdcasting" capabilities that might help teams prioritize analytic reports and data points by allowing individual users to "like" them once they are shared across a team network.

The true potential of mobile applications is just beginning to be realized—and the current extent of mobile analytics is less far-reaching than might be expected. When referring to analytics and mobility, influencers often are referring to the ability to develop analytics that draw on the behavior of device users in real time (e.g., for advertising and other targeted purposes), rather than mobile analytic applications. Although mobile analytic applications will become increasingly useful, especially to companies with large mobile workforces, the analysis of mobile device usage is now also highly valuable to organizations across multiple industries—especially those in healthcare. Several influencers have noted that the ideal mobile application would include data, information, and location.

The need for industry-specific analytic solutions has been discussed by both the media and analysts, with a focus on solutions in healthcare, energy, sustainability, and the public sector. There has also been a push for analytics that can utilize sensor networks or data drawn from the monitoring of road networks, air traffic, railroads, and so on. It is estimated that, in the next five years, the volume of sensor data will surpass the volume of unstructured data collected from social media. Growth in these sectors is often linked to mobile analytics. In healthcare, mobility provides doctors and other health professionals with the ability to diagnose patients by using an iPad to see relevant information or to remotely monitor patients in real time. Big data testimonials are often associated with these industries, because big data often involve managing years of historical data. Organizations in fields such as healthcare

Figure 1: The inflection point: In-memory computing



Source: Plattner and Zeier, 2011, pp. 102, 110, 139.

and government customarily collect and store massive amounts of information.

Although the analysis of *unstructured data* and *natural language processing* are not the same thing, IBM's Watson—the computer that can compete on the game show *Jeopardy!*—has catapulted both into the mainstream media, resulting in the terms being used somewhat interchangeably.[5] Although not always described in these terms, an intense interest has emerged in the unstructured data associated with social media content, with a multitude of vendors racing to offer "comprehensive" solutions or suites to address the issue. Additionally, natural language processing was listed as a "Technology Trigger" on Gartner's 2011 Hype Cycle,[6] with early adopters investigating its applications.

Another challenge: Building a real-time business

In addition to these issues, business itself is now being transacted at an incredible rate. Businesses increasingly need to react faster to the events that affect their operations. They must be able to identify trends and patterns to improve their planning and forecasting, to reduce their response time to customer requests and complaints, and to provide their sales forces with the information needed to close deals in a timely manner.

To achieve these goals, businesses must be able to assess transactional information as events occur, without waiting to extract those data from data warehouses. However, the volume of available operational data often exceeds the capacity of traditional disk-based systems and data warehouses to process within a useful timeframe. Companies today need to be able to answer questions on the fly based on real-time data.[7]

IN-MEMORY TECHNOLOGY AND BIG DATA

The use of in-memory technology marks an inflection point for enterprise applications, especially in dealing with big data (Figure 1). The availability and capacity per dollar of main memory have increased markedly in the last few years. This growth has led to a rethinking of the way mass data should be stored. Instead of using mechanical disk drives, it is now possible to store a primary database in silicon-based main memory, resulting in an orders-of-magnitude improvement in performance and enabling the development of completely new applications. This change in the way data are stored is having—and will continue to have—a significant impact on

enterprise applications and, ultimately, on the way businesses are run. Having real-time information available at the speed of thought provides decision makers with insights that have not previously been available.

In-memory technology represents a significant milestone for large-scale IT systems. It is the technology that will launch a new era of business management, one in which managers can base their decisions on real-time analyses of complex business data.

Some of the advantages that can be associated with this groundbreaking innovation are:

- tremendous improvements in data-processing speed and volume, linked to the improvements that make processing faster by a factor of 143, seen in individual central processing units since 1990;
- in-memory's ability to handle increasing volumes of information—the consequence of improvements in speed of access on an order of 10,000 times (on-disk technology is unable to handle such volumes); and
- technological advances that result in better price-performance ratios, making real-time analysis cost feasible and ripe for mass adoption—the outcome of significant reductions in the cost of central processing units and memory cost in recent years, combined with multi-core and blade architectures.

In a traditional, disk-based system, information is pulled from operational systems; it is then structured in separate analytical data warehouse systems, which can respond to queries. This means that operational applications are disconnected from the analytical environment, resulting in significant lag time between the gathering of data and the process of generating insights into those data.

However, with the availability of in-memory technology, operational data are held in a single comprehensive database that can handle all the day-to-day transactions and updates, as well as analytical requests, in real time. In-memory computing technology allows for the processing of massive quantities of transactional data in the main memory of the server, thereby providing immediate results from the analysis of these transactions. Since in-memory technology allows data to be accessed directly from memory, query results come back much more quickly than they would from a traditional disk-based warehouse. The time it takes to update the database is also significantly reduced, and the system can handle more queries at one time.

With this vast improvement in process speed, query quality, and business insight, in-memory database management systems promise performance that is 10 to 20 times faster than traditional disk-based models.

The elements of in-memory computing are not new, but they have now been developed to a point where common adoption is possible. Recent improvements in hardware economics and innovations in software have now made it possible for massive amounts of data to be sifted, correlated, and updated in seconds with in-memory technology. Technological advances in main memory, multi-core processing, and data management have combined to deliver dramatic increases in performance.

HOW DO BUSINESSES BENEFIT?

In-memory technology promises impressive benefits in many areas. The most significant are cost savings, enhanced efficiency, and greater immediate visibility of a sort that can enable improved decision-making.

Cost savings

Business of all sizes and across all industries can benefit from the cost savings obtainable through in-memory technology. Database management currently accounts for more than 25 percent of most companies' IT budgets. Since in-memory databases use hardware systems that require far less power than traditional database management systems, they dramatically reduce hardware and maintenance costs.

In-memory databases also reduce the burden on a company's overall IT landscape, freeing up resources previously devoted to responding to requests for reports. And since in-memory solutions are based on proven, mature technology, the implementations are non-disruptive, allowing companies to return to operations quickly and easily.

Increased simplicity and efficiency

Any company with operations that depend on frequent data updates will be able to run more efficiently with in-memory technology. The conversion to in-memory technology allows an entire technological layer to be removed from a company's IT architecture, reducing complexity and infrastructure that traditional systems require. This reduced complexity allows data to be retrieved nearly instantaneously, making all teams across the business more efficient.

In-memory computing allows any business user to easily carve out subsets of BI for convenient departmental usage. Workgroups can operate autonomously without affecting the workload imposed on a central data warehouse. And, perhaps most importantly, business users no longer have to call for IT support to gain relevant insight into business data.

These performance gains also allow business users on the road to retrieve more useful information via their mobile devices, an ability that is increasingly important as more businesses incorporate mobile technologies into their operations.

Improved visibility to facilitate better business decisions

In-memory technology makes it easier for organizations to compile a comprehensive overview of their business data, instead of being limited to subsets of data that have been compartmentalized in a data warehouse. With this improved visibility, businesses can shift from after-event analysis to real-time decision-making—and make their business models predictive rather than response-based.

When combined with easy-to-use analytic solutions on the front end, anyone in the organization can build their own queries and dashboards with very little expertise.

IMPACT ON LINES OF BUSINESS

Businesses also benefit from in-memory technology because it allows for greater specificity of information, so that the data are tailored to both the customer and the business user's individual needs. A particular department or line of business may have a specific need that can be addressed. This affects account executives, supply chain management, and financial operations.

Customer account management

With in-memory technology, customer teams can combine different sets of data quickly and easily to analyze a customer's past and current business conditions, either in the office or from the road via mobile devices. Because business users can now interact with the data directly, they can experiment with them to create more insightful sales and marketing campaigns. Sales teams have instant access to the information they need, leading to an entirely new level of customer insight that can maximize revenue growth by enabling more powerful up-selling and cross-selling.

Supply chain management

With traditional disk-based systems, data are processed in nightly operations that can result in businesses being late to react to important supply alerts. With in-memory technology, businesses have full visibility into their supply and demand chains on a second-by-second basis. They gain insight in real time to changing business conditions—for instance, in the form of an early warning to restock a specific product—and can respond accordingly.

Finance

Financial controllers are hit particularly hard by increased data volumes. Because of slow data-response times, they can be forced to limit their analysis timeframes to several days, rather than more useful months or quarters. This can lead to a variety of delays, particularly at the closing of financial periods. In-memory technology, large-volume data analysis, and a flexible modeling environment can result in faster-closing financial quarters and better visibility into detailed finance data across extended time periods.

IMPACT ACROSS INDUSTRIES

In-memory technology has the potential to help businesses across industries operate more efficiently, from consumer products and retailing to manufacturing and financial services.

Consumer products companies can use in-memory technology to manage their suppliers, track and trace products, manage promotions, provide support in complying with US Environmental Protection Agency standards, and perform analyses on defective and under-warranty products. Retail companies can manage store operations across multiple locations; conduct point-of-sale analytics; perform multi-channel pricing analyses; and track damaged, spoiled, and returned products. Manufacturing organizations can use in-memory technology to ensure operational performance management, conduct analytics on production and maintenance, and perform real-time asset utilization studies. Financial services companies can conduct hedge fund trading analyses such as managing client exposures to currencies, equities, derivatives, and other instruments. Using information accessed from in-memory, they can conduct real-time systematic risk management and reporting based on market trading exposure.

CHANGING THE WAY BUSINESS WORKS: EXAMPLES OF IN-MEMORY TECHNOLOGY IN USE

In-memory technology is already being adopted to deliver impressive results. Examples of use that support this paradigm vary across industries and lines of business. For example, a large global consumer products company can leverage in-memory computing to process and analyze large volumes of point-of-sale data during a countrywide trade promotion. The company can collect data on every sale of every product in its portfolio. It knows the average sales history of a particular product for a particular store in any given week, and can make year-over-year comparisons. However, using conventional computational methods—batch process–based analysis that makes calls to relational databases—it takes a minimum of 4 hours to get a particular result. The usual time is 6–12 hours. With in-memory technology, the company can get analysis times that are, on average, 20 times faster. Furthermore, the retailer has reduced shelf turnaround time from five to two days (if a particular product is not doing well, it can be pulled). Moreover, it has eliminated any out-of-stock problems during the promotion—the bane of a retailer. The company can analyze social media feeds and sentiment in real time, as well as improve stock predictive analysis, product affinity insights, and the sales forecast.

In just one example, Yodobashi, a leading retailer in Japan, utilized an in-memory database to calculate

loyalty card points for 5 million members.[8] This process used to take three days on a traditional database; it was performed once a month, as a batch process, to calculate and mail the reward points to customers. With in-memory, this calculation can be now done reliably in two seconds, turning a batch process into a real-time process, where loyalty points can be calculated as and when needed. For example, it can be computing on demand, when a customer enters the store, and the customer can be provided real-time offers based on loyalty status and specific store inventory, thereby altering the business process fundamentally to be more customer oriented and innovative.

NongFu Spring is a leading provider of bottled water and other beverages in China.[9] For NongFu Spring, the ability to have real-time visibility into data was critical for the company to grow and to improve efficiency and reduce costs. The ability to move bottled water from bottling plants to points of consumption is very important for cost savings; however, because of the large volume of data produced in its supply chain, it took more than a day for Nongfu Spring to work with its point-of-sale and channel sale data to display business insights and take action. Executives realized that they would gain significant advantages from having a real-time view into the business, so they looked for in-memory computing to reduce data latency and improve data query and business logic processing speed.

Patrick Hoo, Chief Information Officer at Nongfu Spring, said that the company was able to replace its data mart based on a relational database with in-memory technology and "achieved three goals: fast data display, highly efficient business logic operations and real-time data synchronization." He pointed out that the same script with in-memory technology was returning results 200 to 300 times faster than it was when run on a relational database, and "this query performance improvement was consistent across our 150 reports. We are seeing smooth operations, accurate data and fast performance in our production environment."[10]

For Nongfu Spring, freight calculation procedures and functions that previously took 24 hours to execute were completed in as little as 37 seconds using in-memory, which enabled the company to reduce its account reconciliation process by one day. Additionally, the in-memory platform enabled NongFu Spring to bypass the traditional IT maintenance and data latency issues by synchronizing data from heterogeneous data sources into the in-memory platform instantly.

Another use of in-memory technology is that of Centrica, a large utility company in United Kingdom.[11] Energy markets are deregulated in the United Kingdom, and it is important for utilities to differentiate themselves by offering superior services to their business and residential customers. Centrica is rolling out smart meter technology across the United Kingdom. It is collecting information every 15 minutes from each smart meter, and has fine-grained information on consumption patterns across homes and businesses. This information can be utilized to better segment customers and offer customized pricing plans and energy conservation services to better appeal to different needs. It used to take Centrica three days to do pricing simulations on vast amounts of energy data; these simulations can now be done in seconds. The company also finds that it can perform an instant analysis of huge volumes of data generated by smart meters at any level of granularity. This capability allows the utility to do energy efficiency benchmarking that compares customers with their peer groups and both share that information with customers as well as deliver targeted energy management services. In-memory technology has improved the design of electricity rates and improved load forecast accuracy. It has also decreased customer churn rates.

Wireless provider T-Mobile turned to in-memory when the company set out to implement an aggressive marketing initiative.[12] The goal was to deliver highly targeted offers to more than 21 million customers via channels such as retail stores, customer care centers, and eventually text messages. Such a campaign would require rapid analytical capability so that offers could be fine-tuned on the fly for improved customer adoption, profitability, and retention.

"We recognized that being able to respond to the needs of our customers in real time would give us an incredible competitive advantage and improve the quality of the customer experience," said Jeff Wiggin, vice president, Enterprise Information Technology, T-Mobile USA, Inc. "In order to deliver that kind of experience, we needed an underlying platform behind our sales and marketing efforts, allowing us to uncover customer insights and then act on those insights in minutes, not weeks."[13]

In-memory technology delivered just that and, in three months, T-Mobile shifted 2 billion customer records to an automated system. This allowed the company to run the necessary reports with an average response time of just five seconds. Additionally, the wireless provider is now able to scan 24 months worth of customer records, up dramatically from the three months previously available, thus providing a much larger sample and a more accurate picture of how customers respond to incentives.

CONCLUSION

Continuing advances in technology—from touch-based smartphones and tablets to search engines and social networks—have changed people's perceptions of technology and how it can be harnessed. These expectations apply not just to the consumer world, but to the workplace as well. The increasing demand for an "instant results" experience is driving many trends today. And

with massive amounts of new data coming online every moment, people expect a way to search and sift through it all meaningfully.

In-memory technology offers the best available alternative to slow, costly disk-based data management systems. For those who move first to in-memory technology, the resulting boost in business insight, increased efficiency, and reduced IT costs will provide a true competitive advantage.

According to one estimate, approximately 30 percent of enterprises will have one or more critical applications running on an in-memory database in the next five years; by 2014, 30 percent of analytic applications will use in-memory functions to add scale and computational speed.

Almost three decades ago, Jim Gray defined the "five-minute rule," which demonstrated that any data that was touched with a frequency of five minutes or less could more cost-effectively be stored in active memory rather than on disk.[14] That was when main memory cost over $5,000 dollars per gigabyte. Today it costs less than one penny. Boards that effectively contain more than 1,000 cores are on the horizon; they should be operational within the next 24 months. Taken together, these two trends—declining memory costs and the ascendency of massively multi-core processor architectures—are as transformative to enterprise software as the move to a client-server model was a generation ago. As was done in the client-server revolution of the early 1990s, software needs to be fundamentally redesigned to exploit these hardware innovations. In-memory technology does that.

One of the main benefits of in-memory is speed. In addition to the benefits of speed, in-memory offers significant performance improvements regarding the "reach" of the information that is stored in back-end systems. *Reach* can essentially be defined as the number of people who can access and use these data, multiplied by the scope of usage scenarios that are available to them. Another important benefit derived from the raw performance of in-memory computing is responsiveness.

Additional value is derived by enabling IT organizations to rethink how they deliver services and capabilities to their internal stakeholders. The enterprise data warehouse (EDW) is an almost universal component of most enterprise BI deployments. As part of the EDW approach, data are copied, transformed, aggregated, and tuned across a supply chain that starts with transactional applications such as enterprise resource planning and ends with business information query and analysis tools.

One of the core functions performed by this supply chain is performance optimization. For queries to run fast, the underlying data model needs to be designed, optimized, and maintained for query performance. As a result, when a line of business needs to change the scope or types of data to be analyzed, they have to appeal to IT. At a large, data-intensive company, this process can take weeks. With in-memory computing, performance tweaks and complex views are no longer required to deliver high-performance solutions to business problems. Users can now access and work with data without IT assistance. The result of enabling the business lines is a great reduction in time between identifying and solving a problem. At the same time, IT no longer has to spend valuable time staffing the EDW supply chain and can focus on more strategic tasks.

In-memory computing allows a company to run existing scenarios much more quickly and cost effectively than traditional, on-disk technology. Even more compelling is the fact that in-memory can enable completely new activities and processes. Delivering on this vision requires new applications that are built from the ground up around an in-memory, real-time design center.

In the coming years, we will see more and more such applications in all fields as organizations learn to sift through big data in real time. The world has just begun to learn how to cope with big data, and in future we will see how organizations tap big data and use it to their advantage.

NOTES

1 The Economist 2010, 2011.

2 IDC 2011.

3 Gartner 2011.

4 Gartner 2011.

5 See IBM Watson, available at http://www-03.ibm.com/innovation/us/watson/index.html.

6 Gartner 2011.

7 Sviokla; Manyika et al. 2011.

8 Yodobashi, internal communication.

9 SAP AG 2011a.

10 SAP AG 2011a.

11 SAP N.D.

12 SAP HANA N.D.

13 SAP AG 2011b.

14 Gray and Putzolu 1987.

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CHAPTER 1.8

The Wisdom of the Cloud: Hyperconnectivity, Big Data, and Real-Time Analytics

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In a hyperconnected world, transactions and communication do not happen in a vacuum. Every message, every purchase, every sensor reading, web click, lab test, highway toll, quick response (QR) code scan, mobile-phone location, credit card transaction, and inventory movement is captured and stored at a granular level in databases throughout the world. And, increasingly, savvy leaders are recognizing that these data are interrelated and interconnected through previously undetected relationships and patterns. The data may be collected and stored in silos, so analyzing them in discrete ways can be a challenge. A holistic, integrated approach that mirrors how organizations think, operate, and respond is the most appropriate way to tap that resource. One cell carrier's call-completion rate feeds not only revenue analysis but also quality metrics and regulatory reports. It also drives marketing retention and churn-prevention campaigns. In fact, 15 of the top 17 industry sectors in the United States have more data stored *per company* than the US Library of Congress (which has collected 235 terabytes of data).[1]

COLLECTIVE KNOWLEDGE: THE WISDOM OF THE CLOUD

What many have failed to recognize is that the rapid accumulation of massive data volumes—by itself—is a fairly uninteresting proposition. *Adding* to the data is not so important; it is what you *take away* from the data that matters.

All the data are there, and they are useful if we can assemble them in the right ways to increase our *collective knowledge.* But *without analytics, we will not be able to close the gap between what the data know (collective knowledge) and what we know.* Organizations therefore must develop and deploy new technologies that integrate the data and provide smarter tools for analysis, visualization, and distribution of these massive data volumes. With the convergence of hyperconnectivity, "big data," and next-generation analytics, we can turn the "wisdom of the crowd" into a transformational "wisdom of the cloud."

Many claim that data usage merely amounts to an infringement of privacy. Although some skepticism and concern is entirely appropriate, we cannot escape the fact that big data offer meaningful social and economic benefits that mitigate these legitimate concerns because of the hugely favorable social and/or economic impact they impart—on private commerce, international economies, and economic development. Certainly data security issues are important, but if big data are to become the currency of the future, we need governance, transparency, and security, as opposed to reactionary plans to lock up the data and throw away the key. As with any currency, suppression is not a sustainable way forward.[2]

With proper tools and processes, companies and governments can unlock important benefits from these

Box 1: Data: How valuable are they?

How much value is hidden in the world's existing data sources? Consider these facts:

- US$300 billion is their potential annual value to US healthcare.
- €250 billion is their potential annual value to Europe's public-sector administration.
- US$600 billion is their potential annual consumer surplus from using personal location data globally.
- 60 percent is their potential increase in retailers' operating margins possible with big data.

Source

Taken from Manyika et al., 2011.

massive data stores. The result is more productivity and greater competitiveness that create substantial economic and social value for companies, governments, and consumers (see Box 1). Ultimately, the promise of big data will be realized only with more open data that allow more people to analyze and find value in them. For example, opening government or public-sector data up to others to sift through should engage more eyes and ideas to spot potential value.

As we will see, this new trend in analyzing large, hyperconnected data sources ultimately allows us to close the gap between how much knowledge is available and how much a single person or organization is able to comprehend alone and without assistance.

SOCIAL MEDIA: THE NEW BIG-DATA SOURCE

Interestingly, social media is the big-data trend that did not start in the enterprise. It has been driven by hyperconnected individual users—hundreds of millions of them from almost everywhere in the world. Whether the individual medium is Facebook, Twitter, Flickr, YouTube, blogs, wikis, or other media, people—and, increasingly, sophisticated companies—are engaging in literally billions of conversations and interactions. Twitter recently crossed the threshold of 50 million tweets in a year; Facebook has more than 500 million users worldwide, a number that many expect to double within the next year. The average amount of time consumers spent on social networking sites increased 82 percent last year.[3]

Social media offer an unprecedented plethora of opportunities for corporations and government agencies to engage—immediately, in real time—with millions of people around the world, around the clock. They are sending out messages, experimenting with offers, and strengthening their brands. But, perhaps far more important, effective social media are about listening, understanding, and responding. Consumers can now talk to each other, criticize or recommend products, share feedback with their chosen providers, and generally shape the nature and scope of their preferred brands.

But unlike standard, structured data—with its neat rows and columns and tables, fixed fields, and predictable, validated formats—social media present their data in loosely structured formats, making it far more challenging for public- and private-sector organizations to tap into the undeniably large value it holds. Ad hoc interactions and responses are a dead end. Instead, companies need systematized ways to capture, analyze, and respond to the mountains of social media data sources that are rightfully taking their place alongside traditional structured data.

Of course, the real value comes when these new, unstructured data sources can be combined with traditional data to help make decisions that will benefit the organization, its stakeholders, and the broader global economy (see Box 2).

LEVERAGING UNSTRUCTURED DATA FOR EXPONENTIAL BENEFIT IN KEY SECTORS

Who will benefit from the collective knowledge in this new hyperconnected world? Virtually every sector of the global economy will see changes and improvements, but we anticipate some of the largest benefits to be gained within healthcare, the public sector, and consumer-facing businesses.

Re-engineering healthcare

Our hyperconnected world—driven by a broader set of data sources, including text-based safety data and clinical progress notes—has rewritten the rules for patient-centric healthcare from diagnosis through treatment to payment. These new systems create cost efficiencies, but they also empower the patient to take control of life-threatening diseases through accessibility to support networks and better understanding the nature of their ailments. The technology components enabling such a system are the remote sensors, videos, doctors' virtual access to patient medical records, high-quality diagnostic images, and other connectivity services such as social media. It is no exaggeration to assert that there has been a massive data explosion in the medical field that has significant implications for patients, providers, and payers.

Consider, for instance, the "fog of war" that can overtake epidemiologists when confronting a fast-moving, lethal virus that can have a profound public health impact before it is recognized, understood, and responded to. While Hollywood thrillers might overdramatize the scenarios, it is safe to say that the threat is best described as a massive and diverse data challenge. Bio-surveillance involves data that reach well beyond government health departments.

Using SAS Analytics technology and consulting with experts, the National Collaborative for Bio-Preparedness

(NCB-P) in the United States has demonstrated the ability to perform such analyses. By combining actual data from an outbreak with data from sources such as poison control, agricultural livestock and crops, food supply chain, weather and climate, veterinary databases, and others, they can increase situational awareness and detect a syndrome, no matter where in the biosphere it first appears.

Bio-surveillance means capturing and text-mining the first responder's notes and 911 telephone transcripts to zero in on spikes in chatter about certain symptoms. It means overlaying data with maps to visualize disease outbreaks. For instance, a rise in influenza-like symptoms in emergency medical technician notes and 911 calls in a cluster of ZIP codes can indicate the onset of a flu epidemic.

Hyperconnectivity is revolutionizing health systems all over the world by improving the collective knowledge about the patient and the disease. There is a vast amount of structured and unstructured data and images being stored in hyperconnected healthcare systems. Analytics is the key to drawing insights and actionable intelligence from these data.

Total health expenditures in the United States has reached US$2.5 trillion, which translates to US$8,086 per person, or 17.6 percent of the nation's GDP.[4] If US healthcare could use big data creatively and effectively to drive efficiency and quality, McKinsey pegs the potential value to be more than US$300 billion every year, two-thirds of which would be in the form of reducing national healthcare expenditures by about 8 percent.[5]

One of the keys to that efficiency is simply obtaining knowledge about what other clinicians and researchers are doing. Today a far greater level of coordination is needed to share results, prevent overlapping research, and build on synergistic opportunities.

Successful examples abound. A research hospital in Canada is automating the gathering, management, and updating of critical research data and applying analytics to speed childhood cancer research. In Denmark, healthcare providers are using predictive health systems with advanced telemetry to monitor elderly patients in their homes and share data instantly. And in the United States, a new initiative enables individuals and families to store and track their health information and stream data from medical devices.

For the Stockholm County Council (SCC), Sweden's second-largest health system, patient safety is a top priority. The SCC has implemented a text-mining system that lets medical staff automate a systemic medical review that sifts through both structured and unstructured data to review charts, search for specific triggers, or locate indicators of adverse events. Since its inception in January 2010, the program has spread across the country. Today regulators are planning to award bonuses based on patient safety quantified by these reviews. If the results at the SCC are duplicated countrywide, the system could slash annual healthcare injury costs in Sweden by SEK 2 billion and reduce deaths caused by injuries by up to 50 percent.[6]

The Public Health Agency of Canada is another interesting example of hyperconnectivity. Its Global Public Health Intelligence Network is an Internet-based early warning system that gathers preliminary reports of public health significance in nine languages, around the clock. It relies on news aggregators to scour 20,000 media sources—from wires to websites to blogs. Every 15 minutes, its software pulls articles and assigns them a relevancy score based on keywords and syntax. Expert analysts further parse the material, which ranges from infectious diseases to natural disasters and product safety.

Is privacy a concern? It certainly has to be front and center with respect to virtually any effort connected to healthcare data. However, some experts are gradually adopting a somewhat contrarian view on this topic, believing that our society must move past the fear of data and privacy breaches. Many technological innovations that have revolutionized medicine might not have been possible without sharing data. Any data—electronic or paper-based—are vulnerable. But here, too, hyperconnectivity will enable new tools to fight crime, fraud, and abuse.[7] Yet those who are suffering from dreadful diseases are the least concerned about their data being combined in aggregate with other data sources to find health-related answers. They are much more interested

Box 2: 10 ways organizations can benefit from social media data

The natural question arises: are social media data—with their soft measurements and difficult-to-quantify characteristics—somehow inherently less valuable than traditional data? On the contrary, they comprise a trove of unscripted, often unfiltered information on all aspects of an organization's operations. They constitute feedback that can be highly influential in a market, making it imperative for the organization to understand and respond to them. Social media can help an organization in multiple ways. For starters, it can help:

- protect a brand,
- engage the most influential voices in a market,
- understand what trends lead to sales,
- identify an untapped market,
- enhance market research,
- understand the impact of industry changes,
- gather competitive intelligence,
- improve warranty analysis,
- create a better customer experience, and
- manage a crisis.

Box 3: Five ways to balance customer intimacy and data privacy

1. Create symmetry of information between customers and institutions.
2. Treat the customer as a whole person.
3. Incentivize employees on positive customer interactions.
4. Understand the trade-off between data and judgment.
5. Use caution when using customer data.

in finding cures than in protecting the privacy of their data. But one does not need to be sacrificed for the other (see Box 3).

Pharmaceutical makers are also interested in finding cures, and leaders in this industry have realized the power of social media in a hyperconnected world. Many prominent pharmaceutical companies use social networking for branding, marketing, and advertising. They have also started to communicate directly with the public to engage in conversations on wellness, address unmet medical needs, and explain prospective new medicines and treatments.

Pfizer, for example, has strong presences on Facebook, YouTube, and LinkedIn to bring together patients and clinical researchers studying a particular condition, creating reciprocal relationships where tailored information is used to establish deeper bonds. Patients find others who share the same condition and can share tips and techniques and support to improve their clinical outcomes.

The same is true for Eli Lilly and several other pharmaceutical companies. Online user-group comments can become a sort of parallel trial that can bring to the surface more rapidly various side effects, treatment responses, and other "soft" results that can nonetheless heavily influence a clinical trial. Using hyperconnectivity to enable preventive care holds great promise as well, and is a use that will result in a marked improvement in the quality of life.

As indicated by the NCB-P example mentioned earlier, governments too can benefit from hyperconnected systems to increase awareness about healthcare initiatives and seek feedback from their citizens. They can also use the health/disease data streaming from the remote corners to run disease and drug surveillance programs. For instance, India uses weekly healthcare data from more than 600 districts to run an integrated disease surveillance program that acts as an early warning system to prevent and control disease outbreaks.
During the H1N1 outbreak in 2010, the Internet famously played a starring role by illustrating how the epidemic was spreading. Today, a group including researchers from City University London, the European Centre for Disease Prevention and Control (ECDC), and Britain's National Health Service are teaming up ahead of the 2012 London Olympics to develop ways to detect and respond to epidemics via Twitter.[8]

Transforming the public sector

Seeking citizen input and collaboration to solve problems is not new to government. But today the scale and reach of social media are transforming those processes. Good governance demands greater transparency and improved collaboration and participation. Successful government policy and operations depend on public perception and sentiments. At a time when public finances are under tremendous strain, hyperconnectivity, big data, and analytics are well positioned to drive innovation and improve the value returned to taxpayers.

According to Charles Leadbetter of Demos, a British think tank, social media make it easier than ever for people to voice their views, connect to others, learn to see the world from new vantage points, and gather information on their own terms, creating what he calls "a civic long tail": a mass of loosely connected, small-scale conversations, campaigns, and interest groups that occasionally coalesces into a mass movement. As more conversations between citizens and government move online, masses of data on citizens' views and preferences will be created. The civic long tail creates big data to make government more intelligent and responsive.[9] The impact of social media on public-sector governance can take numerous forms.

Thanks to hyperconnectivity, the Hong Kong government, for example, connects with citizens in real time, addresses complaints, and responds to public inquiries. The Hong Kong Efficiency Unit, the government's interface for public inquiries, gathers insights about the social messages hidden in the data, so that various departments can respond before they become serious issues. This also helps the government determine priority areas for citizens. The Efficiency Unit uses robust, powerful text processing and mining solutions to uncover trends, patterns, and relationships inherent in the complaints.[10]

The general elections in Singapore in May of 2011 saw social media play a major role. Analysts counted more than 40,000 topical blog posts, tweets, and Facebook updates during the month before the election because some candidates used social media to reach the masses, making a compelling business case for governments to integrate social media in their campaigns. Social media analytics can help governments and candidates understand the likes, dislikes, and positions of citizens regarding housing, healthcare, the environment, and other major issues.

The US Geological Survey's Twitter Earthquake Detector gathers real-time Twitter updates during seismic activities—faster than scientific equipment can be tapped

for more precise measurements and alerts. These data report on earthquakes at an anecdotal level—not to replace but to complement scientific analysis.[11]

Government also has a duty to be the best possible steward of taxpayer monies by rooting out fraud, waste, and abuse in various government programs. In one program, the Washington State Department of Labor & Industries has deployed a comprehensive system to review the thousands of unemployment and disability claims it processes each month. The system displays graphical reports that compare data over various time periods. It even scours social media sites and platforms to detect fraud. For instance, one disability claimant was nabbed after he posted a video on YouTube showing himself atop Mt. Rainier.[12]

Likewise, a federal tax-collection agency uses a fraud-detection system to detect, resolve, and prevent criminal and civil non-compliance and reduce issuances of fraudulent tax refunds. A scoring database examines structured and unstructured data using a hybrid scoring model that combines standard rules, predictive analytics, anomaly detection, and social-network analysis to supply answers within a 24-hour processing window. During peak periods, the system can examine as many as 15 million personal and business returns in a single day. The result is a reduction in fraudulent refunds, the ability to discover new fraud patterns, and an increase in tax collections.

In another example, text mining of unstructured data is used to increase value-added tax collections in the Philippines by collecting short message service (SMS) texts from the public, promoted by a state lottery.

CREATING INTELLIGENT INTERSECTIONS BETWEEN BUSINESSES AND CONSUMERS

We turn now from healthcare and public-sector programs to consider how the private sector too can utilize the hyperconnected world to benefit corporations and customers alike. By combining and analyzing multiple data sources—including social, text-based, and point-of-sale data—companies in every sector are seeking to understand the needs of customers and meet those needs in real time. This section provides examples of ways real-time analytics from the retail, telecommunications, and banking sectors are yielding transformational insights.

Massive data volumes comprise both threat and opportunity for marketers and retailers, depending on whether the organization can draw timely benefits from its growing mountain of big data. There are more sources, more attributes, more unstructured data—and more questions—than ever before. Fortunately, hardware processing power has largely kept pace with this growth, meaning that marketers have access to new generations of sophisticated tools to answers to questions before those questions themselves are obsolete.

Today, a business analyst, corporate controller, or divisional vice president cannot wait for weeks or even days to process terabytes of data to answer key questions. They need answers in minutes—or no more than a couple of hours—not next month. For instance, Catalina Marketing, the company that provides targeted coupons at the grocery check-out lane, performs high-speed analytics on 2.5 petabytes of consumer data to provide the right coupon for every customer at thousands of grocery stores—a stunning achievement in real-time analytics that would not be possible without the massive improvements in processing power and software design.[13]

The fact is that companies should not be settling for less-sophisticated analysis just because they have more data. If the size of the data is choking the analytics tools, the problem is not too many data, but an inadequate analytics environment, and analytics deserves an IT environment supported by a full platform or suite of integrated technologies for data access, integration, analytics, and reporting. In other words, real-time analytics is more than simply running analyses faster (although that is certainly a desired outcome). It is also concerned with analyzing problems that simply were not solvable before. This understanding opens up a wide array of new possibilities and enables organizations to unleash analytics on previously untouchable challenges.

For instance, a large insurer might want to strengthen its fraud detection by analyzing *all* of its datasets, instead of analyzing random samples of the data. After all, a mere sample of claims data may not show all the anomalies that indicate potential fraud. Since traditional computing techniques might require days to analyze all of those data, without real-time analytics on the full dataset the insurer settles for samples and decreased accuracy, and pays fraudulent claims.

In another example, a well-known online shoe/clothing retailer is a leader in using social media for sales and customer service. The challenge was simple and daunting: they were being overwhelmed by the amount of data from customer interactions. In a typical day, customer service representatives faced 6,000 phone calls, 400 live chats, and 1.1 million social networking site interactions. From all these data, the company was able to understand only a fraction of what was being said about its products, services, and brand.

With a social media analytics solution, this company can now understand its customers' shopping experiences, using data that extend far beyond its basic website metrics (e.g., page views and transactions). Analysts now have real-time analysis of what current and potential customers are expressing about the company's brand, products, and services through various social media outlets (Facebook, Twitter, etc.). The result is a comprehensive understanding of what customers are saying, the sentiment behind their messages, and emerging trends and preferences. This deeper customer insight allows for

far more effective marketing campaigns and strategies. It is timely knowledge that allows for real-time, individualized interactions, bringing Web 2.0 to life.

Like retailers, telecommunications companies are also finding ways to increase profits and better understand customers by analyzing hyperconnected and text-based data sources. One of Japan's largest telecommunications services providers noticed that better results could be achieved through community marketing and by "influencing the influencer." Specifically, it saw that customers were several times more likely to turn to a different provider in the weeks after a friend switched. To combat this dynamic, the company sought to analyze relationships and lifestyles in the communities created by customers in order to refine its one-to-one marketing efforts and its customer-retention program. That meant combining unstructured social data, musical tastes, and self-defined customer profiles. The company initiated behavioral targeting of its higher usage/higher influence customers with digital content—such as its "new artist content campaign," which garnered a response rate that was 250 percent higher than that of similar/typical campaigns.

The value lies in being able to act quickly through trial campaigns and capitalize on positive discussions. It is a superb example of using social network analysis to drive product innovation and create immediate responses to any competitive threat or trend.[14]

Sometimes, the challenge of real-time analytics lies not in combining different types of data, but in integrating traditionally separate types of analytics to find answers that benefit the business. For example, one large European retail banking subsidiary wanted to integrate enterprise-wide risk analysis with single-customer-view capabilities. To integrate all three areas—risk, customer insight, and finance systems—the bank built a next-generation analytical risk and banking platform.

This single view of the risk and the exposure across all organizational units and risk types eliminates the problem of fragmented views of data from different sources. It also enables the bank to score each individual customer and generate the risk-weighted performance for each customer—scanning 10 million records in 55 seconds as opposed to three months. The result is a unique competitive advantage: instant credit approvals. Instead of waiting 24 to 48 hours, a customer gets a decision in seconds. Company executives estimate the savings from fraud alone could reach hundreds of millions of British pounds. The system enables sales and marketing to work off of the same data, so employees can develop stronger relationships with their 25 million customers while reducing risk and fraud at the same time.

CONCLUSION

Regardless of industry sector, it is clear that the integration of unstructured data with traditional structured data opens up a range of powerful possibilities for organizations of all sizes and stripes. Reflecting on the many examples discussed in this chapter, we see that the wisdom of the cloud—the combination of hyperconnectivity, big data, and powerful analytics—benefits patients, citizens, governments, businesses, and consumers in three key ways:

- **The ability to know.** Although an almost limitless amount of knowledge is available in these massive, fast-growing data stores, there is a gap between the brain's ability to linearly absorb/synthesize information and the data that are available. Sophisticated analytics and data mining let companies know more than ever before about market trends, economic factors, competitors, customers, and more. Likewise, doctors can learn more and know more about their patients and ask better questions as they pursue treatments and offer specific recommendations.
- **The ability to dialogue.** Hyperconnectivity means not just knowing things *post-facto,* it means engaging in real-time dialogue with the audience. Social media has been at the forefront of this movement, helping healthcare patients, government constituents, and business customers get their voices heard.
- **The ability to innovate.** Companies can apply their newfound knowledge and insights from their dialogues toward faster, more effective action, thus changing their operations and processes and improving their results.

As unstructured data—such as the vast pools of data from hyperconnected social media platforms like Facebook, Twitter, and YouTube—continue to grow, they represent a critical source of meaningful information that can augment and complement our world's traditional databases and files, along with our traditional ways of gaining insight. This new big data source offers a new way to tap into the wisdom of the cloud by filling in the gaps, uncovering new insights, making new connections, and identifying unseen patterns.

When we can all draw from that knowledge—citizens, governments, and companies alike—the benefits to society are clear. Individually, we are all limited in what we can know, but together hyperconnectivity makes it possible to overcome those individual limitations and mine different types of data to find insights that will improve our health, increase the efficient use of public resources, best serve the needs of customers, and help drive the innovation needed to maintain strength and profitability in our global economies.

NOTES

1 US Library of Congress, available at http://www.loc.gov/webarchiving/faq.html.

2 See Hagstrom 2011 for more on this debate.

3 Harvard Business Review Analytic Services 2010, p. 2.

4 See https://www.cms.gov/NationalHealthExpendData/downloads/highlights.pdf.

5 Manyika et al. 2011.

6 SAS Institute 2011.

7 Hagstrom 2011.

8 Parr 2008; Red Orbit 2010.

9 Leadbetter 2011.

10 SAS Institute N.D.

11 Recovery.gov, available at http://recovery.doi.gov/press/us-geological-survey-twitter-earthquake-detector-ted/.

12 Hammersburg 2010.

13 Henschen 2011.

14 SAS Institute 2010.

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CHAPTER 1.9

On the Value of Digital Traces for Commercial Strategy and Public Policy: Telecommunications Data as a Case Study

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Just as information and communication technologies (ICT) and the digital economy are transforming everyday life, so they are transforming our ways of knowing about everyday life. The breadth of social practices that are mediated by digital infrastructure, and thus recorded by digital traces, has not gone unnoticed in the social sciences.[1] Coupled with technological and methodological advances in large-scale data capture, storage, and analysis, transactional data on communication, consumption, leisure, health, work, and education are now routinely collected and can, in principle, be employed for a wide range of analyses.

Clearly, the increased traceability of social networks can enhance our ability to extract actionable insight by analyzing their form, distribution, and structure through digital media. Consequently, an enormous potential to generate important insights and innovation exists within the social sciences through an improved understanding of spatialized social networks (i.e., place-based analyses of social network structures over time). As we will show, these networks have applications in—at the very least—regional development, market research, and infrastructure planning because the structure and spatial distribution of social networks underpins demand (and, consequently, supply or provisioning) as well as provides indicators of well-being, integration, and cohesion.

Of course, the analysis of social networks has been a key part of the sociological and social psychological analysis of group behavior as well as resource and opportunity identification since at least the 1970s.[2] Social interaction has also been implicated in both the diffusion of innovation and the distribution of power and hierarchy within groups.[3] To date, however, such analyses have typically involved a number of individuals or groups that is tiny compared with the general population and with the magnitude of newly available data from digital sources.

However, the marriage of "big data"—datasets containing billions of records—to social science is enabling us to examine social and economic relationships in a new light, leading to the emergence of what some researchers have termed a *computational social science.*[4] Although Rogers foresaw this direction of travel back in the 1980s,[5] until recently social science has largely lacked the tools to perform this type of research: what had been missing were the tools that had been tested on meaningfully large volumes of data and could be applied in a range of analytic domains.

Thanks to its tractability, telecommunications data are now starting to play a crucial role in the emergence

Ben Anderson and Jon Reades wish to acknowledge the support of British Telecommunications plc for components of this research. Additionally, Jon Reades acknowledges the support of the EPSRC (Grant #EP/I018433/1) and of the European Commission (Complexity-NET/FP6 ERANET).

of these tools. Researchers have, for instance, used mobile and fixed-line telephone calls and Instant Messaging logs, as well as Twitter and Facebook data, to speculate on "universal laws" of human friendship and mobility.[6] In this chapter we present results from four studies of British telephone usage that offer a sense of the ways in which computational social science can be used to expand our understanding of social and economic activity.

We begin with a study of UK regions, comparing the "geographies of talk" to their administrative counterparts, before turning to the ways in which social networks reflect underlying problems of deprivation and of access to opportunity. We will then examine derived indicators of globalization from the United Kingdom's most economically vibrant area, Greater South East England, before finally discussing early work on real-time data-driven household classification systems.

ANALYSIS

Advances in ICT give us more choice about how, when, and where to interact with one another. In particular, these technologies support increasingly complex forms of communication at a distance—voice has been supplemented by video, the letter by email, the local pub or restaurant by Facebook and Twitter. This is, arguably, giving rise to more flexible and extensive forms of social and economic interaction. It is not that space has ceased to be relevant—reports of the "death of distance" have proven wildly exaggerated—but that the traditional ways in which space was categorized, delineated, and managed by governments and firms as "commuting zones" or "sales regions" appear unable to keep pace with the increasingly fluid ways in which people are choosing how and where to work, play, or purchase goods and services.

Dynamic and permeable boundaries: Regions and communities

By analyzing the connections among people, households, and firms, we can derive boundaries that better reflect their interactions with the environment—for instance, we can determine whether people living in Northern Wales interact more with their linguistic cohorts in Central and Southern Wales, or with their English compatriots in the larger cities on the "other" side of Offa's Dyke. For government, this is hardly a trivial issue because social interaction will be reflected in other forms of exchange as well: should economic development in North Wales focus on building links with Manchester or with Cardiff? Should transportation planners prioritize East-West or North-South infrastructure investment? Or should planners work against the trend and try to disrupt the entrenched geographic ties that might reinforce a region's structural weaknesses?

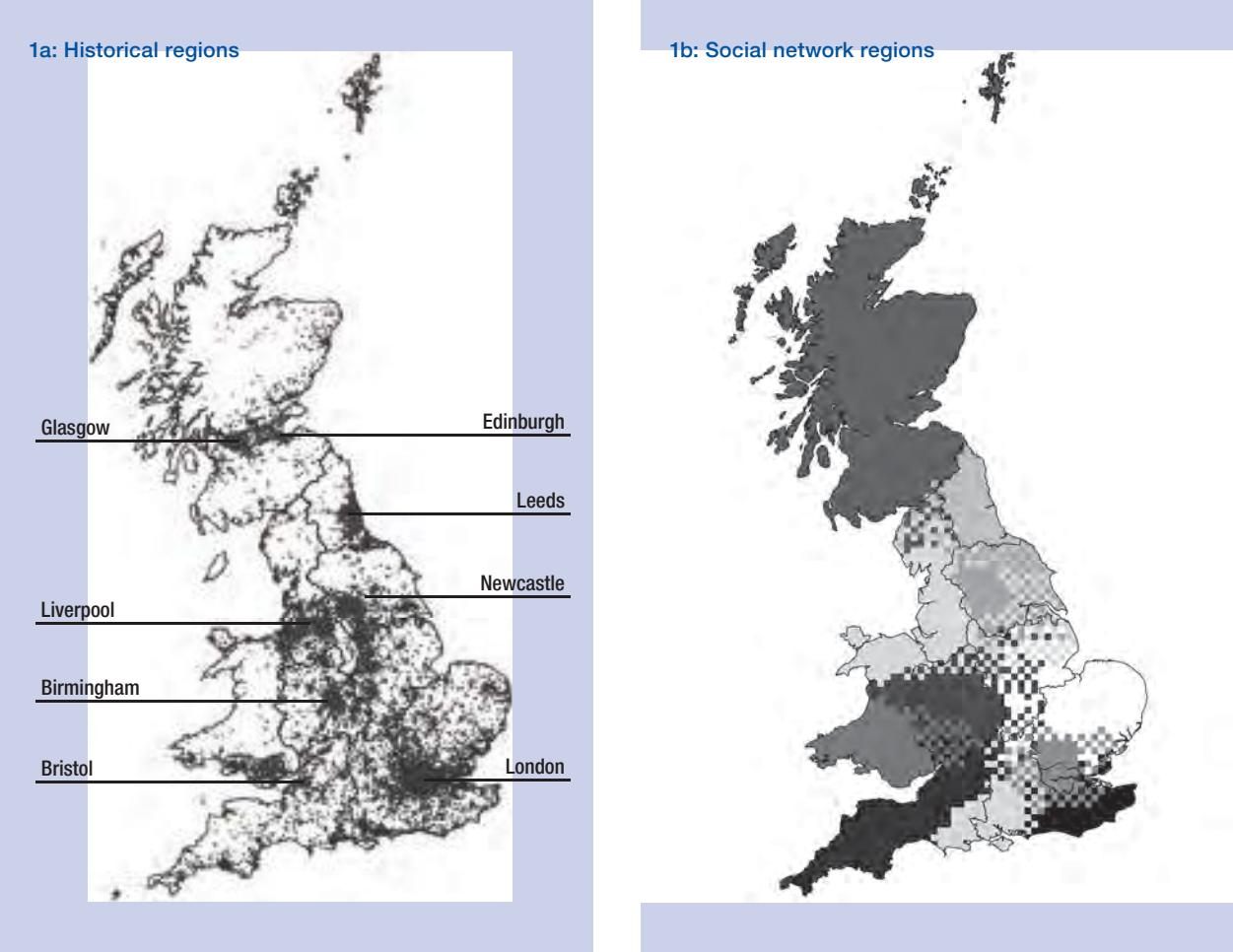
Clearly, it is not within our remit to answer such questions directly, but social network analysis provides us with an important tool with which to investigate the dynamics in play. Ratti et al. built just such a network,[7] deriving 86 million links among more than 20 million numbers made anonymous from an original database of some 8 billion telephone calls. We then examined the resulting network to see if natural communities could be identified in the data, where a community is characterized by relatively dense within-group links and proportionally fewer out-group connections. For example, many social networks fall naturally into two "communities": a group of work colleagues, many of whom will know one another; and a group of friends, many of whom will also know one another, with relatively little overlap between the two.

Our research scaled this approach up to the level of the entire country. The findings appear to capture both deep historical continuities dating back hundreds of years as well as more recent changes in mobility and economic development (see Figure 1). Simply by virtue of its size, the network region that is coterminous with Scotland is particularly visible, but the Devon/Cornwall, Kent, East Anglian, and North East regions are also notable for their overlap with existing administrative regions. But these results are largely to be expected: geography alone dictates that people at the extreme northern and southern ends of the United Kingdom will tend to interact more intensively with others who also fall within these traditional regions. As geographers have often noted: "everything is related to everything else, but near things are more related than distant things."[8]

More intriguing, because they are altogether less expected, are the regions in Wales and in the vicinity of London. Figure 1b highlights areas of overlap: rather than neat lines around geographical or social features, the figure emphasizes areas where these networks seem to pull in more than one direction. The wide belt surrounding London—to which we return later in this chapter—accentuates the extent to which families and firms in these areas are an integral element of a wider "London" that is not visible on administrative maps. The figure also underlines the challenges, faced by the local authorities in these areas, of having one foot in a major world city and the other in a semi-rural economy.

The division of Wales into three distinct subregions, each of which is anchored to a major urban center, further underscores the importance of economic activity and proximity to socioeconomic networks. Thus, although Wales itself has a strong linguistic and cultural heritage, in social network terms it seems to be relatively more important to Northern Wales that it interact with Liverpool and Manchester than with Cardiff, far off in the South. The same applies to Central Wales and Birmingham. In this case, we see little of the "mixing" that exists in the area around London, where several regions overlap geographically. The results for Wales line up nicely with those of Nielsen and Hovgesen,[9] who

Figure 1: Regions of the United Kingdom: Different views



Source: This work is based on data provided through EDINA UKBORDERS with the support of the ESRC and JISC and uses boundary material which is copyright of the Crown. Additionally, the OAC Classification used is subject to Crown Copyright protection.
Note: This shows the centers of non–Countryside Output Areas to give a sense of how population is distributed across Great Britain. The black boundary lines denote the official Government Office Regions.

Source: Based on Ratti et al., 2010.
Note: The shading denotes the core regions of the United Kingdom arising from analysis of communication interactions.

used ward-level commuting data in a similar type of analysis and found clearly demarcated regions whose boundaries were connected both to the accessibility of infrastructure such as the main East-West routes (A5 and A458) and to major employment centers.

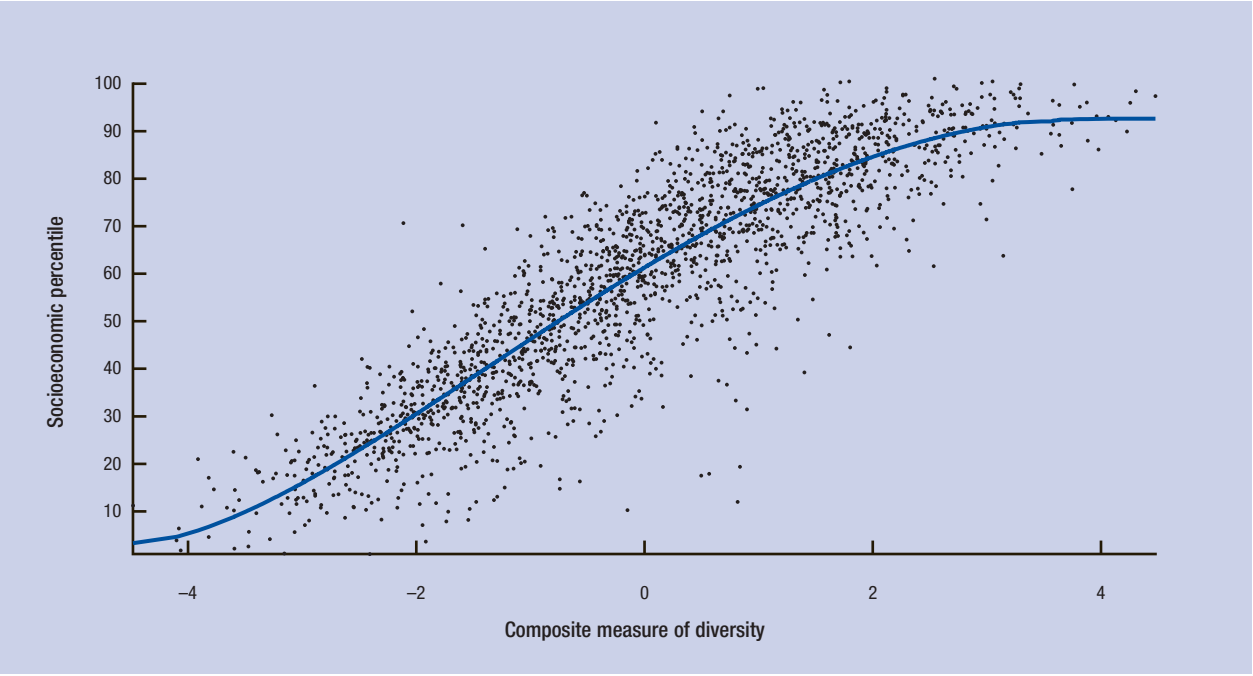
Deprivation and opportunity

We know that social interaction forms the backbone of social and economic life: from finding a good film to landing a deal, who we know and how we know them is a crucial determinant of success. And although the map presented in Figure 1b suggests a strong link on a regional, or even national scale, early work by Granovetter had already established this connection at the individual level.[10] Granovetter's finding—which is self-evident only with hindsight—was that we do not usually uncover novel information through interaction with our close friends. Awareness of a crucial job opportunity or innovation is much more likely to come from acquaintances and those with whom we are only weakly connected.

The simplistic explanation for this weak-ties effect is that we already interact intensively with our close friends and colleagues, and so we come to share the same background knowledge, the same awareness of opportunities, and, ultimately, the same view of the world. This shared perception can blind us to emerging threats—to the firm, community, or country; it can also deprive us of chances to forge new connections and make new discoveries. In contrast, our acquaintances often know people who are not part of our circle of friends; they offer us informational diversity because we are now connected to people who are much less like us socially, economically, and even spatially.

Of course, this is not to suggest that strong ties are less meaningful: they are thought to constitute a major mechanism for social support in hard times. Indeed, the strength of community ties might well be a crucial factor in personal happiness and fulfillment.[11] Eagle et al. sought to test this seemingly simple idea—that the structure of our social interactions can be correlated

Figure 2: Diversity of communications and deprivation



Source: Eagle et al., 2010.

with deprivation and opportunity—on a national scale.[12] Granovetter could test his hypothesis only by using data gathered painstakingly on just two Boston neighborhoods, but with a database of telephone calls encompassing nearly all of the United Kingdom we can examine whether this relationship holds universally or has only local applications for policymaking.

We developed a composite measure of the diversity of calling to and from an area that could be correlated with existing socioeconomic deprivation measures. The results in Figure 2 strongly bear out Granovetter's original work: the wider we cast our social net, the less likely we are to live in a deprived community. More recent work using a much simpler "local-ness" measure—the ratio of local to national calls made from a neighborhood—seems to show a similar effect.[13] Thus it appears that in all cases diversity is correlated with opportunity.

Of course, in reality the picture is a little more complicated because we cannot easily untangle the direction of causality: it is unclear whether people are more deprived because they have less diverse social networks, or they have less diverse social networks because they live in more deprived communities. To put it another way: is it that people who live in deprived areas tend to have made, or have been forced to make, life choices that inhibit their acquisition of more diverse networks, whereas those who live in less deprived areas have been able to take life paths (such as non-local higher education and employment) that tend to lead to more geographically dispersed social networks?

The essential importance of the social dimension makes the answer to this question vital to the planning of appropriate policy interventions. For instance, if it is merely opportunity that is lacking, then we might naively suggest that all that is needed is a job-seekers' forum for enabling introductions. But if the problem is, as seems likely, more deeply rooted in the constrained life-path choices available, then the appropriate policy response is more structural in nature and is unlikely to deliver "quick wins" in the short-term, a circumstance that creates challenges for policymakers looking for 12- to 24-month returns on policy investments.

GLOBALIZATION AND INDUSTRY

As the previous sections have made clear, economic activity is tightly bound up in social interaction. Within the contemporary multi- or transnational firm, these interactions are increasingly global in scope, which indicates the increasingly complex nature of both global supply chains and also knowledge flows between workers in widely separated offices. In order to understand these dynamics in more depth, we need to be able to see the knowledge economy in action, and telecommunications networks remain the best lens through which to do so.

To get at the globalization of knowledge by businesses, we can compare the level of international calling for some small area to the overall level of activity in the region of which that area is a part. The *telecommunications quotient*—named after the classic tool of spatial economic research, the *location quotient*[14]—is a *relative* measure of globalization that gives us a way to compare

different parts of a city or region with one another. And by filtering out individuals, households, and small businesses from the dataset, we can here focus on medium- and large-sized businesses with divergent levels of engagement with the global economy.

The telecommunications quotient is a simple-to-calculate ratio that captures the relative intensity of international calling for a small area within a larger region; it is anonymous, aggregate, and allows us to determine whether an area makes more or fewer calls than we would expect, given the overall behavior of the surrounding region. Thus a quotient of 1 means that the area is "normal" in its international calling behavior, while a quotient of 8 would mean that an area places *eight times* more international calls than expected from the regional average.

This approach enables us to identify differences of behavior both between firms operating in the same industry and between areas with strong specializations in different industries. For example, it is clearly expected that the City of London, which is home to global financial services firms, will be highly internationalized in its calling activity; and it is. But after removing household calling, Figure 3a reveals the rather surprising fact that towns such as Reading, Slough, Sandwich, and Bracknell Forest can match, or even exceed, the city's telecommunications quotient.

Merging the telecommunications quotient results with employment data collected by the government allows us to better understand why this is the case: these smaller cities are home to world-class ICT and defense firms that employ telecommunications to coordinate the activities of developers, designers, and executives in the United Kingdom and the United States. This pattern is rooted in the historical connection between these industries and government procurement, and today the region is an essential part of the United Kingdom's internationally competitive, high-skill service sector.

Figure 3b suggests that, even for finance, there are attractions to moving out of the City: there are back-office sites with extremely high levels of relative international calling visible to the South of Greater London. It is not only highly skilled work in the computing sector—both in software and hardware design—that has left the traditional urban core, but a good deal of work in the media industry has also left Soho to set up around the BBC's facilities in White City. Similarly, in the logistics center, global calling activity is closely tied to major international airports, all of which are located well outside London's core. Most dispersed of all, however, is research and development, with pharmaceutical and high-tech manufacturing lacking any real geographical concentration; major sites are scattered across the region and can be found in smaller towns such as Cambridge, Royal Tunbridge Wells, and—until recently—Sandwich (where Pfizer's facility closed in 2011).

The ability to distinguish between globally and locally interacting industries heralds a step change in our ability to understand the impact of globalization on regional development. The financial industry, because of its effect on government, tends to draw our attention toward the traditional downtowns of Manhattan and the City of London. But our findings point toward the importance of what we could call the "new industrial districts" of the knowledge economy, of which finance is only a part, and their much wider spatial distribution.

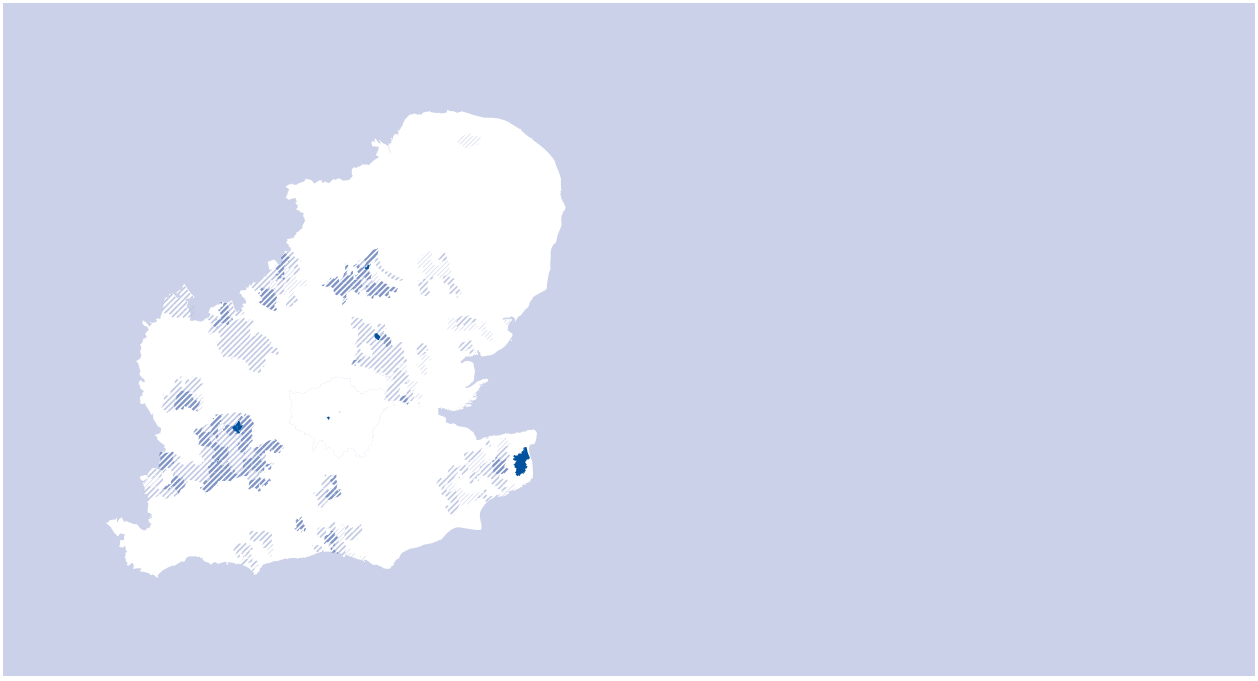
CLASSIFICATION AND CODIFICATION: TOWARD A REAL-TIME CENSUS

And yet, even as government and industry face increasing challenges from globalization and mobility, there is increasing pressure to reduce the cost of data collection while accelerating the timeliness of its provision. For example, in the United Kingdom—as in other countries that maintain the practice—the next population census is expected to cost nearly £500 million and to require many thousands of hours of labor to collect and process, with the results taking many months to reach end users. Consequently, the UK Office for National Statistics is already engaged in a program of research to assess whether the data needs of the national and local policy communities, as well as nongovernmental and commercial actors, can be met by integrating existing administrative, commercial, and imputed/modeled data.[15]

Recently, the number of innovative approaches to this problem has exploded. One of the more notable used names from electoral rolls, telephone books, and related datasets to infer ethnic and demographic characteristics of populations.[16] These characteristics can then be mapped on to neighborhoods with a view to updating a socio-demographic profile whenever someone registers to vote or leaves a forwarding address.

To the extent that this type of data can be collated and quickly associated with people, households, or firms, it provides us with the ability to characterize them at *any* given point in time, and not just every five or ten years. Thus, in addition to being able to provide a form of automated census on specific dates, the data also offer us the potential to understand the flow of life events surrounding an individual or group as well as the changing characteristics of an area. Changes in the telecommunications interactions of an individual, household, or neighborhood could, therefore, act as an early warning system of transitions—such as increased in-migration or changing patterns of work—with significant policy implications.

To illustrate this approach, we surveyed about a thousand households and, with their permission, associated more than a million call records to their responses in order to assess the possibility of classifying households according to their calling networks.[17] The results suggest that some dimensions of social interaction can serve as reasonable predictors of whether a household



is comprised of "Alone, over 56," "Couple, both aged over 55 with no cohabiting children," or "Couple, with children aged under 12." However, it has so far proved less effective at predicting other household types.

Although these are only preliminary results, it suggests that research into linked data has the potential to develop templates that could be applied to flows of telecommunication data in order to provide estimates of the local prevalence of different groups at very low cost and with extremely low latencies. One can easily imagine a future in which network operators would supply a government's statistical body with summary metrics that track month-to-month change at the neighborhood level for the entire country.

CONCLUSIONS

In this review we have endeavored to demonstrate that the insights to be gleaned from the marriage of telecommunications data and network-oriented research span the nature of community, the challenges of deprivation, the growth of knowledge-based industry, and the administration of regional economies. However, the real power of this approach to understanding individuals and communities—in their proper context—lies not only in its unprecedented breadth and depth, but also in the radical improvement of the speed with which such data can be collected and processed, and the results delivered to policymakers and strategic planners in both the public and private sectors.

We began by demonstrating one way in which social network analysis could supplement our understanding of regions and large communities. The results from this work suggest that, although many socioeconomic regions are well aligned with administrative units, in others—Wales, for example—the geography of human interaction appears to be diverging from long-standing historical boundaries, suggesting a new dynamic in play on the national scale.[18] This approach to regional delineation could ultimately be used as a monitoring as well as a modeling tool: long-term changes in these patterns could be connected to changes in accessibility or competitiveness, while also permitting planners to simulate the likely effects of social, economic, and infrastructural interventions.

From the bigger picture of regions, we then narrowed our focus to the neighborhood and saw how social network data could be used to investigate deprivation, cohesion, and access to opportunity. We therefore suggest that telecommunications data could provide a timely proxy for multiple aspects of well-being, addressing an increasingly important dimension of government policy. It may well be that by understanding the individual's or group's unique mix of tie strengths, we become able to locally tune policy interventions to suit the community structure, delivering targeted, measurable impacts on the ground.

Our third section examined how a telecommunications quotient can give us a new way to explore the complex web of informational linkages among industrial actors: using a simple, anonymous metric it becomes possible to assess the degree to which firms in a given area are engaged in international communication. In other words, the big data approach to telecommunications allows us to examine the fine-grained variations in how companies interact with one another, and with suppliers or clients around the world. In addition to highlighting important dependencies, we anticipate that this approach will help both firms and governments to monitor a rapidly changing regional economic landscape.

Finally, we noted that the ultimate promise of a real-time census is an environment in which crucial data about people and place are collected regularly and inexpensively, offering governments and researchers new ways to see change on a fine scale, without losing track of dynamics on the scale of cities, regions, or countries. Moreover, when combined with other measures—such as a telecommunications quotient generated from data filtered so as to contain only households, for example—it may also become possible to derive migration and country-of-origin data that could shed further light on neighborhood dynamics with a lag of days or weeks, rather than months or years.

With this as background, we can outline some preliminary opportunities for the private, public, and nongovernmental sectors:

- the collection of transactional data by telecommunications operators not only for the purposes of billing and system engineering but also explicitly for their aggregation and statistical re-use;
- citizen-data auction services for private citizens to aggregate and manage personal data with options for sale of access to commercial analysts—what Pentland called "a new deal on data";[19]
- new approaches to the local, regional, or national assessment of policy interventions through an analysis of changes in local/neighborhood communications behavior over time; and
- the provision of aggregated small area societal well-being indicators by telecommunications service operators for a future real-time census.

Of course, it is early days yet for the emerging computational social science industry, and there remain significant obstacles to the field's success. First, there are reasons to be concerned with data quality and integrity, since a great deal of time and money may ultimately rest on assumptions about the validity of the data that have yet to be systematically verified. Second, as yet there is no mature working model of how industry (which typically generates and collects this type of data) and government can collaborate successfully in a manner that is also trusted by citizens. And third, individuals are right to be concerned about the impact that this emerging

area might have on their own expectations of personal privacy: although the existing protections appear robust enough for one-time work, this dynamic would change with ongoing, linked data transfers to third parties. These questions must be addressed by all stakeholders—in-dustry, government, and citizens alike—if the potential of this field is to be realized.

NOTES

1 Savage and Burrows 2007.

2 Granovetter 1973.

3 Scott 2010.

4 Lazer et al. 2009.

5 Rogers 1987.

6 cf. Gonzalez et al. 2008; Leskovec and Horvitz 2008.

7 Ratti et al. 2010.

8 Tobler 1970.

9 Nielsen and Hovgesen 2008.

10 Granovetter 1973.

11 Putnam 2000.

12 Eagle et al. 2010.

13 Anderson and Vernitski 2011.

14 Florence 1948.

15 Office for National Statistics 2011.

16 Mateos et al. 2011.

17 Anderson and Vernitski 2011.

18 Ratti et al. 2010.

19 Pentland 2009, p. 79.

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CHAPTER 1.10

The Promise and Peril of Hyperconnectivity for Organizations and Societies

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Within living memory, telephone service has cut its link to the wires overhead. Computers have moved from the climate-controlled environments of enterprises to devices in our pockets. Video has moved to the same devices from our living rooms. Social media have trumped traditional media. Most recently, the cloud has appeared virtually overhead, making massive amounts of data and applications available anywhere there is a broadband connection.

THE ATTRIBUTES OF HYPERCONNECTIVITY

The result of this increasingly accelerated communications evolution is that today we are faced with the phenomenon of *hyperconnectivity.* The term refers not only to the myriad means of communication and interaction, but also to its impact on both personal and organizational behavior.

Hyperconnectivity has several key attributes. It is:

- **Always on:** Broadband and ubiquitous mobile devices enable people to be connected to family, work, friends, avocations, obsessions, and more 24/7.
- **Readily accessible:** A universe of mobile devices and personal computers links people and organizations together; these connections are increasingly available at any time and in any location.
- **Information rich:** Websites, search engines, social media, and 24-hour news and entertainment channels ensure that information—from the strategic to the banal—is always on hand, beyond anyone's capacity to consume.
- **Interactive:** Hyperconnectivity ensures that everyone can offer input on just about everything.
- **Not just about people:** Hyperconnectivity includes people-to-machine and machine-to-machine communications, supporting the development of what has been termed the *Internet of Things.*
- **Always recording:** Service records, virtually unlimited storage capacities, miniaturized video cameras, global positioning systems, sensors, and more—combined with people's desire to document their own activities—ensure that a large portion of everyone's daily activities and communications are part of a semi-permanent record.

The cumulative effect of hyperconnectivity is that the limitations of time and space have largely been overcome. Experience is virtualized. You no longer need to be in the same room, or even the same country, as your colleague, your teacher, or your doctor to accomplish what used to require face-to-face contact.

Hyperconnectivity confronts us with both benefits and challenges. It can be a powerful tool for collaboration that drives global alignment, increased efficiency, and material development. At the same time it has very rapidly changed the way many tasks are performed, and people are expected to accommodate those changes.

All of that information and all of that access also present risks of misuse.

Those who have not yet felt the impact of hyperconnectivity probably soon will. Statistics indicate that it is a burgeoning phenomenon:

- Worldwide fixed broadband subscribers totaled 503 million at the end of 2010, with 48 million subscribers added in the fourth quarter of 2010 alone;[1] this figure is expected to reach 674 million in 2014.[2]
- In 2010 there were estimated to be 7.8 billion global mobile connections.[3]
- The number of cellular mobile broadband subscribers jumped almost 60 percent in 2010 to reach 558 million worldwide; this number should top 2 billion by 2015.[4]

HOW HYPERCONNECTIVITY IS CHANGING THE LANDSCAPE OF SOCIAL AND PROFESSIONAL ORGANIZATIONS

For institutions and organizations (i.e., corporations, industries, governments, and academic and research institutions in a variety of fields), hyperconnectivity is driving monumental shifts in terms of impact on their work styles, functions, and missions in a variety of realms.

Neo-urbanization

As a concept, *neo-urbanization* encompasses several different types of development that are taking place simultaneously. It refers both to the reclaiming of post-industrial spaces in existing cities for new uses as environments in which to live, work, and play and to the rapidly urbanizing development in emerging economies. The term takes in the blurring of the boundaries between traditional definitions of urban, suburban, rural, and even regional, introducing new concepts such as *corridors* and *megacities,* and refers to the rapid growth of smaller cities, which will increasingly be able to deliver many of the amenities and services that characterize larger metropolitan regions.[5]

Hyperconnectivity offers some obvious benefits in this realm, such as improved standards of living in remote areas—the result of increased availability of technology (e.g., in healthcare, education, and entertainment). This is expected to encourage migration back to the rural areas and slow the movement of the populace to cities. Similarly, the growing connectedness of rural areas will lead to more jobs outside existing urban centers, thus delivering substantial economic growth to neo-urbanized rural areas.[6]

Although hyperconnectivity provides the opportunity to live a connected life in remote areas, demographic studies clearly demonstrate that large numbers of people are continuing to migrate to cities. Some communities are being built from scratch and are conceived as true cities of the future, with sustainability engineered into all aspects of life. Hyperconnectivity is an engine for much of that planned sustainability. But in the 21st century, most urban dwellers will live in traditional cities and the phenomenon of the megacity is expanding, particularly in Asia and Africa. As millions and millions of people gather together in environments of dense cohabitation, hyperconnectivity could be added to the list of quality-of-life attributes like adequate shelter, electricity, and plumbing that separate the relatively few haves from the multitudinous have-nots.

However, it is possible that—as access to communication technologies becomes ever cheaper and more available—hyperconnectivity could become a primary tool for governments and other institutions to address the shifting needs of city residents. Better access to government services, education, and healthcare could substantially improve the quality of life for many. We will discuss those possibilities below.

Government

On the political front, governments and other political institutions are coming under pressure to review their role and function because the availability of connectivity anywhere and at any time makes government's actions as well as the consequences of those actions more visible. Hyperconnectivity enables governments to improve communication with their constituents by sharing information more quickly and transparently. Simultaneously, it makes it easier for constituents to contact their government representatives and to access government services, regardless of where they live or work. In this way, hyperconnectivity has the potential to restructure the relationship between governments and those they govern.

At a minimum, hyperconnectivity can make various government services more readily available. We are already seeing a rapid move toward open-format publication of government information on websites, along with constituent engagement in processes and services through the use of social media, particularly in more developed democratic societies. The past decade has seen a shift from services delivered by employees at the counter toward greater self-service or interactive voice response—a consequence of the increased connectedness of government officials and government employees. Smart governance[7]—that is, an administration that applies and integrates information, communication, and operational technologies to address the challenge of planning and managing operations across multiple domains—is becoming a key architectural component in most governmental operational models. Governments of all shapes and sizes, just like their corporate counterparts, rely increasingly on technology to monitor, store, and analyze different kinds of information, with the goal

of delivering more sustainable services and operations as well as a faster response to constituents' concerns.

As a key element of smart governance, mobile government (or *m-government*)[8] allows developing countries a relatively quick and simple means of connecting with their populace, since mobile broadband services can be cheaper and somewhat simpler to deploy than full-scale wired communications networks. Interactive services provided by governments to constituents (i.e., mobile government-to-constituent interactive services) focus on citizen convenience and increase citizen participation in government-related activities and inquiries. In many countries, m-government is becoming a new method of communication between government and constituents based on applications in which constituents are encouraged to report in real time about their experiences and the events happening around them.

That immediacy of response also carries with it potential ramifications of participation in government activity by people who are not physically located in the geographical domain of the government. Expatriates now have the ability to readily follow the issues of their former locales as well as comment upon and potentially influence developments in a place far from where they currently live.

Education

There has been a proliferation of online learning opportunities in recent years, driven in part by individual professional and personal development or enrichment needs. This trend, which has been described as "ed-YOU-cation," reflects the ability of technology to support anytime and anywhere connections, as well as individualized learning plans.[9] As importantly, virtual education creates an environment where learning is more and more liberated from location- and time-specific constraints. It is also de-coupled from age, life stage, and means—people are pursuing learning opportunities throughout their lives, and technology is supporting this development. People can receive degrees from schools located many miles from their homes. Institutions of higher education that were created to serve the populations of specific and limited geographic locales now have alumnae who could be located anywhere and who never have to set foot on a physical campus to earn a degree. Online lessons and discussions held through message board postings mean that people can be anywhere and can participate in classes at any time from any location.

As broadband connectivity becomes more ubiquitous, the use of virtual education tools to reach populations in remote areas becomes much more feasible. The limitations imposed by the logistics of having to travel great distances to attend a classroom are being eliminated.

Healthcare

In the realm of healthcare, hyperconnectivity is already proving to have huge potential.[10] Machine-to-machine-to-human (M2M2H) communications solutions—which are becoming a reality today—can improve patient care, support mobile and virtual care, and reduce travel requirements for both patients and physicians. With a hyperconnected healthcare sector, doctors and nurses can remotely monitor and diagnose patients continuously via medical applications that work with sensors discretely attached to the body.

The availability of remote care has the potential to dramatically reduce overall healthcare costs because more healthcare services can be offered at home instead of in a dedicated healthcare facility. It also allows people to live at much greater distances from healthcare facilities without worrying that they are putting themselves at increased risk. Hyperconnectivity can be a tether to a healthcare system that allows people to pursue life when and where they want, and bring them into a healthcare provider facility if necessary for a physical exam or procedure.

Business

Hyperconnectivity is affecting enterprises of all sizes and types. In the retail sector, hyperconnectivity is already a pervasive force in the interactions between buyers and sellers. The next stage in this transformation is in the area of logistics—where the Internet of Things and related hyperconnectivity will transform the supply chain and connect customers, suppliers, manufacturers, and retailers with each other in a more efficient process.[11] With M2M2H communications, retailers, manufacturers, and suppliers are able to monitor supply and demand, manage inventory, and get products shipped when and where they are needed. This is accomplished by using tags and sensors, which reduce human intervention to a minimum and make supply chains faster and more efficient. Such efficiency can also increase the reach of supply chains. More precise tracking of usage—the movement of goods, inventory management, and so on—can allow for more remote distribution points aligned with more clearly defined requirements or expectations of customer demand. The more efficient distribution networks are, the less need there is to stockpile inventory because products can more easily be delivered on an "as needed" basis. Less risk to the manufacturer/distributer means, potentially, both increased profitability and reduced costs to consumers.

Another key concern of the 21st-century enterprise going forward will be its interactions with customers and its customer relations management. Today, the process of interacting with customers has the potential of spiraling out of control because of the migration to the digital world, hyperconnectivity, and the emergence of online

social networking communities where every customer's criticism comes with the expectation of a direct response from the enterprise. Customers now have more avenues than ever to express their complaints and kudos, and to request new features and capabilities. Savvy executives already know that the customer lifecycle spans multiple channels; today a contemporary approach to customer care includes becoming a part of online social networking communities. Corporate executives must be able to hear what customers are saying to each other, respond in a proactive manner, and communicate with customers through a myriad of channels.[12] To be truly customer-focused today, companies must learn how to better manage relationships with their customers in the hyperconnected world. In other words, the today's paradigm of customer relations and customer care demands 24/7 interaction with customers across multiple channels, especially the web.

Because of the increase in hyperconnectivity, the economic environment is changing drastically as the world becomes more balanced in terms of commercial activities and employment opportunities. Commercial centers will be increasingly spread all over the world, while economic growth is likely to be witnessed in areas that are currently marginalized.

Finally, the reliability of technologies and networks is increasingly an outgrowth of hyperconnectivity. This is because increases in technology adoption, the growing connectedness of cities and towns, and the creation of networked cities are creating a new concept of what is considered to be essential infrastructure. This infrastructure will require better-performing and more reliable technologies. The expectation for a growing variety of services is for 99.999 percent availability, at a minimum. Certain aspects of hyperconnectivity require technology and platforms that never fail.

Workforces

Given the major shifts that have taken place in the world outside corporate organizations, it is no surprise that hyperconnectivity has and will continue to have a deep impact on the workplace: it affects the way we work and connect with colleagues, customers, and suppliers. Hyperconnectivity creates new business model opportunities and new ways of working: because of the proliferation of new mobile devices—from smartphones to tablet computers—and increasing broadband speeds, connecting people has never been easier. Web 2.0 social tools and the hyperconnected workforce are eroding many old work paradigms, ranging from work location requirements to work hours.[13]

Workforces are becoming more virtual, and the 21st-century workforce will need to utilize various technologies to stay connected to one or several business networks. In addition, the workforce will need to utilize Web 2.0–like, people-centric collaboration tools and techniques to increase productivity and engagement. As more companies bring together integrated collaboration experiences for customers (e.g., email, instant messaging or IM, chat, web conferencing), benefits such as enhanced productivity and improved decision making can be realized. The growth of so-called immersive communications offers the potential of moving beyond video conferencing as a way of establishing a virtual presence with colleagues in other locations.

A hyperconnected workforce with always-on communication capabilities will result in material benefits for the 21st-century enterprise. These include lower travel costs, easier and faster data and information access, consistent understanding, and contextual awareness.

Hyperconnectivity will also impact the organization of the labor force. Major structural changes will include shifting patterns and proportions of workers who are part-time, share jobs, and are self-employed; they will also include changes in the ease and cost-effectiveness of telecommuting from any location. There will be new ways of designing how work can be accomplished (e.g., crowd sourcing) to ensure continuous international operations as well as other workforce management challenges. There will be an increase in the phenomenon of non-linear career paths, with people having multi-career and multi-occupational working lives along with the recognition of a greater need to integrate formal educational periods throughout the working life and an increase, as well, in the number of self-managed careers.[14]

Web 2.0 and the emergence of the Millennial Generation in the workforce are already shaping the workplace of the future.[15] The Millennial Generation is made up of people born between 1977 and 1997 who have come to rely on Web 2.0 technologies and services in both their personal and their professional lives. Having effectively been raised in a hyperconnected environment, this generation of workers will increasingly exert pressure on employers to overhaul their approach to talent management. Businesses that can attract and keep these talented young people could find their organizations transformed via increased innovation and improved customer connectedness, and even the ability to compete more effectively in the global marketplace.

Research into the workplace of the future has identified the following 10 forces that will define the working world in 2020:

1. **Demographics:** The demographics of the workforce is shifting; by 2020, there will be five generations working side by side.
2. **The knowledge economy:** Being conversant and skilled in the knowledge economy will become more essential to obtaining and retaining work, with a growing number of jobs requiring a significantly more complex set of interdisciplinary skills.

3. **Globalization:** By 2020, the globalized world will mean that companies will rely on the global marketplace, rather than a domestic or even international marketplace, to fuel growth.
4. **The digital workplace:** The digitalized workplace will result in an easier way for employees to create and access content while securing its accuracy and appropriateness, especially with the growth of cloud computing.
5. **Mobile technology:** The ubiquity of mobile technology will mean that companies (e.g., Bank of America and Wells Fargo) will deliver corporate training via mobile smart phones.
6. **Culture of connectivity:** Hyperconnectivity will grow as a business tool, resulting in a connectivity culture in business as well as personal aspects of life.
7. **Participation:** Improved collaboration and knowledge sharing will usher in a participation society, where it is essential to engage in societal endeavors.
8. **Social learning:** "Learning 3.0," or social learning, will incorporate social media, gaming, real-time feedback, and simulations.
9. **Corporate social responsibility:** Corporations will act out of social responsibility because of an increased cultural intelligence and a deeper appreciation of the relationship between business and society.
10. **The Millennial Generation:** The workforce will include the Millennial Generation, who have grown up with hyperconnectivity and embrace it as an inalienable part of their work culture.

Sustainability

Although it might seem counterintuitive, hyperconnectivity could be a boon to sustainability. The Internet of Things presents an opportunity to eliminate human intervention in many types of business and civil operations. As importantly, robust virtual environments can drive reductions in carbon emissions because major activities (e.g., education, medical care, government-related activities, and retail sales) can take place without requiring physical travel for the subjects involved.[16]

A surplus of resources in one region can be identified in advance and delivered where the need exists in a proactive and efficient way. Cities in the developed world that have lost significant percentages of their population because of shifts in manufacturing and demographics could be revitalized by members of the hyperconnected workforce, who can work from anywhere and are able to take advantage of existing housing stock and urban infrastructure at prices far, far below those in other regions. As more and more talented workers spread themselves around the world in search of attractive, reasonably priced sustainable locales in which to live and work, the dominance of traditional centers of commerce is likely to diminish.

Hyperconnectivity can be used as a tool to help shape and manage the environmental impact of increased consumption of goods and services, which is reaching crisis proportions. This becomes progressively more important, because 800 million new consumers are expected to enter the market over the next 10 years. Designing an eco-friendly consumption pattern for consumers will rely heavily on information and communications technologies (ICT) and related aspects of hyperconnectivity. The Climate Group, a global sustainability initiative, estimates that appropriate applications of ICT can lead to the reduction of the carbon footprint of other sectors by nearly five times the consumption of the ICT sectors themselves.[17] The advent of hyperconnectivity therefore has the potential to exert a substantial positive impact on climate change.

For instance, one of the biggest challenges facing most urban centers is vehicular traffic and transportation. Opportunities to re-envision the traveling experience through the use of hyperconnected transport systems are plentiful. Intelligent transportation systems—which include synchronized traffic and notification systems, onboard tele-metrics, and dynamic signaling—have the potential to encourage eco-driving, reduce congestion, assist with routing and journey management optimization, and enable pay-as-you-go pricing for road usage.[18] Moreover, smart logistics solutions can enable fleet tracking and passenger tracking, which makes it easier to calibrate food and lodging needs with expected real-time demand.

HOW CAN WE SHAPE AND TAKE ADVANTAGE OF HYPERCONNECTIVITY?

Hyperconnectivity is arguably the single most important trend in today's world, as communication technologies are changing so many facets of life and opening so many new possibilities across individual, social, and business spectra.[19]

Thus far, the global communications service providers and their networks—supported by an ecosystem of researchers, developers, and consumer electronics and equipment manufacturers and service people—have been the primary builders and maintainers of the infrastructure that has enabled hyperconnectivity to flourish. For these organizations, hyperconnectivity is likely to be a key component of their business now and will almost certainly be central to the products and services they offer in the future.

Although the free enterprise model must be at the core of the evolution of hyperconnectivity, the service providers and their commercial partners alone cannot be expected to bring it to fruition. A consortium of

public-private partnerships, as well as the involvement of nongovernmental organizations, will be needed to ensure that, as a global community, we are taking the broadest possible view of hyperconnectivity so that it can deliver on its promise of economic development, more efficient healthcare, greater sustainability, and increased educational benefits. This broad view is necessary to craft and execute the coordinated plans necessary to take full advantage of these opportunities.

The technologies that enable hyperconnectivity can be harnessed, ignored, employed on an ad-hoc basis, or incorporated thoughtfully into a government's strategy to carry out a mission. The hyperconnectivity of our world has generated global wealth, but it has also made it possible for shocks on one side of the planet to affect communities on another with frightening speed. In other words, these technologies can be at the same time either beneficial or harmful, empowering or dangerous, depending on the context in which they are used. Recent events in North Africa and the United Kingdom have shown how communications technologies of various kinds and hyperconnectivity have become core to social movements of all types. The only thing that government leaders and enterprise managers cannot do with these technologies is make them go away.

Since these technologies and the related hyperconnected tools are here to stay, government leaders and people managers must learn how to deploy them effectively to their organizations' advantage. Policymakers and business leaders must surmount significant challenges if they are to ensure that the workforce is adequately trained to be able to manage the increased pressure and stress levels of working in an ever-connected environment.[20] Careful use and tight management of these technologies has also become imperative to the responses of authorities on social events. The flash mobs that rioted across cities in the United Kingdom were coordinated—so to speak—by text messages and by Facebook, Twitter, and Blackberry Messenger services. There has been much outcry since the UK riots, yet these were the same technologies that helped fuel the assembling of opposition groups in Tahrir Square in Cairo in 2011. Allowing people and cultures to connect together more easily is a good thing to do and should be encouraged by authorities at all levels. Sharing and communicating is how progress is made, and shaping hyperconnectivity allows us to fuel trends that are beneficial to daily life.

We must recognize that we are in the very early stages of establishing appropriate ground rules regarding how we—as individuals, societies, companies, and government—will need to become accountable for managing our relationships and responsibilities in light of the availability of new technologies and capabilities. The increased levels of access to information, new possibilities for integrating and sharing formerly incompatible data sources, and the pervasive use of connected devices introduce fresh trust and privacy concerns for consumers and businesses. Policymakers and business leaders therefore need to consider how they can best educate users about potential security vulnerabilities and practical solutions. Businesses will need to establish policies to protect their corporate assets and business-critical information as well as their corporate reputations.

Although hyperconnectivity is clearly a 21st-century phenomenon, the drive behind it—to share information and create a community with like-minded people—is as old as humankind. But the tools to fulfill that drive have never been so broad in scope or so widely available to so many people; therein lies both the promise and the challenge.

NOTES

1 Blackwell and Lynn 2011.

2 TIA 2011.

3 Obiodu 2011.

4 Teral 2011.

5 See Followwill et al. 2010 for some insights into the phenomenon.

6 OECD 2007.

7 Bittinger 2011.

8 Eskandar et al. 2011.

9 See the weblog http://edyoucation.wordpress.com.

10 For an overview of the impact of ICT on healthcare, see Media Lab Asia 2005.

11 European Commission 2008.

12 Cole and Brillhart 2011.

13 Fauscette et al. 2011.

14 Verdon 2010.

15 Miller 2011; Berg 2010.

16 OECD 2009; Roberts 2011.

17 The Climate Group 2008.

18 The European Community has defined a common strategic framework to overcome many of the challenges in the transportation fields; see Ferreira 2011.

19 For the importance of connectedness in crisis situations, see Collins 2011.

20 Pedley 2011.

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CHAPTER 1.11

Maximizing the Impact of Digitization

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Policymakers today face a different environment for information and communications technology (ICT) than the one for which they designed policies. ICT technologies are far more pervasive than they were previously: more people today have access to a mobile phone than to electricity, powering exponential growth in global data generation.[1] With ICT access approaching ubiquity, policymakers' next challenge is to ensure that individuals, businesses, and governments are making the best possible use of networks and applications. Countries that have achieved advanced levels of *digitization*—the mass adoption of connected digital technologies and applications by consumers, enterprises, and governments—have realized significant benefits in their economies, their societies, and the functioning of their public sectors.

Previous attempts to measure the impact of ICT have focused primarily on assessing the economic effects of widespread access to either wireless or broadband technologies. But in developing a comprehensive methodology to measure the impact of digitization, Booz & Company found greater benefits linked to growing usage of digital technologies and applications, rather than access alone. We also found that benefits are not just economic, but encompass social and political spheres as well. Digitization offers incremental economic growth: countries at the most advanced stage of digitization derive 20 percent more in economic benefits than those at the initial stage. Digitization has a proven impact on reducing unemployment, improving quality of life, and boosting citizens' access to public services. Finally, digitization allows governments to operate with greater transparency and efficiency.

Policymakers have an important role to play in ensuring that their countries are progressing toward advanced stages of digitization. They need to acknowledge where they currently stand and recognize the benefits of digitization. Finally, they need to shift focus away from access and set into motion programs and plans that focus on the widespread adoption and usage of technology. That includes elevating digitization on the national agenda, including the systematic planning and tracking of their efforts; evolving sector governance structure; adopting an ecosystem perspective; enabling competition; and stimulating demand.

DIGITIZATION: ICT'S NEXT EVOLUTION

The proliferation of digital technologies over the past two decades has been substantial, marking one of history's most rapid rates of adoption of new technologies. The number of personal computers (PCs) in use worldwide surged from 100 million in 1990 to 1.4 billion by 2010. There were 10 million mobile phone users in the world in 1990; today there are more than 5 billion.[2] The number of Internet users grew at an even more rapid rate over the same decades, from 3 million to 2 billion.[3] To put that into context, only two decades ago there were as

many Internet users in the world as people in the city of Madrid; today, there are as many people online as are living in all of Asia. The surge in ICT use has not been restricted to the developed world. In Africa, for example, more than half a billion people today connect to mobile networks.[4]

The explosive growth of ICT services is presenting policymakers with three key challenges. The first challenge is to establish standard performance indicators to measure the extent to which ICT is being assimilated in societies. During most of the sector's development, ICT stakeholders focused primarily on access, building the networks that today connect much of the planet; they devised metrics accordingly. In a world of near ubiquity in terms of access, policymakers need a new way to look at the ICT sector.

The second challenge concerns the lack of tools that can determine the impact that the mass adoption of connected digital technologies and applications is having on societies and economies. With practical, reliable tools to measure the benefits of digitization, governments could potentially be more ambitious in developing and investing in the ICT sector.

The third challenge is for policymakers to adopt new policy tools to accelerate digitization and reap its accompanying benefits. Over the past two decades, policymakers established rules to enhance access to communication services—setting policies that introduce competition and promote infrastructure sharing, for example. Now they need to gain a similar understanding of the ways in which they can encourage adoption and boost the usage of digital applications by consumers, businesses, and public institutions.

DEFINING AND MEASURING DIGITIZATION

We believe the extent of a country's digitization can be measured across six key attributes:

- Ubiquity[5]—the extent to which consumers and enterprises have universal access to digital services and applications;
- Affordability[6]—the extent to which digital services are priced in a range that makes them available to as many people as possible;
- Reliability[7]—the quality of available digital services;
- Speed[8]—the extent to which digital services can be accessed in real time;
- Usability[9]—the ease of use of digital services and the ability of local ecosystems to boost adoption of these services; and
- Skill[10]—the ability of users to incorporate digital services into their lives and businesses.

To measure digitization and chart its evolution, we created a composite score consisting of the six critical attributes and measured these with data collected across 23 indicators with the aid of proxy measures (see Figure 1).[11]

Understanding digitization: The stages

We measured digitization for a sample of 150 countries on a scale of 0 to 100, with 100 being the most advanced, and then isolated four distinct stages of digitization development: constrained, emerging, transitional, and advanced (see Figure 2). These groupings will allow policymakers to recognize their nation's current level of digitization and provide perspective on how to progress.

Constrained economies—those with a digitization score below 25—face challenges in realizing basic digitization building blocks such as widespread access and affordability. In these nations, services remain expensive and limited in reach.

Emerging economies—those with a score between 25 and 30—largely have addressed the affordability challenge and have achieved significant progress in providing affordable and widespread access. However, the reliability of services in emerging digitization nations remains below par and capacity is limited.

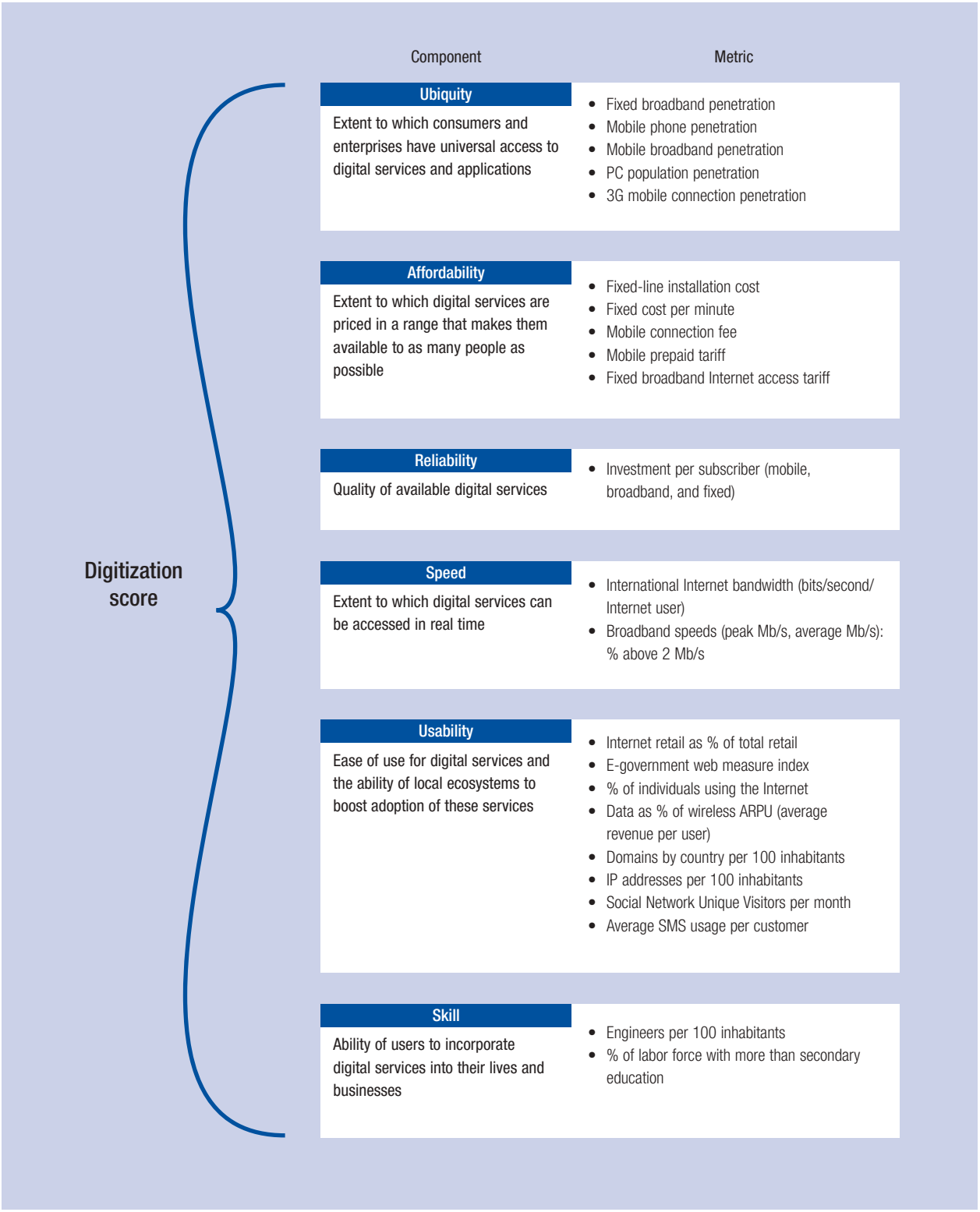
Transitional is the next digitization stage, encompassing those countries with a digitization score in the range of 30 to 40. Countries in the transitional stage have addressed the reliability challenge and provide citizens with access to ubiquitous, affordable, and reasonably reliable services. Alongside the jump in reliability, transitional countries show minor advances in the speed, usability, and skill indexes.

Advanced is the most mature stage of digitization, achieved with a score greater than 40. These countries have made significant strides in addressing ICT usability and developing a talent base to take advantage of available technologies, products, and services while improving the speed and quality of digital services.

The accelerating pace of digitization

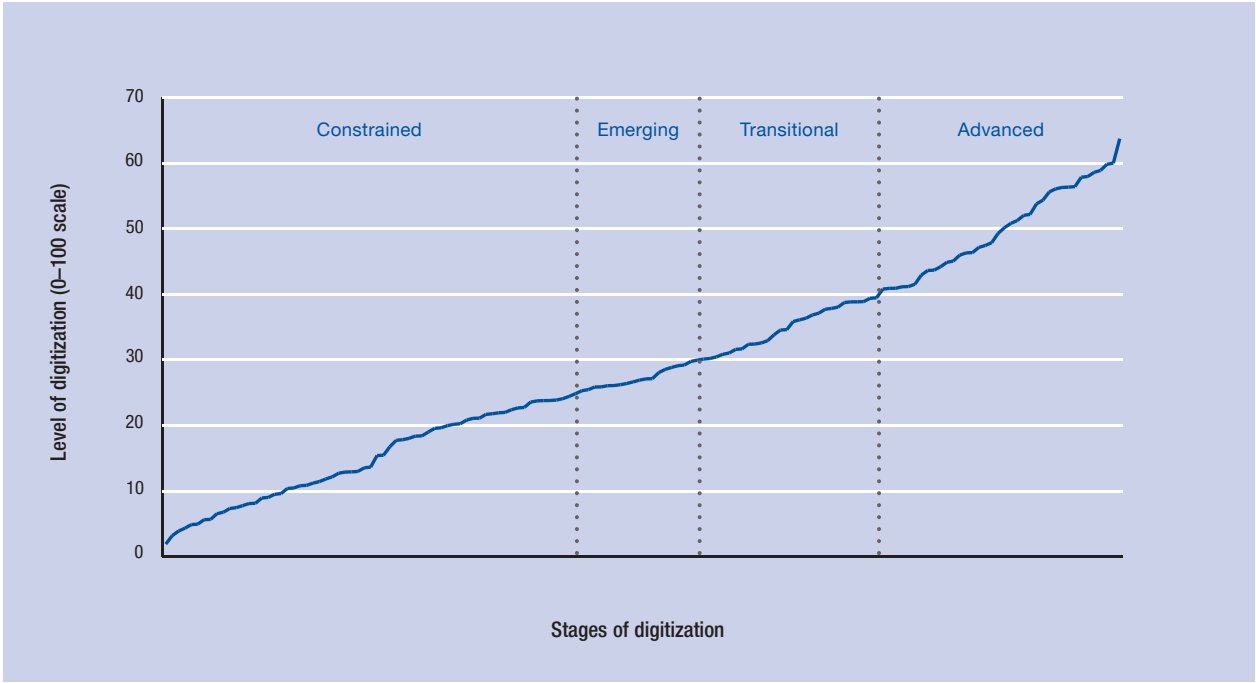
The pace of digitization and movement between stages is accelerating rapidly. Developed countries such as Germany, the United Kingdom, and the United States took nearly four years on average to move from the emerging to the transitional stage of digitization; now, developing countries such as the United Arab Emirates, Kuwait, and Estonia are making that same amount of progress in less than two years. Overall, between 2004 and 2007, countries registered 39 stage leaps; in the ensuing three-year period of 2007 to 2010, 65 countries progressed to the next level of digitization development. Not only has the pace quickened, but the jump in development has also been more marked. From 2004 to 2007, the average growth in the digitization score was seven points. From 2007 to 2010, the average jump was ten points.

Figure 1: Key components of the digitization score



Sources: Data from ITU, Ovum, Euromonitor, Akamai, ILO (Laborsta), Global Insight, UN, WCDM, Webometrics, Bgexpert, Internet World Stats, UNESCO, Wireless Intelligence, and Telecom Advisory Services; Booz & Company analysis.

Figure 2: Stages of digitization, 2010 digitization levels

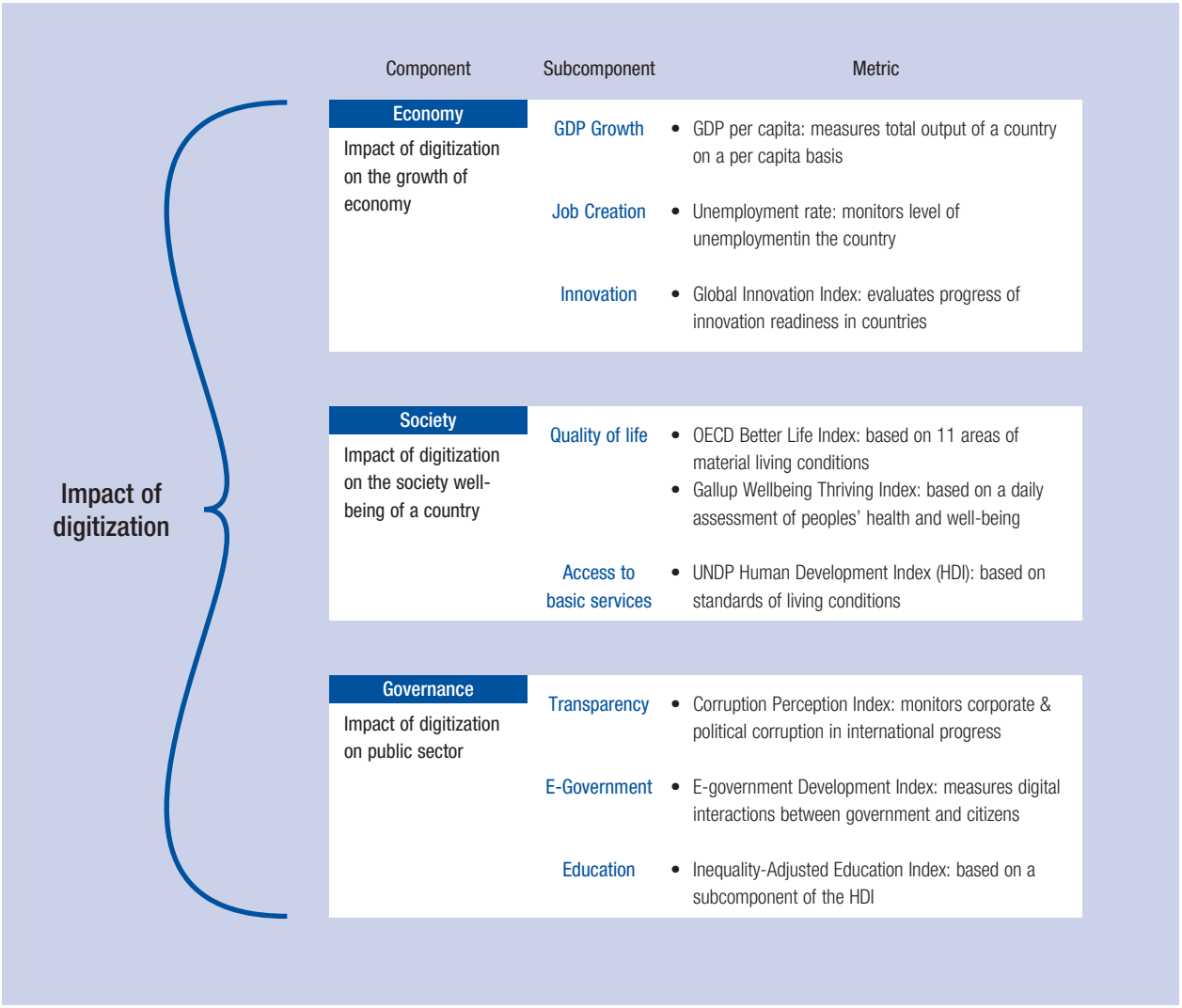


150 economies

Constrained		Emerging	Transitional	Advanced
Ethiopia	Morocco	Georgia	Jordan	Lithuania
Comoros	Honduras	Bosnia and Herzegovina	Seychelles	New Zealand
Niger	Kyrgyzstan	Ecuador	Barbados	Slovenia
Burkina Faso	Bolivia	China	Mexico	Belarus
Madagascar	Sri Lanka	Armenia	Turkey	Hungary
Afghanistan	Moldova	Trinidad and Tobago	Montenegro	Poland
Lesotho	Aruba	Botswana	Colombia	Greece
Mali	Namibia	Antigua and Barbuda	Bahrain	United Arab Emirates
Rwanda	Guatemala	Azerbaijan	Philippines	Slovak Republic
Yemen	Dominican Republic	Panama	Iran, Islamic Republic	Romania
Togo	Suriname	Venezuela	Macao SAR	Russia
Cameroon	Pakistan	Albania	Serbia	Czech Republic
Mozambique	Paraguay	Saint Lucia	Argentina	Netherlands
Sao Tome and Principe	El Salvador	Macedonia FYR	Oman	Ireland
Benin	Gabon	Peru	Uruguay	Italy
Burundi	Fiji	Brazil	Latvia	Spain
Lao PDR	Egypt	Costa Rica	Croatia	Austria
Senegal	India	Mongolia	Bulgaria	Germany
Djibouti	Belize	Lebanon	Cyprus	Portugal
Cuba	South Africa		Ukraine	France
Nepal	Guyana		Estonia	Singapore
Iraq	Kazakhstan		Kuwait	Belgium
Uganda	Algeria		Malta	Australia
Uzbekistan	Thailand		Qatar	Finland
Kenya	Tunisia		Saudi Arabia	Sweden
Vanuatu	Brunei Darussalam		Mauritius	United Kingdom
Swaziland	Indonesia		Malaysia	Japan
Côte d'Ivoire			Chile	Denmark
Vietnam				Israel
Bangladesh				Canada
Cambodia				Taiwan, China
Nigeria				Luxembourg
Zambia				United States
Ghana				Switzerland
Syria				Hong Kong SAR
Angola				Korea, Rep.
Cape Verde				Iceland
Bhutan				Norway

Sources: Data from ITU, Ovum, Euromonitor, Akamai, ILO (Laborsta), Global Insight, UN, WCDM, Webometrics, Bgexpert, Internet World Stats, UNESCO, Wireless Intelligence, and Telecom Advisory Services; Booz & Company analysis.
Note: Countries are ordered from the least to the most digitized within each stage.

Figure 3: The framework for measuring digitization's socioeconomic impact



Sources: Data from the World Bank, the World Economic Forum, INSEAD 2011, the OECD, Gallup Wellbeing Surveys, the UNDP Human Development Report, Transparency International, the UN Public Administration Network, and Telecom Advisory Services; Booz & Company analysis.

This acceleration stems from a number of factors. Emerging countries now can follow the path that developed nations have already blazed, learning from their best practices. They also can take advantage of mature technologies and markets, and the resulting price reductions. Furthermore, acceleration between stages can stem from increased liberalization and the growing affordability and availability of digital technologies and skills. This hastens the implementation and usage of new technologies and the deployment of supporting infrastructure.

In sum, the whole world is moving toward an advanced stage of digitization at a rapid clip.

ASSESSING THE IMPACT OF DIGITIZATION

After developing a methodology to determine a nation's level of digitization, the next step was to understand the contribution of digitization to economic strength, societal well-being, and effective governance (see Figure 3).

Economic impact

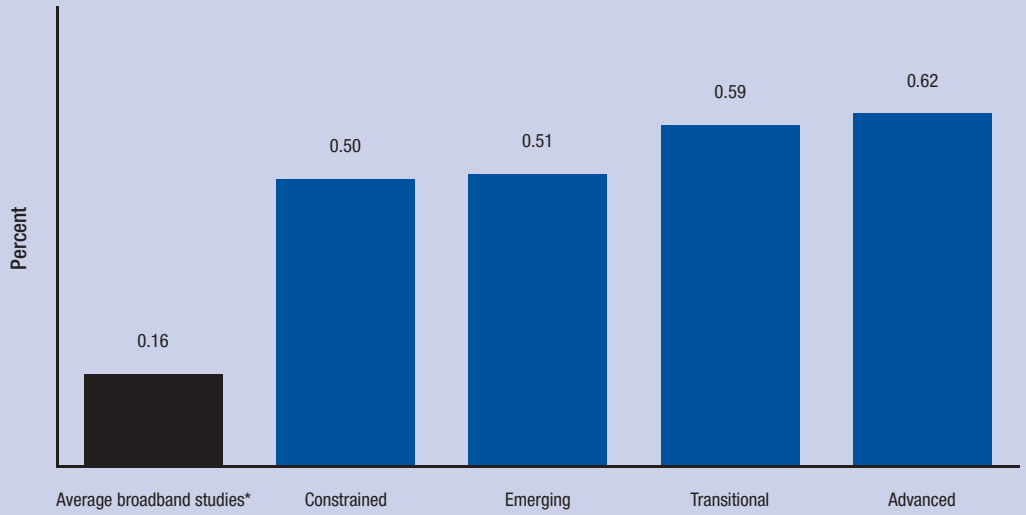
Our analysis confirms that digitization has a material economic impact, which we assessed with three variables: growth in per capita GDP, job creation, and innovation. We analyzed 150 countries using a classical production function model to assess economic impact, controlling for a number of variables.[12]

We found that an increase in digitization of 10 percentage points triggers a 0.50 to 0.62 percent gain in per capita GDP. By contrast, previous studies that focused mainly on broadband penetration established that a 10 percentage point increase in broadband penetration contributes a gain in per capita GDP of just 0.16 to 0.25 percent.[13] Thus the GDP impact from digitization is more than twice as large as the impact of broadband penetration (see Figure 4).

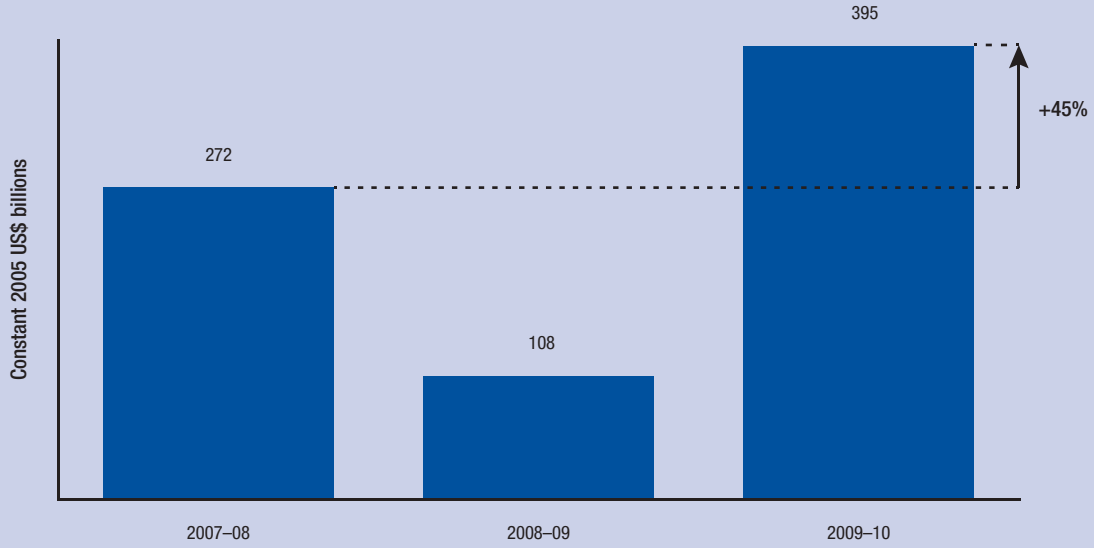
Additionally, the economic impact of digitization accelerates as countries transition to more advanced stages. Constrained digital economies realize a 0.5

Figure 4: Digitization and GDP

4a: Contribution to GDP per capita growth of a 10 percent increase in digitization (per stage)



4b: Impact of digitization on GDP



Source: Data from Global Insight, and Telecom Advisory Services; Booz & Company analysis.
* Average of OECD, Germany, Latin America, Brazil, Chile, and Malaysia.

percent increase in GDP per capita for every 10 percent increase in digitization, while advanced digital economies show a 0.62 percent increase in GDP per capita for every 10 percent digitization increase (see Figure 4).

Digitization also has a significant impact on job creation in the overall economy: an increase of 10 percent in digitization reduces a nation's unemployment rate by 0.84 percent. From 2009 to 2010, digitization added an estimated 19 million jobs to the global economy, up from the estimated 18 million jobs added from 2007 to 2008. This is an especially critical finding for emerging markets, which will need to create hundreds of millions of jobs in the coming decade in order to ensure that a booming population of young people can contribute to their national economies.

Finally, a 10-point increase in digitization results in a 6-point increase in the country's score on the Global Innovation Index[14]—a correlation suggesting that, as a country progresses in its digitization development, it also becomes more innovative.

Social impact

Assessing the impact of digitization on societies is complicated because there are no universal metrics that act as a barometer of societal advancement. Studies often tend to look at the level of inequality in a society (as measured by the Gini coefficient), but in emerging economies that are in the process of elevating millions from poverty, a complex relationship between economic growth and inequality remains. Therefore we analyzed societal impact on two levels: the level of quality of life in a society and the equality of access to basic services that a society requires. We used the widely published Gallup Wellbeing Thriving Index and the Organisation for Economic Co-operation and Development (OECD) Better Life Index to measure quality of life,[15] and the United Nations Development Programme (UNDP)'s Human Development Index (HDI) to measure access to basic services,[16] and correlated all three with the digitization levels of 150 countries.[17]

We found that increasing digitization significantly boosts societal well-being in a developed economy: a correlation run on the 34 OECD countries shows that a 10-point increase in the digitization score results in an increase of approximately 1.3 points in the OECD Better Life Index (see Figure 5). However, the analysis reveals that in countries with lower levels of economic development, the impact of digitization is not as pronounced. The difference appears to be that in less-developed economies, factors beyond digitization are more critical to quality of life: of primary importance is food; then housing, clothing, water, and energy; followed by health; and finally transportation and communication. As a result, it would appear that, as expected, digitization has an impact on quality of life only when the population has satisfied its basic needs.

Increasing digitization also supports better access to basic services, as measured by the UNDP's HDI, which tracks global access to health and education as well as overall living standards. Our analysis indicates that, as countries become more digitized, all of these measures improve (see Figure 5). Digitization's impact on the measures of health, education, and living standards is more pronounced in constrained and emerging economies, with a 10-point increase in the digitization score leading to an increase of approximately 0.13 points in the HDI. As economies develop, access to basic services becomes a given and digitization's impact is less pronounced.

To sum up, the correlational analysis suggests that digitization has an impact on social well-being, partially as a result of the increased access to basic services. However, because the populations in developing nations are confronted with the necessity of addressing some basic needs—ranging from food to shelter and basic care—that must be satisfied before they can address other issues, digitization would appear to have a less important social contribution there than it does in more advanced economies.

Governance impact

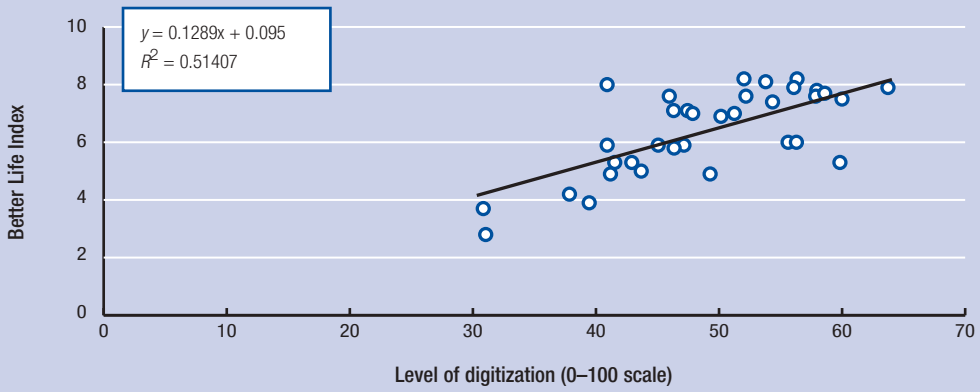
The final area in which we analyzed the impact of digitization was government effectiveness. As for the analysis reviewed above, we relied on three metrics: the transparency of governmental activities, for which we used the 2010 Corruption Perception Index published by Transparency International;[18] the delivery of e-government services, for which we used the e-government development index developed by the United Nations Public Administration Network (UNPAN);[19] and the provisioning of public education—a key government service—for which we used the Inequality-Adjusted Education Index, measured by the UNDP as a subcomponent of the HDI.[20]

Our correlational analysis demonstrates that greater digitization enables a society to be more transparent, increasing public participation and the government's ability to disseminate information in an accessible manner: a 10-point increase in digitization increases the Transparency International index by approximately 1.2 points. Digital technology gives the population more insight into government policies and function—an insight that might, in turn, lead to more active political participation and support the development of human rights.

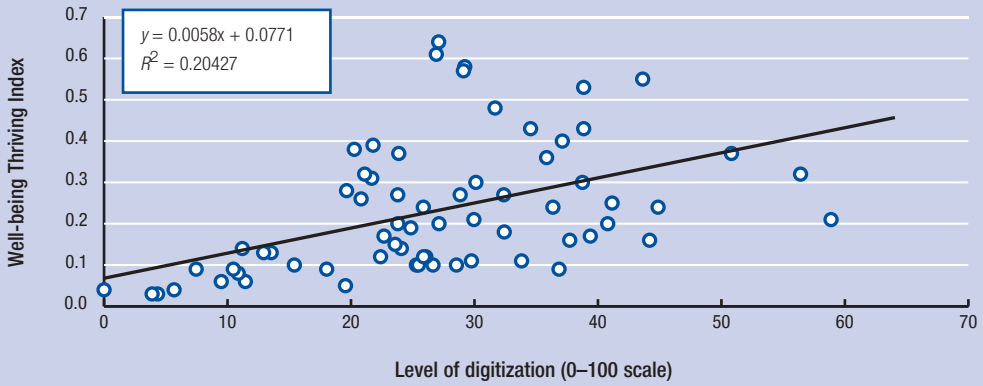
Additionally, as expected, e-government services are more effective in a digitized environment. An increase of 10 points in digitization fosters an improvement in the effectiveness of e-government services (as measured on the UNPAN E-government Development Index) by approximately 0.1 points. Current research indicates that causality in this case acts both ways. Higher digitization contributes to more efficient delivery of e-government

Figure 5: Societal well-being and digitization

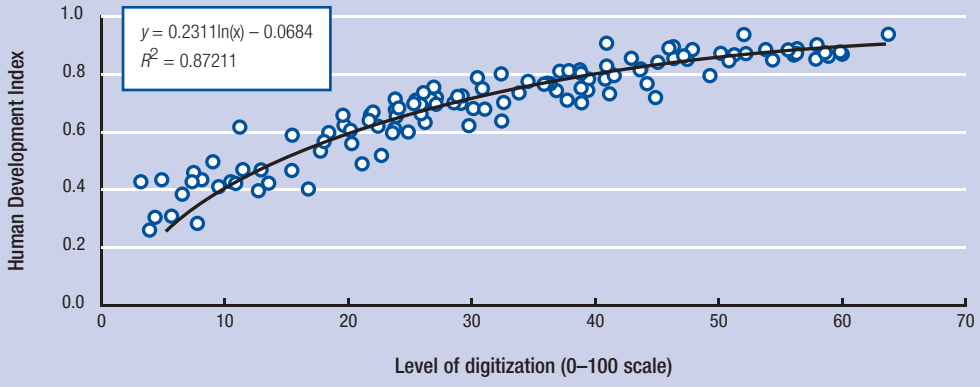
5a: Digitization and the Better Life Index (34 OECD countries)



5b: Digitization and the Wellbeing Thriving Index (67 non-OECD countries)



5c: Digitization and the Human Development Index (120 countries)



Sources: Data from the OECD Better Life Index, Gallup WellBeing Surveys, and the UNDP HDI; Booz & Company analysis.

Table 1: The impact of increased digitization

	Variable	Metrics	Positive Impact of Digitization
Economic	GDP Growth	GDP per capita: Overall	0.60%*
		GDP per capita: Constrained Stage	0.50%*
		GDP per capita: Emerging Stage	0.51%*
		GDP per capita: Transitional Stage	0.59%*
		GDP per capita: Advanced Stage	0.62%*
Society	Job Creation	Unemployment rate	–0.84%*
	Innovation	Global Innovation Index	6.27 points†
	Quality of Life	OECD Better Life Index	1.29 points†
	Access to Basic Services	UN HDI: Constrained & Emerging	0.13 points†
		UN HDI: Transitional & Advanced	0.06 points†
Governance	Transparency	Corruption Perception Index	1.17 points†
	E-government	E-government Development Index	0.10 points†
	Education	Inequality Adjusted Education Index: Constrained & Emerging	0.17 points†
		Inequality-Adjusted Education Index: Transitional & Advanced	0.07 points†

* 10 percent increase in digitization; † 10-point increase in digitization.

services, while better e-government services stimulate an increase in digitization.

Finally, digitization supports better delivery of basic government services, such as public education. As previously noted, digitization's impact on the human development indexes and subindexes is more pronounced in the case of developing countries, and a 10-point increase in digitization results in an approximately 0.17-point increase in the Inequality-Adjusted Education Index. However, this trend is projected to level out in developed countries that have access to such basic services.

Summary

Overall, our analysis indicates that digitization clearly has a positive impact on economic advancement, social well-being, and government effectiveness, although this impact varies according to a country's level of digitization. Digitization has an increasing impact on the economy and quality of life as countries advance through the stages of digitization, and more impact on access to basic services and education in countries that are just beginning their journey (see Table 1).

KEY POLICY IMPERATIVES

The digitization index and analysis will be an invaluable tool for countries to understand their current level of digitization and how to build on it.

In recent years, both developing and developed countries have invested significantly in broadband infrastructure, ensuring that their citizens have high-speed access to the Internet and communications services. But this investment is not enough. We studied the countries that have made rapid advances through the four stages of digitization to see what measures and policies contributed to their progress and found that policymakers can play a pivotal role by focusing on five key imperatives.

These imperatives are critical for all countries—both the mature economies that have reached the advanced stage of digitization, and the developing economies that fall primarily into the constrained, emerging, and transitional stages of digitization. They are:

- **Elevate digitization on the national agenda:** Ensure that national policy and senior government stewardship provide the platform for progress; create a plan for digitization that is tracked and monitored, with accountability residing at senior levels of government.
- **Evolve sector governance:** Segregate regulatory and policy roles; clarify both ownership and accountability for ICT and digitization.
- **Adopt an ecosystem philosophy:** Address the convergence of telecommunications, media, and information technology; develop a strategy that addresses all stages of the value chain in a holistic way; and consider the local ecosystem as well as export opportunities.
- **Enable sustainable competition:** Develop a competitive ICT model that stimulates both innovation and adoption, while ensuring sector sustainability and investments.
- **Stimulate demand:** Invest in boosting digitization usage and service adoption; ensure that public services are available through e-channels.

Depending on their current stage of digitization, countries will vary in how they can implement these imperatives.

Elevating digitization on the national agenda

To reach the advanced stage of digitization and realize the wide-ranging benefits it offers, countries need support from the highest levels of government. National leaders must formulate and commit to a national digitization policy, with oversight at the executive branch level. Governments need to play a leading role in setting the agenda for digitization because many participants are seeking to stake a claim in this fast-growing arena. As a result, without a coherent strategy and oversight, the sector may devolve into a "tragedy of commons" in which too many competitive stakeholders impede progress.

Governments also need to recognize the importance of the ICT sector for overall economic growth and treat it accordingly, rather than focusing on the direct tax revenues it can offer. Many developing countries still struggle to make the transition from viewing the sector as a source of tax revenue to understanding it as an enabler of socioeconomic development. But countries that have made that transition have been rewarded. For example, in recognition of its role as a vital economic enabler, Qatar has reduced the royalties paid by the telecommunications sector and as a result has incentivized investments, growing the ICT sector's contribution to Qatar's GDP by approximately 16 percent for the last five years and doubling Qatar's share of total ICT activity in the Middle East region.

Another essential element of elevating digitization to the national level is to create an effective system that measures, tracks, and demonstrates conclusively the significant impact of every dollar that is invested in it. First, policymakers need to create a detailed national- and sector-level digitization plan, clearly identifying goals, milestones, and corresponding metrics. Second, policymakers need to institutionalize systems to measure and monitor digitization progress against those plans, while creating accountability for the targets defined.

Irrespective of their stage of digitization development, most economies are still in the process of establishing the relevant metrics. Some developed countries have revised and refined their plans; for example, the United States has laid out its National Broadband Plan. Its six goals (ensuring high-speed Internet in 100 million homes, providing leadership in mobile innovation, developing a ubiquitous and robust broadband network, ensuring affordable broadband service, establishing wireless nationwide access for first responders, and enabling a clean energy economy) are intended to bring "the power and promise of broadband to us all."[21]

Evolving sector governance

Governance is another critical consideration. Countries need to effectively fulfill four complementary roles: policy, regulation, sector development, and e-enablement. Each role must maintain a distinct and dedicated function, yet must be coordinated with the others. In finding this balance, countries may choose to establish separate institutions or create clearly defined roles within an umbrella organization. Although the separate institutional model initially allows better focus and enables more effective capabilities building, countries might opt to envelop all four governance functions within a single organization to ensure synergies and efficiencies, as the United Kingdom and Qatar have done.

Countries' approach to ICT governance should also enable close collaboration between the public and private sectors, through industry forums, government and industry policy consultations, and frameworks for public-private partnerships (PPPs). Developing an effective PPP model requires countries to provide incentives for less-attractive investments while enabling the private sector to target high-return investments. For example, governments may decide to fund broadband deployment in remote areas, but let the private sector target the attractive urban areas.

Finally, effective governance will allow for close collaboration among telecommunications, media, and technology players, as well as the integration of the ICT sector with other industry verticals. Common agencies—for example, entities that consider sector governance in conjunction for players in telecommunications, media, and information technology—can support such collaboration.

Most developed countries have established strong sector governance. Singapore, for example, has successfully executed its digitization plan and grew the ICT sector by 13.6 percent between 2006 and 2008, due in part to its robust governance. The Singapore Infocomm Development Authority (IDA) is a sector regulator and pursues development; in addition, the Singapore Media Development Authority (MDA) performs the sector regulator and development role in the media sector. Both the IDA and the MDA are coordinated through the Ministry of Information, Communications and Arts.[22]

Developing countries can accelerate development of their ICT sectors by establishing a policymaking function and investing early in a sector-development arm. Saudi Arabia, for example, advanced rapidly through the stages of digitization by ensuring fulfillment of all regulatory and oversight roles at the national level.[23]

Adopting an ecosystem philosophy

Governments need to recognize the changing scope and boundaries of the sector and make policy decisions on the basis of what is best for the ecosystem as a whole. This requires policymakers to recognize the convergence among the telecommunications, media, and technology industries; the integration of the various stages of the value chain, from infrastructure to applications and usage; and the need to look beyond their local markets and capture potential export opportunities.

First, convergence among the telecommunications, media, and information technology sectors demands that governments address all three when formulating ICT policies. For example, developing markets have thus far focused primarily on telecommunications infrastructure, and as a result this sector is fairly well developed. In many developing markets, however, information technology is still lagging. For instance, in the United Arab Emirates, non-telecommunications ICT spending accounts for 21 percent of total ICT spending,[24] compared with 37 percent in developed markets such as Finland;[25] this means that there is significant untapped ICT opportunity beyond telecommunications.

Second, policymakers need to look beyond infrastructure and shift their attention to building local capabilities in creating content and applications. In Estonia, for example, by 2001 ICT companies had contributed to more than 500 million euros in annual revenues and created more than 400,000 jobs since 1999.[26] This encouraged Estonia to launch a Development Fund in 2007 to further develop its knowledge economy, investing in resources such as ICT parks and innovation centers.

Finally, in addition to developing the local ICT ecosystem, countries should explore their ability to capture export opportunities. Countries targeting export opportunities will need to build fairly robust innovation capabilities if they are to become international ICT players. Egypt, for instance, has introduced ICT into its educational system, developed e-content, created technology parks, encouraged the creation of small and medium-sized enterprises focused on ICT via developing technology incubators, and established an ICT Trust Fund that uses ICT to promote and enhance the performance of these enterprises.[27] As a result, Egypt has emerged as one of the largest ICT exporters in the Middle East and North Africa region, with 27 percent yearly growth in ICT service exports from 2005 to 2009.[28]

Enabling sustainable competition

Competition in the ICT sector fosters innovation and drives adoption—two elements that enable countries to progress in their digitization efforts.

Most developing markets see liberalization as a key mechanism to drive competition. Policymakers have favored auctions to introduce competition, while simultaneously generating revenues from finite resources such as spectrum. In Saudi Arabia, for example, Saudi Telecom preparations for market liberalization led to a 9 percent annual growth rate in digitization between 2000 and 2004. This spurred heavy investment in fixed and mobile broadband by the two main service providers, which in turn fueled a 17 percent annual growth in digitization between 2005 and 2010.

In some cases, excessive competition can backfire. In India, for example, excessive liberalization triggered aggressive competition and unsustainable returns for shareholders. In cases where intense competition and market fragmentation hinders investment and creates an innovation roadblock, policymakers should consider strategies to encourage consolidation to restore balance to the sector.

Developed economies are even considering regulated monopolies for certain telecommunications services, such as passive infrastructure, where they recognize the need for protected, utility-like returns. In such circumstances, regulators need to ensure that the monopolistic entity is well regulated and that there is significant service-level competition to spur innovation. Singapore, for example, created a regulatory framework for next-generation that effectively gave Opennet a monopoly in building and operating the country's passive networks. This framework allows regulated returns on investment in infrastructure while ensuring competition in services. Similarly, in the United Kingdom, policymakers are encouraging consolidation of the infrastructure—as evidenced by the merger of Orange and T-Mobile—while maintaining a competitive environment in services.

Stimulating demand

As countries move beyond providing access to ICT, they need to encourage the adoption of connected digital applications by individuals, businesses, and government agencies. Developing markets in the early stages of digitization should focus on boosting demand for basic telecommunications services such as fixed, mobile, and broadband across both public and private sectors. As countries move to more mature stages, governments should focus on boosting service adoption. Governments can also stimulate demand by ensuring that all public services—such as paying taxes, renewing drivers' licenses, and enrolling in school—can be performed using broadband networks.

Creating demand for ICT services requires a high level of ICT literacy and skilled human capital. Policymakers therefore can invest in digitization by providing training programs and education incentives. In addition, they can educate the population about the digital services available. Finally, they can boost usage by promoting high-speed broadband services and ensuring that these networks both are widely available and affordable.

A number of countries in advanced stages of digitization offer lessons in effectively stimulating demand. For instance, France has increased ICT spending at a yearly rate of 5 percent for the past eight years through a number of initiatives.[29] Among these are the Villes Internet association, which works with local authorities to develop Internet-literate citizens;[30] and the Comité interministériel pour la société de l'information, which was created in

2003 to encourage Internet usage, improve public services via technological innovation, and strengthen the competitiveness of French companies.[31]

CONCLUSION

It has been clear to policymakers for several years that digitization has the potential for dramatic economic, social, and political improvements. Anecdotal evidence abounds: water utilities have installed sensors that reduce leakage, saving water and money; healthcare organizations send text messages to pregnant women with advice on prenatal care, creating a healthier new generation before children are even born; fleets of trucks use digital GPS devices that direct them to shorter routes, cutting down on their greenhouse gas emissions.

The challenge for all stakeholders in the ICT ecosystem has been to quantify the impact of digitization. Numerous organizations, including the World Economic Forum with its evolution of the Networked Readiness Index, are taking steps in that direction. Our hope is that this analysis, which illustrates the need to define and measure ICT beyond broadband access, can provide an input on such efforts.

However, realizing the opportunity that broadband presents will require that policymakers undergo a shift in their thinking. They must go beyond considering ICT and focus instead on digitization, with an emphasis on ICT usage rather than just access. They must take into account their current level of digitization in order to ensure that they are focusing on the right investments to advance to the next stage. And they need to look with fresh eyes at policies that were developed a decade ago to understand how they can be updated for a new era.

Policymakers are hopeful about this opportunity, and many are committed to action. The steps they take in the coming years will determine whether they can translate opportunity into reality.

NOTES

1 See ITU's World Telecommunication/ICT Indicators, the World dataBank World Development Indicators (WDI).

2 Morgan Stanley 2009.

3 ITU's World Telecommunication/ICT Indicators and World dataBank World Development Indicators (WDI), available at http://databank.worldbank.org.

4 ITU's World Telecommunication/ ICT Indicators.

5 This attribute is the result of a combination of several measures, taken from ITU's World Telecommunication/ ICT Indicators, Hartley and Mackenzie 2009, and Wireless Intelligence.

6 This attribute is the result of a combination of several measures, taken from ITU's World Telecommunication/ ICT Indicators and the World dataBank World Development Indicators (WDI).

7 This attribute is the result of a combination of several measures, taken from ITU's World Telecommunication/ICT Indicators.

8 This attribute is the result of a combination of several measures, taken from ITU's World Telecommunication/ICT Indicators and Akamai State of the Internet report, 2010.

9 This attribute is the result of a combination of several measures, taken from the Euromonitor World Retail Data and Statistics, the UNPAN's "E-government Web measure index," ITU's World Telecommunication/ ICT Indicators, Webometrics, Bgexpert, and Internet World Stats available at http://www.economywatch.com/economic-statistics/economic-indicators/Facebook_Penetration_Rate, Wireless Intelligence.

10 This attribute is the result of a combination of several measures, taken from the UNESCO Institutes for Statistics, available at http://stats.uis.unesco.org/unesco/TableViewer/tableView.aspx?ReportId=169, and ILO LABORSTA, available at http://laborsta.ilo.org.

11 Proxy measures were used because exact and accurate data were not available. For example, the overall investments in the telecommunications sector was used as proxy to measure the reliability of the underlying network; eight metrics were used to measure usability because of the lack of data that measure actual businesses online and other more indicative metrics.

12 We developed a classic growth model to assess the impact of digitization on national and per capita GDP. This model controls for human capital and capital formation and provides an accurate snapshot of relative impact of digitization on economic development. Similarly, to assess its impact on job creation, we controlled for gross capital formation, foreign direct investment, other financial investments, and secondary school enrollment. In addition, we performed statistical tests on the index to ensure that the components and subcomponents adequately measured different features of the same underlying concept. We performed factor analysis among those tests and estimated the Kaiser-Meyer-Olkin measure of sampling adequacy.

13 See Koutroumpis 2009; Katz 2012; Katz et al. 2010.

14 Given the lack of a large established set of data for historical analysis, this analysis was based on a simple correlation. We recognize that such analysis, while providing an indication of the relationship, does not provide a sense of causality. However, these results will be able to be better measured in the near future as more data emerge. See INSEAD 2011.

15 The Gallup Wellbeing Thriving Index is available at http://www.gallup.com/poll/147167/High-Wellbeing-Eludes-Masses-Countries-Worldwide.aspx#2; the OECD Better Life Index is available at http://www.oecdbetterlifeindex.org/.

16 The UNDP Human Development Index, 2010, is available at http://hdr.undp.org/en/statistics/hdi/.

17 Again, the lack of time-series data prevented us from building a regression model.

18 Corruption Perception Index 2010 results are available at http://www.transparency.org/policy_research/surveys_indices/cpi/2010/results /.

19 UNPAN E-government Surveys are available at http://unpan1.un.org/intradoc/groups/public/documents/un-dpadm/unpan038858.pdf.

20 See the UNDP Human Development Index, 2010, available at http://hdr.undp.org/en/statistics/hdi/.

21 See the National Broadband Plan: Connecting America, available at http://www.broadband.gov/plan/.

22 See Singapore's Ministry of Information, Communications and Arts (MICA) at http://app.mica.gov.sg/ and the Singapore Telecommunications Regulator at the IDA website at http://www.ida.gov.sg/home/index.aspx.

23 See Saudi Arabia's Communication and Information Technology Commission, available at http://www.citc.gov.sa/.

24 WITSA 2010.

25 WITSA 2010.

26 Pihl 2001.

27 Egyptian Ministry of Communications Information and Technology, available at http://www.mcit.gov.eg/.

28 World dataBank, World Development Indicators (WDI).

29 WITSA 2010.

30 See the Villes Internet website at http://www.villes-internet.net/.

31 CISI 2003.

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CHAPTER 1.12

Trusting the Unknown: The Effects of Technology Use in Education

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Governments have been investing in educational technology since the early 1980s.[1] The devices, services, and applications of this technology are constantly evolving, and schools and classroom arrangements continue to develop in order to take advantage of it. The increasing emphasis on personal ubiquitous access to connectivity for communication and information purposes, coupled with the evolution of technology and lower prices, contribute to modifying the context in which investment decisions about educational technology—the technology policies in education—have to be made.

When reviewing these policies, it is striking how little is known about the effects of using technology on the quality of school education,[2] and, more specifically, which particular uses of technology can result in better student performance. If a good evidence-supported knowledge base existed in this domain, then the analysis of these effects, and the factors that determine or condition them, could be used to unveil what works and why. But in the absence of hard evidence, the evaluation of these policies remains an almost impossible endeavor and the whole issue of how these policy decisions are made remains open.

This chapter addresses two questions. First, it looks at what is currently known and the limitations of the existing knowledge base—recognizing the paradox that developing countries, which make comparatively bigger efforts in this domain, lag behind also in terms of knowledge base. Second, it considers both what elements are missing and how the important methodological challenges required to assemble them could be met.

WHY TECHNOLOGY POLICIES MATTER IN EDUCATION

During the past 30 years, governments have made important efforts to support school technology adoption. Typically,[3] school technology policies have involved the acquisition of equipment and networks; the provision of teacher-training programs and teacher-support schemes; and, lately, the development of digital content by public institutions, the private sector, or teachers themselves. There are no estimates about the total amount of these investments, although some data, such as the ratio of students per computer, can provide a very rough indication if compared internationally. No doubt, for most developed and middle-income countries a serious effort has been made; it is likely that the scale of the effort in low-income countries may be proportionally higher.[4]

The rationale for such investments relies on a number of assumptions about the role that school could play in key areas for economic and social development if technology was used in teaching and learning to a significant extent.[5] First, from an economic perspective, it is assumed that the emerging model of the knowledge economy requires not only an increased proportion of digitally skilled workers, but also the development

and acquisition of new skills that depend on, or can be fostered by, technology-enhanced or supported learning processes.[6] It is therefore expected that schools will provide adequate learning opportunities for this acquisition.

Second, from a social perspective, schools have always been seen as a crucial bastion in the struggle against the digital divide, which was originally seen as the gap between those who have access to technology and those who do not. Nowadays, the concept of digital divide has been expanded to include a second definition, according to which the real divide relates not to access but to the ability to benefit from use: young people with equal access to technology could benefit from it in different ways according to their socioeconomic backgrounds and, in particular, to peer pressure. School education is expected to offer compensatory opportunities to perform better for those unable to benefit as intended from technology.

Third, the concept of culture itself has evolved dramatically because technology has not only a direct impact on cultural contents, by generating new forms of cultural expression, but also an indirect impact on the relationships that people have with culture, by allowing every individual to consume and produce, indistinctly, digital content. If school education is expected, among other things, to allow people to benefit from culture, it follows that schools have a role to play and therefore should do their best to address the issues posed by digital culture. And fourth, a policy perspective also has to be considered, because civic values are being challenged by technological developments and, on top of this, citizens are increasingly required to operate in contexts of e-democracy or e-administration. Schools can be seen in this respect as providing an environment where these values can be learned experientially.

Given the scale of the challenges, any of these assumptions would in fact suffice to justify the public efforts made to incorporate technology into school education. However, if there is one key assumption behind technology policies in education, it is that technology, if adequately used, can boost the quality of school education. This improved quality would be the result either of a higher efficiency of teaching and learning or of dramatic changes in the nature of the processes involved, leading to a paradigm shift in education. To sum up, students would learn more, better, or even differently, thanks to technology.

THE EXISTING KNOWLEDGE BASE

As in many other areas of public policy, the education sector has been subject to an increasing public scrutiny in which data and indicators both play a major role. Policymakers can now look at an expanding knowledge base that allows them to make informed decisions on the basis of benchmarking indicators.[7] They could also benefit from a dedicated (sub) set of indicators in education that would allow to them to benchmark inputs, processes, and outcomes in relation to technology policies in education, and situate all of these factors in an appropriate context. If the overarching policy ambition is that students learn more, better, or even differently thanks to technology, then the corresponding indicators should provide factual information about the extent to which this is actually happening; in sum, they should tell the whole story about the effects of technology in education—or at least provide useful indications.

Given the importance of the policy goals and the assumptions made, it could be expected that there would be an ever-growing knowledge base about the effects of technology policies in education. Yet the reality is that even the most well known international sources for education indicators lack basic information about technology policies in education. For developed countries, neither the Organisation for Economic Co-operation and Development (OECD) nor the European Commission has a comprehensive set of indicators (that is, one involving inputs, processes, and outcomes), although they both are increasingly improving the dataset to include, for instance, assessments of student performance in digital skills. In fact, the OECD's Programme for International Student Assessment (PISA) dataset remains the most reliable source of information on access, use, and outcomes in this domain,[8] despite its limitations in terms of geographical coverage and reliability,[9] and its inadequacy regarding current classroom practices.[10]

For developing countries, the situation is even worse. UNESCO has only recently begun some regional initiatives intended to provide at least a comparative worldwide perspective of access to computers and the Internet in schools, while the World Bank's System Assessment and Benchmarking for Education Results (SABER) initiative and the Inter-American Development Bank are currently focusing in a compilation of detailed information about technology policies in education, mostly from a qualitative perspective. Unfortunately, neither of these initiatives has yet produced tangible results.

As has been pointed out several times—for developed countries,[11] as well as developing ones[12]—the existing knowledge base is quite scattered and limited in scope: it covers only some of the important aspects related to the inputs (how many devices have been sent to schools, for example); it provides only very limited information about the processes (how many students per device, for example); and it is rather confusing, if not biased, in relation to the outcomes (the effects of technology use on student performance).

The three reasons that the knowledge base is so limited and scattered are each related to a different piece of the puzzle: inputs, process, and outcomes. The first reason is an overemphasis on access as a key objective of technology policies in education. The second reason derives from the methodological challenges that

the investigation of the teaching and learning processes poses, in particular in relation to the role that technology plays in the improvement of student outcomes. The final reason is the poor understanding of what the issue about the effects of technology in education really is and how to address it.

Inputs: An overemphasis on access

In many respects, the public discourse about technology policies in education seems to be stuck back in the mid 1980s. Then the key policy goal was to grant access to emerging technologies (computers); at that time, very few students had a computer at home. Thus introducing computers into the classroom was seen as an efficient strategy to cope with the digital divide between the haves and the haves not. Although in many developed countries this policy goal does not apply because of the high level of technology equipment in homes, the public discourse still seems to privilege investments in equipment and connectivity as an appropriate way to modernize schools.

Certainly, there are policy advantages in this overemphasis on granting access to technology in schools. One is that the required investments have a high visibility: equipment shines—even if it is actually used only marginally, if at all. Taxpayers can easily see how public money translates into real investments. On the other hand, technology equipment also has also a symbolic value over other possible investments in education: equipment talks, because it conveys the promise of modernization and symbolizes the commitment of public authorities to support quality education.

Back in the mid 1980s it made a lot of sense to set benchmarking indicators about access to technology in schools, because that was in line with the policy priorities at that time. This resulted in a focus on clearing data about the ratios of students per computer and, more recently, about the percentage of schools connected to broadband Internet. In fact, two complementary indicators are used: the number of devices or services that have been installed (inputs) and the ratio of students per each of these devices—which is, in fact, how far the existing indicators about educational technology can go in terms of process. As an example, Figure 1 presents the latest available data (2009) about the progress made in terms of access to computers in schools by reflecting the evolution of the ratios of computers per student between years 2000 and 2009.

No doubt, in most developed countries the ratios have improved, sometimes dramatically, in just nine years. However, the significance of such a measurement becomes problematic because, lacking other indicators, access becomes overemphasized. Implicitly, the overemphasis on these measurements sends the public message that reducing ratios is a relevant policy concern—regardless of whether the effects of such a reduction on student outcomes are barely correlated, if not entirely unknown. The current problem with this overemphasis on access is that it diverts attention from the core issue: the intensity and variety of uses of technology for enhancing the quality of learning.

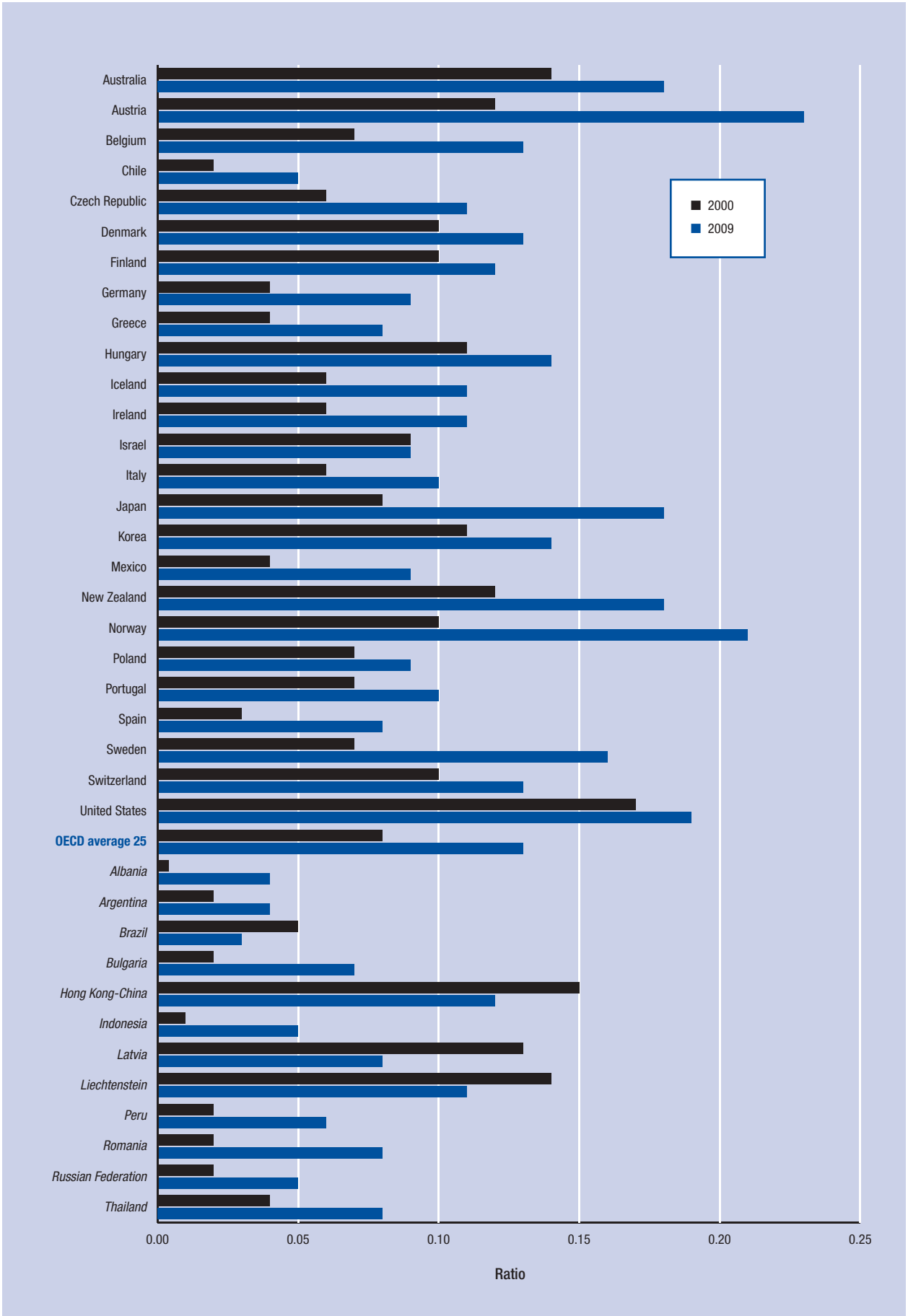
Process: The unaddressed challenge of investigating the role of educational technology

In the context of providing public services, school education is very unusual because it is strongly dependent on the professional decisions made by the teaching professionals, quite often taken individually in the context of a particular classroom and a given subject matter. Obviously, the quality of the educational system cannot be higher than the quality of its teaching body. Yet, in education, policies modify the conditions under which teachers operate, but they hardly modify the nature of the processes involved—that is, teaching and learning. In this context, technology policies have mostly tried to open a window of opportunity for teachers to become more efficient and eventually transform the processes for which they are responsible. But the final responsibility of technology adoption has always been, and will continue to be, in the hands of each individual teacher. This is why technology policies have tended to focus solely on providing access to technology opportunities, assuming that every individual teacher would benefit from this opportunity in the most professionally sound way.

Interestingly, this leads to another important issue that goes beyond technology policies: the governance of school education, particularly when it comes to the issues driving teaching practices. In most countries, the education sector still lacks the kind of evaluation, support, and incentive arrangements that are already found in other areas of public service. How, in the absence of professional evaluation systems, teachers can get their professional development needs duly identified; can be provided with adequate tailored support; and, finally, can be rewarded for good practices remain questions open to policy debate internationally. The problems encountered in relation to how teachers' technology adoption can be driven, monitored, and supported is an indication of the current weakness in policy and governance arrangements in the education sector.

There are also technical issues related to measurement. To begin with, it is worth considering that there are no well-established monitoring systems of teaching and learning practices. In other words, when it comes to analyzing predominant classroom practices, most educational systems are totally blind. What is even more important is that this missing information puts a severe constraint on the ability of educational systems to link practices with student outcomes. Clearly, this lack of monitoring arrangements also sets the current limits on what is known in relation to classroom practices with

Figure 1: Computers-per-student ratios, 2000 and 2009



Source: OECD, 2011.
Notes: OECD average 25 is the average value for the non-OECD participating countries in this survey. Names of partner countries are italicized.

technology—to put it simply, these practices are not monitored at all.

The issue of measurement has a second aspect: the specific difficulties linked to monitoring technology use. Measuring access to technology is far easier than measuring its use, in every sector. In addition, the way in which access is measured in education has nothing to do with the intensity of access, but rather it is linked to the availability of resources—in particular computers and Internet connections—to grant teachers and students opportunities to use technology, whether these opportunities are realized or not. Measured this way, technology use seems to be equivalent again to technology provision but, as a very well known essay on this issue recalled some years ago,[13] it may well be that equipment is oversold and underused, resulting in the paradox of high access but null significant use. An initial indication of this can be seen in Figure 2, which shows the time spent using computers in language-of-instruction lessons, as declared by 15-year-olds in PISA.

The effects: Rephrasing the question

In the domain of technology policies in education, a very simple question is quite often posed: does technology-supported education make a difference? Or, more generally, does technology lead to better student results? When looking for a response in the existing knowledge base about the effects of technology in education, a striking fact seems to emerge: there is no conclusive evidence. This has been known for some years as the "non-significance phenomenon,"[14] leading to the overall conclusion that, in education, technology makes no difference because the investments made have not translated into improved educational productivity,[15] thus reasserting Solow's productivity paradox in the education sector.[16]

Although it appears that the answer to such a question (whether technology improves students' results or not) is quite intuitive, the problem is that the question is neither logical nor useful because it is not formulated in a way that takes into account the complexity of education. Additionally, and more importantly, it does not help to inform policy decisions in an appropriate way, leaving unanswered the issue of whether the investments in technology are worth the effort. Briefly, when phrased this way, without caution, the issue leads to confusion because it is ill-defined or, at least, not sufficiently defined for a proper empirical assessment.

Behind all this ambiguity is a poor understanding between those who make the decisions about investments and those who are expected to benefit from them, because two different rationales are quite often in place. The former would like to receive a clear-cut response about whether or not the investments in educational technology pay off. For the decision makers, these investments are one possible option among many. Teacher training, career incentives, salary increases, or a decrease in class size are just some of the alternative options for educational investments that policymakers can use to improve the quality of education. To make informed decisions, policymakers need cost-effectiveness analysis—although their final decisions could also take into account other factors, such as the symbolic value of the proposed policy. For them, the issue is straightforward: is it worth investing in educational technology?

Teachers and educationalists look at the issue very differently. They usually insist on the complexity of education—that is, on the fact that learning is not only a function of formal teaching activities that take place in the classroom but also of other, nonformal educational influences that can hardly be accounted for in the productivity equation of school education. Activities undertaken by the learner outside school—and even inside school—at home or with peers interact with those carried out during formal instruction hours. As a result, when learning results are measured—as in the context of national or international student assessments—it is almost impossible to isolate the role played by one individual teacher in one specific subject matter during one particular academic year.[17] For the same reason, it is also impossible to isolate the effects of the technology components in learning from the most important factor: the strategies put in place.[18]

Therefore, the issue about the effects of technology in education has to be rephrased in a way that takes into account the complexity of the intervening factors in learning. The real question is not about whether to use technology or not, but about teaching and learning strategies and the ways in which technology solutions can make them more efficient. The problem is that no data are available to address this question comprehensively as of yet.

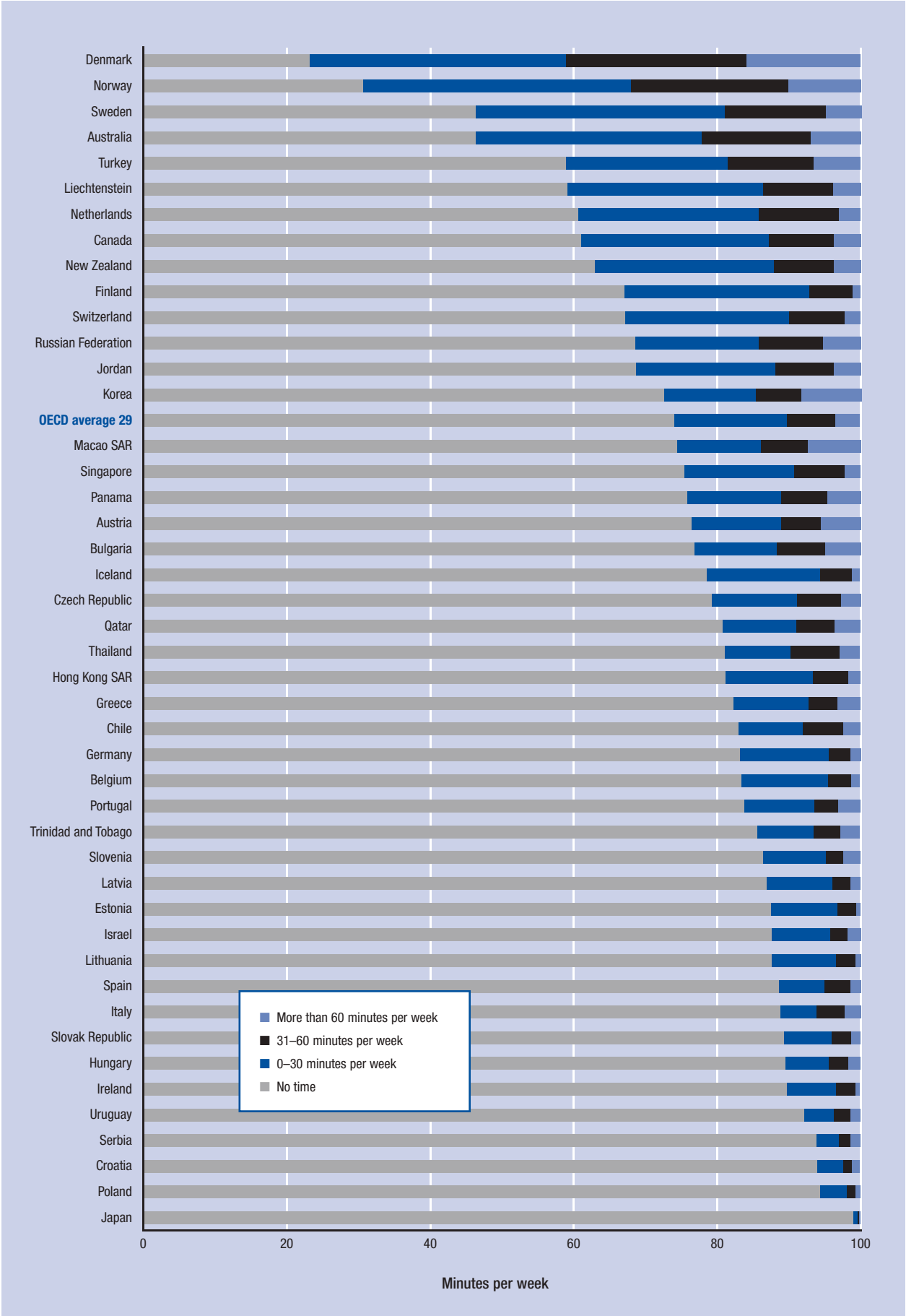
DATA MUST INFORM POLICYMAKING

Despite the limitations of the existing knowledge base, there is no particular argument against a functional approach—one that considers inputs, processes, outputs, and context—in the assessment of technology policies in education. This simple approach provides a clear way to address the key questions, although it has been challenged by competing perspectives.[19] Yet, as it can be seen below, these questions remain mostly unaddressed.

Inputs

The key questions about the inputs of technology policies in education include three different domains: (1) the nature of the technologies proposed and their range (how many different solutions are being backed), (2) the relative financial effort made to support them, and (3) the equitability of access to technology inputs. More specifically:

Figure 2: Intensity of computer use during language-of-instruction lessons



Source: OECD, 2011.
Notes: OECD average 29 is the average value for the non-OECD participating countries in this survey.

1. *What is the nature and range of educational technologies put into the hands of users?* Despite the fact that most literature still refers only to computers, there are competing technology solutions, some of which (such as interactive whiteboards) are more appropriate for teachers, while others (such as tablets) are more suitable for learners. Data about the nature and range of these solutions would help to understand better what type of educational models are being proposed—whether, for instance, they privilege teaching technologies (like interactive whiteboards) or learning technologies (as in one-to-one computing initiatives).
2. *What is the relative size of the investment in educational technology?* The answer to this question should provide key data about the investment in educational technology per user, distinguishing between technology for teacher and for student use. In addition, the resulting data could be compared with other important indicators, such as average teachers' salaries, to provide relevant information about the relative effort made and the comparative importance attached to educational technology.
3. *How equitable is access to educational technology?* The issue of the digital divide is still relevant in most countries, although inequity of access is higher in developing countries. In this particular domain, variance across schools and territories can give an indication of equity of access, which may be linked to poorly designed technology policies (which can neglect the realities facing the teachers, in some cases), or to technology limitations (such as weak networks).

Process

Questions about processes point to a lack of clarity about the purpose of educational technology and thus an ambiguity in its role in teaching and learning. This is far more difficult to measure than the inputs, because a single technology device or service permits multiple uses. Moreover, any attempt to unveil the role that technology plays in teaching and learning would require a degree of transparence in what is going on inside the classroom that currently either does not exist or cannot easily be accepted by the teaching profession. This poses a methodological challenge: how to address the issue of how little is known about the teaching and learning processes. Although the challenge is currently on the agenda of major international assessment efforts, it will take a long time to obtain a clear picture of what teachers and students actually do in the classroom. In the best-case scenario, the areas to be covered are the following:

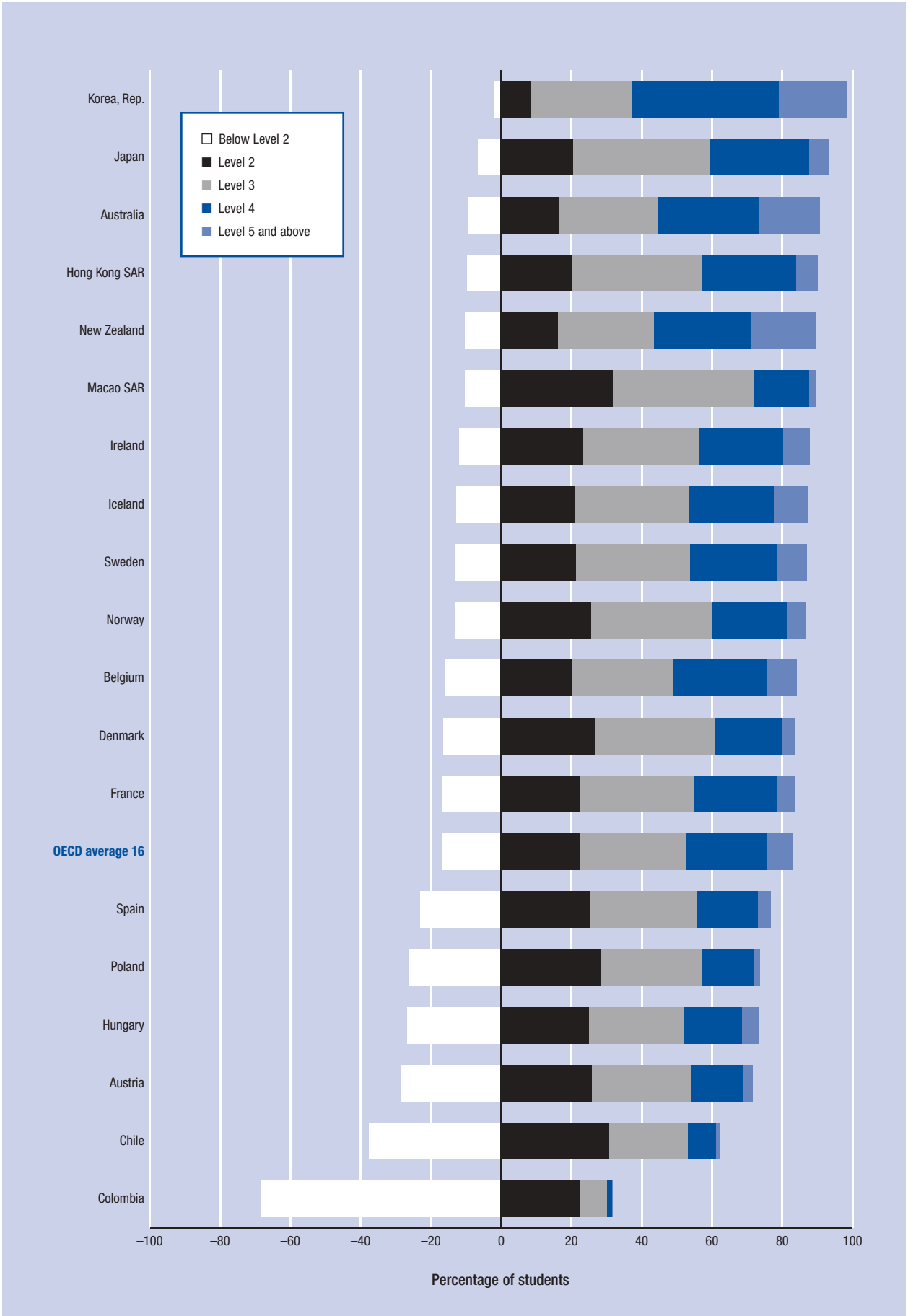
1. *For what purposes are the different technology solutions being used?* This is commonly known as the issue of the variety of ways that technology can be used. Addressing it must take into account not only different subject areas but also different ages and educational levels of students. Again, it is important to distinguish between uses of technology by teachers and uses by students. In both cases, different technology solutions can be adopted inside the classroom and outside it—for instance, one solution may be used to prepare lessons and a different solution used for doing homework. Thus a comprehensive approach that considers what the user of the technology does in different and multiple settings is needed.
2. *How long is each technology solution being used?* This second question relates to the intensity of the use of technology. As for the previous question, it is important to address this by considering different intervening factors: the type of technology, its purpose, the subject area, the type of user (teacher or student), the educational level, and the location in which it is used. Although some international surveys provide initial indications, existing measures of the intensity of use are left to the individual user and, as it has been already seen, teachers and students tend to have very different perceptions.

Effects on outcomes

To establish a comprehensive approach to the effects of technology in education, two important elements are missing. The first missing factor is a knowledge base about how technology is actually being used in the classroom, which in turn points to the need for a better understanding of the two key variables of intensity and variety of uses. The second missing element is an exploration of the learning outcomes that, going beyond traditional subject areas, are more closely related to technology; these are widely known as "21st-century skills." This is quite often seen as the million dollar question: which technology policies contribute most to the quality of education? Which uses of technology boost student performance in the different subject domains? Given the endless array of possible combinations of teaching and learning strategies, the only way to operationalize this question is to look at the relationships between variety and intensity of uses, on the one hand, and variations in outcomes, on the other.[20]

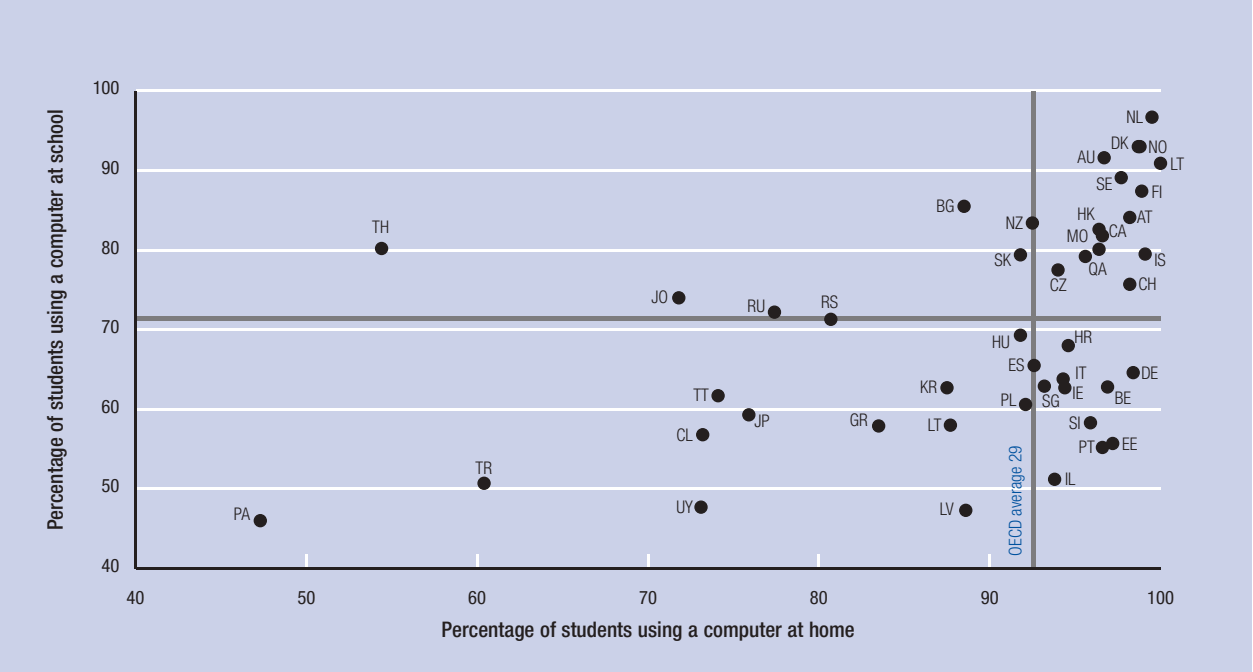
To know more about the contribution of technology to the improvement of learning results, it is necessary to expand the knowledge base about teaching and learning at large—that is, to discover what is going on inside the classroom. A better understanding of the strategies that are currently used in the classroom would not only be informative about the intensity and the variety of uses of technology, but would also be crucial for understanding what works in light of student outcomes and determining the added-value, if any, that educational technology brings to teaching and learning both in the classroom and outside it. Therefore, going further than the mere issue of access, there are clearly two areas for which more information is needed: the intensity and the variety of educational technology usage in the classroom. The

Figure 3: Proficiency of 15-year-olds in digital reading, 2009



Source: OECD, 2011.
Note: OECD average 16 is the average value for the non-OECD participating countries in this survey.

Figure 4: Percentage of 15-year-olds who reported using a computer at home and at school, 2009



Source: OECD, 2011.

Note: OECD average 29 is the average value for the non-OECD participating countries in this survey. Each economy is identified by the two-letter abbreviation used for Internet top-level domain names, available http://www.greenbuilder.com/general/countries.html: AT = Austria, AU = Australia, BE = Belgium, BG = Bulgaria, CA = Canada, CH = Switzerland, CL = Chile, CZ = Czech Republic, DE = Germany, DK = Denmark, EE = Estonia, ES = Spain, FI = Finland, GR = Greece, HK = Hong Kong SAR, HR = Croatia, HU = Hungary, IE = Ireland, IL = Israel, IS = Iceland, IT = Italy, JO = Jordan, JP = Japan, KR = Korea, Rep., LI = Lichtenstein, LT = Lithuania, LV = Latvia, MO = Macao SAR, NL = Netherlands, NO = Norway, NZ = New Zealand, PA = Panama, PT = Portugal, QA = Qatar, RS = Serbia, RU = Russian Federation, SE = Sweden, SG = Singapore, SI = Slovenia, SK = Slovak Republic, TH = Thailand, TR = Turkey, TT = Trinidad and Tobago, and UY = Uruguay.

intensity of use refers to the amount of time and the sequence of use—that is, how much a particular technology solution is being used, either by the teacher or by individual students. The *variety of use,* in turn, is related to the vast array of uses that a particular technology device or service allows—again, either in the hands of the teacher or the student.

An exploration of the outcomes also requires addressing the growing number of calls for a wider approach to skills formation for the knowledge economy and society. These calls insist on the need to include those 21st-century skills in national and international student assessments. Although an international consensus about what these skills are or how to assess them adequately is not yet in place,[21] what emerges from the ongoing discussions is that many, but not all, of these new skills can be duly trained and assessed only through an intensive use of technology solutions. This in turn provides an opportunity to assess the actual benefits to be obtained by using technology in education. A good example of the relevance of this type of assessment is given in Figure 3, which presents the results of the first assessment of student outcomes in digital reading.[22]

To sum up, the evaluating the interaction among processes and outcomes should take into account two different types of outcomes:

1. outcomes in traditional subject areas or skill domains, such as literacy, mathematics, and science, which are those most often assessed in national and international student assessments; and
2. outcomes in new skill domains, such as those often considered to be part of the set of 21st-century skills—these include digital literacy as well as other skills whose execution can be either supported or enhanced by technology.

In addition, it is in outcomes that the complex issue of equity has to be examined, by focusing on the weight of key variables such as gender, socioeconomic status, and location in determining what outcomes are actually achieved.

Context

The investigation of contextual factors is critical to an understanding of the reasons that particular technology solutions receive more financial support, are more widely used across the board, or are more closely linked to better student outcomes. As in other policy sectors, the range of contextual variables can be overwhelming and the right choice can be made only on the basis of a sound theory about educational technology use. A good example of the importance of contextual variables is offered in Figure 4, which presents the percentage of

15-year-olds with access to a computer both at home and at school. Clearly, the gap between the two uses (at home and in the classroom) is far from being constant across countries, thus indicating that intervening variables do matter more than contextual pressure.[23]

The analysis of the contextual variables should consider three different layers:

1. *The micro level:* This level looks at the classroom and, in particular, the individual characteristics of teachers and students, including attachment to technology and views about teaching and learning.
2. *The meso level:* This level considers the school and, more specifically, the institutional policies concerned with educational technology, including technical and educational support arrangements.
3. *The macro level:* This level takes into account the technology policies in the education sector, as supported and enforced by the corresponding public authority at the system level.

METHODOLOGICAL APPROACHES AND CHALLENGES

There is no doubt that data gaps remain unaddressed because of the serious methodological challenges and the scale of the efforts required to address them. Rather than dedicated questionnaires to ministries, which can answer only questions about investments and access, what may work best is a mixed-methods approach that combines empirical experiments, large-scale surveys, and direct observations.

The challenges ahead

In the investigation of technology policies in education with a focus on their effects, three methodological challenges are particularly demanding. These are (1) the way in which teachers make decisions about the role attached to technology in their teaching and learning strategies; (2) the differences present across disciplines and subject areas; and (3) the growing opportunities to use technology from which students benefit outside the classroom.

First, it is essential that the professional decisions a teacher makes about teaching and learning strategies do not consider technology components in an isolated way.[24] Teachers, in light of their assumptions, professional judgments, and available resources make choices in the context of what can be considered to be a constellation of technological opportunities, with a wide range of possibilities that can include the blackboard and printed books and workbooks as well as interactive whiteboards, teacher computers or student laptops, and tablets or portable devices. Teachers do not consider decisions about what particular technology suits them more as if one technology option excluded the rest; instead, they consider which technology solutions (that is, what particular combinations of resources and tools) best suit their teaching and learning strategies for a given purpose.

Second, both intensity and variety of use have to be examined specifically for different subject areas (language, mathematics, science, foreign languages, social sciences, etc.) because the disciplinary cultures as well as the particular learning objectives set for each area require different teaching and learning strategies. Accordingly, it may be expected that different educational technology approaches will also emerge in each subject area.

And third, in yet another important challenge for education, the issue of how today's students relate to digital devices and services in their daily lives and how much they rely on them for information and communication has to be addressed. Young people play an important prescribing role when it comes to families' propensity to buy technological devices or services, as it can be seen in the difference in the percentage of homes with children that have Internet access and those homes without children that have Internet access. On the other hand, children—adolescents in particular—tend to use technology solutions that suit their socialization needs, leading to high levels of technology attachment. Although some experts are convinced that this reliance immediately translates into higher student expectations of technology use in the classroom—a claim that research has not yet been able to support—students do use technology solutions to address their learning needs at home. Typically, they benefit from computers to do their homework and from the Internet to download resources and communicate with peers—partially, but not only, about homework. Clearly, the particular way in which students benefit from technology solutions to learn outside the classroom has to be considered when trying to ascertain the effects of technology on student outcomes.

A mixed-methods approach

There is no doubt that a winning methodological strategy to analyze the effects of technology in education will have to be a mixed-methods approach. Although questionnaires addressed to ministries can work relatively well in centralized systems to investigate the scale of the investments or the state of access, they hardly can be of any use when a more comprehensive perspective, including processes and outcomes, is envisaged or when technology policies in education are decentralized—particularly if the competent authority is each individual school, as seems increasingly to be the case. Empirical experiments, large-scale surveys, and direct observations can be used to address different research questions and, if appropriately combined, result in a holistic approach.

Empirical experiments serve the purpose of investigating which technology solutions result in better

learning outcomes while keeping other intervening factors constant. Yet they pose the challenge of how to reach a critical mass of evidence from which clear messages can emerge, which is not yet possible. As has been repeatedly shown,[25] different attempts to conduct meta-analysis provide inconclusive, if not confusing, messages. This is probably because existing experiments have taken a piecemeal approach, using alternative theories that can hardly be combined into one theoretical body and focusing on small-scale and very specific interventions.[26] National and international efforts should be made to reach scientific consensus about the lessons learned and the way forward.

Large-scale surveys, both national and international, can provide basic data about the intensity and variety of uses of technology, although these also have important drawbacks. The most important problem with these surveys is that the perspectives of teachers and students have to be combined to obtain a balanced picture. Teachers, on the one hand, may be tempted to provide socially appropriate responses that suit the taste of the public authority on which they depend, possibly overstating the use of technology. Students, on the other hand, may not be qualified enough—because of their age and their lack of wide experience and mature judgment and expression—to properly qualify either the intensity or the variety of uses: hence the problems with surveys of primary school children. However, surveys have an important role to play in determining how and for what purpose technology is being used at the system level, as well as the internal variance present across territories, schools, or subject areas. If, instead of questionnaires dedicated to technology usage, student outcomes assessment surveys were used, then the resulting knowledge base could be boosted by linking outcomes to intervening factors and thus setting the foundations for a general theory.[27] Ideally, to properly address the issue of the effects of technology, student assessments should provide data about performance both in traditional subject matters and in the more specific domain of the digital skills.

And finally, direct observations are quite complicated methodological exercises that frequently bring up questions about intrusiveness or fake behaviors. However, such observations are the only way to understand the dynamics of technology use in the classroom. They are essential for understanding the reasons behind teachers' professional choices, which would otherwise remain incomprehensible, as well as for knowing the rationale for students' preferences in detail. Ultimately, direct observations can result in a wide array of assessments of what works.[28] When well documented, they facilitate the identification of the key factors to consider when replicating successful experiments and scaling up the lessons learned, thus setting the pace for true systemic innovation.[29]

CONCLUDING REMARKS: HOW ARE TECHNOLOGY POLICIES IN EDUCATION MONITORED AND EVALUATED?

In the context of the issues just discussed, it is easy to conclude that technology policies in education are far from being based on evidence. The limited scope and scarcity of the existing knowledge base would certainly support this conclusion. Moreover, in the absence of a robust knowledge base and appropriate monitoring and evaluation arrangements, there is no way to inform policymaking with empirical evidence. As the title of this chapter suggests, policymakers may be trusting an unknown. However, they may be doing it for a reason: by prioritizing access to technology they convey a very simple message—that they are using taxpayers' money to modernize schools in a way that can be actually seen and touched. What use schools and teachers make of this modernization opportunity it is a different issue that can be addressed only if more powerful accountability systems are in place.

Hopeful indications point to a transition initiated less than two decades ago with the emergence of national and international student assessments. When it comes to an analysis of the effects of technology in education, these large assessment efforts should be seen as a window of opportunity for investigating further the role that technology solutions play in improving the quality of education. But the right research questions must be asked. Because educational phenomena are quite complex and multi-faceted, the right questions are not about whether or not to use technology at all, but about which technology solutions can best suit the evolving learning requirements that each individual teacher has to manage in the classroom. Equipment may shine and speak for itself, but unless it is properly used no educational effects will be ever seen.

NOTES

1 In this document, a reference to *educational technology* is meant to encompass all kinds of digital devices, services, and applications that can be used in a school context, either by teachers or by students. Yet, from a historical perspective, the first public investments aimed at modernizing the tools at the service of teaching and learning can be said to have started in the mid 1950s with large-scale rollouts of school equipments for radio and television.

2 Unless otherwise stated, all the considerations made here refer to primary and lower secondary education only. The context and characteristics of vocational or higher education would require a different approach.

3 Benavides and Pedró 2007.

4 Among other things, this is because the costs of the devices are roughly comparable worldwide but teachers' salaries are not. The ratio between the cost of a laptop computer and the monthly salary of a primary school teacher tends to be higher than 1 in many low-income countries.

5 Pedró 2011.

6 These are commonly referred to as *21st-century skills.*

7 The UNESCO Institute of Statistics (UIS) publishes in cooperation with the World Education Indicators. Other international organizations, in particular the OECD, publish their own analysis based on the same analytical framework, under the series title of *Education at a Glance*.

8 This is particularly evident since PISA's inclusion of assessment of digital skills, such as on-screen reading. See OECD 2011. The International Computer and Information Literacy study (ICILS) is a study that will provide a more comprehensive assessment of digital skills in the coming years. See also the International Association for the Evaluation of Student Achievement, http://www.iea.nl/.

9 The PISA information about these issues is based only on the declarations of students and head teachers.

10 For instance, no information about the use of interactive whiteboards is available, nor is information about teacher practices with technology.

11 OECD 2010a; Scheuermann et al. 2009.

12 Trucano 2005.

13 Cuban 2001.

14 This expression was first used to indicate that, in the particular case of distance education, research was unable to demonstrate the superiority of technology-supported courses over traditional arrangements of distance education. It has been later extended to all other areas of education. See Russell 1999.

15 Brynjolfsson 1993; Hikmet et al. 2008; Peslak 2005.

16 Triplett 1999.

17 However, different techniques related to the measurement of added value aim at improving the chances of isolating influences.

18 Technology components include both traditional (such as paper and pencil) and digital.

19 Some of these perspectives, representing the views of different international organizations—such as the OECD, the European Commission, or the Inter-American Development Bank—are discussed in Scheuermann et al. 2009.

20 This process assumes that all other variables remained constant.

21 Ananiadou and Claro 2010.

22 No international assessments on other digital skills are available as of yet.

23 This is the argument often claimed by proponents of the "digital natives" discourse. See Prensky 2001a, 2001b.

24 Frank et al. 2004.

25 Olofsson et al. 2011.

26 Ross et al. 2010.

27 This has been the case for developing models of technology acceptance that have been successfully texted empirically in the education sector; see Davis et al. 1989; Schwarz and Chin 2007; Venkatesh et al. 2007.

28 Nachmias 2004.

29 OECD 2010b.

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Part 2

Case Studies of Leveraging ICT for Competitiveness and Well-Being

CHAPTER 2.1

Big Ambitions in Rapidly Changing World: Azerbaijan

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During its 20 years of independence, the Republic of Azerbaijan has leveraged its position as a key oil and gas center in order to develop strong regional ties while simultaneously utilizing its revenues from these sectors to promote economic diversity. Such diversification has been a crucial part of Azerbaijan's national strategy since 1993. The major goals of the government for the upcoming years are:

- maintaining prudent macroeconomic management and improving trade policies and institutions,
- strengthening Azerbaijan`s role as a regional transport corridor and improving the road and highway system within the country, and
- improving the business environment to encourage high growth in non-oil sectors.[1]

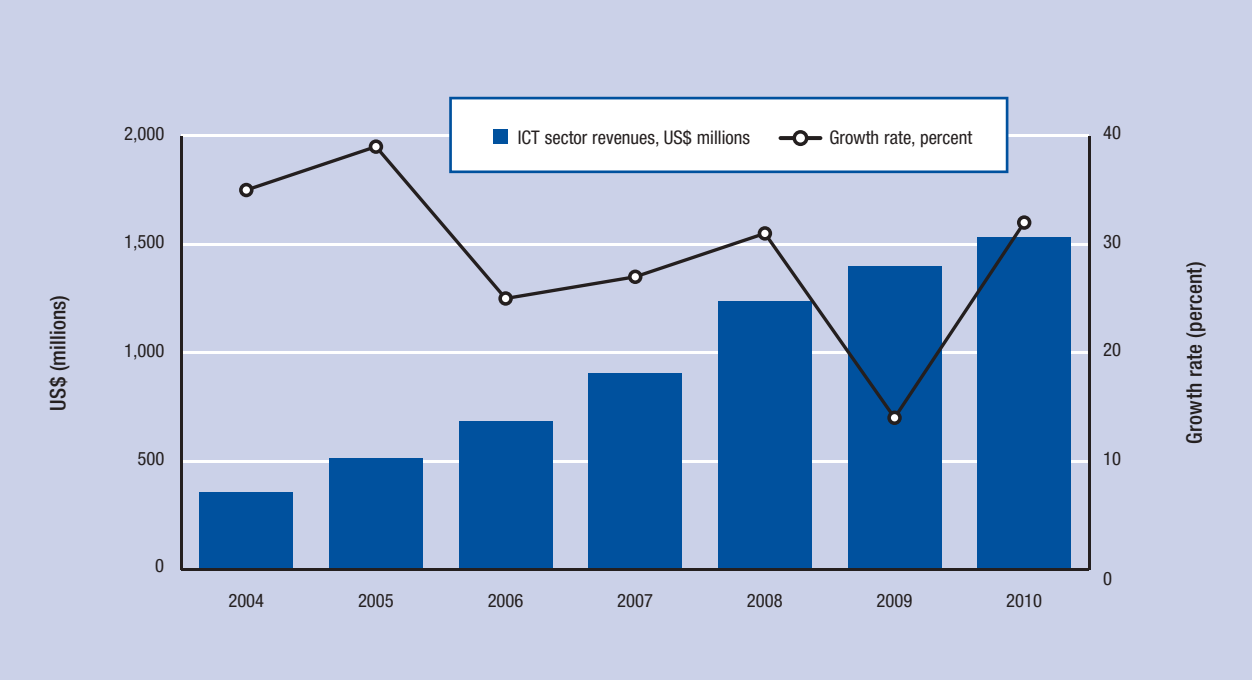
In line with the government's plans for diversification, attracting foreign direct investment (FDI) has been established as a high priority. Accordingly, the government has acted aggressively to create a favorable environment for foreign investment in Azerbaijan. Among the many actions taken by the government in that regard has been to simplify the business registration procedures. In the World Bank's *Doing Business 2011,*[2] Azerbaijan positioned reasonably well in the rankings with respect to starting up a business, registering property, protecting investors' interests, enforcing contracts, and obtaining access to credit. Progress also has been made with respect to the registration period for foreign companies through benefiting e-service applications. It is worth noting that Azerbaijan has been ranked the most competitive economy among the Commonwealth of Independent States (CIS) countries in both the 2009–2010 and 2010–2011 *Global Competitiveness Report*s published by the World Economic Forum.[3]

Economic policies carried out over the last decade have resulted in threefold GDP growth in Azerbaijan. Moreover, budget revenues and expenditures increased by more than eight times and strategic currency reserves reached US$41 billion. Other economic indicators also show a positive trend: the unemployment rate declined to 5.5 percent, the inflation rate decreased to 5.1 percent, and the poverty level dropped to 9.11 percent.

From 2005 to 2010, total investment in Azerbaijan's economy was about US$74 billion.[4] Despite the fact that Azerbaijan's economy has cooled from the dizzy days of 34.5 percent growth recorded in 2006, the country has maintained double-digit growth during the years of the global financial crisis. Although growth has slowed in the oil sector, mainly because of lower oil prices in 2009, the non-oil sector has been able to pick up much of the slack, with the information and communication technologies (ICT), banking, construction, and real estate sectors all experiencing substantial growth.

Several state programs in various sectors—including ICT, tourism, construction, and agriculture—gave a

Figure 1: ICT sector revenues and growth rate, US$ million



Source: State Statistical Committee of the Republic of Azerbaijan.

strong boost to Azerbaijan's economy in 2010. Non-oil economic growth was robust in 2010 at 7.9 percent, compared with 3 percent a year earlier, largely because of significant public investment.[5] Azerbaijan's key economic goal for the next 10 years is to double its GDP. ICT is expected to play a major role in this projected economic development, both in its own right and by supporting the further development of other economic sectors, such as the oil and gas industry.

ICT AND ECONOMIC DEVELOPMENT

In recent years, the ICT sector has played an increasingly important role in the socioeconomic development of Azerbaijan. In recognition of that important role, the government has identified ICT as one of the priority sectors of the national economy, and has taken significant steps toward the formation of an information society and knowledge economy in Azerbaijan.

The strategic development of ICT in the Republic of Azerbaijan is defined by the National Information and Communication and Technologies Strategy for the Development of the Republic of Azerbaijan (2003–2012),[6] along with two state programs concerned with the development of ICT and other relevant programs of Azerbaijan. This strategy consists mainly of three essential pillars:

1. liberalization of the telecommunications market and the creation of an effective regulatory mechanism;
2. development of telecommunications infrastructure; and
3. development and deployment of e-government and e-services.

Liberalization of the telecommunications market

The goals of Azerbaijan's ICT liberalization and regulation include the following:

- maintaining compliance of domestic legislation with relevant international standards and the requirements of the World Trade Organization;
- attracting new telecommunications operators to the market and establishing a sound competitive environment for market participants;
- ensuring the efficient, effective, and fair use of a limited number of resources and frequencies; and
- regulating interconnection issues and ensuring the implementation of advanced practices with respect to telecommunications licensing.

The liberalization of the telecommunications market and the introduction of competition have opened up tremendous opportunities for doing business in the ICT sector in Azerbaijan. As a result, and because of the government's support of entrepreneurship in the sector

Table 1: Major ICT infrastructure development indicators

Indicator	2009	2010	2011
Fixed-line penetration (per 100 inhabitants)	16.0	16.2	18.6
Broadband Internet users penetration	10	15	30
Internet penetration (per 100 inhabitants)	41	50	65
International Internet bandwidth capacity (GB/s)	15	40	87
Digital television broadcast (percent of the country's inhabited territory)	30	45	85
Mobile telephony penetration (cellular subscriptions per 100 inhabitants)	86.2	100	110
Computer penetration (computers per 100 inhabitants)	12	15	20

Source: State Statistical Committee of the Republic of Azerbaijan and the MCIT.

and the establishment of a sound competitive environment to ensure the proper development of the market, new fixed and mobile telephone network operators have begun operation. Currently, there are 4 mobile operators, 7 fixed-line operators, and 35 Internet service providers. The same policies have helped attract ICT commodity equipment manufacturers and broadcasting companies to Azerbaijan.

These developments are reflected by the private sector's share of the overall ICT market, which has soared from 67.3 percent in 2003 to 80.0 percent in 2011. Moreover, all of the above-mentioned market players have been very active in investing. As a result, by 2011 ICT-related investments had summed to US$2.0 billion since 2004, 25 percent of which was in FDI.

Such a high volume of investment inevitably boosted the growth of the ICT sector in general. Azerbaijan has witnessed double-digit growth in the last eight years. During that same period, the income produced by the country's ICT sector increased by 5.3 times. In 2010 alone, ICT generated US$1.5 billion and the annual growth rate of the sector was 32 percent. Furthermore, the share of the ICT sector in non-oil GDP increased by 7.3 percent.

ICT infrastructure development

ICT infrastructure development is crucial. A necessary first step in maintaining the growth of the ICT sector is attracting FDI and increasing the impact and share of ICT in the national economy. Azerbaijan has made significant achievements in developing fixed telephony; increasing broadband penetration and international Internet bandwidth capacity; and improving its television, radio, and mobile telephony infrastructure (Table 1).

Fixed telephony infrastructure

Over the past decade, Azerbaijan's telecommunications and information technology (IT) infrastructure has advanced considerably, both in its use of modern technology and with respect to its geographic coverage. Azerbaijan still is the only post-Soviet state where all residential areas are serviced by landline telephony. In one of the major achievements in the development of the country's telecommunications infrastructure, fixed-line penetration reached 18.6 percent by 2011. Moreover, Azerbaijan's fixed-line network has increased from 48 percent digital in 2003 to 100 percent digital in 2011.

Broadband penetration

Azerbaijan has witnessed significant growth in broadband connectivity, and has a current penetration rate of 30 per 100 inhabitants (Figure 2). In order to expand this connectivity, Azerbaijan has adopted a special action plan for increasing penetration and usage of broadband and Internet in 2012 and 2013. These efforts to increase broadband penetration will benefit from Azerbaijan's relatively high level of fixed-line penetration, which provides the basis for fixed broadband connections.

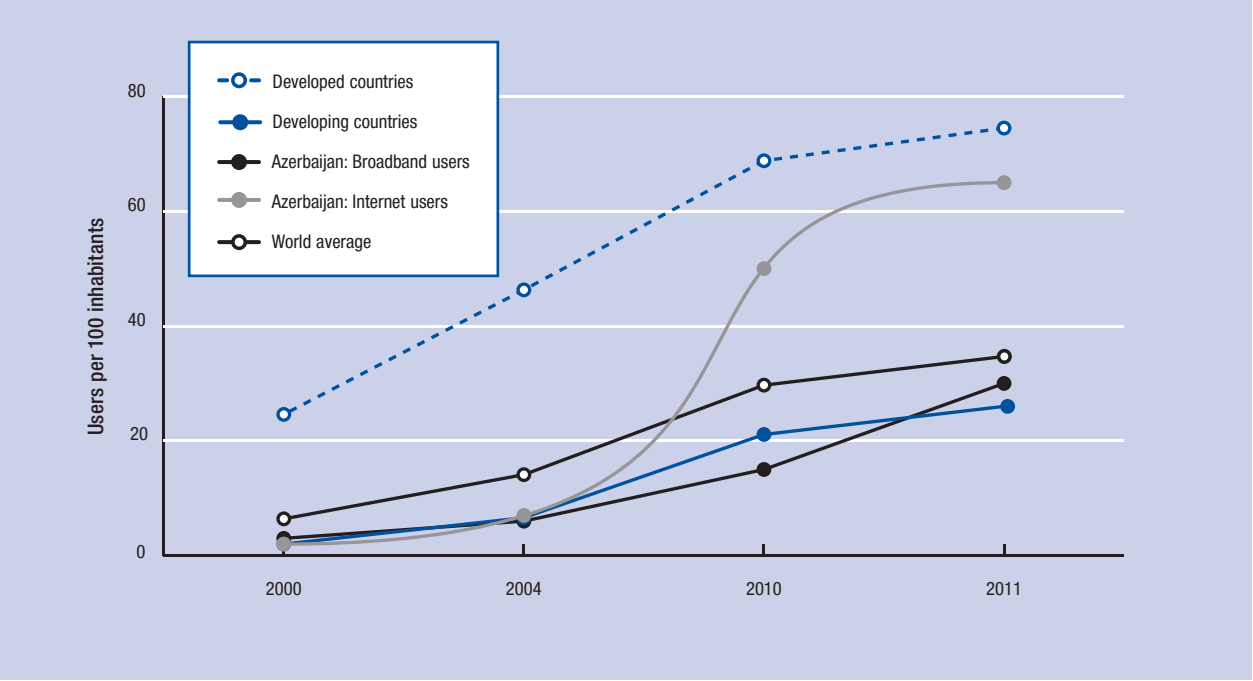
Television and radio infrastructure

Although Internet penetration is becoming more pervasive, television is still the most popular source of information in the country. Currently, there are 25 television and 14 radio channels available in Azerbaijan. Transition from analog to digital television broadcasting is the Ministry of Communication and Information Technologies (MCIT)'s priority and is expected to be completed by the end of 2012. Meanwhile, by the end of 2011, digital television broadcast (a social package of 10–12 channels) was expected to cover 85 percent of the inhabited territory of the country. In addition, plans are underway to launch high-definition (HD) radio services in Azerbaijan in the near future.

Mobile telephony infrastructure

The largest FDI in the ICT sector occurs in mobile telephony (Figure 3), followed by a number of companies with fixed-line operations, Internet, and cable television distribution. In 2007, the public shares in two mobile operators—Azercell and Bakcell—were privatized. In 2009, Azerfon—the country's newest mobile operator—signed a partner market agreement with Vodafone to ensure

Figure 2: Internet users per 100 inhabitants, 2000–11



Sources: Data from International Telecommunication Union; the State Statistical Committee of the Republic of Azerbaijan.

Vodafone's local presence in Azerbaijan. Mobile broadband increased significantly after Azerfon was granted a third-generation (3G) license. Azercell and Bakcell have also recently been granted 3G licenses. Furthermore, mobile operators have begun to consider the implementation of novel fourth-generation long-term evolution (4G LTE) technologies. For the first half of 2011, the number of mobile subscriptions exceeded 10,120,000 and mobile cellular subscriptions per 100 inhabitants reached 110, which is 1.4 times higher than the world average.

E-government and e-services development

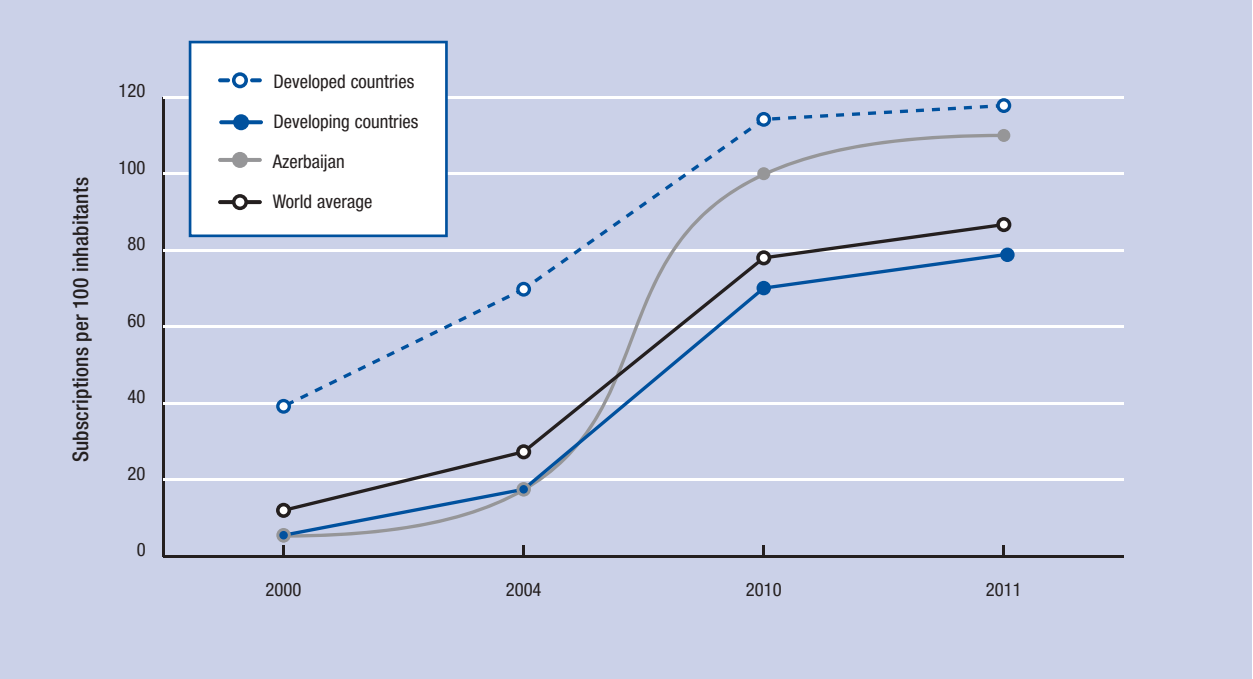
Azerbaijan's robust ICT infrastructure not only helps increase the economic competiveness of the country, but it also enables the efficient provision of government services as well as healthcare, education, social services, and so on. Thus implementation of e-services in different economic sectors has continued to advance and improve. This has also been the case with respect to e-government. Among the e-government services and activities that have been undertaken in Azerbaijan are the following:

- the establishment of unified, automatized information exchange and management systems in a public management process;
- the development of the state registry of citizens;
- the performance of e-services for taxpayers;
- the registration of entrepreneurship units;
- the introduction of "one-stop-shop" for formalizing and monitoring customs;
- the expansion of automatized systems of migration services;
- the provision of electronic healthcare services; and
- the establishment of an education management information system and the ability to submit applications online for university admissions.

In order to expand this level of development, Azerbaijan has adopted a special action program to support further e-government development in 2011 and 2012.

Out of 20 basic e-services defined by the European Union for citizens and businesses, 8 are already performed in Azerbaijan (electronic submission of tax and customs declarations, electronic submission of applications for university entrance exams, etc.). The number of these services in Azerbaijan has steadily increased. Thus, in the UN's 2010 E-government Survey, Azerbaijan ranked 83rd among 192 states, up from its rank of 89 in the UN's 2008 report; the country was also 68th in terms of e-participation index among 157 participating states.[7]

Figure 3: Mobile subscriptions per 100 inhabitants, 2000–11



Sources: Data from International Telecommunication Union; the State Statistical Committee of the Republic of Azerbaijan.

Improving the business environment: Developing e-applications and combating piracy

Based on a Microsoft solution, the national Electronic Digital Signature (EDS) was recently launched by the MCIT. Through the EDS system, a connection to an electronic payment system is provided in order to ensure the capability of making electronic payments. In addition, an e-government portal was created to organize and utilize electronic services based on the one-stop-shop concept. Implementation of EDS in Azerbaijan is expected to have a positive impact on the development of e-services and the provision of information security. Reflecting Azerbaijan's support for e-government and also the supporting legal environment that has been created, business and financial services are also gradually going online. Two e-payment systems are actively functioning in Azerbaijan and more than 100 companies are now utilizing online payments. However, the majority of business transactions still are carried out in traditional ways, either in person or through phone, fax, or paper-based communications. Nevertheless, the development of electronic services in the country has reached a level that requires integration in a single system under one umbrella. For this purpose, the "X-road" project, which is based on Estonian experience and designed to unite existing information bases and systems built on different platforms, was launched and is expected to be ready in 2012.

In 2011, the MCIT signed a formal agreement with Microsoft to help ensure that all government offices covered by the agreement will run legally licensed software, signaling a new commitment to reduce software piracy throughout the country. The agreement was aimed at addressing the piracy issue in Azerbaijan and fostering awareness of the increasing risks associated with non-genuine software, such as malware and data loss.[8] By setting a strong example for safeguarding intellectual property rights in the public and private sectors, the agreement will have a positive influence on the country's national competitiveness. The MCIT also supports the anti-piracy program led by USAID that aims to train commercial bank auditors to detect the use of unlicensed software in banks and businesses nationwide. Moreover, the project focuses on the risks that large and medium-sized enterprises face by using pirated software. Under the two state programs for improving the educational system in Azerbaijan, 40,000 computers were supplied with legally licensed software. It should also be noted that local software developers and integrators have made a significant contribution to the improvement of content and system management processing in education.

LATEST DEVELOPMENTS IN THE ICT SECTOR

The ICT sector is growing rapidly in Azerbaijan. The latest developments are particularly evident in the country's

tariff policies, the expansion of its ICT industry, and its satellite program.

Tariff policy

Growing competition has increased end user/consumer benefits and the level of satisfaction in the services received, in terms of both quality and price. Tariffs for many services have dramatically decreased over the last few years. For example, mobile services tariffs have decreased by 30 percent, while the price for a 1 Mb/s Internet connection has decreased by 50 percent. Consequently Azerbaijan managed to move from rank 99 to 53 among 165 countries, in terms of the ICT Price Basket indicator elucidated by International Telecommunication Union (ITU). The country was also ranked in the top 10 countries drawing ICT prices down.[9]

The national ICT industry and its expansion into regional markets

Azerbaijan was one of four republics that manufactured computers and computer chips in the former Soviet Union. However, the collapse and economic disintegration of the Soviet Union resulted in the total devastation of Azerbaijan's ICT industry in the early 1990s.

The industry is now experiencing a re-birth. Along with the development and enhancement of ICT infrastructure, the government of Azerbaijan devoted a significant amount of attention to the development of IT applications and products. In addition to providing fiscal and monetary incentives, the Azerbaijani government has also been an efficient market driver of IT usage and adoption. Because of its transparent and streamlined public procurement processes, all IT companies have equal access to public resources. Such a situation has enabled them to produce competitive products and, by doing so, to open up regional and international markets.

The ICT sector in Azerbaijan has witnessed growth not only in services but also in the production of hardware and software products. In just the last three years, exports of IT products have increased four times. At least 16 large- and medium-sized companies in Azerbaijan produce computer hardware, making up 60 percent of the hardware available on the local market. In addition, some 27 companies, most of them small- and medium-sized enterprises, assemble and manufacture telecommunications and radio equipment. There are also more than 40 companies developing software applications and systems integration and providing web-hosting and web-designing services.[10] The number of people involved in the ICT sector is about 60,000, which is 4.5 percent of total domestic employment in Azerbaijan. Currently the IT companies of Azerbaijan are not only participating in national projects but they are even engaged in the South Caucasus region and Central Asia. Today computers and ICT equipment manufactured in Azerbaijan are being exported to the countries of the region. Despite the increase of domestic ICT capacity, however, Azerbaijan has considerably increased its import of ICT-related products to meet its major requirements for telecommunications equipment, computers, and computer equipment and electronic devices.

FDI in Azerbaijan's ICT sector

At present, 10 of the top 20 ICT companies in the world—Microsoft, Cisco Systems, Hewlett Packard, IBM, Apple Computer, Intel, Oracle, Google, Nokia-Siemens Networks, and Ericsson—are operating in Azerbaijan and actively participating in the implementation of various projects. The operation of such large and world-renowned companies in Azerbaijan is a result of the business- and ICT-friendly environment created by the government, and is a testament to the potential these companies perceive as existing in Azerbaijan in the ICT sector.

The satellite program

Another remarkable fact in the development of the Azerbaijan's ICT infrastructure is its advanced satellite program under the direction of state-owned Azercosmos OJSC. The first step in that program will be the planned launch in 2012 of Azerspace-1—the region's first communications satellite. This satellite will upgrade the quality of television broadcasting and telecommunications not only in Azerbaijan but throughout the Eurasia and CIS regions, and will lead Azerbaijan to becoming a major relay site for signal transmission between Europe and Asia. The satellite's footprint will cover Eastern Europe, Central Asia, and Africa. Azerbaijan itself is going to use only one-fourth of the Azerspace-1 capacity, while the rest will be available for lease. Azercosmos plans to launch a second satellite, Azerspace-2, in 2015, which will further expand Azerbaijan's satellite communications capacity, and to launch a remote sensing satellite to low Earth orbit in the future. This remote sensing satellite will enhance and accelerate Azerbaijan's capacity in the areas of environmental protection, agriculture, topography, and cartography, as well as in national security and related areas.

SUCCESS FACTORS

The Government of the Republic of Azerbaijan, represented by the MCIT, is a driving force for ICT development. The importance of the government's role can be better understood in the context of Azerbaijan's post-Communist transition, when it was coping with relatively weak market institutions and a still-emerging business sector. The government, in response to current global trends, was quick to realize the need for policy and strategic leadership going beyond just technology management. Adopting the National Strategy indicated the transition from the traditional view of ICT as an aid in day-to-day operations to viewing it as an important

Table 2: Azerbaijan in the 2010–2011 Networked Readiness Index

Pillar	Rank	Pillar	Rank	Pillar	Rank
Market environment	78	Political and regulatory environment	79	Infrastructure environment	79
Individual readiness	67	Government readiness	33	Business readiness	83
Individual usage	69	Government usage	56	Business usage	76

Source: World Economic Forum 2011.

vehicle in overall economic development. In this regard, the MCIT's leadership has operated not only as an implementer and provider of public policy but as a driving force and initiator, by promoting the role of ICT at all levels and raising awareness of its substantial benefits in both the public and private sectors.

Of course, there is still a lot to be done and some serious challenges impede the country's ICT sector development. Nonetheless, Azerbaijan has made a considerable—and productive—effort to recognize and address those problems through a long-term strategic approach to ICT development and deployment. Another important factor in its success lies in the financial domain. Rich oil and gas resources have provided Azerbaijan with substantial revenues that, in turn, have created a solid financial basis for ambitious ICT development projects. However—as demonstrated by the lack of success by other states with significant revenues from natural resources and other factors—economic wealth does not guarantee a productive outcome. Sound strategy and good management and leadership are critical to success. The ICT policy success in Azerbaijan can be explained by the following factors:

1. the strong political support of the MCIT from the Government of Azerbaijan, thereby ensuring that it has enough authority to enable it to perform its strategic management role;
2. sufficient and appropriate authority of the MCIT with respect to the allocation of scare resources;
3. the ability of the MCIT to successfully integrate its organizational strategy with various relevant national policies and coordinate its activities with other actors (public agencies, donors, businesses, nongovernment organizations, etc.); and
4. the ability of the MCIT to inspire other actors (public agencies, donors, businesses, nongovernment organizations, etc.) to appreciate ICT development and acquire additional support.

All relevant state programs provide the MCIT with a high level of both responsibility and authority to serve as the focal point for the country's ICT development. At the same time, the MCIT's leadership is actively involved in national, regional, and international forums and policy discussions, and is trusted by both Azerbaijan's executive and legislative leadership. This trust, as well as appropriate institutional arrangements, enables the MCIT to perform as a strategic leader in the field of ICT development. The multiple initiatives and projects created and led by the MCIT demonstrates and confirms its important role in the ICT sector.

It is also worth mentioning that the MCIT—as a leading agency responsible for implementation of important state programs and projects mentioned in this chapter—has been provided with enough resources for it to fulfill its responsibilities. It defines and manages these resources and can then further allocate them where appropriate.

Another important factor of its success is the ability of the government to be engaged in open debate with civil society and to provide clear and readily available methods for receiving feedback. Communicating the government's set priorities and strategies on all levels is crucial because there are multiple actors involved and all need to be clear on the implemented public policies, each of their roles, and the potential benefits. This also has been a success factor in Azerbaijan, where the MCIT has undertaken substantial efforts to promote public dialogue, raise awareness, and engage in public relations.

Transparency and openness to cooperation also has helped to attract international donor organizations and companies to actively participate in the government-initiated programs.

CHALLENGES

Despite the above-mentioned achievements, there are some serious challenges that need to be addressed in Azerbaijan. These challenges can be summarized as follows:

1. individual and business readiness lag behind public policies,
2. a disconnect is evident between the research and business communities,
3. general institutional problems remain, and
4. individual and business readiness continue to be an issue.

The 2010–2011 Networked Readiness Index ranked Azerbaijan 77 out of 138 countries. Table 2 summarizes the major rankings, organized by market, political, and infrastructure environments and individual, business, and government readiness and usage. According to the

World Economic Forum, Azerbaijan's business usage and readiness scores are the lowest of these various rankings.

The problem is that many Azerbaijanis still access the Internet from shared connections at their workplaces, at universities, or in Internet cafés. The rate of computer ownership is low and Internet usage at home is moderate. Currently, almost half of the computer market is served by local assemblers importing parts from their Asian partners. In order to increase the number of PC owners and also to enhance the use of licensed software, the MCIT, in cooperation with Ministry of Education, HP, and Microsoft, launched a joint project called *National PC.*

The National PC project is a successful public-private partnership that provides computers at a discount and is being implemented well in many parts of the country. The total cost of a computer together with the software offered under the project is as much as 40 percent lower than market prices. Owing to successfully implemented ventures such as National PC, PC penetration in Azerbaijan has increased by 6.5 times during the last five years.

Along with the substantial growth of PC use in both the public and the private sectors is a corresponding demand for accessible and sophisticated software systems. Investment by new companies in Azerbaijan and the enhancement and growth of e-services have increased the importance of IT specialists with backgrounds in engineering, management, and marketing. However, there is a lack of qualified professionals who possess the necessary software development skills. According to *The Global Competitiveness Report 2011–2012,* Azerbaijan ranked 105th in its reliance on professional management, 125th in the quality of its management schools, and 99th in terms of math and science education.[11] These indicators demonstrate the potential seriousness of a problem that would certainly undermine other achievements if not resolved. Moreover, in the same report, an inadequately educated workforce is identified as the 6th major problem among Azerbaijan's top 15 problematic factors for doing business—following corruption, access to finance, tax regulations, inadequate supply of infrastructure, and tax rates.

The good news is that these challenges are not being ignored but have been recognized and appreciated by the government. In order to address them, in 2007 the MCIT, in alliance with local ICT entities, initiated the Human Resources Foundation for the Development of ICT. Thus far it has provided scholarships to dozens of young boys and girls enabling them to study ICT in a number of universities worldwide. It is expected that future high-capacity services, including user-generated content and cloud computing, will provide job opportunities for these skilled graduates.

Furthermore, Azerbaijan leads the region in the performance of an initiative for increasing teacher and student access to computers. Almost all of the schools are computerized and 40 percent of them have access to broadband Internet. By 2012 the country's secondary school connectivity to broadband Internet is expected to reach 100 percent. PC penetration in secondary schools has now reached 1 PC per 20 pupils.

Disconnect between research and business

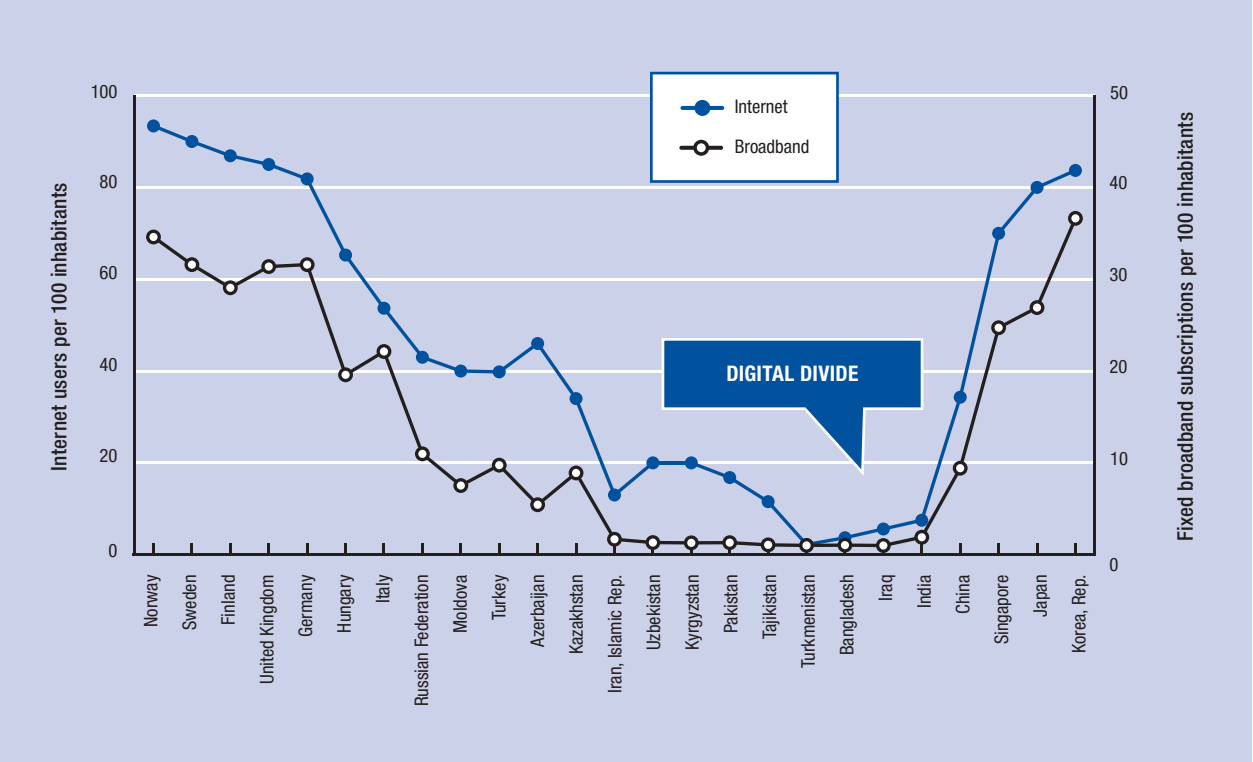
The disconnect between the research and business communities in Azerbaijan has led to the country's loss of competitive standing in this regard. According to *The Global Competitiveness Report 2011–2012,* Azerbaijan ranks 106th in terms of university-business collaboration in R&D, which is one of the worst rankings of the country with respect to its overall competitiveness ranking.[12] Moreover, the shortage of high-skilled technical labor as well as high custom duties creates excessive obstacles for the increase of export-oriented products. In order to solve this problem, ensure a sustainable ICT sector in Azerbaijan, and create alternative income sources as well as to increase attractiveness of local markets for foreign investment, the MCIT developed the concept of the Regional Innovation Zone. The goals of the Regional Innovation Zone are the following:

1. to accelerate the application of technological innovations in the small- and medium-sized enterprises;
2. to develop and train human resources and to create an IT university;
3. to evaluate the opportunities for the creation of an international information resources center (a data center);
4. to increase new capital investment in Azerbaijan as well as FDI; and
5. to promote ICT export in Azerbaijan.

Institutional issues

As previously noted and recognized in respected international reports, Azerbaijan's economy has been flourishing and expanding rapidly. Nevertheless, the country still faces major development challenges emanating from various institutional problems. These problems cause restrictive regulations, limited access to finance, and monopoly and taxation issues; they also indirectly affect the development of the ICT sector. Finding the solution to these obstacles has always been a priority for the society. Thus, the Azerbaijani government has continually been implementing institutional reforms. In order to further develop the goal of institutional reform, the Law on Combating Corruption was adopted in 2004 and various independent regulators established across different sectors. ICT development will be a new step in addressing these issues and, through the development

Figure 4: Internet and broadband penetration in the Eurasian region, 2010



Source: International Telecommunication Union.

of e-government services, will contribute positively to the necessary institutional reforms.

A PATH FORWARD: FROM NATIONAL TO REGIONAL DEVELOPMENT

During Azerbaijan's next stage of ICT development, the main target of ICT policy is the elimination of digital divide, as exemplified by Figure 4. This figure demonstrates that the divide is not on the national level but has broader dimensions and is between various social layers and geographical areas. To address this issue many elements must be tackled, including raising the development level of broadband technologies to that of the developed countries; ensuring the establishment of an information society; increasing the application level of electronic services; and jointly utilizing the existing potential of regional states along with the country's resources in the regional projects related to ICT development, thus allowing it to gain from the synergy of collective and coordinated efforts.

For this purpose, for 17 years Azerbaijan has hosted the annual BakuTel International Exhibition and Conference. BakuTel has been a venue for the regional IT industry, promoting new contacts and cooperation, with more than 10,000 specialists attending the exhibition each year. The 17th BakuTel Exhibition, held in November 2011, was on an even larger scale than previous events. It brought together representatives of 29 countries with 18 national pavilions and 250 companies. BakuTel provides an opportunity to demonstrate the newest solutions and the most advanced technologies and is an event that brings together Azerbaijan's old and new partners from the global scientific and business communities. And because it attracts leading businesses from the global ICT market, this annual event also opens up investment horizons in Azerbaijan's ICT sector.

Because of its role as the regional transportation hub and its leadership in the field of ICT development, and because it has one of the foremost economies in the region, Azerbaijan is a driving force in the Trans-Eurasian Information Superhighway initiative. This project will create a communications backbone spanning the region, with multiple international access points and numerous points of connection among national networks. The network will cover many countries and as much of the population as possible with the shortest route, and will be designed in a way that allows for expansion later. It must be able to reach various international connectivity points, and its designers will have to establish more than one trans-Caspian route to ensure intraregional connectivity and resilience/redundancy in case of interruption.

After a year of complex negotiation and high-level collaboration, in October 2009 the 64th Session of the UN General Assembly adopted the Resolution

on Building Connectivity through the Trans-Eurasian Information Superhighway.[13] The resolution welcomed the initiative and the readiness of Azerbaijan to coordinate regional efforts aimed at realizing this initiative. With the leadership of the MCIT, the Secretariat of the Project was created with initial input from Aztelecom, Turktelecom, China Telecom, Rostelecom, and Kaztranscom; in June 2011, the advisory meeting was held. Going forward, the group will take necessary steps to provide further detail on the required infrastructure investment, design the operating model, and ensure the project's economic feasibility.

The information highway is expected to bring broadband connectivity to the region, allow intra-regional/continental networking, and strengthen international trade and socioeconomic development. The countries of the region will derive significant benefits from the improved infrastructure. International traffic will need to become more balanced—that is, it will need to exhibit an almost equal distribution of facilities for providing and consuming Internet and broadband. It will need to cater to increased capacity demand as the Internet "roads" (spectrum) get more and more congested, Internet traffic continues to multiply, and the supply of high-bandwidth Internet continues to have difficulties keeping up.

A new high-capacity fiber optic cable system, the Europe Persia Express Gateway (EPEG), is expected to play a crucial role in expanding connectivity in the whole region. Azerbaijan will participate as both a primary and a reserve transit route in the project, with one of Azerbaijan's leading communication companies, Delta Telecom, along with companies from the United Kingdom, Russia, Iran, and Oman. The system will pass from Frankfurt across Eastern Europe, Russia, Azerbaijan, Iran, and the Persian Gulf to Barka, in Oman. It should be noted that Delta Telecom has been placing Google's servers in Azerbaijan, leading it to become a regional exporter of Internet services.

By strengthening regulatory frameworks and embarking on strategic initiatives to expand domestic and international connectivity while improving citizens' capacities to access and utilize broadband, Azerbaijan has the potential to create an infrastructure that supports its development of the knowledge-based economy and that helps diversify its economy. Maintaining its legacy of the historical Silk Road, Azerbaijan continues to play its traditional role as a transit country for a number of emerging opportunities for the development of the region.

LESSONS LEARNED

The Republic of Azerbaijan—a post-Soviet nation with an emerging resource-based economy—has been thriving, gaining its competitiveness in the global market despite all the challenges it has faced since achieving independence in 1991. The country's rich hydrocarbon resources are a mixed blessing. On the one hand, they have brought additional revenues and economic growth; but on the other hand, they have placed the country at risk of so-called resource dependence. However, Azerbaijan is in the process of addressing and overcoming these challenges by diversifying its economy for the long term through its ICT sector.

International experts expect that domestic and regional ICT projects—carried out in accordance with the programs and strategies adopted by the Azerbaijani government—along with the sector's growth rate, will establish the economic performance of Azerbaijan's ICT sector as equal to that of the oil-gas sector by 2025, with Azerbaijan serving as a regional ICT hub.

Thus Azerbaijan represents a useful case study and possible model for other emerging economies and natural resource–based economies willing to put in place national ICT development strategies to help drive long-term growth and competitiveness.

The experience of Azerbaijan in promoting the rapid development of the ICT sector suggests that it is crucial to have in place the necessary fundamentals in order to attract more FDI and to develop a domestic private sector capable of further investment in ICT. Other countries that wish to learn from Azerbaijan's experience should remember the country's gradual change with respect to legislation and policies in the areas of trade and ICT liberalization, human resource development, and facilitating broader access to technologies, while maintaining political and macroeconomic stability. Moreover, in the case of the Republic of Azerbaijan, government has played a critical role as the strategic promoter and supporter of the ICT sector. Through the MCIT as the responsible focal point, which the government provided with sufficient resources and authority, the Azerbaijani government has developed and implemented sound long-term policies and made all sector stakeholders aware of their important roles. Those countries wishing to utilize Azerbaijan as an appropriate model for the development of their own national ICT sector should adapt and apply the lessons learned from Azerbaijan's own experience to fit their own unique political, economic, and social environments.

NOTES

1 World Bank 2010a.

2 World Bank 2010b.

3 World Economic Forum 2009, 2010.

4 See the State Statistical Committee of the Republic of Azerbaijan.

5 IMF 2011.

6 The National Information and Communication and Technologies Strategy for the Development of the Republic of Azerbaijan (2003–2012) is available at http://unpan1.un.org/intradoc/groups/public/documents/untc/unpan018110.pdf.

7 UNPAN 2008.

8 BSA 2011.

9 See ITU 2011. This index is a tool used in monitoring the affordability of ICT services. The statistics compare 2008 and 2010 tariffs on fixed-telephony, mobile-cellular, and fixed-broadband Internet services.

10 Forthcoming report by Kalba International, Inc. working with infoDev, *Assessment of the Broadband Market and Connectivity Gaps in Armenia, Azerbaijan and Georgia.*

11 World Economic Forum 2011, pp. 106–07.

12 World Economic Forum 2011, pp. 106–07.

13 UN General Assembly 2009.

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CHAPTER 2.2

The Making of a Digital Nation: Toward i-Mauritius

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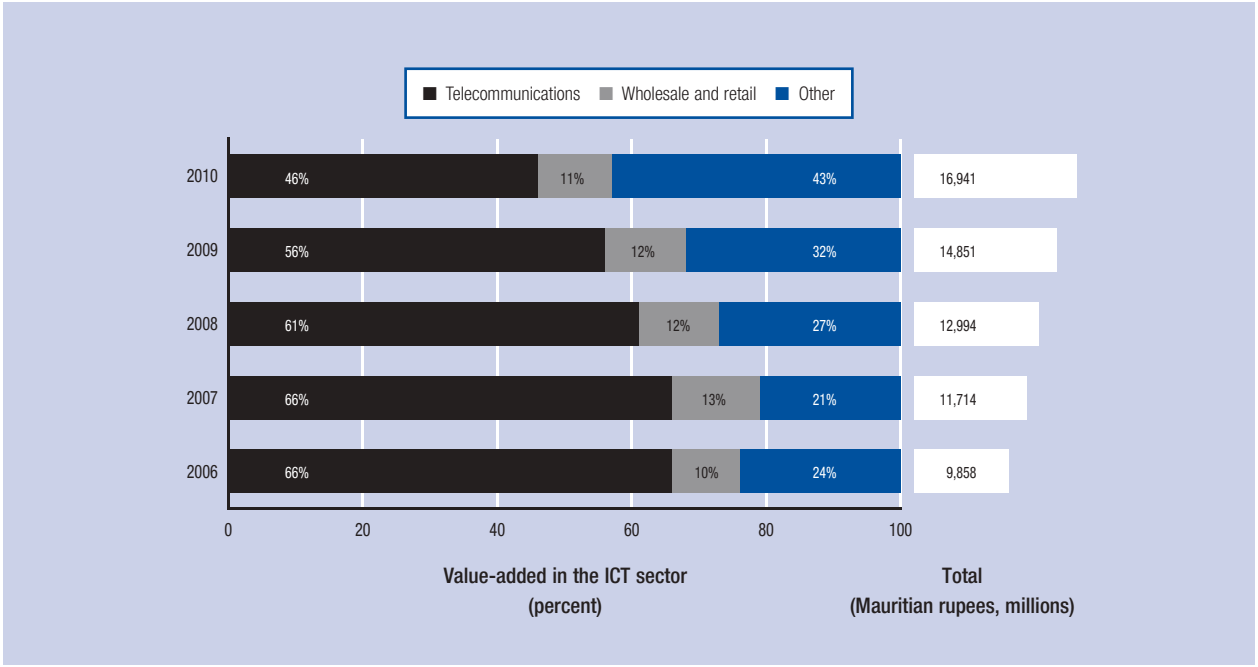
The Republic of Mauritius, a small island state with a population of 1.3 million inhabitants, is nestled in the middle of the Indian Ocean. It has undergone major changes in the last four decades, following its independence. Categorized under lower-income group countries in the early days of its economic development,[1] with an economy dominated by the mono crop sugarcane, today the landscape has been transformed into a service-oriented economy. In fact, recent economic indicators show that the services sector contributes 67 percent of the country's GPD with three leading economic poles: tourism; the financial sector; and, recently, information and communication technologies (ICT).[2] Although the tourism and the financial sectors are well anchored in its traditional economic setup, the ICT sector—albeit a nascent industry a few years ago—has recently been propelled into its new role as the third pillar of the Mauritian economy. ICT's contribution to the nation's GDP stood at 6.5 percent in 2011, with a turnover of US$1 billion; the sector employs some 15,000 people, which represents around 4 to 5 percent of the total workforce.

The definition of the ICT sector of Mauritius conforms to the recommendations of the international initiative Partnership on Measuring ICT for Development.[3] In essence, this definition ascertains all the nomenclatures (by activity) that make up the ICT industry, thus allowing a scientific measurement of its output.

Several milestones have been met in the ICT sector reform of Mauritius. First, the telecommunications sector was fully liberalized in January 2003 pursuant to the General Agreement on Trade in Services (GATS) commitment made by Mauritius in 1998.[4] The first Cyber City project was conceived with the partnership and expertise of the Government of India as a cornerstone for the development of the Mauritian ICT sector. Around the same period, Mauritius was also connected for the first time to a submarine optical fiber route linking Europe to Asia via South Africa. In addition, legislative reforms were undertaken to create an enabling environment for the sector's introduction and to ensure sustainability and predictability for the coming years. A National ICT Strategic Plan was first elaborated in 1998; this was subsequently reviewed to respond to the structural changes brought about with the evolution in technology, markets, and users' demands. The above initiatives are a tribute to the foresight of the Prime Minister who, in 1997, boldly created the first-ever ministry dedicated to the ICT sector. This was a turning point in paving the way toward the transformation of Mauritius into a knowledge-based economy.

In the remaining sections of this chapter we describe the major actions adopted by Mauritius along with their results, focusing on the challenges faced by the country in making the sector emerge as an important pillar. On the basis of the lessons learned in terms of strengths and weaknesses, as well as the opportunities

Figure 1: Growth and size of the ICT sector, 2006–10



Source: Statistics Mauritius, 2011.

that lie ahead, we present some strategic moves—on both policy and operational levels—to undertake in the future in order to consolidate the country's position and enable the ICT/business process outsourcing (BPO) sector to emerge as an engine for sustained economic growth.

POLICY AND LEGISLATIVE FRAMEWORKS

The key to the country's ICT sector development has been the successive formulation of National Strategic Plans since 1998 and the review of the legislative framework. The latest plan is the National ICT Strategic Plan 2011–2014 (NICTSP-2014),[5] which gives significant policy guidance to successfully embrace the knowledge economy journey and to respond to the dynamic changes occurring in that sector. The Plan falls in line with the government's aspirations of transforming the nation into a high-value economy while always ensuring inclusiveness in its approach. The country will continue to see more implementations of such initiatives as the momentum toward this vision of the 2014 aspiration gains speed.

The NICTSP-2014, which is built on previous plans, has two main objectives: first, to review projects recommended in the previous ICT Strategic Plan 2007–2011; and second, to make recommendations to ensure that the ICT sector becomes a main pillar of the national economy and that Mauritius rightly positions itself as a regional ICT hub. The plan contains nine strategic areas of intervention that range from the development of a comprehensive broadband strategy for Mauritius and a review of the legal and regulatory ICT environment to an institutional overhaul, the establishment of a human resources strategy intended to meet the needs to the industry, the international promotion of Mauritius as a credible ICT destination, the creation of an ICT-literate nation, the encouragement of the adoption of ICT services everywhere, a review of the e-government strategy, and the strengthening of the cyber security framework.

The government has further enhanced the regulatory framework to comply with international best practices by introducing various pieces of legislation such as the Computer Misuse and Cybercrime Act, the Information and Communication Technologies Act, the Electronic Transactions Act, the Independent Broadcasting Act, the Copyright Act, the Postal Services Act, and the Data Protection Act. All these legislative elements serve to consolidate the sector and to position Mauritius as a safe and secure destination for ICT/BPO investments.

DEVELOPMENT OF THE ICT SECTOR

It is pertinent to draw some macroeconomic observations by taking the liberalization of the ICT sector since 2003 as a reference point with a view to obtaining quantitative measures. With the spotlight firmly directed toward ICT becoming a major pillar of the economy, it is crucial to confirm the importance of the ICT in the country's economic landscape and establish the sector's contribution to GDP and, by extension, to the socioeconomic growth of the country. Figure 1 depicts the value-added contribution of this sector.

Table 1: ICT sector growth relative to overall GDP growth, 2004–10

Indicator	2004	2005	2006	2007	2008	2009	2010
ICT sector growth rate (%)	22.7	18.2	12.9	14.9	12.6	13.1	13.1
GDP growth rate (%)	4.7	2.3	5.1	5.5	5.0	3.1	4.2

Source: Statistics Mauritius, 2004–10.

The ICT sector recorded an average growth rate of 16.3 percent per annum from 2004 through 2010, while the country's overall annual GDP grew by 4.5 percent (Table 1). The ITU Information Development Index (IDI) for Mauritius has improved from 3.30 in 2008 to 4.00 in 2010. It is now being categorized as Upper Medium (UM) in terms of ICT development rating (the UM range is 2.59–4.05). This is a direct result of improvements in the Mauritian infrastructure, accessibility, and affordability of ICT products and services.

The impetus for the ICT sector to grow as a strong pillar of the Mauritian economy has gathered even more momentum, especially because of its spillover effects, which bring in services and industries that go beyond the boundaries of the sector itself. This sector in Mauritius has, in addition to its double-digit growth, witnessed falling connectivity costs and rising employment levels, and anticipates an employment capability peaking to 30,000 knowledge workers by the end of 2014.

TELECOMMUNICATIONS INFRASTRUCTURE

In order to sustain development of the ICT sector and make access to the Internet a basic citizens' right, as well as to establish an inclusiveness approach and make e-government services popular, high-quality infrastructure facilities and services along with a robust and reliable telecommunications network are necessary. These elements should not only be highly accessible but must also be affordable for everyone.

To assist in propelling the ICT sector as an engine of economic growth, the Government of India extended vital strategic assistance to Mauritius in the form of a US$100 million line of credit facility; half of that sum has been invested in e-government and e-education initiatives. In 1999, the Mauritian government, with the assistance of the Software Technology Park of India, used half of that credit facility to construct the country's first Cyber City to host ICT/BPO companies; it stands as an icon for ICT development in the heart of the island. This flagship technology park is now well known for its leading ICT/BPO companies, which symbolize the success of the ICT sector. All buildings in this area are connected to the international gateway through a gigabit-capable passive optical network–fiber-to-the-business architecture.

There is an *international information infrastructure* consisting of international circuits via fiber optic undersea cables (the South Africa-Fare East, or SAFE, cable and the Lower Indian Ocean Network cable, or LION cable) and as backup via satellite. The present pooled capacity available is the equivalent of about 10 Gb/s from Mauritius to France, with two international gateways, and is expected to more than quadruple in the next two years. As such, Mauritius is acknowledged as having resiliency, route diversity, and enough capacity to drive the international connectivity requirements.

The *national information infrastructure,* for its part, consists of the high-capacity digital microwave links and fiber optic cable system deployment that are used primarily as the network's backbone and backhaul connectivity. Major business cities and residential areas are now being connected via fiber-to-the-building deployment. The total capacity of the local exchange for the network device known as DSLAM, or digital subscriber line access multiplexer, for broadband access caters to some 350,000 subscribers representing about 30 percent of households with access to broadband facilities. A new operator has recently been licensed and is currently deploying fiber-to-the-home infrastructure with a proposed minimum of 10 Mb/s download access to every household. Mauritius will be the first country in sub-Saharan Africa to have nationwide fiber-to-the-home technology deployment. This deployment will further boost broadband penetration, in particular to household usage, allowing it to achieve the target of having at least 60 percent broadband connectivity by the end of 2014.

Rodrigues, one of the outer islands, is presently connected using satellite links; it will be connected through fiber during next year.

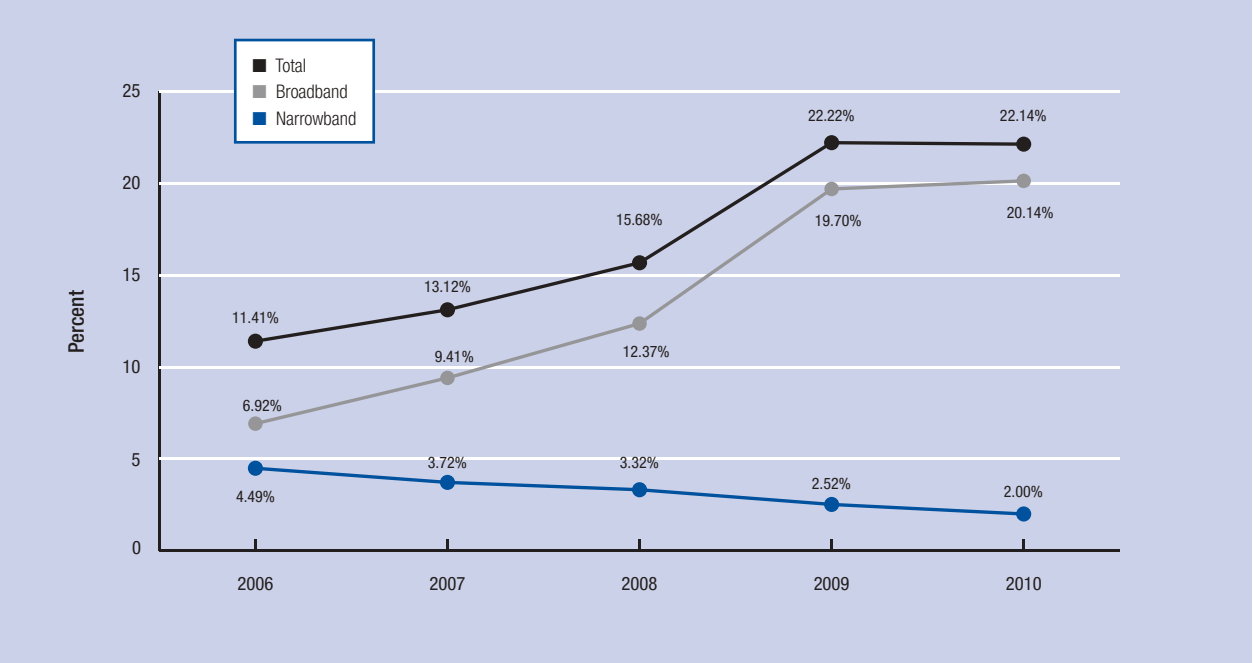
DEVELOPMENT OF THE INFORMATION SOCIETY: INCREASING ACCESSIBILITY

This section describes the extent of ICT's permeation in Mauritian society by considering the evolution of the country's telecommunications services, with particular emphasis on key information society indicators—notably fixed-line teledensity, mobile cellular penetration, and Internet penetration.

Fixed-line penetration

Penetration rates for standard telephone access lines in Mauritius have witnessed a significant increase. In 1995, fixed-line teledensity stood at 13.2 percent; it had reached 30.21 percent by the end of 2010. As of Q2 of 2011 the figure stands at 29.25 percent, which confirms

Figure 2: Internet penetration rate



Source: Republic of Mauritius, Information & Communication Technologies Authority.

Notes: 1. Figures for subscriptions have been rounded to the nearest hundred where applicable; 2. Figures for penetration rates have been rounded to 2 decimal places where applicable; 3. Broadband Internet refers to connection to the Internet at a speed equal to or greater than 256 Kb/s, as the sum of capacity in both directions; 4. Narrowband Internet refers to connection to the Internet at a speed less than 256 Kb/s, as the sum of capacity in both directions; 5. The statistics provided are based on the best available estimates for the period ending 2011 at the time of disclosure; 6. In 2009, subscriptions based on mobile access network were 179,000; for the year 2010 we noted a drastic decrease: i.e., 177,500. This is because one of the mobile operators was been counting double in the ICTA quarterly reports. They were reporting distinct WAP and distinct Web browsing users and just adding them together, leading to a double count, as web users is a subset of WAP users.

the international trend of fixed-to-mobile substitutability in local markets.

Mobile penetration

Mobile penetration rates have exploded from a mere 1.05 percent in 1995 to a staggering 92.79 percent by the end of 2010. As of Q2 of 2011 the figure stands at 96.78 percent. This enormous increase is the result of the intensive network rollout by three mobile operators—Emtel Ltd, MTML, and Cellplus Mobile Communications Ltd—which has ensured almost complete coverage of the island. Moreover, growth in mobile cellular subscriptions per hundred inhabitants is sustained in the double digits, suggesting that the mobile market is still some way from reaching its carrying capacity.

Internet penetration

The rate of Internet penetration per 100 inhabitants remains a key information society indicator that governs the progress made by a country in its transition toward a fully digital broadband–based economy. Figure 2 depicts the Internet penetration rate. It is noted that broadband Internet penetration has been on an exponential progression, while narrowband Internet penetration has been on the decline.

Although much progress has been made since liberalization in 2003 in terms of overall Internet penetration, much remains to be done to steer the economy into the broadband arena, which would be expected to positively influence economic growth. However, the evident trend that broadband is increasingly becoming the preferred subscription approach of end users seeking to connect to the Internet is encouraging. Supporting this trend is indeed one of the main challenges facing the country.

INTERNATIONAL BANDWIDTH CONNECTIVITY: OUTSOURCING OPPORTUNITIES

The affordability of international connectivity is of particular relevance for the ICT/BPO sector, especially since Mauritius is quite far from major European and American markets. Over the past five years, various determinations have been made by the Mauritian ICT Regulatory Authority regarding international connectivity. The price for a 2 MB international private leased circuit capacity is now US$3,500, compared with US$12,600 some five years ago. The price of Internet protocol (IP) transits has also been revised downward to US$600 per mb/s.

ICT CULTURE PROMOTION: ICT OUTREACH FOR ALL

The inclusiveness approach and a re-engineering of the e-government services toward more citizen-centric

delivery require an aggressive ICT culture promotion program. Mauritius fares well in ICT literacy outreach as a result of a comprehensive and well-thought-out strategy in ensuring that not only the relevant ICT literacy/proficiency programs are offered but also free ICT facilities with broadband access are made available throughout the country. The National Computer Board (NCB) has, since September 2006, implemented the Universal ICT Education Programme, an initiative of the Prime Minister of Mauritius. One of the main objectives of the program is to train the population in Internet and Computing Core Certification, the internationally acknowledged computer proficiency course.

Community Empowerment Programme

The Community Empowerment Programme (CEP) is another citizens' outreach initiative meant to enable the creation and sharing of information and knowledge for community development.[6] It is in line with the government's ambition to build an all-inclusive information society, to improve digital literacy, and to encourage the development of local content and creativity. In the context of the CEP, the NCB has set up more than 180 computer clubs in social welfare and community centers around the island in collaboration with other ministries. Furthermore, the NCB manages 94 public Internet access points in all postal offices across Mauritius, set up with the assistance of the ICT Regulator, the Information & Communication Technologies Authority.

Moreover, in an attempt not to leave any citizen behind and for a wider outreach, three cyber caravans travel across the island every day to provide ICT training and computer awareness courses, particularly in areas where ICT facilities are not readily available and accessible.

In a bid to further create an Intelligent Mauritius and to increase broadband penetration, the installation of wireless fidelity (Wi-Fi) networks across Mauritius and Rodrigues is underway under the purview of the Universal Service Fund of Mauritius.

Cyber security initiative

A comprehensive and resilient cyber security strategy is a cornerstone that ensures the trustworthiness of the country's ICT infrastructure and creates the necessary confidence in all stakeholders. Mauritius is among the few African countries with a National Computer Emergency Response Team (CERT-MU). CERT-MU has operated under the NCB since May 2008 and was established based on the recommendations of the National Information Security Strategy. CERT-MU's mission is to provide information and assistance to its constituents in implementing proactive measures to reduce the risk(s) of information security incidents.

QUALIFIED HUMAN CAPITAL FOR ICT GLOBAL TALENT NEEDS

The world today is in a stage of globalization where talent and brain power are becoming the predominant currency.[7] The Mauritian government, in recognizing that skills and knowledge development are strategic to economic growth, was one of the rare countries that introduced free education for all in 1976. This vision has today been acknowledged as the basis for enabling the Mauritian economy to move toward a knowledge-intensive stage of evolution.

The Mauritian educational system is based on a 6-5-2 model. This means 6 years of primary education, which starts at the age of 5 after pre-primary; then 5 years of secondary education; and then an additional 2 years of higher-secondary education. Post-secondary education usually starts at the age of 18. Enrollment is approximately 35,000 students at the primary level, about 30,000 at the secondary level, and about 18,000 at the higher-secondary level. University enrollment is about 8,000 per year. The enrollment rate at the tertiary level as compared with primary intake is presently about 25 percent. Over the last decade, the higher-education enrollment rate has evolved with the population's growing interest in pursuing higher education.

Mauritius has two national universities and several privately owned universities. The latter have ties to foreign universities and deliver programs leading to qualifications with worldwide recognition. Although Mauritius has a limited number of graduates in the ICT sector compared with many other emerging nations, the quality of Mauritian graduates is well known worldwide, mainly because the country's universities have adopted the same stringent standards and benchmarks as European universities. However, the government recognizes that the enrollment rate at the tertiary level is still low and should be improved. In this context, the Ministry of Tertiary Education is currently implementing an initiative entitled One Graduate per Family with the dual aims of, first, overcoming the low rate of graduates being turned out each year and, second, ensuring that every capable student of any strata of the society is given an opportunity to undertake tertiary education.

English and French languages and mathematics are compulsory subjects for 11 consecutive years of schooling. This legacy of the English as well as the French colonies has proven to be very valuable in making the population bilingual.

It is to be noted that in the area of human capital Mauritius faces the inherent barrier of limited ICT professionals, given the small size of the population and relatively small number of students who study science and engineering subjects. Furthermore, very few people have so far developed the ICT/BPO work culture; this is another challenge that the country needs to meet.

SETTING UP THE ICT CENTER OF EXCELLENCE: HUMAN CAPACITY BUILDING INITIATIVE

The ICT Center of Excellence has been set up taking into consideration that adequate human capital is one of the country's most challenging factors. Transforming the island into a knowledge-based economy requires human capital of global talents capable of executing global tasks. It has been acknowledged officially as well as by international consultancy organizations in this area that Mauritius, with its relatively low level of graduates, lags behind many ICT destinations for producing a sufficient number of these global talents. The government has therefore set up an ICT Academy, the main objective of which is to train school leavers in various streams of ICT industry–led courses. In this model, all trainees will undergo internationally recognized industry-led ICT certification courses such as those provided by multinational ICT companies such as Microsoft, Oracle, CISCO, and SAP. The government will also cater for courses that recognize prior learning for those who have extensive experience but who could not integrate a formal academic stream and could not secure the appropriate qualifications. The ICT Academy has planned to train at least 10,000 knowledge workers by the end of 2014 and is being operated as a public-private partnership, where the government is contributing 45 percent of the cost.

OPEN ACCESS POLICY AND DEREGULATION FOR TELECOMMUNICATIONS

Open access is the "possibility for third parties to use an existing network infrastructure," according to the Best Practice Guidelines for Enabling Open Access, adopted by the 2010 Global Symposium for Regulators. The open access policy allows telecommunications operators to enter the market on an equal footing with various local operators in terms of the use of common telecommunications infrastructure.[8] In fact, with a view to further stimulating competition in the ICT market, the Mauritian government agreed, in October 2010, to apply an open access policy for the operation of undersea cable landing stations in Mauritius. It has also encouraged smaller local companies to enter the market and seeks to ensure that no entity can take the position of dominant market power. This has the short-term effect of allowing competitors of the incumbent operators to offer international IP standards of service at rates up to 44 percent lower than previously available.

LESSONS LEARNED

We have presented and synthesized a number of economic and social benefits that countries, such as Mauritius, have used to leverage when favoring ICT investment from global companies to capitalize on global economic opportunities. Mauritius has witnessed significant improvements on all the macroeconomic development indicators in its ICT sector, thus surpassing the net African average.

However, in view of securing such business opportunities locally against a backdrop of the comparative advantage of other established outsourcing destinations, Mauritius faces daunting challenges. The island's geographic location, while at times presenting itself as a safe ICT destination, can also be viewed as a challenge—especially as its major markets are in Europe. This unique situation calls for constantly adapting strategies to reflect the ever-changing global environment. Policymakers should therefore be mindful of similar economic transformations that aim to build a knowledge-based economy in nearby countries, and maintain a competitive advantage by staying on top of human resource development especially.

The complex and continuous transformation of the Mauritian economy from a country dependent on a mono crop to a knowledge-based economy has required major reforms to ensure a smooth and needed transition. However, Mauritius still suffers from a long response time in building up the human capital required, including the major transformation needed to re-skill workers in the traditional agricultural industry for the emerging sector. One consequence of this transformation has been workers' resistance to adapting to the new round-the-clock imperatives and the new cultural environment. These challenges have invariably had a spillover effect on government policies, private-sector strategies, and existing institutional arrangements.

The uptake of the ICT sector and its integration into the global economy requires the adaption to a situation where protectionism, which used to provide a benefit, is today no longer relevant or possible. This paradigm shift for Mauritius has enabled the country to focus on the need to position technological outreach, blended with quality and innovation, at the center of its development strategies.

Clearly the transition to a more technology-intensive, knowledge-based economy is not straightforward. Success depends on a number of critical elements. First, a committed and visionary political leadership that truly believes in the adoption of emerging technologies is a crucial factor in realizing these objectives. Equally important is the provision of a broadband infrastructure that can adequately support and sustain the new economic agenda. This can be realized only if the country has an integrated approach that incorporates the culture of technological development and adoption for all cross-sections of the population. The NICTSP-2014, in fact, provides direction for policy to address challenges and ensure the attainment of the government's objectives to make Mauritius a high-income economy through the adoption of the ICT sector as an enabler.

Another important aspect is the adoption of e-government services. Although the government is committed to promoting ICT culture among its citizens, many e-government services have not experienced a robust take-up rate—in fact, astonishingly, the population is showing some resistance. To date, many departmental systems are already operational; these back-office applications are a major building block of the e-government program. In order to address the relatively low take-up rate, e-government initiatives need to shift away from a focus on the tools and service delivery channels and instead adopt a citizen-centric approach to public service development and delivery. Such a strategic shift would ensure that user needs and demands are met by government.

The refocusing of energies around citizen-centric e-services should be accompanied by the establishment of an e-government centralized coordination body. This body would ensure an enhanced coordination for the development of e-services, and hence the realization of e-services would be harmonized and unaligned actions would be decreased or eliminated.

Of the 53 online services available on the government portal, some 12 e-services are more popular. The most effective is the e-filing system for tax returns, which reaches about 70 percent of taxpayers (around 140,000+). To harness the full power of online service delivery, the government has recently made the usage of e-government e-services mandatory in all relevant ministries and departments. This directive is supported by a reorganization of departmental processes around the needs of the citizens and businesses, which have been established through surveys and feedback. Key performance indicators such as transaction costs, convenience, and user experience are being assessed to get a clear indication of the benefits derived both for the government and the end user. A complete revamping of the government e-services is being undertaken with a new government portal with interactive applications in place.

Moreover, the forthcoming formulation of an e-government strategy will ensure that the e-services are demand-driven, citizen- and business-centric, and hence enhance the value-added of these initiatives.

THE WAY FORWARD

As we look toward the way forward, Mauritius will need to focus its efforts on key areas, some of which are described below.

Developing and implementing a National Broadband Policy

The National Broadband Policy 2020 sets out a strategic vision for an Intelligent Mauritius (branded as "i-Mauritius") and establishes national goals regarding broadband while elaborating specific policies to achieve those goals. As an immediate objective, Mauritius aspires to surge from a typical 1 MB Internet connectivity to at least a 10 MB connection by 2014. The government is fully aware that the National Broadband Policy formulation must take into consideration the short- and long-term national objectives within a context of ever-changing social, economic, political, and technological conditions. The salient features of this policy comprise:

- defining the broadband ecosystem for Mauritius;
- creating an environment that is conducive to attracting new investments and players in the new ecosystem;
- establishing and promoting the national broadband infrastructure;
- consolidating the regulatory and legislative frameworks to allow the emergence of Broadband i-Mauritius;
- ensuring the quality of service of broadband services from "best effort" to "minimum guaranteed" levels;
- developing a broadband-handling culture for adequate usage;
- developing a content-production culture to stimulate sufficient supply and demand mixes;
- developing efficient management strategies in the use of scarce resources for broadband deployment and monitoring thereof;
- providing adequate broadband services within accessibility, availability, and affordability ranges;
- promoting research, innovation, and competition for sustaining the broadband ecosystem;
- introducing adequate regulatory safety nets to ensure the "universalization" of broadband; and
- defining the institutional framework and responsibilities to achieve objectives set.

Moving the value chain of the outsourcing industry

The current ICT/BPO global positioning offers important opportunities for high-value-added and high-income services as long as the challenges highlighted above have been properly addressed. Acknowledging the strengths and weaknesses, the positioning of Mauritius toward more investment in outsourcing is anticipated to be as follows:

- *Data center and infrastructure outsourcing*: As the price of international bandwidth decreases and capacity becomes more abundant, service providers are seriously considering implementing high-value-added and high-earnings projects in Africa, particularly in the Eastern Region where there has been a boom of submarine fiber optic connectivity projects in recent years. Companies are likely to focus on deploying more and more tier-3 elements.[9]

- *Data centers in the Eastern African Region, including Mauritius*: Such a strategy would circumvent the inherent low number of ICT-skilled workers because data centers remain technology-intensive rather than human resource capacity–intensive. Mauritius is poised to be in a position to offer bandwidth capacity, route diversity, redundancy, and safety for such activities.
- *Diversifying product and service portfolio*: Mauritius is traditionally known to be the preferred destination for many low-end ICT/BPO activities because it offers a unique amalgamation of attributes. Mauritius should consider catering to global knowledge process outsourcing (KPO) needs and its high-end processes such as valuation research, investment research, patent filing, legal and insurance claims processing, online teaching, and media content supply, among others. Mauritius—with its internationally recognized pool of skilled workers (although limited in number), including chartered accountants, doctors, MBAs, lawyers, and so on—has important advantages in the KPO market. This pool of workers will increase with the operation of the ICT Academy. This, combined with the multilingual capabilities of the workforce and cost arbitrage as well as global partnerships, will definitely help Mauritius emerge as a global winner in the KPO sector.

CONCLUSION

This chapter has shown how policy and regulatory frameworks have evolved to continue fostering the digital economy and information society of Mauritius. It has addressed the challenges faced by the country in its relatively limited pool of natural resources and the quality of its human capital, and has presented the country's strategy for ensuring that Mauritius is prepared to be part of the global economy.

The aligned vision and efforts of all the relevant stakeholders in the ICT sector at the national level will also clearly contribute toward asserting the visibility of the Republic of Mauritius on the international scene, especially in relation to the global ICT/BPO market. Therefore, continued and sustained efforts to bring down the costs of international connectivity, to improve the quality of the workforce, and to promote a business-friendly environment will further ensure that Mauritius becomes a preferred platform and solutions provider in the global ICT/BPO realm. The solid foundations upon which the ICT/BPO sector is being elevated have endowed Mauritius with the right attributes to meet aspirations and challenges confidently as the country ascends the development ladder of the new global economy.

NOTES

1 World Bank 2011.

2 Statistics Mauritius, available at http://www.gov.mu/portal/site/cso.

3 The ICT sector of Mauritius includes manufacturing and services industries whose products capture, transmit, or display data and information electronically. It includes related activities of manufacturing, wholesale and retail trade, communications, and business services (such as call centers, software development, website development and hosting, multimedia, IT consulting, and disaster recovery). Since 2008, training in IT has been excluded from the definition of the ICT sector. See the Partnership on Measuring ICT for Development, an international, multi-stakeholder initiative to improve the availability and quality of ICT data and indicators, particularly in developing countries, which was launched in 2004. Available at http://www.itu.int/ITU-D/ict/partnership/.

4 WTO 2012.

5 See http://www.gov.mu/portal/site/telcomit.

6 See the NCB (National Computer Board). Available at http://www.gov.mu/portal/sites/ncbnew/main.jsp (accessed February 24, 2012).

7 Cheese et al. 2008.

8 ITU 2011.

9 Manyika et al. 2011.

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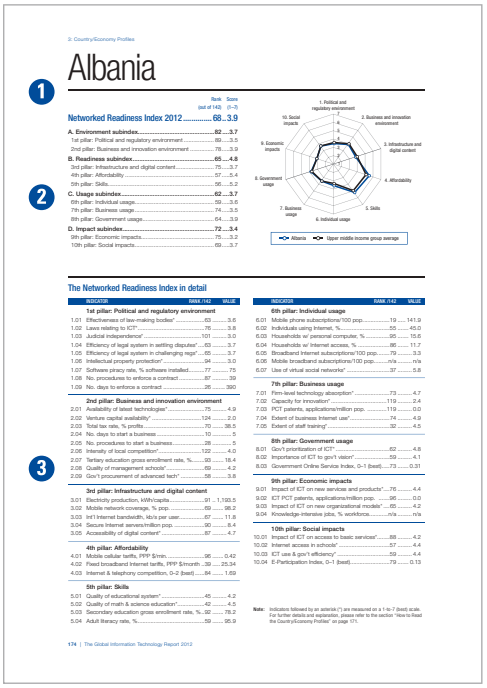
Part 3

Country/Economy Profiles

How to Read the Country/Economy Profiles

The Country/Economy Profiles section presents a profile for each of the 142 economies covered in *The Global Information Technology Report 2012.* Each profile summarizes an economy's performance in the various dimensions of the Networked Readiness Index (NRI).



1 PERFORMANCE HIGHLIGHTS

The first section of the profile presents the economy's overall performance in the NRI, along with its performance in the NRI's four components and ten pillars. The economy's rank (out of 142 economies) and score (on a 1-to-7 scale) are reported.

2 On the radar chart to the right of the table, a blue line plots the economy's score on each of the ten pillars. The black line represents the average score of all economies in the income group to which the economy under review belongs. The country classification by income group is defined by the World Bank and reflects the situation as of July 2011. Note that the two high-income groups in this classification system, *High income: OECD* and *High income: non-OECD*, were merged into a single group for the purpose of the analysis.

3 THE NETWORKED READINESS INDEX IN DETAIL

This section presents an economy's performance in each of the 53 indicators composing the NRI. The indicators are organized by pillar. The numbering of the variables matches that of the data tables found at the end of the *Report*, which provide descriptions, rankings, and scores for all the indicators.

The indicators derived from the 2010 and 2011 editions of the World Economic Forum's Executive Opinion Survey are identified by an asterisk (*). These indicators are always measured on a 1-to-7 scale (where 1 is the lowest score and 7 is the highest). For those indicators not derived from the World Economic Forum's Executive Opinion Survey, the scale is reported next to the title. The section "Technical Notes and Sources" at the end of this *Report* provides further details on each indicator, including its definition, method of computation, and sources.

Note that for the sake of readability, the period to which each data point corresponds is omitted, but can be found in the corresponding data table. For more information on the framework and computation of the NRI, as well as on the Executive Opinion Survey, please refer to Chapter 1.1.

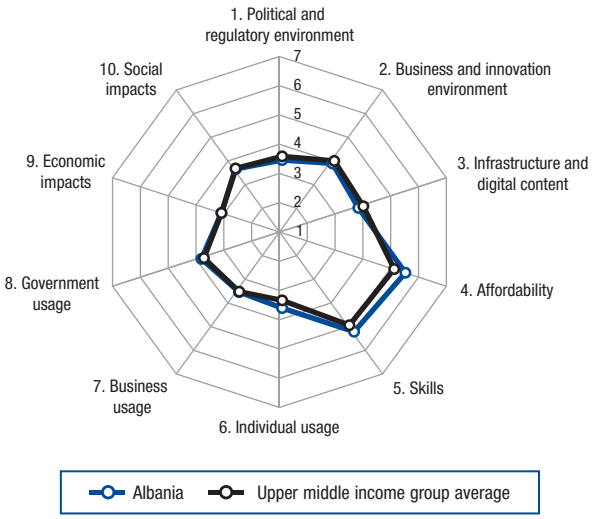
ONLINE DATA PORTAL

In additon to the analysis presented in this *Report*, an online data portal can be accessed via www.weforum.org/gitr. The platform offers a number of analytical tools and visualizations, including sortable rankings, scatter plots, bar charts, and maps, as well as the possibility of downloading portions of the NRI dataset.

Index of Country/Economy Profiles

Albania

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**68**	**3.9**
A. Environment subindex	**82**	**3.7**
1st pillar: Political and regulatory environment	89	3.5
2nd pillar: Business and innovation environment	78	3.9
B. Readiness subindex	**65**	**4.8**
3rd pillar: Infrastructure and digital content	75	3.7
4th pillar: Affordability	57	5.4
5th pillar: Skills	56	5.2
C. Usage subindex	**62**	**3.7**
6th pillar: Individual usage	59	3.6
7th pillar: Business usage	74	3.5
8th pillar: Government usage	64	3.9
D. Impact subindex	**72**	**3.4**
9th pillar: Economic impacts	75	3.2
10th pillar: Social impacts	69	3.7



The Networked Readiness Index in detail

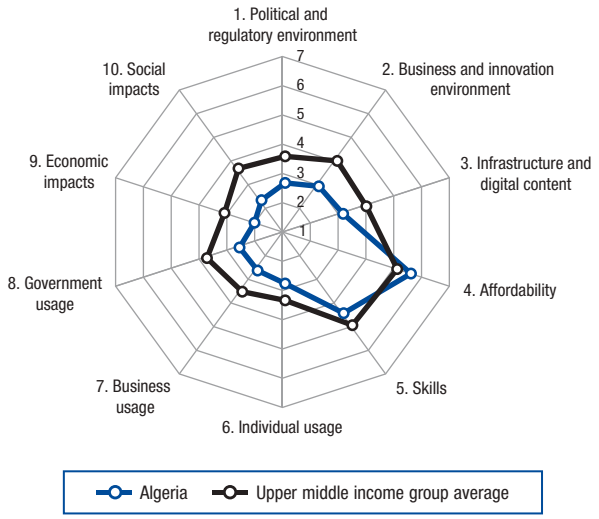
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	63	3.6
1.02	Laws relating to ICT*	76	3.8
1.03	Judicial independence*	101	3.0
1.04	Efficiency of legal system in settling disputes*	63	3.7
1.05	Efficiency of legal system in challenging regs*	65	3.7
1.06	Intellectual property protection*	94	3.0
1.07	Software piracy rate, % software installed	77	75
1.08	No. procedures to enforce a contract	87	39
1.09	No. days to enforce a contract	26	390
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	75	4.9
2.02	Venture capital availability*	124	2.0
2.03	Total tax rate, % profits	70	38.5
2.04	No. days to start a business	10	5
2.05	No. procedures to start a business	28	5
2.06	Intensity of local competition*	122	4.0
2.07	Tertiary education gross enrollment rate, %	94	18.4
2.08	Quality of management schools*	69	4.2
2.09	Gov't procurement of advanced tech*	58	3.8
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	91	1,193.5
3.02	Mobile network coverage, % pop.	69	98.2
3.03	Int'l Internet bandwidth, kb/s per user	67	11.8
3.04	Secure Internet servers/million pop.	90	8.4
3.05	Accessibility of digital content*	87	4.7
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	96	0.42
4.02	Fixed broadband Internet tariffs, PPP $/month	39	25.34
4.03	Internet & telephony competition, 0–2 (best)	84	1.69
	5th pillar: Skills		
5.01	Quality of educational system*	45	4.2
5.02	Quality of math & science education*	42	4.5
5.03	Secondary education gross enrollment rate, %	92	78.2
5.04	Adult literacy rate, %	59	95.9

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	19	141.9
6.02	Individuals using Internet, %	55	45.0
6.03	Households w/ personal computer, %	95	15.6
6.04	Households w/ Internet access, %	86	11.7
6.05	Broadband Internet subscriptions/100 pop.	79	3.3
6.06	Mobile broadband subscriptions/100 pop.	n/a	n/a
6.07	Use of virtual social networks*	37	5.8
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	73	4.7
7.02	Capacity for innovation*	119	2.4
7.03	PCT patents, applications/million pop.	119	0.0
7.04	Extent of business Internet use*	74	4.9
7.05	Extent of staff training*	32	4.5
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	62	4.8
8.02	Importance of ICT to gov't vision*	59	4.1
8.03	Government Online Service Index, 0–1 (best)	73	0.31
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	76	4.4
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	65	4.2
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	88	4.2
10.02	Internet access in schools*	57	4.4
10.03	ICT use & gov't efficiency*	59	4.4
10.04	E-Participation Index, 0–1 (best)	79	0.13

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Algeria

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**118**	**3.0**
A. Environment subindex	**136**	**2.8**
1st pillar: Political and regulatory environment	132	2.7
2nd pillar: Business and innovation environment	137	3.0
B. Readiness subindex	**88**	**4.3**
3rd pillar: Infrastructure and digital content	105	3.1
4th pillar: Affordability	51	5.5
5th pillar: Skills	97	4.4
C. Usage subindex	**127**	**2.7**
6th pillar: Individual usage	89	2.7
7th pillar: Business usage	140	2.6
8th pillar: Government usage	135	2.6
D. Impact subindex	**140**	**2.2**
9th pillar: Economic impacts	140	2.1
10th pillar: Social impacts	135	2.4



The Networked Readiness Index in detail

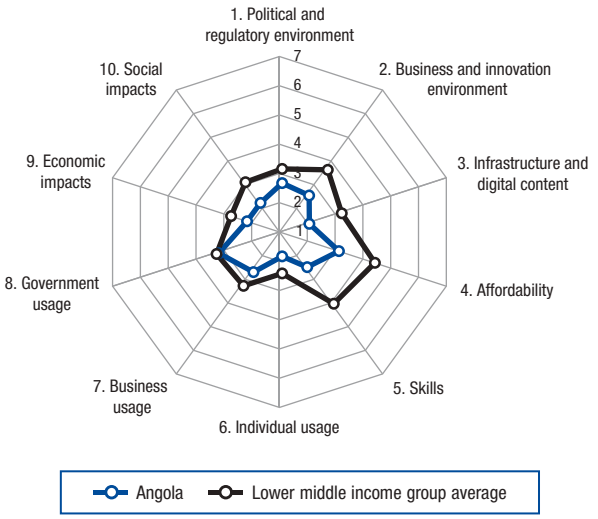
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	114	2.7
1.02	Laws relating to ICT*	130	2.6
1.03	Judicial independence*	126	2.5
1.04	Efficiency of legal system in settling disputes*	109	3.0
1.05	Efficiency of legal system in challenging regs*	104	3.0
1.06	Intellectual property protection*	135	2.2
1.07	Software piracy rate, % software installed	93	83
1.08	No. procedures to enforce a contract	123	45
1.09	No. days to enforce a contract	95	630
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	122	4.0
2.02	Venture capital availability*	110	2.1
2.03	Total tax rate, % profits	134	72.0
2.04	No. days to start a business	92	25
2.05	No. procedures to start a business	133	14
2.06	Intensity of local competition*	131	3.9
2.07	Tertiary education gross enrollment rate, %	74	30.8
2.08	Quality of management schools*	101	3.7
2.09	Gov't procurement of advanced tech*	137	2.4
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	92	1,168.7
3.02	Mobile network coverage, % pop.	114	81.5
3.03	Int'l Internet bandwidth, kb/s per user	83	8.1
3.04	Secure Internet servers/million pop.	123	0.9
3.05	Accessibility of digital content*	126	3.6
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	43	0.22
4.02	Fixed broadband Internet tariffs, PPP $/month	42	27.38
4.03	Internet & telephony competition, 0–2 (best)	104	1.31
	5th pillar: Skills		
5.01	Quality of educational system*	123	2.8
5.02	Quality of math & science education*	96	3.4
5.03	Secondary education gross enrollment rate, %	49	94.9
5.04	Adult literacy rate, %	115	72.6

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	81	92.4
6.02	Individuals using Internet, %	105	12.5
6.03	Households w/ personal computer, %	84	20.0
6.04	Households w/ Internet access, %	91	10.0
6.05	Broadband Internet subscriptions/100 pop.	88	2.5
6.06	Mobile broadband subscriptions/100 pop.	n/a	n/a
6.07	Use of virtual social networks*	86	5.0
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	134	3.7
7.02	Capacity for innovation*	138	2.0
7.03	PCT patents, applications/million pop.	91	0.2
7.04	Extent of business Internet use*	141	3.1
7.05	Extent of staff training*	126	3.1
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	123	3.7
8.02	Importance of ICT to gov't vision*	133	2.7
8.03	Government Online Service Index, 0–1 (best)	126	0.10
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	141	2.5
9.02	ICT PCT patents, applications/million pop.	83	0.0
9.03	Impact of ICT on new organizational models*	142	2.1
9.04	Knowledge-intensive jobs, % workforce	77	19.1
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	133	3.1
10.02	Internet access in schools*	125	2.6
10.03	ICT use & gov't efficiency*	137	2.6
10.04	E-Participation Index, 0–1 (best)	129	0.01

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Angola

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**140**	**2.5**
A. Environment subindex	**141**	**2.6**
1st pillar: Political and regulatory environment	133	2.7
2nd pillar: Business and innovation environment	141	2.6
B. Readiness subindex	**139**	**2.5**
3rd pillar: Infrastructure and digital content	137	2.0
4th pillar: Affordability	121	3.0
5th pillar: Skills	137	2.5
C. Usage subindex	**130**	**2.6**
6th pillar: Individual usage	127	1.8
7th pillar: Business usage	137	2.7
8th pillar: Government usage	112	3.3
D. Impact subindex	**137**	**2.3**
9th pillar: Economic impacts	135	2.3
10th pillar: Social impacts	139	2.3



The Networked Readiness Index in detail

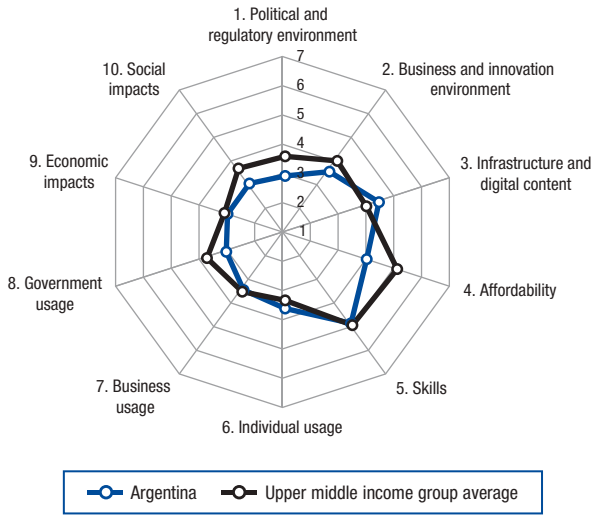
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	83	3.3
1.02	Laws relating to ICT*	135	2.5
1.03	Judicial independence*	129	2.4
1.04	Efficiency of legal system in settling disputes*	136	2.5
1.05	Efficiency of legal system in challenging regs*	133	2.5
1.06	Intellectual property protection*	130	2.4
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	126	46
1.09	No. days to enforce a contract	130	1,011
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	140	3.4
2.02	Venture capital availability*	140	1.5
2.03	Total tax rate, % profits	116	53.2
2.04	No. days to start a business	132	68
2.05	No. procedures to start a business	86	8
2.06	Intensity of local competition*	142	3.2
2.07	Tertiary education gross enrollment rate, %	131	3.7
2.08	Quality of management schools*	142	1.8
2.09	Gov't procurement of advanced tech*	86	3.4
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	121	221.3
3.02	Mobile network coverage, % pop.	129	40.0
3.03	Int'l Internet bandwidth, kb/s per user	130	0.6
3.04	Secure Internet servers/million pop.	104	2.7
3.05	Accessibility of digital content*	137	3.2
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	80	0.34
4.02	Fixed broadband Internet tariffs, PPP $/month	130	181.75
4.03	Internet & telephony competition, 0–2 (best)	101	1.33
	5th pillar: Skills		
5.01	Quality of educational system*	141	1.9
5.02	Quality of math & science education*	142	1.5
5.03	Secondary education gross enrollment rate, %	132	31.3
5.04	Adult literacy rate, %	118	70.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	126	46.7
6.02	Individuals using Internet, %	115	10.0
6.03	Households w/ personal computer, %	111	7.1
6.04	Households w/ Internet access, %	101	5.7
6.05	Broadband Internet subscriptions/100 pop.	120	0.1
6.06	Mobile broadband subscriptions/100 pop.	86	1.5
6.07	Use of virtual social networks*	130	3.9
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	133	3.7
7.02	Capacity for innovation*	141	1.6
7.03	PCT patents, applications/million pop.	114	0.0
7.04	Extent of business Internet use*	140	3.4
7.05	Extent of staff training*	89	3.7
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	119	3.8
8.02	Importance of ICT to gov't vision*	121	3.0
8.03	Government Online Service Index, 0–1 (best)	63	0.34
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	134	3.1
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	138	2.6
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	138	3.1
10.02	Internet access in schools*	140	1.6
10.03	ICT use & gov't efficiency*	131	3.0
10.04	E-Participation Index, 0–1 (best)	105	0.07

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Argentina

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**92**	**3.5**
A. Environment subindex	**122**	**3.3**
1st pillar: Political and regulatory environment	122	2.9
2nd pillar: Business and innovation environment	113	3.6
B. Readiness subindex	**84**	**4.4**
3rd pillar: Infrastructure and digital content	58	4.4
4th pillar: Affordability	103	3.9
5th pillar: Skills	80	4.8
C. Usage subindex	**77**	**3.4**
6th pillar: Individual usage	58	3.6
7th pillar: Business usage	86	3.4
8th pillar: Government usage	119	3.1
D. Impact subindex	**96**	**3.1**
9th pillar: Economic impacts	82	3.1
10th pillar: Social impacts	108	3.1



The Networked Readiness Index in detail

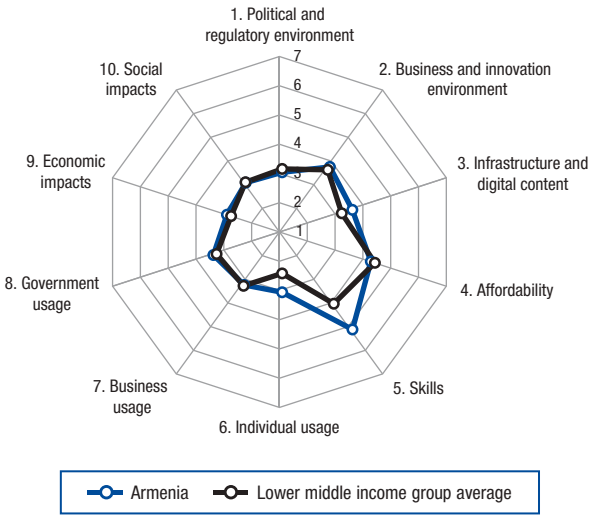
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	136	2.2
1.02	Laws relating to ICT*	106	3.2
1.03	Judicial independence*	124	2.6
1.04	Efficiency of legal system in settling disputes*	124	2.7
1.05	Efficiency of legal system in challenging regs*	136	2.4
1.06	Intellectual property protection*	128	2.5
1.07	Software piracy rate, % software installed	70	70
1.08	No. procedures to enforce a contract	55	36
1.09	No. days to enforce a contract	84	590
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	83	4.8
2.02	Venture capital availability*	129	1.9
2.03	Total tax rate, % profits	139	108.2
2.04	No. days to start a business	93	26
2.05	No. procedures to start a business	133	14
2.06	Intensity of local competition*	105	4.3
2.07	Tertiary education gross enrollment rate, %	20	68.7
2.08	Quality of management schools*	22	5.1
2.09	Gov't procurement of advanced tech*	127	2.8
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	62	3,057.4
3.02	Mobile network coverage, % pop.	90	94.1
3.03	Int'l Internet bandwidth, kb/s per user	41	27.5
3.04	Secure Internet servers/million pop.	63	26.1
3.05	Accessibility of digital content*	88	4.7
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	132	0.71
4.02	Fixed broadband Internet tariffs, PPP $/month	93	44.66
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	86	3.4
5.02	Quality of math & science education*	113	3.2
5.03	Secondary education gross enrollment rate, %	77	85.8
5.04	Adult literacy rate, %	51	97.7

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	20	141.8
6.02	Individuals using Internet, %	74	36.0
6.03	Households w/ personal computer, %	60	40.0
6.04	Households w/ Internet access, %	71	21.3
6.05	Broadband Internet subscriptions/100 pop.	53	9.6
6.06	Mobile broadband subscriptions/100 pop.	56	6.1
6.07	Use of virtual social networks*	57	5.4
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	93	4.5
7.02	Capacity for innovation*	77	2.9
7.03	PCT patents, applications/million pop.	66	1.1
7.04	Extent of business Internet use*	85	4.8
7.05	Extent of staff training*	76	3.9
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	134	3.3
8.02	Importance of ICT to gov't vision*	135	2.6
8.03	Government Online Service Index, 0–1 (best)	43	0.41
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	75	4.4
9.02	ICT PCT patents, applications/million pop.	66	0.2
9.03	Impact of ICT on new organizational models*	63	4.2
9.04	Knowledge-intensive jobs, % workforce	83	17.7
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	117	3.6
10.02	Internet access in schools*	106	3.3
10.03	ICT use & gov't efficiency*	125	3.2
10.04	E-Participation Index, 0–1 (best)	56	0.20

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Armenia

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**94**	**3.5**
A. Environment subindex	**110**	**3.4**
1st pillar: Political and regulatory environment	112	3.1
2nd pillar: Business and innovation environment	93	3.8
B. Readiness subindex	**90**	**4.3**
3rd pillar: Infrastructure and digital content	85	3.5
4th pillar: Affordability	97	4.2
5th pillar: Skills	62	5.1
C. Usage subindex	**89**	**3.2**
6th pillar: Individual usage	75	3.0
7th pillar: Business usage	104	3.2
8th pillar: Government usage	95	3.5
D. Impact subindex	**99**	**3.0**
9th pillar: Economic impacts	90	3.0
10th pillar: Social impacts	106	3.1



The Networked Readiness Index in detail

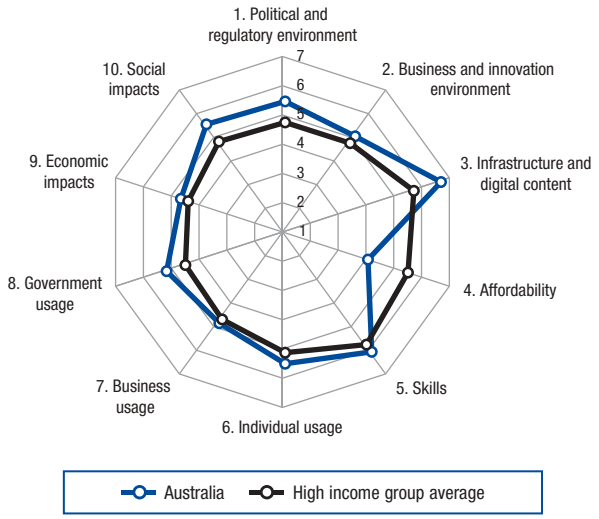
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	88	3.2
1.02	Laws relating to ICT*	88	3.6
1.03	Judicial independence*	108	2.8
1.04	Efficiency of legal system in settling disputes*	81	3.4
1.05	Efficiency of legal system in challenging regs*	84	3.2
1.06	Intellectual property protection*	96	3.0
1.07	Software piracy rate, % software installed	102	89
1.08	No. procedures to enforce a contract	133	49
1.09	No. days to enforce a contract	48	440
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	116	4.2
2.02	Venture capital availability*	109	2.1
2.03	Total tax rate, % profits	79	40.9
2.04	No. days to start a business	33	8
2.05	No. procedures to start a business	8	3
2.06	Intensity of local competition*	139	3.4
2.07	Tertiary education gross enrollment rate, %	47	51.5
2.08	Quality of management schools*	131	3.1
2.09	Gov't procurement of advanced tech*	124	2.8
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	83	1,874.6
3.02	Mobile network coverage, % pop.	66	98.9
3.03	Int'l Internet bandwidth, kb/s per user	86	7.8
3.04	Secure Internet servers/million pop.	72	17.5
3.05	Accessibility of digital content*	101	4.4
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	31	0.17
4.02	Fixed broadband Internet tariffs, PPP $/month	104	57.39
4.03	Internet & telephony competition, 0–2 (best)	109	1.21
	5th pillar: Skills		
5.01	Quality of educational system*	97	3.2
5.02	Quality of math & science education*	81	3.8
5.03	Secondary education gross enrollment rate, %	55	92.0
5.04	Adult literacy rate, %	10	99.5

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	33	125.0
6.02	Individuals using Internet, %	59	44.0
6.03	Households w/ personal computer, %	83	21.0
6.04	Households w/ Internet access, %	79	15.0
6.05	Broadband Internet subscriptions/100 pop.	86	2.8
6.06	Mobile broadband subscriptions/100 pop.	69	3.7
6.07	Use of virtual social networks*	102	4.7
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	114	4.1
7.02	Capacity for innovation*	61	3.1
7.03	PCT patents, applications/million pop.	62	1.2
7.04	Extent of business Internet use*	113	4.3
7.05	Extent of staff training*	105	3.5
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	76	4.5
8.02	Importance of ICT to gov't vision*	74	3.8
8.03	Government Online Service Index, 0–1 (best)	110	0.17
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	109	3.9
9.02	ICT PCT patents, applications/million pop.	58	0.2
9.03	Impact of ICT on new organizational models*	96	3.7
9.04	Knowledge-intensive jobs, % workforce	56	24.1
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	110	3.8
10.02	Internet access in schools*	92	3.6
10.03	ICT use & gov't efficiency*	91	3.8
10.04	E-Participation Index, 0–1 (best)	117	0.04

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Australia

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**17**	**5.3**
A. Environment subindex	**12**	**5.3**
1st pillar: Political and regulatory environment	11	5.5
2nd pillar: Business and innovation environment	18	5.1
B. Readiness subindex	**26**	**5.5**
3rd pillar: Infrastructure and digital content	7	6.6
4th pillar: Affordability	100	4.0
5th pillar: Skills	11	6.0
C. Usage subindex	**17**	**5.2**
6th pillar: Individual usage	16	5.5
7th pillar: Business usage	22	4.8
8th pillar: Government usage	8	5.3
D. Impact subindex	**16**	**5.2**
9th pillar: Economic impacts	20	4.7
10th pillar: Social impacts	8	5.6



The Networked Readiness Index in detail

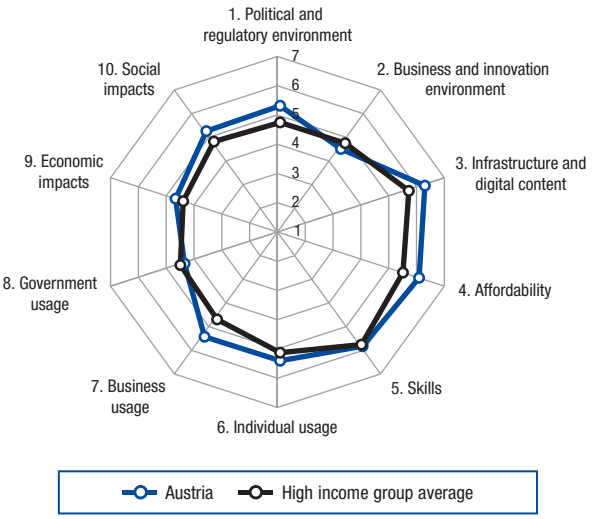
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	9	5.3
1.02	Laws relating to ICT*	14	5.4
1.03	Judicial independence*	13	6.1
1.04	Efficiency of legal system in settling disputes*	14	5.1
1.05	Efficiency of legal system in challenging regs*	16	4.8
1.06	Intellectual property protection*	19	5.3
1.07	Software piracy rate, % software installed	5	24
1.08	No. procedures to enforce a contract	12	28
1.09	No. days to enforce a contract	30	395
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	23	6.1
2.02	Venture capital availability*	21	3.5
2.03	Total tax rate, % profits	104	47.7
2.04	No. days to start a business	2	2
2.05	No. procedures to start a business	3	2
2.06	Intensity of local competition*	7	5.9
2.07	Tertiary education gross enrollment rate, %	12	75.9
2.08	Quality of management schools*	15	5.4
2.09	Gov't procurement of advanced tech*	50	3.9
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	11	11,240.6
3.02	Mobile network coverage, % pop.	47	99.1
3.03	Int'l Internet bandwidth, kb/s per user	32	41.4
3.04	Secure Internet servers/million pop.	5	1,760.8
3.05	Accessibility of digital content*	24	6.1
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	128	0.64
4.02	Fixed broadband Internet tariffs, PPP $/month	92	43.74
4.03	Internet & telephony competition, 0–2 (best)	85	1.67
	5th pillar: Skills		
5.01	Quality of educational system*	13	5.1
5.02	Quality of math & science education*	19	5.1
5.03	Secondary education gross enrollment rate, %	1	129.2
5.04	Adult literacy rate, %	15	99.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	70	101.0
6.02	Individuals using Internet, %	19	76.0
6.03	Households w/ personal computer, %	18	81.1
6.04	Households w/ Internet access, %	18	74.1
6.05	Broadband Internet subscriptions/100 pop.	24	24.2
6.06	Mobile broadband subscriptions/100 pop.	6	53.1
6.07	Use of virtual social networks*	20	6.1
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	19	5.8
7.02	Capacity for innovation*	27	4.0
7.03	PCT patents, applications/million pop.	20	83.1
7.04	Extent of business Internet use*	16	6.0
7.05	Extent of staff training*	17	4.9
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	28	5.4
8.02	Importance of ICT to gov't vision*	23	4.8
8.03	Government Online Service Index, 0–1 (best)	5	0.77
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	27	5.2
9.02	ICT PCT patents, applications/million pop.	18	24.0
9.03	Impact of ICT on new organizational models*	24	4.9
9.04	Knowledge-intensive jobs, % workforce	12	42.9
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	30	5.3
10.02	Internet access in schools*	19	5.9
10.03	ICT use & gov't efficiency*	44	4.6
10.04	E-Participation Index, 0–1 (best)	2	0.91

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Austria

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**19**	**5.3**
A. Environment subindex	**21**	**4.9**
1st pillar: Political and regulatory environment	14	5.3
2nd pillar: Business and innovation environment	37	4.5
B. Readiness subindex	**10**	**6.0**
3rd pillar: Infrastructure and digital content	12	6.2
4th pillar: Affordability	24	6.0
5th pillar: Skills	24	5.8
C. Usage subindex	**20**	**5.1**
6th pillar: Individual usage	17	5.4
7th pillar: Business usage	11	5.4
8th pillar: Government usage	39	4.4
D. Impact subindex	**20**	**5.0**
9th pillar: Economic impacts	19	4.8
10th pillar: Social impacts	16	5.3



The Networked Readiness Index in detail

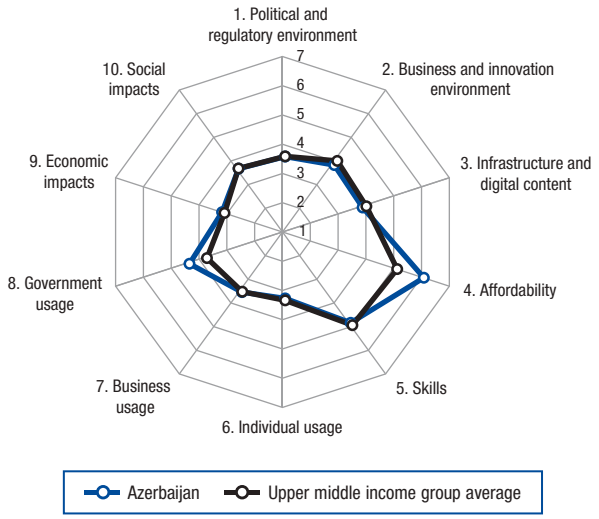
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	34	4.4
1.02	Laws relating to ICT*	10	5.5
1.03	Judicial independence*	22	5.5
1.04	Efficiency of legal system in settling disputes*	18	5.0
1.05	Efficiency of legal system in challenging regs*	15	4.8
1.06	Intellectual property protection*	16	5.5
1.07	Software piracy rate, % software installed	5	24
1.08	No. procedures to enforce a contract	4	25
1.09	No. days to enforce a contract	32	397
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	10	6.4
2.02	Venture capital availability*	43	2.9
2.03	Total tax rate, % profits	115	53.1
2.04	No. days to start a business	97	28
2.05	No. procedures to start a business	86	8
2.06	Intensity of local competition*	8	5.8
2.07	Tertiary education gross enrollment rate, %	35	60.2
2.08	Quality of management schools*	34	4.8
2.09	Gov't procurement of advanced tech*	26	4.2
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	25	7,830.9
3.02	Mobile network coverage, % pop.	49	99.0
3.03	Int'l Internet bandwidth, kb/s per user	16	73.7
3.04	Secure Internet servers/million pop.	18	856.6
3.05	Accessibility of digital content*	4	6.4
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	12	0.08
4.02	Fixed broadband Internet tariffs, PPP $/month	74	35.04
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	24	4.7
5.02	Quality of math & science education*	38	4.6
5.03	Secondary education gross enrollment rate, %	31	99.6
5.04	Adult literacy rate, %	15	99.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	13	145.8
6.02	Individuals using Internet, %	23	72.7
6.03	Households w/ personal computer, %	25	76.2
6.04	Households w/ Internet access, %	21	72.9
6.05	Broadband Internet subscriptions/100 pop.	25	23.9
6.06	Mobile broadband subscriptions/100 pop.	20	24.9
6.07	Use of virtual social networks*	13	6.1
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	12	5.9
7.02	Capacity for innovation*	12	4.8
7.03	PCT patents, applications/million pop.	10	143.9
7.04	Extent of business Internet use*	18	5.9
7.05	Extent of staff training*	14	5.0
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	41	5.2
8.02	Importance of ICT to gov't vision*	48	4.2
8.03	Government Online Service Index, 0–1 (best)	33	0.48
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	22	5.4
9.02	ICT PCT patents, applications/million pop.	14	31.6
9.03	Impact of ICT on new organizational models*	37	4.7
9.04	Knowledge-intensive jobs, % workforce	27	36.7
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	15	5.7
10.02	Internet access in schools*	18	5.9
10.03	ICT use & gov't efficiency*	12	5.5
10.04	E-Participation Index, 0–1 (best)	21	0.50

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Azerbaijan

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**61**	**3.9**
A. Environment subindex	**77**	**3.7**
1st pillar: Political and regulatory environment	75	3.6
2nd pillar: Business and innovation environment	80	3.9
B. Readiness subindex	**61**	**4.9**
3rd pillar: Infrastructure and digital content	72	3.8
4th pillar: Affordability	25	6.0
5th pillar: Skills	82	4.8
C. Usage subindex	**57**	**3.7**
6th pillar: Individual usage	70	3.2
7th pillar: Business usage	72	3.5
8th pillar: Government usage	38	4.4
D. Impact subindex	**70**	**3.5**
9th pillar: Economic impacts	68	3.3
10th pillar: Social impacts	67	3.7



The Networked Readiness Index in detail

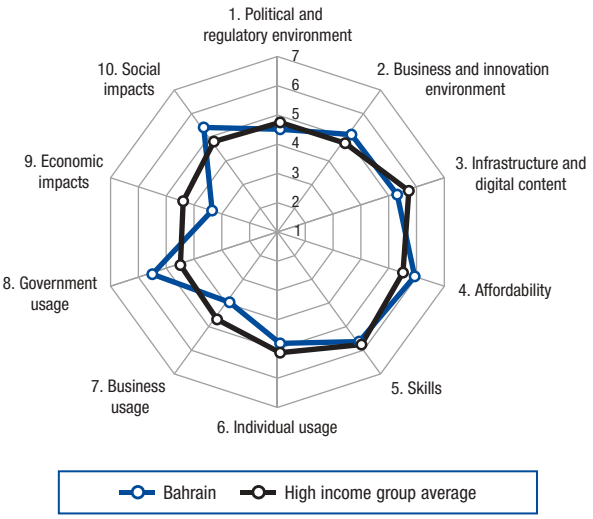
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	56	3.7
1.02	Laws relating to ICT*	64	4.0
1.03	Judicial independence*	83	3.4
1.04	Efficiency of legal system in settling disputes*	95	3.3
1.05	Efficiency of legal system in challenging regs*	59	3.8
1.06	Intellectual property protection*	60	3.7
1.07	Software piracy rate, % software installed	100	88
1.08	No. procedures to enforce a contract	87	39
1.09	No. days to enforce a contract	5	237
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	87	4.6
2.02	Venture capital availability*	54	2.8
2.03	Total tax rate, % profits	74	40.0
2.04	No. days to start a business	33	8
2.05	No. procedures to start a business	46	6
2.06	Intensity of local competition*	133	3.8
2.07	Tertiary education gross enrollment rate, %	92	19.3
2.08	Quality of management schools*	125	3.2
2.09	Gov't procurement of advanced tech*	24	4.2
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	68	2,669.5
3.02	Mobile network coverage, % pop.	1	100.0
3.03	Int'l Internet bandwidth, kb/s per user	75	9.7
3.04	Secure Internet servers/million pop.	99	5.1
3.05	Accessibility of digital content*	81	4.8
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	22	0.15
4.02	Fixed broadband Internet tariffs, PPP $/month	26	21.76
4.03	Internet & telephony competition, 0–2 (best)	99	1.35
	5th pillar: Skills		
5.01	Quality of educational system*	113	3.0
5.02	Quality of math & science education*	99	3.4
5.03	Secondary education gross enrollment rate, %	81	84.5
5.04	Adult literacy rate, %	12	99.5

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	75	99.0
6.02	Individuals using Internet, %	53	46.0
6.03	Households w/ personal computer, %	82	21.5
6.04	Households w/ Internet access, %	53	35.3
6.05	Broadband Internet subscriptions/100 pop.	72	5.0
6.06	Mobile broadband subscriptions/100 pop.	95	0.6
6.07	Use of virtual social networks*	33	5.8
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	66	4.8
7.02	Capacity for innovation*	52	3.2
7.03	PCT patents, applications/million pop.	81	0.4
7.04	Extent of business Internet use*	106	4.5
7.05	Extent of staff training*	67	4.0
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	30	5.4
8.02	Importance of ICT to gov't vision*	14	5.0
8.03	Government Online Service Index, 0–1 (best)	67	0.32
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	46	4.8
9.02	ICT PCT patents, applications/million pop.	80	0.1
9.03	Impact of ICT on new organizational models*	59	4.3
9.04	Knowledge-intensive jobs, % workforce	70	20.3
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	59	4.5
10.02	Internet access in schools*	88	3.7
10.03	ICT use & gov't efficiency*	47	4.5
10.04	E-Participation Index, 0–1 (best)	66	0.17

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Bahrain

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**27**	**4.9**
A. Environment subindex	**27**	**4.8**
1st pillar: Political and regulatory environment	35	4.5
2nd pillar: Business and innovation environment	12	5.1
B. Readiness subindex	**25**	**5.5**
3rd pillar: Infrastructure and digital content	31	5.2
4th pillar: Affordability	31	5.8
5th pillar: Skills	36	5.6
C. Usage subindex	**26**	**4.8**
6th pillar: Individual usage	30	4.8
7th pillar: Business usage	39	3.9
8th pillar: Government usage	4	5.6
D. Impact subindex	**30**	**4.4**
9th pillar: Economic impacts	54	3.4
10th pillar: Social impacts	12	5.4



The Networked Readiness Index in detail

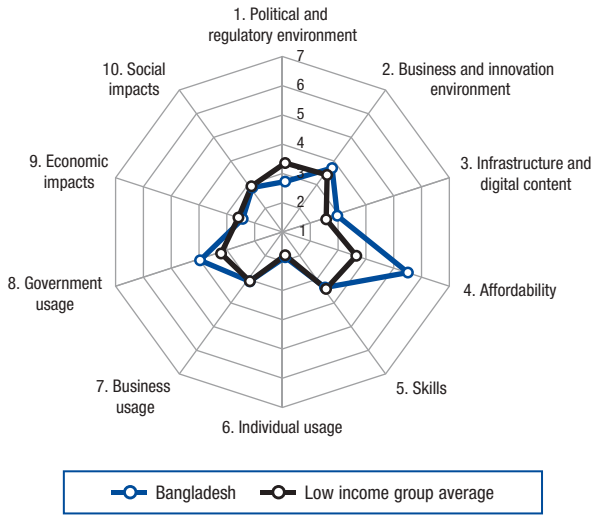
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	36	4.3
1.02	Laws relating to ICT*	33	4.9
1.03	Judicial independence*	26	5.3
1.04	Efficiency of legal system in settling disputes*	31	4.7
1.05	Efficiency of legal system in challenging regs*	25	4.6
1.06	Intellectual property protection*	20	5.3
1.07	Software piracy rate, % software installed	40	54
1.08	No. procedures to enforce a contract	132	48
1.09	No. days to enforce a contract	96	635
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	22	6.1
2.02	Venture capital availability*	8	4.2
2.03	Total tax rate, % profits	8	15.0
2.04	No. days to start a business	42	9
2.05	No. procedures to start a business	72	7
2.06	Intensity of local competition*	25	5.5
2.07	Tertiary education gross enrollment rate, %	49	51.2
2.08	Quality of management schools*	60	4.3
2.09	Gov't procurement of advanced tech*	17	4.4
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	10	11,339.3
3.02	Mobile network coverage, % pop.	1	100.0
3.03	Int'l Internet bandwidth, kb/s per user	62	14.4
3.04	Secure Internet servers/million pop.	47	97.5
3.05	Accessibility of digital content*	19	6.1
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	30	0.16
4.02	Fixed broadband Internet tariffs, PPP $/month	65	32.97
4.03	Internet & telephony competition, 0–2 (best)	62	1.92
	5th pillar: Skills		
5.01	Quality of educational system*	31	4.6
5.02	Quality of math & science education*	40	4.5
5.03	Secondary education gross enrollment rate, %	18	103.1
5.04	Adult literacy rate, %	80	91.4

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	37	124.2
6.02	Individuals using Internet, %	41	55.0
6.03	Households w/ personal computer, %	8	87.0
6.04	Households w/ Internet access, %	19	74.0
6.05	Broadband Internet subscriptions/100 pop.	71	5.4
6.06	Mobile broadband subscriptions/100 pop.	18	27.1
6.07	Use of virtual social networks*	21	6.1
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	20	5.7
7.02	Capacity for innovation*	117	2.4
7.03	PCT patents, applications/million pop.	51	2.1
7.04	Extent of business Internet use*	40	5.5
7.05	Extent of staff training*	11	5.0
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	7	6.0
8.02	Importance of ICT to gov't vision*	6	5.4
8.03	Government Online Service Index, 0–1 (best)	8	0.73
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	30	5.2
9.02	ICT PCT patents, applications/million pop.	71	0.1
9.03	Impact of ICT on new organizational models*	42	4.6
9.04	Knowledge-intensive jobs, % workforce	68	20.7
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	13	5.8
10.02	Internet access in schools*	32	5.4
10.03	ICT use & gov't efficiency*	8	5.6
10.04	E-Participation Index, 0–1 (best)	11	0.67

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Bangladesh

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**113**	**3.2**
A. Environment subindex	**123**	**3.2**
1st pillar: Political and regulatory environment	130	2.7
2nd pillar: Business and innovation environment	100	3.7
B. Readiness subindex	**103**	**3.9**
3rd pillar: Infrastructure and digital content	114	2.9
4th pillar: Affordability	58	5.4
5th pillar: Skills	125	3.3
C. Usage subindex	**108**	**3.0**
6th pillar: Individual usage	125	1.8
7th pillar: Business usage	118	3.1
8th pillar: Government usage	56	4.1
D. Impact subindex	**124**	**2.7**
9th pillar: Economic impacts	125	2.5
10th pillar: Social impacts	120	2.9



The Networked Readiness Index in detail

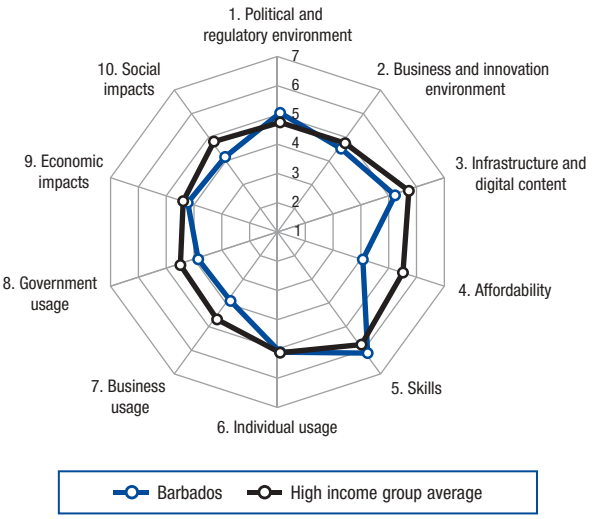
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	94	3.0
1.02	Laws relating to ICT*	117	3.0
1.03	Judicial independence*	90	3.2
1.04	Efficiency of legal system in settling disputes*	100	3.1
1.05	Efficiency of legal system in challenging regs*	81	3.3
1.06	Intellectual property protection*	129	2.4
1.07	Software piracy rate, % software installed	103	90
1.08	No. procedures to enforce a contract	106	41
1.09	No. days to enforce a contract	138	1,442
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	95	4.6
2.02	Venture capital availability*	94	2.3
2.03	Total tax rate, % profits	55	35.0
2.04	No. days to start a business	80	19
2.05	No. procedures to start a business	72	7
2.06	Intensity of local competition*	92	4.5
2.07	Tertiary education gross enrollment rate, %	108	10.6
2.08	Quality of management schools*	90	3.9
2.09	Gov't procurement of advanced tech*	117	3.0
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	120	240.3
3.02	Mobile network coverage, % pop.	97	90.0
3.03	Int'l Internet bandwidth, kb/s per user	110	2.8
3.04	Secure Internet servers/million pop.	134	0.3
3.05	Accessibility of digital content*	112	4.0
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	2	0.03
4.02	Fixed broadband Internet tariffs, PPP $/month	76	36.28
4.03	Internet & telephony competition, 0–2 (best)	107	1.25
	5th pillar: Skills		
5.01	Quality of educational system*	85	3.4
5.02	Quality of math & science education*	106	3.3
5.03	Secondary education gross enrollment rate, %	116	49.3
5.04	Adult literacy rate, %	128	55.9

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	127	46.2
6.02	Individuals using Internet, %	130	3.7
6.03	Households w/ personal computer, %	127	3.1
6.04	Households w/ Internet access, %	119	2.6
6.05	Broadband Internet subscriptions/100 pop.	127	0.0
6.06	Mobile broadband subscriptions/100 pop.	n/a	n/a
6.07	Use of virtual social networks*	122	4.3
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	95	4.4
7.02	Capacity for innovation*	121	2.4
7.03	PCT patents, applications/million pop.	115	0.0
7.04	Extent of business Internet use*	117	4.2
7.05	Extent of staff training*	121	3.3
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	49	5.0
8.02	Importance of ICT to gov't vision*	62	4.1
8.03	Government Online Service Index, 0–1 (best)	58	0.36
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	100	4.0
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	105	3.6
9.04	Knowledge-intensive jobs, % workforce	103	7.3
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	105	3.9
10.02	Internet access in schools*	128	2.5
10.03	ICT use & gov't efficiency*	104	3.6
10.04	E-Participation Index, 0–1 (best)	94	0.10

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Barbados

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**35**	**4.6**
A. Environment subindex	**29**	**4.8**
1st pillar: Political and regulatory environment	20	5.1
2nd pillar: Business and innovation environment	35	4.5
B. Readiness subindex	**51**	**5.1**
3rd pillar: Infrastructure and digital content	33	5.1
4th pillar: Affordability	102	4.0
5th pillar: Skills	10	6.1
C. Usage subindex	**34**	**4.3**
6th pillar: Individual usage	24	5.1
7th pillar: Business usage	41	3.9
8th pillar: Government usage	61	3.9
D. Impact subindex	**36**	**4.3**
9th pillar: Economic impacts	26	4.3
10th pillar: Social impacts	44	4.2



The Networked Readiness Index in detail

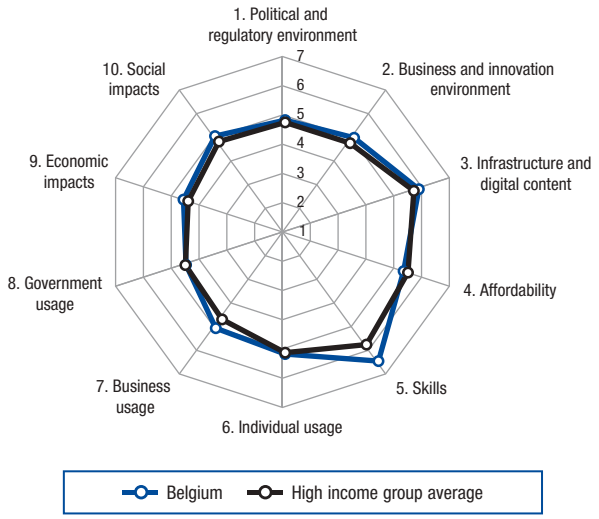
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	6	5.5
1.02	Laws relating to ICT*	53	4.2
1.03	Judicial independence*	17	5.9
1.04	Efficiency of legal system in settling disputes*	20	4.9
1.05	Efficiency of legal system in challenging regs*	24	4.6
1.06	Intellectual property protection*	24	5.1
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	n/a	n/a
1.09	No. days to enforce a contract	n/a	n/a
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	27	6.1
2.02	Venture capital availability*	93	2.3
2.03	Total tax rate, % profits	n/a	n/a
2.04	No. days to start a business	n/a	n/a
2.05	No. procedures to start a business	n/a	n/a
2.06	Intensity of local competition*	68	4.9
2.07	Tertiary education gross enrollment rate, %	24	65.9
2.08	Quality of management schools*	26	5.0
2.09	Gov't procurement of advanced tech*	39	4.1
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	55	3,714.5
3.02	Mobile network coverage, % pop.	25	99.9
3.03	Int'l Internet bandwidth, kb/s per user	49	20.6
3.04	Secure Internet servers/million pop.	27	329.3
3.05	Accessibility of digital content*	28	6.0
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	94	0.40
4.02	Fixed broadband Internet tariffs, PPP $/month	99	50.39
4.03	Internet & telephony competition, 0–2 (best)	110	1.20
	5th pillar: Skills		
5.01	Quality of educational system*	15	5.1
5.02	Quality of math & science education*	10	5.3
5.03	Secondary education gross enrollment rate, %	28	100.6
5.04	Adult literacy rate, %	15	99.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	29	128.1
6.02	Individuals using Internet, %	28	70.2
6.03	Households w/ personal computer, %	39	61.4
6.04	Households w/ Internet access, %	45	51.0
6.05	Broadband Internet subscriptions/100 pop.	31	20.6
6.06	Mobile broadband subscriptions/100 pop.	n/a	n/a
6.07	Use of virtual social networks*	42	5.7
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	38	5.4
7.02	Capacity for innovation*	91	2.7
7.03	PCT patents, applications/million pop.	32	11.5
7.04	Extent of business Internet use*	39	5.5
7.05	Extent of staff training*	36	4.4
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	29	5.4
8.02	Importance of ICT to gov't vision*	45	4.3
8.03	Government Online Service Index, 0–1 (best)	104	0.20
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	49	4.8
9.02	ICT PCT patents, applications/million pop.	34	2.7
9.03	Impact of ICT on new organizational models*	64	4.2
9.04	Knowledge-intensive jobs, % workforce	1	57.6
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	32	5.3
10.02	Internet access in schools*	30	5.5
10.03	ICT use & gov't efficiency*	52	4.5
10.04	E-Participation Index, 0–1 (best)	94	0.10

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Belgium

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**22**	**5.1**
A. Environment subindex	**22**	**4.9**
1st pillar: Political and regulatory environment	26	4.8
2nd pillar: Business and innovation environment	21	5.0
B. Readiness subindex	**20**	**5.8**
3rd pillar: Infrastructure and digital content	21	5.8
4th pillar: Affordability	68	5.3
5th pillar: Skills	3	6.4
C. Usage subindex	**23**	**4.9**
6th pillar: Individual usage	23	5.1
7th pillar: Business usage	19	5.0
8th pillar: Government usage	34	4.6
D. Impact subindex	**22**	**4.9**
9th pillar: Economic impacts	22	4.7
10th pillar: Social impacts	20	5.1



The Networked Readiness Index in detail

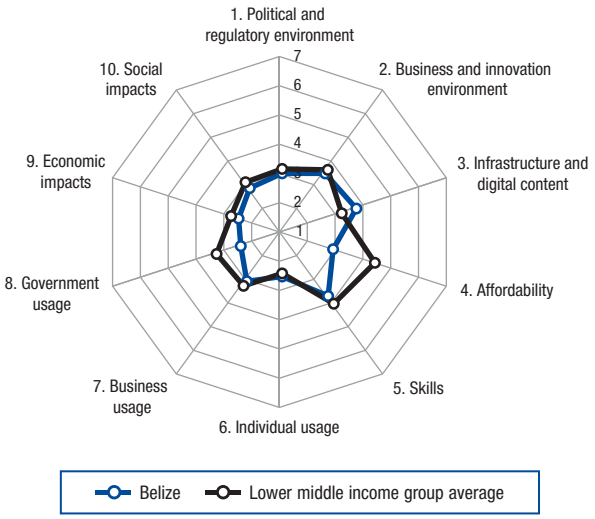
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	73	3.4
1.02	Laws relating to ICT*	35	4.8
1.03	Judicial independence*	29	5.3
1.04	Efficiency of legal system in settling disputes*	51	4.1
1.05	Efficiency of legal system in challenging regs*	41	4.2
1.06	Intellectual property protection*	26	5.1
1.07	Software piracy rate, % software installed	7	25
1.08	No. procedures to enforce a contract	5	26
1.09	No. days to enforce a contract	59	505
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	8	6.5
2.02	Venture capital availability*	20	3.5
2.03	Total tax rate, % profits	119	57.3
2.04	No. days to start a business	8	4
2.05	No. procedures to start a business	8	3
2.06	Intensity of local competition*	2	6.0
2.07	Tertiary education gross enrollment rate, %	21	67.5
2.08	Quality of management schools*	1	6.1
2.09	Gov't procurement of advanced tech*	36	4.1
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	20	8,412.1
3.02	Mobile network coverage, % pop.	25	99.9
3.03	Int'l Internet bandwidth, kb/s per user	11	112.0
3.04	Secure Internet servers/million pop.	23	489.8
3.05	Accessibility of digital content*	10	6.3
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	126	0.58
4.02	Fixed broadband Internet tariffs, PPP $/month	27	21.82
4.03	Internet & telephony competition, 0–2 (best)	80	1.75
	5th pillar: Skills		
5.01	Quality of educational system*	6	5.5
5.02	Quality of math & science education*	2	6.3
5.03	Secondary education gross enrollment rate, %	8	110.5
5.04	Adult literacy rate, %	15	99.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	53	113.5
6.02	Individuals using Internet, %	20	75.0
6.03	Households w/ personal computer, %	22	76.7
6.04	Households w/ Internet access, %	22	72.7
6.05	Broadband Internet subscriptions/100 pop.	12	31.5
6.06	Mobile broadband subscriptions/100 pop.	48	8.0
6.07	Use of virtual social networks*	24	6.0
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	26	5.6
7.02	Capacity for innovation*	14	4.7
7.03	PCT patents, applications/million pop.	16	102.1
7.04	Extent of business Internet use*	26	5.8
7.05	Extent of staff training*	13	5.0
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	51	4.9
8.02	Importance of ICT to gov't vision*	66	4.0
8.03	Government Online Service Index, 0–1 (best)	17	0.63
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	37	5.0
9.02	ICT PCT patents, applications/million pop.	19	21.7
9.03	Impact of ICT on new organizational models*	27	4.9
9.04	Knowledge-intensive jobs, % workforce	10	43.4
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	25	5.5
10.02	Internet access in schools*	20	5.9
10.03	ICT use & gov't efficiency*	58	4.4
10.04	E-Participation Index, 0–1 (best)	17	0.59

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Belize

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**119**	**3.0**
A. Environment subindex	**121**	**3.3**
1st pillar: Political and regulatory environment	116	3.0
2nd pillar: Business and innovation environment	119	3.5
B. Readiness subindex	**112**	**3.4**
3rd pillar: Infrastructure and digital content	78	3.7
4th pillar: Affordability	131	2.8
5th pillar: Skills	116	3.7
C. Usage subindex	**123**	**2.7**
6th pillar: Individual usage	99	2.5
7th pillar: Business usage	119	3.1
8th pillar: Government usage	137	2.5
D. Impact subindex	**123**	**2.7**
9th pillar: Economic impacts	123	2.6
10th pillar: Social impacts	122	2.9



The Networked Readiness Index in detail

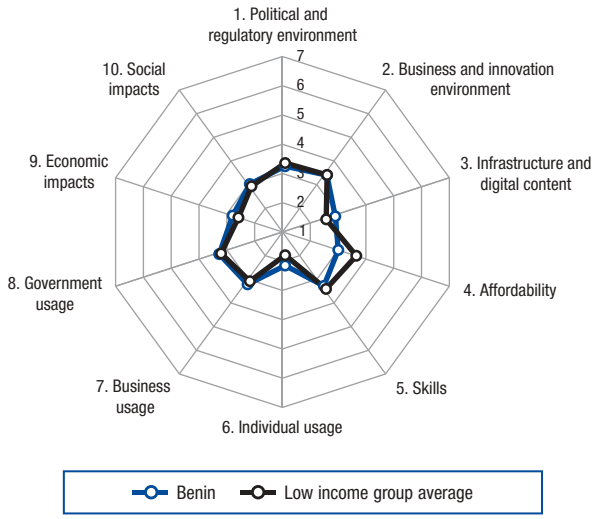
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	89	3.2
1.02	Laws relating to ICT*	124	2.7
1.03	Judicial independence*	98	3.1
1.04	Efficiency of legal system in settling disputes*	98	3.1
1.05	Efficiency of legal system in challenging regs*	98	3.0
1.06	Intellectual property protection*	81	3.3
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	137	51
1.09	No. days to enforce a contract	124	892
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	92	4.6
2.02	Venture capital availability*	134	1.8
2.03	Total tax rate, % profits	47	33.2
2.04	No. days to start a business	122	44
2.05	No. procedures to start a business	97	9
2.06	Intensity of local competition*	107	4.2
2.07	Tertiary education gross enrollment rate, %	90	21.5
2.08	Quality of management schools*	120	3.4
2.09	Gov't procurement of advanced tech*	125	2.8
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	101	720.2
3.02	Mobile network coverage, % pop.	n/a	n/a
3.03	Int'l Internet bandwidth, kb/s per user	54	18.3
3.04	Secure Internet servers/million pop.	30	301.7
3.05	Accessibility of digital content*	113	4.0
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	118	0.53
4.02	Fixed broadband Internet tariffs, PPP $/month	129	162.74
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	126	2.7
5.02	Quality of math & science education*	109	3.3
5.03	Secondary education gross enrollment rate, %	99	74.8
5.04	Adult literacy rate, %	n/a	n/a

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	114	62.3
6.02	Individuals using Internet, %	101	14.0
6.03	Households w/ personal computer, %	108	8.2
6.04	Households w/ Internet access, %	n/a	n/a
6.05	Broadband Internet subscriptions/100 pop.	84	2.9
6.06	Mobile broadband subscriptions/100 pop.	n/a	n/a
6.07	Use of virtual social networks*	98	4.7
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	129	3.9
7.02	Capacity for innovation*	131	2.3
7.03	PCT patents, applications/million pop.	55	1.8
7.04	Extent of business Internet use*	81	4.8
7.05	Extent of staff training*	123	3.2
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	136	3.1
8.02	Importance of ICT to gov't vision*	139	2.4
8.03	Government Online Service Index, 0–1 (best)	116	0.16
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	130	3.3
9.02	ICT PCT patents, applications/million pop.	75	0.1
9.03	Impact of ICT on new organizational models*	130	3.0
9.04	Knowledge-intensive jobs, % workforce	69	20.4
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	121	3.5
10.02	Internet access in schools*	91	3.6
10.03	ICT use & gov't efficiency*	133	2.8
10.04	E-Participation Index, 0–1 (best)	94	0.10

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Benin

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**117**	**3.0**
A. Environment subindex	**114**	**3.3**
1st pillar: Political and regulatory environment	101	3.3
2nd pillar: Business and innovation environment	124	3.4
B. Readiness subindex	**128**	**3.0**
3rd pillar: Infrastructure and digital content	116	2.8
4th pillar: Affordability	125	2.9
5th pillar: Skills	126	3.2
C. Usage subindex	**112**	**2.9**
6th pillar: Individual usage	112	2.1
7th pillar: Business usage	106	3.2
8th pillar: Government usage	104	3.4
D. Impact subindex	**106**	**3.0**
9th pillar: Economic impacts	101	2.9
10th pillar: Social impacts	110	3.1



The Networked Readiness Index in detail

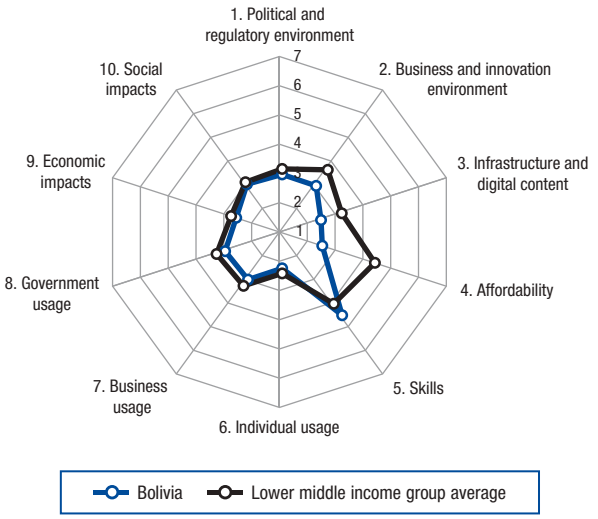
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	72	3.4
1.02	Laws relating to ICT*	120	2.9
1.03	Judicial independence*	95	3.1
1.04	Efficiency of legal system in settling disputes*	77	3.5
1.05	Efficiency of legal system in challenging regs*	85	3.2
1.06	Intellectual property protection*	95	3.0
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	112	42
1.09	No. days to enforce a contract	114	795
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	108	4.4
2.02	Venture capital availability*	87	2.3
2.03	Total tax rate, % profits	128	66.0
2.04	No. days to start a business	99	29
2.05	No. procedures to start a business	46	6
2.06	Intensity of local competition*	93	4.5
2.07	Tertiary education gross enrollment rate, %	120	6.0
2.08	Quality of management schools*	56	4.4
2.09	Gov't procurement of advanced tech*	38	4.1
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	139	16.3
3.02	Mobile network coverage, % pop.	97	90.0
3.03	Int'l Internet bandwidth, kb/s per user	115	2.2
3.04	Secure Internet servers/million pop.	140	0.1
3.05	Accessibility of digital content*	116	3.9
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	89	0.38
4.02	Fixed broadband Internet tariffs, PPP $/month	121	106.11
4.03	Internet & telephony competition, 0–2 (best)	107	1.25
	5th pillar: Skills		
5.01	Quality of educational system*	43	4.3
5.02	Quality of math & science education*	54	4.2
5.03	Secondary education gross enrollment rate, %	127	37.1
5.04	Adult literacy rate, %	136	41.7

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	99	79.9
6.02	Individuals using Internet, %	131	3.1
6.03	Households w/ personal computer, %	132	2.5
6.04	Households w/ Internet access, %	139	0.1
6.05	Broadband Internet subscriptions/100 pop.	128	0.0
6.06	Mobile broadband subscriptions/100 pop.	n/a	n/a
6.07	Use of virtual social networks*	103	4.7
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	101	4.3
7.02	Capacity for innovation*	79	2.9
7.03	PCT patents, applications/million pop.	110	0.0
7.04	Extent of business Internet use*	114	4.2
7.05	Extent of staff training*	110	3.4
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	58	4.8
8.02	Importance of ICT to gov't vision*	91	3.6
8.03	Government Online Service Index, 0–1 (best)	123	0.12
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	85	4.2
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	117	3.4
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	101	3.9
10.02	Internet access in schools*	105	3.3
10.03	ICT use & gov't efficiency*	109	3.6
10.04	E-Participation Index, 0–1 (best)	105	0.07

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Bolivia

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**127**	**2.9**
A. Environment subindex	**133**	**3.0**
1st pillar: Political and regulatory environment	118	3.0
2nd pillar: Business and innovation environment	135	3.0
B. Readiness subindex	**122**	**3.1**
3rd pillar: Infrastructure and digital content	129	2.4
4th pillar: Affordability	136	2.4
5th pillar: Skills	95	4.5
C. Usage subindex	**120**	**2.7**
6th pillar: Individual usage	108	2.2
7th pillar: Business usage	123	3.0
8th pillar: Government usage	120	3.0
D. Impact subindex	**116**	**2.8**
9th pillar: Economic impacts	117	2.6
10th pillar: Social impacts	112	3.0



The Networked Readiness Index in detail

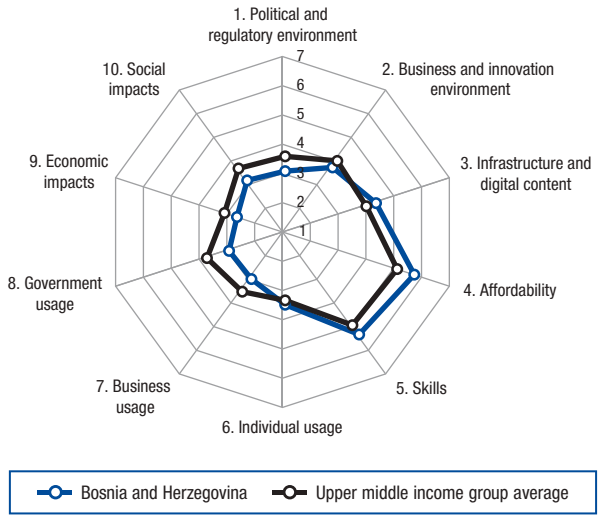
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	108	2.9
1.02	Laws relating to ICT*	119	3.0
1.03	Judicial independence*	100	3.0
1.04	Efficiency of legal system in settling disputes*	110	2.9
1.05	Efficiency of legal system in challenging regs*	107	2.9
1.06	Intellectual property protection*	118	2.6
1.07	Software piracy rate, % software installed	87	80
1.08	No. procedures to enforce a contract	97	40
1.09	No. days to enforce a contract	85	591
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	136	3.7
2.02	Venture capital availability*	48	2.9
2.03	Total tax rate, % profits	136	80.0
2.04	No. days to start a business	125	50
2.05	No. procedures to start a business	136	15
2.06	Intensity of local competition*	134	3.8
2.07	Tertiary education gross enrollment rate, %	62	38.6
2.08	Quality of management schools*	122	3.3
2.09	Gov't procurement of advanced tech*	107	3.2
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	106	648.8
3.02	Mobile network coverage, % pop.	128	45.9
3.03	Int'l Internet bandwidth, kb/s per user	102	4.3
3.04	Secure Internet servers/million pop.	92	8.0
3.05	Accessibility of digital content*	122	3.6
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	117	0.52
4.02	Fixed broadband Internet tariffs, PPP $/month	116	84.40
4.03	Internet & telephony competition, 0–2 (best)	125	0.80
	5th pillar: Skills		
5.01	Quality of educational system*	106	3.1
5.02	Quality of math & science education*	117	3.0
5.03	Secondary education gross enrollment rate, %	88	81.0
5.04	Adult literacy rate, %	82	90.7

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	105	72.3
6.02	Individuals using Internet, %	95	20.0
6.03	Households w/ personal computer, %	91	17.0
6.04	Households w/ Internet access, %	107	3.9
6.05	Broadband Internet subscriptions/100 pop.	100	1.0
6.06	Mobile broadband subscriptions/100 pop.	77	2.7
6.07	Use of virtual social networks*	123	4.2
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	139	3.6
7.02	Capacity for innovation*	70	3.0
7.03	PCT patents, applications/million pop.	106	0.0
7.04	Extent of business Internet use*	128	3.9
7.05	Extent of staff training*	113	3.4
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	131	3.4
8.02	Importance of ICT to gov't vision*	123	2.9
8.03	Government Online Service Index, 0–1 (best)	77	0.30
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	119	3.6
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	98	3.7
9.04	Knowledge-intensive jobs, % workforce	93	14.3
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	126	3.4
10.02	Internet access in schools*	113	3.2
10.03	ICT use & gov't efficiency*	117	3.4
10.04	E-Participation Index, 0–1 (best)	56	0.20

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Bosnia and Herzegovina

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**84**	**3.7**
A. Environment subindex	**109**	**3.4**
1st pillar: Political and regulatory environment	108	3.1
2nd pillar: Business and innovation environment	97	3.8
B. Readiness subindex	**50**	**5.1**
3rd pillar: Infrastructure and digital content	62	4.3
4th pillar: Affordability	45	5.6
5th pillar: Skills	45	5.3
C. Usage subindex	**99**	**3.1**
6th pillar: Individual usage	61	3.5
7th pillar: Business usage	126	3.0
8th pillar: Government usage	123	3.0
D. Impact subindex	**105**	**3.0**
9th pillar: Economic impacts	111	2.7
10th pillar: Social impacts	101	3.2



The Networked Readiness Index in detail

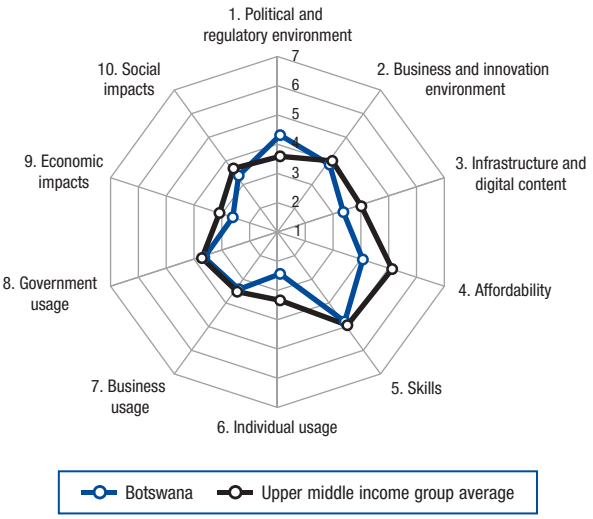
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	121	2.5
1.02	Laws relating to ICT*	115	3.1
1.03	Judicial independence*	97	3.1
1.04	Efficiency of legal system in settling disputes*	119	2.8
1.05	Efficiency of legal system in challenging regs*	109	2.9
1.06	Intellectual property protection*	121	2.6
1.07	Software piracy rate, % software installed	63	66
1.08	No. procedures to enforce a contract	69	37
1.09	No. days to enforce a contract	87	595
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	105	4.4
2.02	Venture capital availability*	125	2.0
2.03	Total tax rate, % profits	21	25.0
2.04	No. days to start a business	119	40
2.05	No. procedures to start a business	121	12
2.06	Intensity of local competition*	132	3.8
2.07	Tertiary education gross enrollment rate, %	69	35.9
2.08	Quality of management schools*	71	4.1
2.09	Gov't procurement of advanced tech*	109	3.2
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	59	3,513.6
3.02	Mobile network coverage, % pop.	42	99.7
3.03	Int'l Internet bandwidth, kb/s per user	60	15.6
3.04	Secure Internet servers/million pop.	73	16.0
3.05	Accessibility of digital content*	66	5.0
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	81	0.34
4.02	Fixed broadband Internet tariffs, PPP $/month	47	28.30
4.03	Internet & telephony competition, 0–2 (best)	60	1.93
	5th pillar: Skills		
5.01	Quality of educational system*	73	3.6
5.02	Quality of math & science education*	41	4.5
5.03	Secondary education gross enrollment rate, %	64	89.6
5.04	Adult literacy rate, %	48	97.8

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	97	82.7
6.02	Individuals using Internet, %	44	52.0
6.03	Households w/ personal computer, %	70	33.7
6.04	Households w/ Internet access, %	77	18.1
6.05	Broadband Internet subscriptions/100 pop.	58	8.2
6.06	Mobile broadband subscriptions/100 pop.	n/a	n/a
6.07	Use of virtual social networks*	85	5.0
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	107	4.2
7.02	Capacity for innovation*	124	2.4
7.03	PCT patents, applications/million pop.	49	2.1
7.04	Extent of business Internet use*	108	4.4
7.05	Extent of staff training*	137	2.7
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	127	3.6
8.02	Importance of ICT to gov't vision*	128	2.8
8.03	Government Online Service Index, 0–1 (best)	88	0.28
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	118	3.6
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	107	3.6
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	67	4.4
10.02	Internet access in schools*	81	3.8
10.03	ICT use & gov't efficiency*	120	3.3
10.04	E-Participation Index, 0–1 (best)	117	0.04

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Botswana

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**89**	**3.6**
A. Environment subindex	**52**	**4.1**
1st pillar: Political and regulatory environment	40	4.3
2nd pillar: Business and innovation environment	79	3.9
B. Readiness subindex	**98**	**4.0**
3rd pillar: Infrastructure and digital content	93	3.3
4th pillar: Affordability	101	4.0
5th pillar: Skills	85	4.8
C. Usage subindex	**96**	**3.2**
6th pillar: Individual usage	102	2.4
7th pillar: Business usage	87	3.4
8th pillar: Government usage	72	3.7
D. Impact subindex	**98**	**3.1**
9th pillar: Economic impacts	113	2.7
10th pillar: Social impacts	91	3.4



The Networked Readiness Index in detail

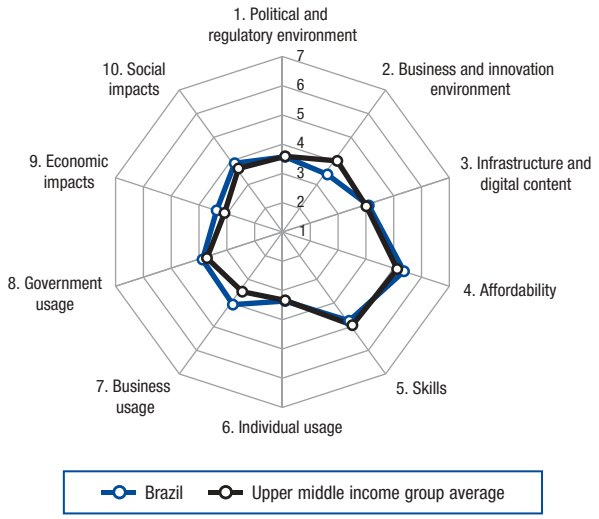
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	22	4.8
1.02	Laws relating to ICT*	80	3.7
1.03	Judicial independence*	25	5.4
1.04	Efficiency of legal system in settling disputes*	23	4.9
1.05	Efficiency of legal system in challenging regs*	18	4.7
1.06	Intellectual property protection*	49	4.0
1.07	Software piracy rate, % software installed	82	79
1.08	No. procedures to enforce a contract	12	28
1.09	No. days to enforce a contract	94	625
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	84	4.7
2.02	Venture capital availability*	46	2.9
2.03	Total tax rate, % profits	13	19.4
2.04	No. days to start a business	129	61
2.05	No. procedures to start a business	110	10
2.06	Intensity of local competition*	75	4.8
2.07	Tertiary education gross enrollment rate, %	118	7.4
2.08	Quality of management schools*	95	3.7
2.09	Gov't procurement of advanced tech*	57	3.8
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	116	322.8
3.02	Mobile network coverage, % pop.	49	99.0
3.03	Int'l Internet bandwidth, kb/s per user	90	6.4
3.04	Secure Internet servers/million pop.	89	8.5
3.05	Accessibility of digital content*	107	4.3
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	109	0.49
4.02	Fixed broadband Internet tariffs, PPP $/month	103	54.55
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	58	3.9
5.02	Quality of math & science education*	70	4.0
5.03	Secondary education gross enrollment rate, %	91	80.0
5.04	Adult literacy rate, %	103	84.1

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	45	117.8
6.02	Individuals using Internet, %	126	6.0
6.03	Households w/ personal computer, %	113	6.5
6.04	Households w/ Internet access, %	117	2.8
6.05	Broadband Internet subscriptions/100 pop.	106	0.6
6.06	Mobile broadband subscriptions/100 pop.	39	10.4
6.07	Use of virtual social networks*	109	4.5
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	91	4.5
7.02	Capacity for innovation*	104	2.6
7.03	PCT patents, applications/million pop.	119	0.0
7.04	Extent of business Internet use*	97	4.6
7.05	Extent of staff training*	44	4.3
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	61	4.8
8.02	Importance of ICT to gov't vision*	54	4.2
8.03	Government Online Service Index, 0–1 (best)	104	0.20
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	114	3.8
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	119	3.4
9.04	Knowledge-intensive jobs, % workforce	85	17.1
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	81	4.2
10.02	Internet access in schools*	93	3.5
10.03	ICT use & gov't efficiency*	63	4.3
10.04	E-Participation Index, 0–1 (best)	94	0.10

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Brazil

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**65**	**3.9**
A. Environment subindex	**101**	**3.5**
1st pillar: Political and regulatory environment	77	3.6
2nd pillar: Business and innovation environment	121	3.5
B. Readiness subindex	**72**	**4.7**
3rd pillar: Infrastructure and digital content	68	4.0
4th pillar: Affordability	67	5.3
5th pillar: Skills	86	4.7
C. Usage subindex	**54**	**3.8**
6th pillar: Individual usage	66	3.3
7th pillar: Business usage	33	4.0
8th pillar: Government usage	59	4.0
D. Impact subindex	**53**	**3.7**
9th pillar: Economic impacts	52	3.5
10th pillar: Social impacts	54	3.9



The Networked Readiness Index in detail

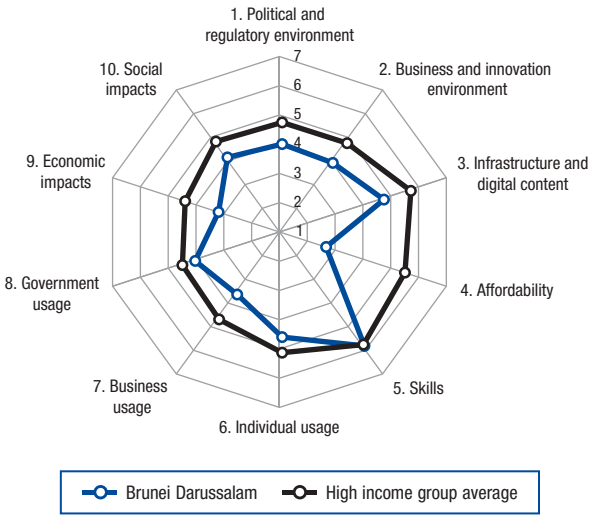
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	113	2.7
1.02	Laws relating to ICT*	46	4.4
1.03	Judicial independence*	71	3.7
1.04	Efficiency of legal system in settling disputes*	75	3.5
1.05	Efficiency of legal system in challenging regs*	66	3.7
1.06	Intellectual property protection*	84	3.2
1.07	Software piracy rate, % software installed	40	54
1.08	No. procedures to enforce a contract	123	45
1.09	No. days to enforce a contract	107	731
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	53	5.4
2.02	Venture capital availability*	52	2.8
2.03	Total tax rate, % profits	130	67.1
2.04	No. days to start a business	138	119
2.05	No. procedures to start a business	129	13
2.06	Intensity of local competition*	48	5.2
2.07	Tertiary education gross enrollment rate, %	68	36.1
2.08	Quality of management schools*	61	4.3
2.09	Gov't procurement of advanced tech*	52	3.9
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	72	2,419.1
3.02	Mobile network coverage, % pop.	35	99.9
3.03	Int'l Internet bandwidth, kb/s per user	65	12.6
3.04	Secure Internet servers/million pop.	58	40.7
3.05	Accessibility of digital content*	71	4.9
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	133	0.73
4.02	Fixed broadband Internet tariffs, PPP $/month	12	17.60
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	115	3.0
5.02	Quality of math & science education*	127	2.7
5.03	Secondary education gross enrollment rate, %	23	101.3
5.04	Adult literacy rate, %	85	90.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	66	104.1
6.02	Individuals using Internet, %	64	40.7
6.03	Households w/ personal computer, %	66	34.9
6.04	Households w/ Internet access, %	64	27.1
6.05	Broadband Internet subscriptions/100 pop.	62	6.8
6.06	Mobile broadband subscriptions/100 pop.	55	6.3
6.07	Use of virtual social networks*	55	5.5
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	48	5.2
7.02	Capacity for innovation*	31	3.8
7.03	PCT patents, applications/million pop.	47	2.7
7.04	Extent of business Internet use*	29	5.7
7.05	Extent of staff training*	33	4.4
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	67	4.7
8.02	Importance of ICT to gov't vision*	65	4.0
8.03	Government Online Service Index, 0–1 (best)	53	0.37
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	29	5.2
9.02	ICT PCT patents, applications/million pop.	52	0.3
9.03	Impact of ICT on new organizational models*	34	4.8
9.04	Knowledge-intensive jobs, % workforce	76	19.3
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	54	4.6
10.02	Internet access in schools*	86	3.8
10.03	ICT use & gov't efficiency*	42	4.7
10.04	E-Participation Index, 0–1 (best)	41	0.29

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Brunei Darussalam

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**54**	**4.0**
A. Environment subindex	**57**	**4.0**
1st pillar: Political and regulatory environment	48	4.0
2nd pillar: Business and innovation environment	76	3.9
B. Readiness subindex	**87**	**4.3**
3rd pillar: Infrastructure and digital content	48	4.7
4th pillar: Affordability	135	2.6
5th pillar: Skills	25	5.8
C. Usage subindex	**41**	**4.1**
6th pillar: Individual usage	39	4.6
7th pillar: Business usage	61	3.6
8th pillar: Government usage	50	4.1
D. Impact subindex	**50**	**3.7**
9th pillar: Economic impacts	64	3.3
10th pillar: Social impacts	46	4.2



The Networked Readiness Index in detail

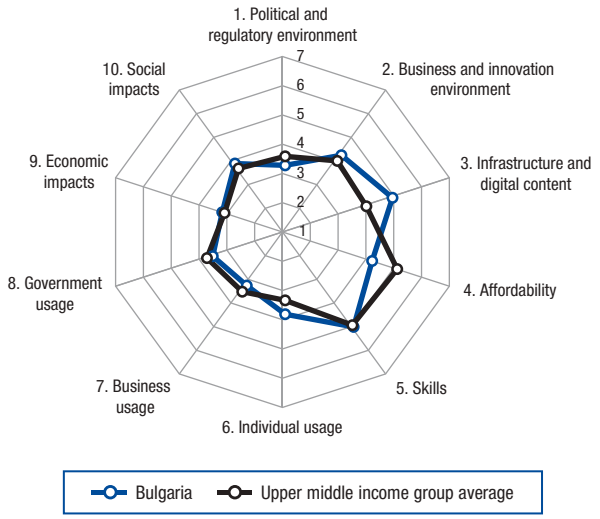
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	25	4.6
1.02	Laws relating to ICT*	70	3.9
1.03	Judicial independence*	42	4.8
1.04	Efficiency of legal system in settling disputes*	39	4.4
1.05	Efficiency of legal system in challenging regs*	52	3.9
1.06	Intellectual property protection*	50	3.9
1.07	Software piracy rate, % software installed	63	66
1.08	No. procedures to enforce a contract	130	47
1.09	No. days to enforce a contract	71	540
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	70	5.0
2.02	Venture capital availability*	42	2.9
2.03	Total tax rate, % profits	12	16.8
2.04	No. days to start a business	135	101
2.05	No. procedures to start a business	136	15
2.06	Intensity of local competition*	63	5.0
2.07	Tertiary education gross enrollment rate, %	98	17.2
2.08	Quality of management schools*	64	4.2
2.09	Gov't procurement of advanced tech*	23	4.3
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	16	8,898.0
3.02	Mobile network coverage, % pop.	n/a	n/a
3.03	Int'l Internet bandwidth, kb/s per user	42	25.1
3.04	Secure Internet servers/million pop.	53	65.2
3.05	Accessibility of digital content*	51	5.3
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	103	0.45
4.02	Fixed broadband Internet tariffs, PPP $/month	115	81.24
4.03	Internet & telephony competition, 0–2 (best)	126	0.78
	5th pillar: Skills		
5.01	Quality of educational system*	28	4.6
5.02	Quality of math & science education*	25	4.9
5.03	Secondary education gross enrollment rate, %	11	107.3
5.04	Adult literacy rate, %	61	95.3

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	56	109.1
6.02	Individuals using Internet, %	48	50.0
6.03	Households w/ personal computer, %	19	79.6
6.04	Households w/ Internet access, %	25	71.3
6.05	Broadband Internet subscriptions/100 pop.	69	5.4
6.06	Mobile broadband subscriptions/100 pop.	13	33.6
6.07	Use of virtual social networks*	45	5.7
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	63	4.9
7.02	Capacity for innovation*	75	3.0
7.03	PCT patents, applications/million pop.	54	1.9
7.04	Extent of business Internet use*	57	5.1
7.05	Extent of staff training*	59	4.1
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	37	5.3
8.02	Importance of ICT to gov't vision*	37	4.4
8.03	Government Online Service Index, 0–1 (best)	85	0.28
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	87	4.2
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	70	4.1
9.04	Knowledge-intensive jobs, % workforce	47	28.4
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	39	5.1
10.02	Internet access in schools*	37	5.1
10.03	ICT use & gov't efficiency*	50	4.5
10.04	E-Participation Index, 0–1 (best)	66	0.17

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Bulgaria

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**70**	**3.9**
A. Environment subindex	**73**	**3.8**
1st pillar: Political and regulatory environment	99	3.3
2nd pillar: Business and innovation environment	53	4.3
B. Readiness subindex	**73**	**4.7**
3rd pillar: Infrastructure and digital content	39	4.9
4th pillar: Affordability	98	4.1
5th pillar: Skills	70	5.0
C. Usage subindex	**68**	**3.5**
6th pillar: Individual usage	56	3.8
7th pillar: Business usage	101	3.2
8th pillar: Government usage	87	3.6
D. Impact subindex	**60**	**3.6**
9th pillar: Economic impacts	69	3.3
10th pillar: Social impacts	55	3.9



The Networked Readiness Index in detail

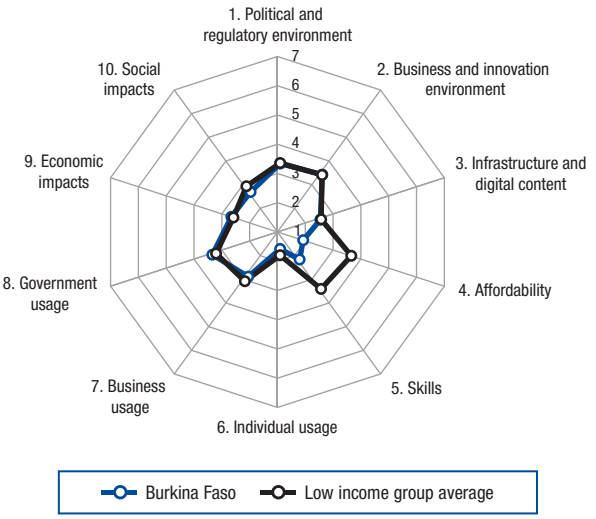
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	109	2.9
1.02	Laws relating to ICT*	60	4.1
1.03	Judicial independence*	104	2.9
1.04	Efficiency of legal system in settling disputes*	126	2.7
1.05	Efficiency of legal system in challenging regs*	120	2.8
1.06	Intellectual property protection*	100	2.9
1.07	Software piracy rate, % software installed	60	65
1.08	No. procedures to enforce a contract	87	39
1.09	No. days to enforce a contract	75	564
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	106	4.4
2.02	Venture capital availability*	66	2.6
2.03	Total tax rate, % profits	29	28.1
2.04	No. days to start a business	76	18
2.05	No. procedures to start a business	20	4
2.06	Intensity of local competition*	99	4.4
2.07	Tertiary education gross enrollment rate, %	44	53.0
2.08	Quality of management schools*	102	3.7
2.09	Gov't procurement of advanced tech*	77	3.5
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	38	5,873.0
3.02	Mobile network coverage, % pop.	22	100.0
3.03	Int'l Internet bandwidth, kb/s per user	21	64.2
3.04	Secure Internet servers/million pop.	51	73.4
3.05	Accessibility of digital content*	54	5.2
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	136	0.80
4.02	Fixed broadband Internet tariffs, PPP $/month	53	29.50
4.03	Internet & telephony competition, 0–2 (best)	98	1.36
	5th pillar: Skills		
5.01	Quality of educational system*	101	3.2
5.02	Quality of math & science education*	82	3.8
5.03	Secondary education gross enrollment rate, %	69	88.0
5.04	Adult literacy rate, %	45	98.3

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	23	136.1
6.02	Individuals using Internet, %	52	46.2
6.03	Households w/ personal computer, %	65	35.1
6.04	Households w/ Internet access, %	58	33.1
6.05	Broadband Internet subscriptions/100 pop.	39	14.5
6.06	Mobile broadband subscriptions/100 pop.	68	3.8
6.07	Use of virtual social networks*	60	5.4
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	127	3.9
7.02	Capacity for innovation*	82	2.9
7.03	PCT patents, applications/million pop.	46	3.6
7.04	Extent of business Internet use*	52	5.2
7.05	Extent of staff training*	128	3.1
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	112	3.9
8.02	Importance of ICT to gov't vision*	101	3.4
8.03	Government Online Service Index, 0–1 (best)	44	0.41
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	88	4.2
9.02	ICT PCT patents, applications/million pop.	45	0.8
9.03	Impact of ICT on new organizational models*	82	3.9
9.04	Knowledge-intensive jobs, % workforce	46	28.6
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	76	4.3
10.02	Internet access in schools*	47	4.8
10.03	ICT use & gov't efficiency*	92	3.8
10.04	E-Participation Index, 0–1 (best)	38	0.30

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Burkina Faso

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**135**	**2.7**
A. Environment subindex	**113**	**3.4**
1st pillar: Political and regulatory environment	96	3.4
2nd pillar: Business and innovation environment	123	3.4
B. Readiness subindex	**141**	**2.1**
3rd pillar: Infrastructure and digital content	127	2.4
4th pillar: Affordability	139	1.8
5th pillar: Skills	142	2.1
C. Usage subindex	**128**	**2.6**
6th pillar: Individual usage	139	1.6
7th pillar: Business usage	131	2.9
8th pillar: Government usage	98	3.4
D. Impact subindex	**122**	**2.7**
9th pillar: Economic impacts	109	2.8
10th pillar: Social impacts	127	2.7



The Networked Readiness Index in detail

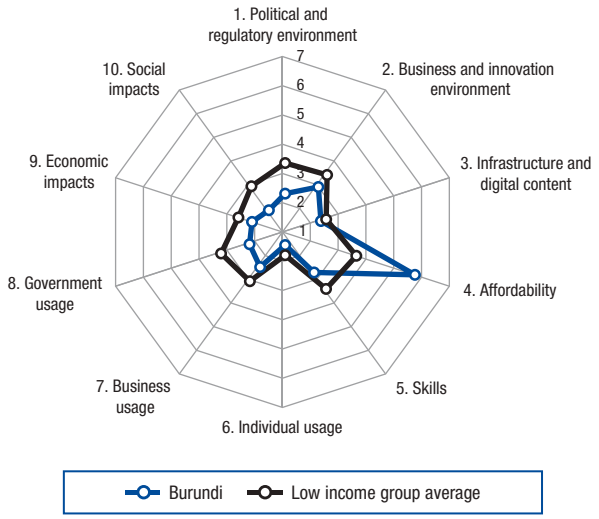
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	92	3.1
1.02	Laws relating to ICT*	103	3.4
1.03	Judicial independence*	125	2.6
1.04	Efficiency of legal system in settling disputes*	86	3.4
1.05	Efficiency of legal system in challenging regs*	106	2.9
1.06	Intellectual property protection*	87	3.2
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	69	37
1.09	No. days to enforce a contract	49	446
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	132	3.8
2.02	Venture capital availability*	138	1.6
2.03	Total tax rate, % profits	86	43.6
2.04	No. days to start a business	58	13
2.05	No. procedures to start a business	8	3
2.06	Intensity of local competition*	130	3.9
2.07	Tertiary education gross enrollment rate, %	134	3.3
2.08	Quality of management schools*	98	3.7
2.09	Gov't procurement of advanced tech*	88	3.4
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	136	41.6
3.02	Mobile network coverage, % pop.	125	61.1
3.03	Int'l Internet bandwidth, kb/s per user	104	3.5
3.04	Secure Internet servers/million pop.	137	0.2
3.05	Accessibility of digital content*	130	3.5
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	137	0.80
4.02	Fixed broadband Internet tariffs, PPP $/month	132	193.53
4.03	Internet & telephony competition, 0–2 (best)	127	0.75
	5th pillar: Skills		
5.01	Quality of educational system*	124	2.7
5.02	Quality of math & science education*	88	3.6
5.03	Secondary education gross enrollment rate, %	140	20.7
5.04	Adult literacy rate, %	139	28.7

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	135	34.7
6.02	Individuals using Internet, %	139	1.4
6.03	Households w/ personal computer, %	134	2.1
6.04	Households w/ Internet access, %	135	0.2
6.05	Broadband Internet subscriptions/100 pop.	121	0.1
6.06	Mobile broadband subscriptions/100 pop.	n/a	n/a
6.07	Use of virtual social networks*	137	3.5
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	106	4.2
7.02	Capacity for innovation*	128	2.3
7.03	PCT patents, applications/million pop.	109	0.0
7.04	Extent of business Internet use*	124	4.0
7.05	Extent of staff training*	138	2.7
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	75	4.6
8.02	Importance of ICT to gov't vision*	76	3.8
8.03	Government Online Service Index, 0–1 (best)	117	0.16
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	94	4.1
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	127	3.1
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	118	3.6
10.02	Internet access in schools*	137	1.9
10.03	ICT use & gov't efficiency*	79	4.1
10.04	E-Participation Index, 0–1 (best)	111	0.06

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Burundi

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**137**	**2.6**
A. Environment subindex	**140**	**2.6**
1st pillar: Political and regulatory environment	141	2.3
2nd pillar: Business and innovation environment	138	2.9
B. Readiness subindex	**109**	**3.5**
3rd pillar: Infrastructure and digital content	131	2.3
4th pillar: Affordability	43	5.7
5th pillar: Skills	135	2.7
C. Usage subindex	**142**	**2.1**
6th pillar: Individual usage	140	1.4
7th pillar: Business usage	142	2.5
8th pillar: Government usage	139	2.3
D. Impact subindex	**141**	**2.1**
9th pillar: Economic impacts	138	2.2
10th pillar: Social impacts	141	1.9



The Networked Readiness Index in detail

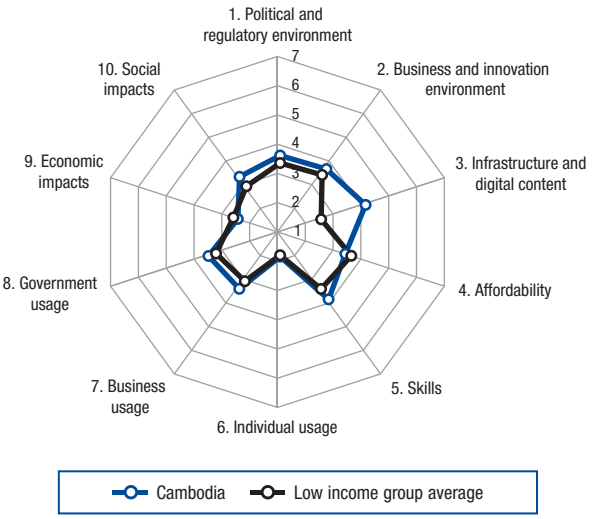
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	129	2.3
1.02	Laws relating to ICT*	141	2.0
1.03	Judicial independence*	141	1.7
1.04	Efficiency of legal system in settling disputes*	130	2.7
1.05	Efficiency of legal system in challenging regs*	134	2.5
1.06	Intellectual property protection*	139	1.9
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	120	44
1.09	No. days to enforce a contract	118	832
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	142	3.1
2.02	Venture capital availability*	142	1.4
2.03	Total tax rate, % profits	98	46.2
2.04	No. days to start a business	66	14
2.05	No. procedures to start a business	97	9
2.06	Intensity of local competition*	113	4.2
2.07	Tertiary education gross enrollment rate, %	135	3.2
2.08	Quality of management schools*	137	2.6
2.09	Gov't procurement of advanced tech*	140	2.3
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	138	26.2
3.02	Mobile network coverage, % pop.	111	83.0
3.03	Int'l Internet bandwidth, kb/s per user	142	0.1
3.04	Secure Internet servers/million pop.	138	0.2
3.05	Accessibility of digital content*	142	2.4
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	79	0.33
4.02	Fixed broadband Internet tariffs, PPP $/month	n/a	n/a
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	137	2.3
5.02	Quality of math & science education*	122	2.8
5.03	Secondary education gross enrollment rate, %	138	24.8
5.04	Adult literacy rate, %	120	66.6

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	141	13.7
6.02	Individuals using Internet, %	136	2.1
6.03	Households w/ personal computer, %	n/a	n/a
6.04	Households w/ Internet access, %	n/a	n/a
6.05	Broadband Internet subscriptions/100 pop.	140	0.0
6.06	Mobile broadband subscriptions/100 pop.	n/a	n/a
6.07	Use of virtual social networks*	142	2.6
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	142	3.2
7.02	Capacity for innovation*	140	1.8
7.03	PCT patents, applications/million pop.	119	0.0
7.04	Extent of business Internet use*	136	3.7
7.05	Extent of staff training*	139	2.6
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	135	3.1
8.02	Importance of ICT to gov't vision*	138	2.4
8.03	Government Online Service Index, 0–1 (best)	133	0.04
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	136	3.1
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	140	2.5
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	141	2.6
10.02	Internet access in schools*	142	1.3
10.03	ICT use & gov't efficiency*	134	2.8
10.04	E-Participation Index, 0–1 (best)	129	0.01

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Cambodia

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**108**	**3.3**
A. Environment subindex	**89**	**3.7**
1st pillar: Political and regulatory environment	73	3.6
2nd pillar: Business and innovation environment	106	3.7
B. Readiness subindex	**106**	**3.7**
3rd pillar: Infrastructure and digital content	66	4.1
4th pillar: Affordability	110	3.3
5th pillar: Skills	111	3.8
C. Usage subindex	**111**	**2.9**
6th pillar: Individual usage	126	1.8
7th pillar: Business usage	89	3.4
8th pillar: Government usage	88	3.6
D. Impact subindex	**110**	**2.9**
9th pillar: Economic impacts	126	2.5
10th pillar: Social impacts	93	3.4



The Networked Readiness Index in detail

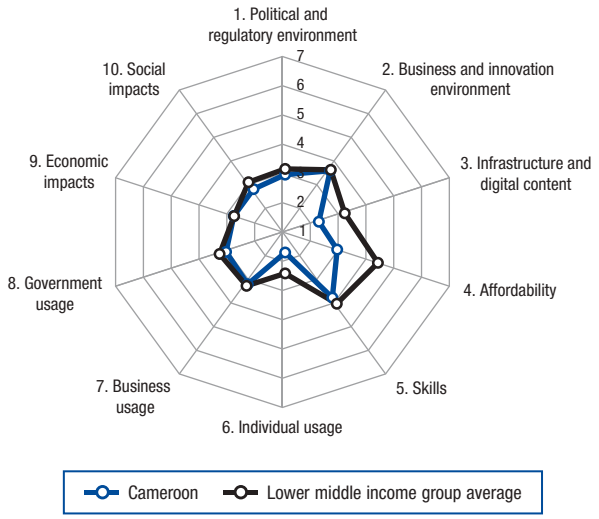
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	55	3.8
1.02	Laws relating to ICT*	93	3.6
1.03	Judicial independence*	96	3.1
1.04	Efficiency of legal system in settling disputes*	58	3.9
1.05	Efficiency of legal system in challenging regs*	48	4.0
1.06	Intellectual property protection*	91	3.1
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	120	44
1.09	No. days to enforce a contract	34	401
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	98	4.5
2.02	Venture capital availability*	61	2.7
2.03	Total tax rate, % profits	17	22.5
2.04	No. days to start a business	133	85
2.05	No. procedures to start a business	97	9
2.06	Intensity of local competition*	88	4.6
2.07	Tertiary education gross enrollment rate, %	117	7.8
2.08	Quality of management schools*	112	3.5
2.09	Gov't procurement of advanced tech*	40	4.1
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	129	105.7
3.02	Mobile network coverage, % pop.	49	99.0
3.03	Int'l Internet bandwidth, kb/s per user	40	28.1
3.04	Secure Internet servers/million pop.	112	1.7
3.05	Accessibility of digital content*	106	4.4
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	41	0.21
4.02	Fixed broadband Internet tariffs, PPP $/month	124	125.31
4.03	Internet & telephony competition, 0–2 (best)	99	1.35
	5th pillar: Skills		
5.01	Quality of educational system*	68	3.8
5.02	Quality of math & science education*	97	3.4
5.03	Secondary education gross enrollment rate, %	118	46.2
5.04	Adult literacy rate, %	107	77.6

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	120	57.7
6.02	Individuals using Internet, %	140	1.3
6.03	Households w/ personal computer, %	122	4.3
6.04	Households w/ Internet access, %	133	0.4
6.05	Broadband Internet subscriptions/100 pop.	114	0.3
6.06	Mobile broadband subscriptions/100 pop.	90	0.7
6.07	Use of virtual social networks*	108	4.6
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	77	4.7
7.02	Capacity for innovation*	85	2.8
7.03	PCT patents, applications/million pop.	119	0.0
7.04	Extent of business Internet use*	86	4.8
7.05	Extent of staff training*	97	3.6
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	60	4.8
8.02	Importance of ICT to gov't vision*	58	4.1
8.03	Government Online Service Index, 0–1 (best)	120	0.14
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	77	4.3
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	93	3.7
9.04	Knowledge-intensive jobs, % workforce	110	2.5
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	83	4.2
10.02	Internet access in schools*	95	3.5
10.03	ICT use & gov't efficiency*	80	4.1
10.04	E-Participation Index, 0–1 (best)	88	0.11

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Cameroon

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**125**	**2.9**
A. Environment subindex	**118**	**3.3**
1st pillar: Political and regulatory environment	119	3.0
2nd pillar: Business and innovation environment	111	3.6
B. Readiness subindex	**131**	**2.9**
3rd pillar: Infrastructure and digital content	132	2.2
4th pillar: Affordability	129	2.9
5th pillar: Skills	114	3.7
C. Usage subindex	**126**	**2.7**
6th pillar: Individual usage	134	1.7
7th pillar: Business usage	107	3.2
8th pillar: Government usage	118	3.1
D. Impact subindex	**117**	**2.8**
9th pillar: Economic impacts	105	2.8
10th pillar: Social impacts	124	2.8



The Networked Readiness Index in detail

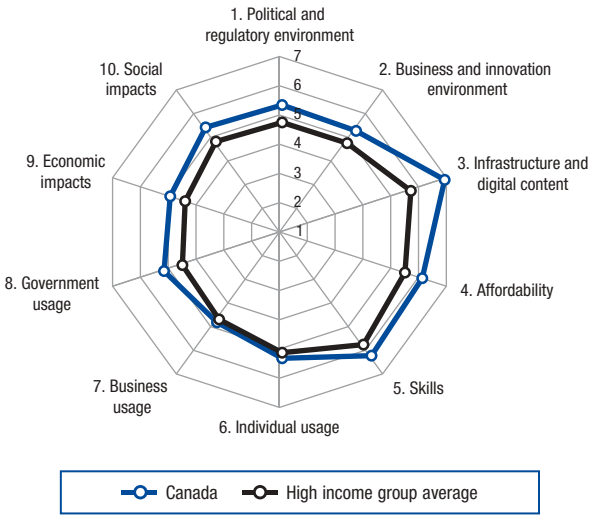
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	86	3.2
1.02	Laws relating to ICT*	122	2.8
1.03	Judicial independence*	113	2.7
1.04	Efficiency of legal system in settling disputes*	85	3.4
1.05	Efficiency of legal system in challenging regs*	87	3.2
1.06	Intellectual property protection*	97	3.0
1.07	Software piracy rate, % software installed	90	82
1.08	No. procedures to enforce a contract	115	43
1.09	No. days to enforce a contract	115	800
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	125	3.9
2.02	Venture capital availability*	116	2.1
2.03	Total tax rate, % profits	106	49.1
2.04	No. days to start a business	71	15
2.05	No. procedures to start a business	28	5
2.06	Intensity of local competition*	90	4.6
2.07	Tertiary education gross enrollment rate, %	107	11.5
2.08	Quality of management schools*	65	4.2
2.09	Gov't procurement of advanced tech*	79	3.5
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	118	295.9
3.02	Mobile network coverage, % pop.	126	58.0
3.03	Int'l Internet bandwidth, kb/s per user	133	0.4
3.04	Secure Internet servers/million pop.	129	0.6
3.05	Accessibility of digital content*	135	3.3
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	97	0.42
4.02	Fixed broadband Internet tariffs, PPP $/month	127	160.03
4.03	Internet & telephony competition, 0–2 (best)	97	1.36
	5th pillar: Skills		
5.01	Quality of educational system*	78	3.5
5.02	Quality of math & science education*	80	3.8
5.03	Secondary education gross enrollment rate, %	123	42.2
5.04	Adult literacy rate, %	109	75.9

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	130	44.1
6.02	Individuals using Internet, %	128	4.0
6.03	Households w/ personal computer, %	118	5.4
6.04	Households w/ Internet access, %	122	1.5
6.05	Broadband Internet subscriptions/100 pop.	138	0.0
6.06	Mobile broadband subscriptions/100 pop.	106	0.2
6.07	Use of virtual social networks*	128	4.0
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	108	4.2
7.02	Capacity for innovation*	114	2.5
7.03	PCT patents, applications/million pop.	86	0.2
7.04	Extent of business Internet use*	94	4.6
7.05	Extent of staff training*	95	3.6
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	104	4.1
8.02	Importance of ICT to gov't vision*	105	3.3
8.03	Government Online Service Index, 0–1 (best)	118	0.15
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	93	4.1
9.02	ICT PCT patents, applications/million pop.	74	0.1
9.03	Impact of ICT on new organizational models*	120	3.4
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	122	3.5
10.02	Internet access in schools*	131	2.4
10.03	ICT use & gov't efficiency*	116	3.5
10.04	E-Participation Index, 0–1 (best)	73	0.16

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Canada

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**9**	**5.5**
A. Environment subindex	**8**	**5.3**
1st pillar: Political and regulatory environment	12	5.4
2nd pillar: Business and innovation environment	5	5.3
B. Readiness subindex	**4**	**6.4**
3rd pillar: Infrastructure and digital content	3	6.8
4th pillar: Affordability	21	6.0
5th pillar: Skills	5	6.2
C. Usage subindex	**18**	**5.1**
6th pillar: Individual usage	20	5.3
7th pillar: Business usage	23	4.8
8th pillar: Government usage	9	5.2
D. Impact subindex	**14**	**5.2**
9th pillar: Economic impacts	17	5.0
10th pillar: Social impacts	11	5.4



The Networked Readiness Index in detail

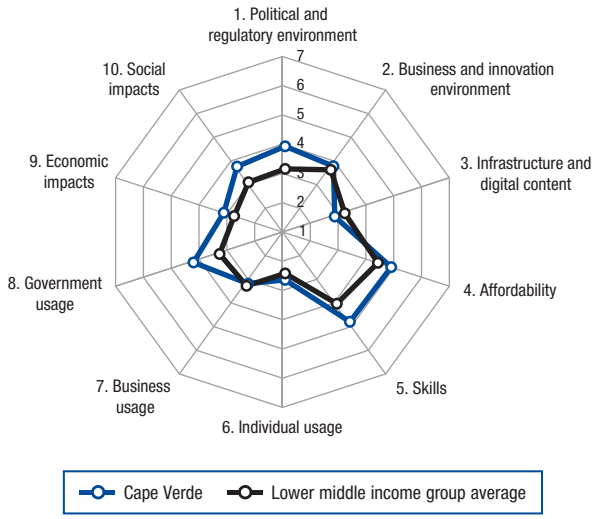
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	11	5.2
1.02	Laws relating to ICT*	21	5.3
1.03	Judicial independence*	8	6.3
1.04	Efficiency of legal system in settling disputes*	10	5.4
1.05	Efficiency of legal system in challenging regs*	11	5.1
1.06	Intellectual property protection*	18	5.4
1.07	Software piracy rate, % software installed	14	28
1.08	No. procedures to enforce a contract	55	36
1.09	No. days to enforce a contract	79	570
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	14	6.3
2.02	Venture capital availability*	19	3.6
2.03	Total tax rate, % profits	32	28.8
2.04	No. days to start a business	10	5
2.05	No. procedures to start a business	1	1
2.06	Intensity of local competition*	21	5.6
2.07	Tertiary education gross enrollment rate, %	36	60.0
2.08	Quality of management schools*	4	5.8
2.09	Gov't procurement of advanced tech*	35	4.1
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	4	18,485.8
3.02	Mobile network coverage, % pop.	49	99.0
3.03	Int'l Internet bandwidth, kb/s per user	25	54.0
3.04	Secure Internet servers/million pop.	14	1,238.9
3.05	Accessibility of digital content*	14	6.2
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	78	0.33
4.02	Fixed broadband Internet tariffs, PPP $/month	29	22.11
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	7	5.4
5.02	Quality of math & science education*	8	5.4
5.03	Secondary education gross enrollment rate, %	24	101.3
5.04	Adult literacy rate, %	15	99.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	107	70.7
6.02	Individuals using Internet, %	13	81.6
6.03	Households w/ personal computer, %	12	83.9
6.04	Households w/ Internet access, %	16	78.2
6.05	Broadband Internet subscriptions/100 pop.	14	29.8
6.06	Mobile broadband subscriptions/100 pop.	16	30.4
6.07	Use of virtual social networks*	5	6.3
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	29	5.6
7.02	Capacity for innovation*	24	4.1
7.03	PCT patents, applications/million pop.	21	77.4
7.04	Extent of business Internet use*	10	6.1
7.05	Extent of staff training*	18	4.9
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	38	5.2
8.02	Importance of ICT to gov't vision*	53	4.2
8.03	Government Online Service Index, 0–1 (best)	3	0.88
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	14	5.5
9.02	ICT PCT patents, applications/million pop.	16	29.5
9.03	Impact of ICT on new organizational models*	12	5.3
9.04	Knowledge-intensive jobs, % workforce	14	42.4
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	28	5.4
10.02	Internet access in schools*	15	6.1
10.03	ICT use & gov't efficiency*	30	4.9
10.04	E-Participation Index, 0–1 (best)	8	0.73

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Cape Verde

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**81**	**3.7**
A. Environment subindex	**65**	**3.9**
1st pillar: Political and regulatory environment	54	4.0
2nd pillar: Business and innovation environment	90	3.8
B. Readiness subindex	**95**	**4.1**
3rd pillar: Infrastructure and digital content	117	2.8
4th pillar: Affordability	86	4.8
5th pillar: Skills	84	4.8
C. Usage subindex	**80**	**3.4**
6th pillar: Individual usage	94	2.6
7th pillar: Business usage	110	3.2
8th pillar: Government usage	45	4.3
D. Impact subindex	**68**	**3.5**
9th pillar: Economic impacts	74	3.2
10th pillar: Social impacts	62	3.8



The Networked Readiness Index in detail

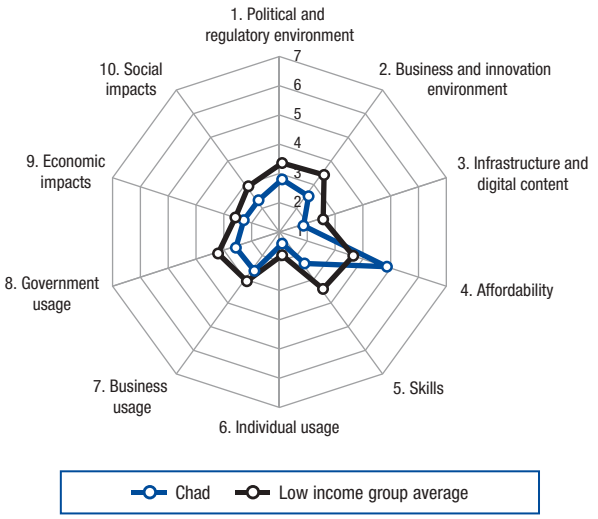
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	27	4.5
1.02	Laws relating to ICT*	72	3.9
1.03	Judicial independence*	57	4.2
1.04	Efficiency of legal system in settling disputes*	70	3.6
1.05	Efficiency of legal system in challenging regs*	69	3.6
1.06	Intellectual property protection*	114	2.6
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	69	37
1.09	No. days to enforce a contract	42	425
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	67	5.1
2.02	Venture capital availability*	105	2.2
2.03	Total tax rate, % profits	68	37.8
2.04	No. days to start a business	51	11
2.05	No. procedures to start a business	86	8
2.06	Intensity of local competition*	126	4.0
2.07	Tertiary education gross enrollment rate, %	96	17.8
2.08	Quality of management schools*	119	3.4
2.09	Gov't procurement of advanced tech*	44	4.0
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	112	526.3
3.02	Mobile network coverage, % pop.	119	72.0
3.03	Int'l Internet bandwidth, kb/s per user	108	3.1
3.04	Secure Internet servers/million pop.	79	14.1
3.05	Accessibility of digital content*	103	4.4
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	112	0.50
4.02	Fixed broadband Internet tariffs, PPP $/month	81	37.80
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	66	3.8
5.02	Quality of math & science education*	95	3.5
5.03	Secondary education gross enrollment rate, %	72	87.5
5.04	Adult literacy rate, %	100	84.8

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	103	75.0
6.02	Individuals using Internet, %	82	30.0
6.03	Households w/ personal computer, %	104	11.3
6.04	Households w/ Internet access, %	111	3.5
6.05	Broadband Internet subscriptions/100 pop.	80	3.2
6.06	Mobile broadband subscriptions/100 pop.	n/a	n/a
6.07	Use of virtual social networks*	94	4.8
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	64	4.8
7.02	Capacity for innovation*	137	2.1
7.03	PCT patents, applications/million pop.	119	0.0
7.04	Extent of business Internet use*	98	4.6
7.05	Extent of staff training*	116	3.3
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	26	5.4
8.02	Importance of ICT to gov't vision*	22	4.8
8.03	Government Online Service Index, 0–1 (best)	89	0.27
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	65	4.5
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	73	4.1
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	53	4.6
10.02	Internet access in schools*	96	3.4
10.03	ICT use & gov't efficiency*	27	5.1
10.04	E-Participation Index, 0–1 (best)	66	0.17

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Chad

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**138**	**2.6**
A. Environment subindex	**139**	**2.7**
1st pillar: Political and regulatory environment	127	2.8
2nd pillar: Business and innovation environment	142	2.5
B. Readiness subindex	**130**	**2.9**
3rd pillar: Infrastructure and digital content	141	1.8
4th pillar: Affordability	88	4.8
5th pillar: Skills	140	2.3
C. Usage subindex	**140**	**2.2**
6th pillar: Individual usage	141	1.4
7th pillar: Business usage	138	2.6
8th pillar: Government usage	134	2.7
D. Impact subindex	**135**	**2.4**
9th pillar: Economic impacts	130	2.4
10th pillar: Social impacts	136	2.4



The Networked Readiness Index in detail

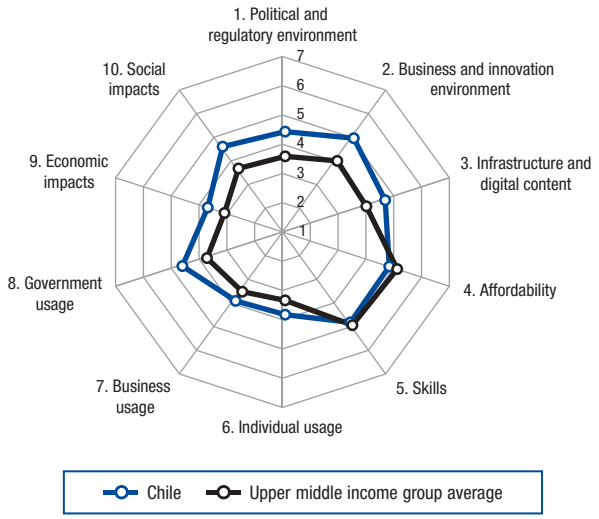
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	118	2.5
1.02	Laws relating to ICT*	131	2.6
1.03	Judicial independence*	121	2.6
1.04	Efficiency of legal system in settling disputes*	118	2.8
1.05	Efficiency of legal system in challenging regs*	103	3.0
1.06	Intellectual property protection*	132	2.3
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	106	41
1.09	No. days to enforce a contract	109	743
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	141	3.2
2.02	Venture capital availability*	81	2.4
2.03	Total tax rate, % profits	126	65.4
2.04	No. days to start a business	130	66
2.05	No. procedures to start a business	119	11
2.06	Intensity of local competition*	141	3.2
2.07	Tertiary education gross enrollment rate, %	136	2.2
2.08	Quality of management schools*	127	3.2
2.09	Gov't procurement of advanced tech*	115	3.0
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	141	9.4
3.02	Mobile network coverage, % pop.	133	24.0
3.03	Int'l Internet bandwidth, kb/s per user	141	0.1
3.04	Secure Internet servers/million pop.	n/a	n/a
3.05	Accessibility of digital content*	141	2.6
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	129	0.67
4.02	Fixed broadband Internet tariffs, PPP $/month	34	23.97
4.03	Internet & telephony competition, 0–2 (best)	92	1.50
	5th pillar: Skills		
5.01	Quality of educational system*	109	3.1
5.02	Quality of math & science education*	116	3.1
5.03	Secondary education gross enrollment rate, %	136	25.7
5.04	Adult literacy rate, %	138	33.6

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	139	23.8
6.02	Individuals using Internet, %	137	1.7
6.03	Households w/ personal computer, %	139	0.6
6.04	Households w/ Internet access, %	137	0.2
6.05	Broadband Internet subscriptions/100 pop.	141	0.0
6.06	Mobile broadband subscriptions/100 pop.	n/a	n/a
6.07	Use of virtual social networks*	141	3.0
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	141	3.6
7.02	Capacity for innovation*	109	2.6
7.03	PCT patents, applications/million pop.	104	0.0
7.04	Extent of business Internet use*	142	2.9
7.05	Extent of staff training*	129	3.1
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	122	3.7
8.02	Importance of ICT to gov't vision*	113	3.2
8.03	Government Online Service Index, 0–1 (best)	136	0.02
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	133	3.2
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	134	2.9
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	123	3.5
10.02	Internet access in schools*	139	1.6
10.03	ICT use & gov't efficiency*	129	3.0
10.04	E-Participation Index, 0–1 (best)	111	0.06

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Chile

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**39**	**4.4**
A. Environment subindex	**30**	**4.7**
1st pillar: Political and regulatory environment	38	4.5
2nd pillar: Business and innovation environment	23	5.0
B. Readiness subindex	**71**	**4.7**
3rd pillar: Infrastructure and digital content	50	4.6
4th pillar: Affordability	89	4.7
5th pillar: Skills	83	4.8
C. Usage subindex	**39**	**4.1**
6th pillar: Individual usage	55	3.8
7th pillar: Business usage	42	3.9
8th pillar: Government usage	26	4.7
D. Impact subindex	**37**	**4.2**
9th pillar: Economic impacts	35	3.8
10th pillar: Social impacts	36	4.6



The Networked Readiness Index in detail

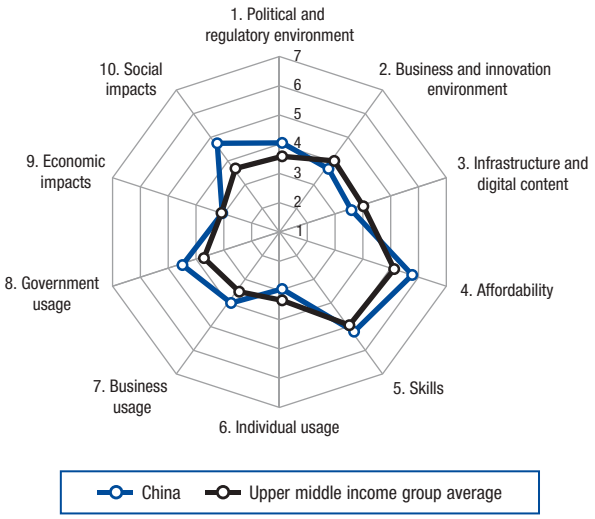
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	38	4.2
1.02	Laws relating to ICT*	32	5.0
1.03	Judicial independence*	24	5.5
1.04	Efficiency of legal system in settling disputes*	26	4.8
1.05	Efficiency of legal system in challenging regs*	23	4.6
1.06	Intellectual property protection*	63	3.6
1.07	Software piracy rate, % software installed	55	62
1.08	No. procedures to enforce a contract	55	36
1.09	No. days to enforce a contract	56	480
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	30	6.0
2.02	Venture capital availability*	34	3.1
2.03	Total tax rate, % profits	21	25.0
2.04	No. days to start a business	24	7
2.05	No. procedures to start a business	72	7
2.06	Intensity of local competition*	36	5.4
2.07	Tertiary education gross enrollment rate, %	37	59.2
2.08	Quality of management schools*	14	5.4
2.09	Gov't procurement of advanced tech*	47	4.0
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	57	3,554.7
3.02	Mobile network coverage, % pop.	1	100.0
3.03	Int'l Internet bandwidth, kb/s per user	52	19.1
3.04	Secure Internet servers/million pop.	55	52.8
3.05	Accessibility of digital content*	49	5.3
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	60	0.29
4.02	Fixed broadband Internet tariffs, PPP $/month	97	49.58
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	87	3.4
5.02	Quality of math & science education*	124	2.8
5.03	Secondary education gross enrollment rate, %	71	87.9
5.04	Adult literacy rate, %	43	98.6

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	48	116.0
6.02	Individuals using Internet, %	55	45.0
6.03	Households w/ personal computer, %	54	46.8
6.04	Households w/ Internet access, %	55	35.0
6.05	Broadband Internet subscriptions/100 pop.	50	10.5
6.06	Mobile broadband subscriptions/100 pop.	45	9.0
6.07	Use of virtual social networks*	29	5.8
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	40	5.4
7.02	Capacity for innovation*	66	3.0
7.03	PCT patents, applications/million pop.	45	3.6
7.04	Extent of business Internet use*	38	5.5
7.05	Extent of staff training*	37	4.4
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	57	4.9
8.02	Importance of ICT to gov't vision*	30	4.6
8.03	Government Online Service Index, 0–1 (best)	18	0.61
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	25	5.2
9.02	ICT PCT patents, applications/million pop.	48	0.5
9.03	Impact of ICT on new organizational models*	35	4.8
9.04	Knowledge-intensive jobs, % workforce	42	30.6
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	34	5.3
10.02	Internet access in schools*	45	4.8
10.03	ICT use & gov't efficiency*	15	5.4
10.04	E-Participation Index, 0–1 (best)	34	0.34

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

China

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**51**	**4.1**
A. Environment subindex	**64**	**3.9**
1st pillar: Political and regulatory environment	46	4.1
2nd pillar: Business and innovation environment	105	3.7
B. Readiness subindex	**66**	**4.8**
3rd pillar: Infrastructure and digital content	87	3.5
4th pillar: Affordability	42	5.7
5th pillar: Skills	57	5.2
C. Usage subindex	**51**	**3.8**
6th pillar: Individual usage	82	2.9
7th pillar: Business usage	37	4.0
8th pillar: Government usage	33	4.6
D. Impact subindex	**41**	**4.0**
9th pillar: Economic impacts	79	3.2
10th pillar: Social impacts	30	4.8



The Networked Readiness Index in detail

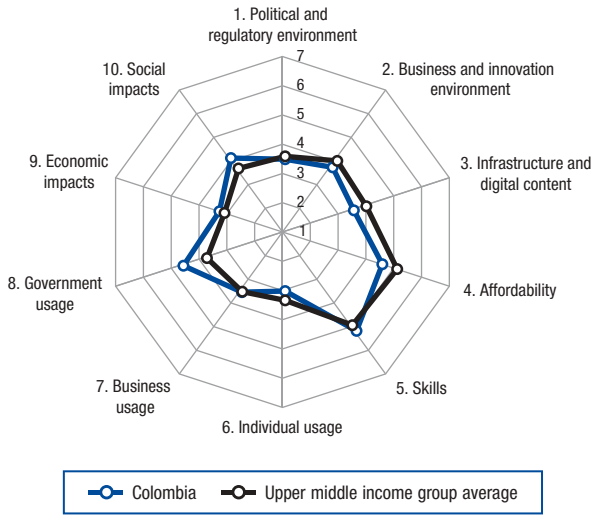
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	29	4.4
1.02	Laws relating to ICT*	47	4.4
1.03	Judicial independence*	63	3.9
1.04	Efficiency of legal system in settling disputes*	42	4.3
1.05	Efficiency of legal system in challenging regs*	44	4.0
1.06	Intellectual property protection*	47	4.0
1.07	Software piracy rate, % software installed	80	78
1.08	No. procedures to enforce a contract	41	34
1.09	No. days to enforce a contract	35	406
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	100	4.5
2.02	Venture capital availability*	22	3.5
2.03	Total tax rate, % profits	124	63.5
2.04	No. days to start a business	116	38
2.05	No. procedures to start a business	133	14
2.06	Intensity of local competition*	22	5.5
2.07	Tertiary education gross enrollment rate, %	84	24.3
2.08	Quality of management schools*	59	4.3
2.09	Gov't procurement of advanced tech*	16	4.4
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	70	2,602.6
3.02	Mobile network coverage, % pop.	46	99.5
3.03	Int'l Internet bandwidth, kb/s per user	114	2.4
3.04	Secure Internet servers/million pop.	110	1.9
3.05	Accessibility of digital content*	37	5.6
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	26	0.15
4.02	Fixed broadband Internet tariffs, PPP $/month	55	30.41
4.03	Internet & telephony competition, 0–2 (best)	92	1.50
	5th pillar: Skills		
5.01	Quality of educational system*	54	4.0
5.02	Quality of math & science education*	31	4.7
5.03	Secondary education gross enrollment rate, %	90	80.1
5.04	Adult literacy rate, %	68	94.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	113	64.0
6.02	Individuals using Internet, %	76	34.3
6.03	Households w/ personal computer, %	64	35.4
6.04	Households w/ Internet access, %	67	23.7
6.05	Broadband Internet subscriptions/100 pop.	54	9.4
6.06	Mobile broadband subscriptions/100 pop.	82	1.8
6.07	Use of virtual social networks*	89	4.9
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	61	4.9
7.02	Capacity for innovation*	23	4.2
7.03	PCT patents, applications/million pop.	38	6.5
7.04	Extent of business Internet use*	49	5.3
7.05	Extent of staff training*	45	4.2
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	18	5.6
8.02	Importance of ICT to gov't vision*	16	5.0
8.03	Government Online Service Index, 0–1 (best)	53	0.37
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	38	5.0
9.02	ICT PCT patents, applications/million pop.	32	2.9
9.03	Impact of ICT on new organizational models*	33	4.8
9.04	Knowledge-intensive jobs, % workforce	102	7.4
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	31	5.3
10.02	Internet access in schools*	28	5.7
10.03	ICT use & gov't efficiency*	31	4.9
10.04	E-Participation Index, 0–1 (best)	32	0.37

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Colombia

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**73**	**3.9**
A. Environment subindex	**94**	**3.6**
1st pillar: Political and regulatory environment	82	3.5
2nd pillar: Business and innovation environment	95	3.8
B. Readiness subindex	**85**	**4.4**
3rd pillar: Infrastructure and digital content	88	3.5
4th pillar: Affordability	95	4.5
5th pillar: Skills	58	5.1
C. Usage subindex	**58**	**3.7**
6th pillar: Individual usage	76	3.0
7th pillar: Business usage	71	3.5
8th pillar: Government usage	28	4.7
D. Impact subindex	**48**	**3.8**
9th pillar: Economic impacts	58	3.4
10th pillar: Social impacts	47	4.2



The Networked Readiness Index in detail

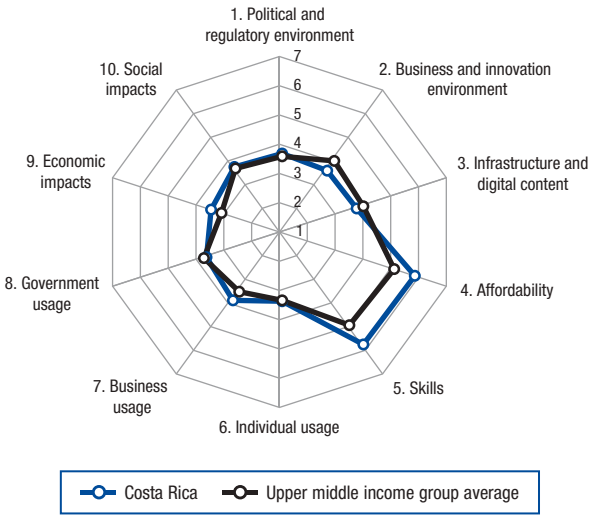
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	106	2.9
1.02	Laws relating to ICT*	50	4.3
1.03	Judicial independence*	81	3.5
1.04	Efficiency of legal system in settling disputes*	88	3.3
1.05	Efficiency of legal system in challenging regs*	78	3.4
1.06	Intellectual property protection*	86	3.2
1.07	Software piracy rate, % software installed	40	54
1.08	No. procedures to enforce a contract	41	34
1.09	No. days to enforce a contract	136	1,346
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	78	4.8
2.02	Venture capital availability*	49	2.9
2.03	Total tax rate, % profits	135	74.8
2.04	No. days to start a business	66	14
2.05	No. procedures to start a business	97	9
2.06	Intensity of local competition*	85	4.6
2.07	Tertiary education gross enrollment rate, %	61	39.1
2.08	Quality of management schools*	53	4.4
2.09	Gov't procurement of advanced tech*	45	4.0
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	90	1,244.8
3.02	Mobile network coverage, % pop.	111	83.0
3.03	Int'l Internet bandwidth, kb/s per user	72	10.2
3.04	Secure Internet servers/million pop.	76	14.3
3.05	Accessibility of digital content*	89	4.7
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	62	0.29
4.02	Fixed broadband Internet tariffs, PPP $/month	101	53.23
4.03	Internet & telephony competition, 0–2 (best)	64	1.91
	5th pillar: Skills		
5.01	Quality of educational system*	72	3.7
5.02	Quality of math & science education*	83	3.7
5.03	Secondary education gross enrollment rate, %	43	96.4
5.04	Adult literacy rate, %	73	93.2

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	78	96.1
6.02	Individuals using Internet, %	72	36.5
6.03	Households w/ personal computer, %	77	26.1
6.04	Households w/ Internet access, %	76	19.3
6.05	Broadband Internet subscriptions/100 pop.	67	5.6
6.06	Mobile broadband subscriptions/100 pop.	70	3.7
6.07	Use of virtual social networks*	75	5.1
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	83	4.6
7.02	Capacity for innovation*	59	3.2
7.03	PCT patents, applications/million pop.	65	1.1
7.04	Extent of business Internet use*	67	5.0
7.05	Extent of staff training*	84	3.7
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	83	4.5
8.02	Importance of ICT to gov't vision*	49	4.2
8.03	Government Online Service Index, 0–1 (best)	9	0.71
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	55	4.7
9.02	ICT PCT patents, applications/million pop.	73	0.1
9.03	Impact of ICT on new organizational models*	40	4.6
9.04	Knowledge-intensive jobs, % workforce	66	21.6
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	70	4.4
10.02	Internet access in schools*	68	4.1
10.03	ICT use & gov't efficiency*	51	4.5
10.04	E-Participation Index, 0–1 (best)	26	0.44

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Costa Rica

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**58**	**4.0**
A. Environment subindex	**90**	**3.7**
1st pillar: Political and regulatory environment	67	3.7
2nd pillar: Business and innovation environment	108	3.6
B. Readiness subindex	**54**	**5.1**
3rd pillar: Infrastructure and digital content	77	3.7
4th pillar: Affordability	35	5.8
5th pillar: Skills	26	5.7
C. Usage subindex	**63**	**3.6**
6th pillar: Individual usage	65	3.3
7th pillar: Business usage	43	3.9
8th pillar: Government usage	74	3.7
D. Impact subindex	**58**	**3.7**
9th pillar: Economic impacts	45	3.6
10th pillar: Social impacts	63	3.8



The Networked Readiness Index in detail

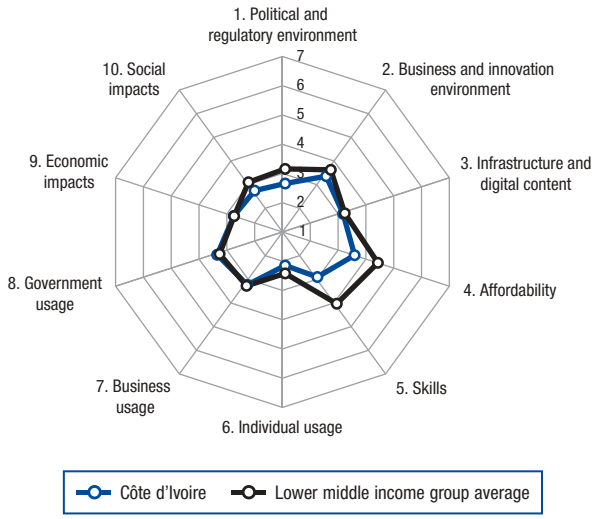
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	126	2.4
1.02	Laws relating to ICT*	68	3.9
1.03	Judicial independence*	38	4.9
1.04	Efficiency of legal system in settling disputes*	65	3.7
1.05	Efficiency of legal system in challenging regs*	47	4.0
1.06	Intellectual property protection*	70	3.5
1.07	Software piracy rate, % software installed	50	58
1.08	No. procedures to enforce a contract	97	40
1.09	No. days to enforce a contract	120	852
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	68	5.0
2.02	Venture capital availability*	102	2.2
2.03	Total tax rate, % profits	117	55.0
2.04	No. days to start a business	128	60
2.05	No. procedures to start a business	121	12
2.06	Intensity of local competition*	65	4.9
2.07	Tertiary education gross enrollment rate, %	80	25.6
2.08	Quality of management schools*	20	5.2
2.09	Gov't procurement of advanced tech*	64	3.7
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	79	2,095.3
3.02	Mobile network coverage, % pop.	121	69.5
3.03	Int'l Internet bandwidth, kb/s per user	64	12.7
3.04	Secure Internet servers/million pop.	45	107.8
3.05	Accessibility of digital content*	77	4.8
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	18	0.10
4.02	Fixed broadband Internet tariffs, PPP $/month	4	10.51
4.03	Internet & telephony competition, 0–2 (best)	131	0.67
	5th pillar: Skills		
5.01	Quality of educational system*	23	4.8
5.02	Quality of math & science education*	46	4.4
5.03	Secondary education gross enrollment rate, %	30	99.7
5.04	Adult literacy rate, %	58	96.1

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	111	65.1
6.02	Individuals using Internet, %	72	36.5
6.03	Households w/ personal computer, %	57	41.3
6.04	Households w/ Internet access, %	66	24.1
6.05	Broadband Internet subscriptions/100 pop.	64	6.2
6.06	Mobile broadband subscriptions/100 pop.	n/a	n/a
6.07	Use of virtual social networks*	50	5.6
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	55	5.0
7.02	Capacity for innovation*	40	3.4
7.03	PCT patents, applications/million pop.	57	1.7
7.04	Extent of business Internet use*	51	5.2
7.05	Extent of staff training*	29	4.6
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	85	4.4
8.02	Importance of ICT to gov't vision*	70	3.9
8.03	Government Online Service Index, 0–1 (best)	77	0.30
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	40	5.0
9.02	ICT PCT patents, applications/million pop.	67	0.2
9.03	Impact of ICT on new organizational models*	45	4.5
9.04	Knowledge-intensive jobs, % workforce	50	27.4
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	55	4.6
10.02	Internet access in schools*	66	4.2
10.03	ICT use & gov't efficiency*	74	4.1
10.04	E-Participation Index, 0–1 (best)	56	0.20

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Côte d'Ivoire

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**122**	**3.0**
A. Environment subindex	**130**	**3.0**
1st pillar: Political and regulatory environment	135	2.7
2nd pillar: Business and innovation environment	127	3.4
B. Readiness subindex	**121**	**3.1**
3rd pillar: Infrastructure and digital content	106	3.1
4th pillar: Affordability	108	3.5
5th pillar: Skills	131	2.9
C. Usage subindex	**110**	**2.9**
6th pillar: Individual usage	113	2.1
7th pillar: Business usage	105	3.2
8th pillar: Government usage	97	3.4
D. Impact subindex	**118**	**2.8**
9th pillar: Economic impacts	103	2.8
10th pillar: Social impacts	125	2.8



The Networked Readiness Index in detail

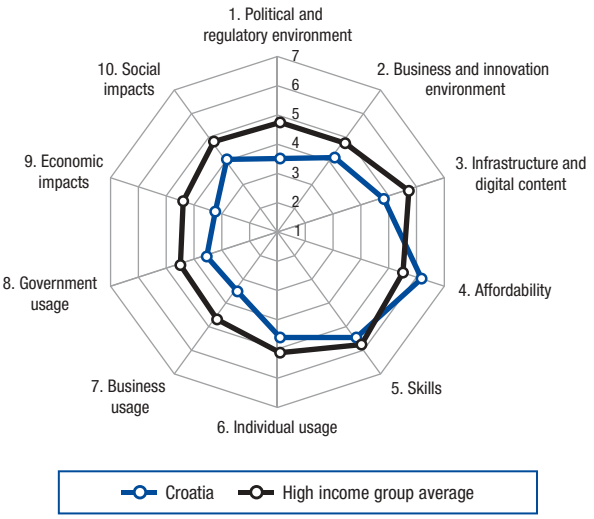
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	120	2.5
1.02	Laws relating to ICT*	136	2.5
1.03	Judicial independence*	137	1.8
1.04	Efficiency of legal system in settling disputes*	120	2.8
1.05	Efficiency of legal system in challenging regs*	129	2.6
1.06	Intellectual property protection*	131	2.3
1.07	Software piracy rate, % software installed	82	79
1.08	No. procedures to enforce a contract	36	33
1.09	No. days to enforce a contract	110	770
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	80	4.8
2.02	Venture capital availability*	139	1.5
2.03	Total tax rate, % profits	92	44.3
2.04	No. days to start a business	105	32
2.05	No. procedures to start a business	110	10
2.06	Intensity of local competition*	83	4.6
2.07	Tertiary education gross enrollment rate, %	114	8.9
2.08	Quality of management schools*	96	3.7
2.09	Gov't procurement of advanced tech*	121	2.9
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	117	305.5
3.02	Mobile network coverage, % pop.	93	92.2
3.03	Int'l Internet bandwidth, kb/s per user	85	7.8
3.04	Secure Internet servers/million pop.	118	1.1
3.05	Accessibility of digital content*	132	3.4
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	66	0.30
4.02	Fixed broadband Internet tariffs, PPP $/month	107	65.96
4.03	Internet & telephony competition, 0–2 (best)	110	1.20
	5th pillar: Skills		
5.01	Quality of educational system*	114	3.0
5.02	Quality of math & science education*	90	3.6
5.03	Secondary education gross enrollment rate, %	135	27.1
5.04	Adult literacy rate, %	130	55.3

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	102	76.1
6.02	Individuals using Internet, %	134	2.6
6.03	Households w/ personal computer, %	136	1.8
6.04	Households w/ Internet access, %	128	1.1
6.05	Broadband Internet subscriptions/100 pop.	129	0.0
6.06	Mobile broadband subscriptions/100 pop.	n/a	n/a
6.07	Use of virtual social networks*	93	4.8
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	65	4.8
7.02	Capacity for innovation*	133	2.2
7.03	PCT patents, applications/million pop.	119	0.0
7.04	Extent of business Internet use*	130	3.9
7.05	Extent of staff training*	51	4.1
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	88	4.4
8.02	Importance of ICT to gov't vision*	118	3.0
8.03	Government Online Service Index, 0–1 (best)	67	0.32
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	82	4.3
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	123	3.3
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	120	3.5
10.02	Internet access in schools*	134	2.2
10.03	ICT use & gov't efficiency*	118	3.4
10.04	E-Participation Index, 0–1 (best)	66	0.17

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Croatia

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**45**	**4.2**
A. Environment subindex	**68**	**3.9**
1st pillar: Political and regulatory environment	80	3.5
2nd pillar: Business and innovation environment	62	4.2
B. Readiness subindex	**31**	**5.4**
3rd pillar: Infrastructure and digital content	45	4.7
4th pillar: Affordability	19	6.1
5th pillar: Skills	42	5.4
C. Usage subindex	**47**	**3.9**
6th pillar: Individual usage	36	4.6
7th pillar: Business usage	79	3.5
8th pillar: Government usage	82	3.6
D. Impact subindex	**51**	**3.7**
9th pillar: Economic impacts	61	3.3
10th pillar: Social impacts	50	4.1



The Networked Readiness Index in detail

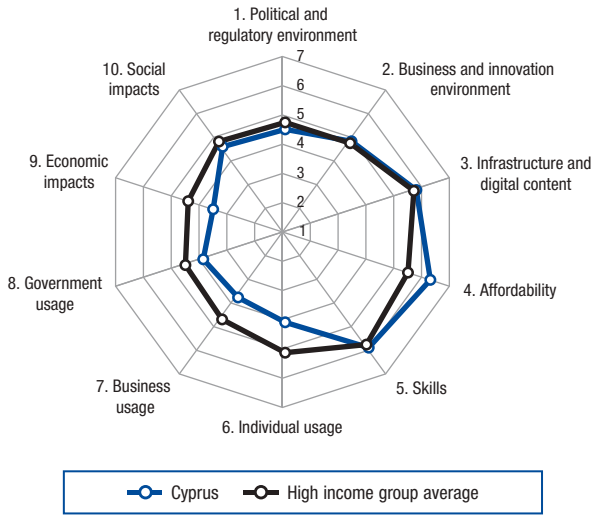
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	87	3.2
1.02	Laws relating to ICT*	69	3.9
1.03	Judicial independence*	99	3.1
1.04	Efficiency of legal system in settling disputes*	129	2.7
1.05	Efficiency of legal system in challenging regs*	126	2.7
1.06	Intellectual property protection*	69	3.5
1.07	Software piracy rate, % software installed	40	54
1.08	No. procedures to enforce a contract	78	38
1.09	No. days to enforce a contract	74	561
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	51	5.4
2.02	Venture capital availability*	108	2.1
2.03	Total tax rate, % profits	43	32.3
2.04	No. days to start a business	24	7
2.05	No. procedures to start a business	46	6
2.06	Intensity of local competition*	115	4.1
2.07	Tertiary education gross enrollment rate, %	50	49.2
2.08	Quality of management schools*	83	3.9
2.09	Gov't procurement of advanced tech*	122	2.9
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	66	2,764.8
3.02	Mobile network coverage, % pop.	1	100.0
3.03	Int'l Internet bandwidth, kb/s per user	31	42.9
3.04	Secure Internet servers/million pop.	37	168.6
3.05	Accessibility of digital content*	46	5.4
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	49	0.23
4.02	Fixed broadband Internet tariffs, PPP $/month	40	25.76
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	89	3.3
5.02	Quality of math & science education*	29	4.9
5.03	Secondary education gross enrollment rate, %	46	95.3
5.04	Adult literacy rate, %	41	98.8

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	16	144.5
6.02	Individuals using Internet, %	39	60.3
6.03	Households w/ personal computer, %	42	60.0
6.04	Households w/ Internet access, %	40	56.5
6.05	Broadband Internet subscriptions/100 pop.	36	18.3
6.06	Mobile broadband subscriptions/100 pop.	30	15.5
6.07	Use of virtual social networks*	80	5.1
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	80	4.7
7.02	Capacity for innovation*	64	3.1
7.03	PCT patents, applications/million pop.	33	10.1
7.04	Extent of business Internet use*	54	5.2
7.05	Extent of staff training*	125	3.2
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	99	4.2
8.02	Importance of ICT to gov't vision*	114	3.2
8.03	Government Online Service Index, 0–1 (best)	40	0.42
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	89	4.2
9.02	ICT PCT patents, applications/million pop.	37	1.7
9.03	Impact of ICT on new organizational models*	79	3.9
9.04	Knowledge-intensive jobs, % workforce	44	30.1
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	75	4.3
10.02	Internet access in schools*	43	4.8
10.03	ICT use & gov't efficiency*	115	3.5
10.04	E-Participation Index, 0–1 (best)	25	0.46

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Cyprus

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**32**	**4.7**
A. Environment subindex	**31**	**4.7**
1st pillar: Political and regulatory environment	36	4.5
2nd pillar: Business and innovation environment	25	4.9
B. Readiness subindex	**15**	**5.9**
3rd pillar: Infrastructure and digital content	23	5.7
4th pillar: Affordability	14	6.2
5th pillar: Skills	17	5.9
C. Usage subindex	**46**	**3.9**
6th pillar: Individual usage	45	4.1
7th pillar: Business usage	50	3.7
8th pillar: Government usage	62	3.9
D. Impact subindex	**38**	**4.1**
9th pillar: Economic impacts	43	3.6
10th pillar: Social impacts	37	4.6



The Networked Readiness Index in detail

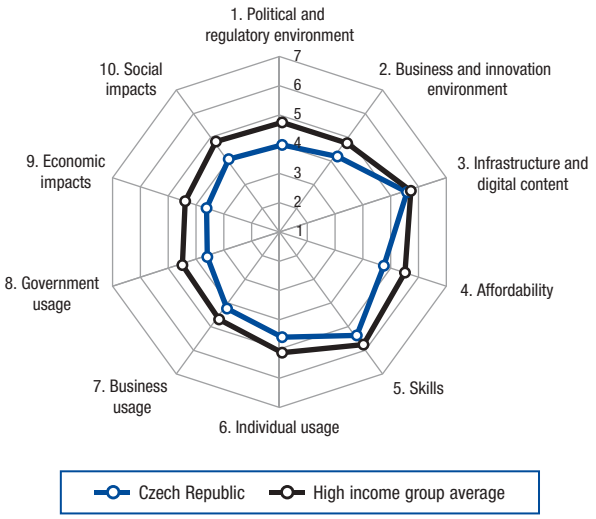
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	19	4.8
1.02	Laws relating to ICT*	41	4.6
1.03	Judicial independence*	27	5.3
1.04	Efficiency of legal system in settling disputes*	32	4.6
1.05	Efficiency of legal system in challenging regs*	20	4.6
1.06	Intellectual property protection*	38	4.4
1.07	Software piracy rate, % software installed	34	48
1.08	No. procedures to enforce a contract	115	43
1.09	No. days to enforce a contract	108	735
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	41	5.6
2.02	Venture capital availability*	32	3.2
2.03	Total tax rate, % profits	19	23.1
2.04	No. days to start a business	33	8
2.05	No. procedures to start a business	46	6
2.06	Intensity of local competition*	30	5.4
2.07	Tertiary education gross enrollment rate, %	46	52.0
2.08	Quality of management schools*	47	4.6
2.09	Gov't procurement of advanced tech*	37	4.1
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	47	4,714.9
3.02	Mobile network coverage, % pop.	24	100.0
3.03	Int'l Internet bandwidth, kb/s per user	26	51.6
3.04	Secure Internet servers/million pop.	19	838.1
3.05	Accessibility of digital content*	43	5.4
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	16	0.10
4.02	Fixed broadband Internet tariffs, PPP $/month	22	19.91
4.03	Internet & telephony competition, 0–2 (best)	95	1.40
	5th pillar: Skills		
5.01	Quality of educational system*	30	4.6
5.02	Quality of math & science education*	16	5.1
5.03	Secondary education gross enrollment rate, %	34	98.4
5.04	Adult literacy rate, %	47	97.9

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	80	93.7
6.02	Individuals using Internet, %	43	53.0
6.03	Households w/ personal computer, %	40	60.5
6.04	Households w/ Internet access, %	43	53.7
6.05	Broadband Internet subscriptions/100 pop.	37	17.6
6.06	Mobile broadband subscriptions/100 pop.	57	5.9
6.07	Use of virtual social networks*	65	5.2
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	43	5.2
7.02	Capacity for innovation*	60	3.2
7.03	PCT patents, applications/million pop.	35	9.4
7.04	Extent of business Internet use*	64	5.0
7.05	Extent of staff training*	69	4.0
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	82	4.5
8.02	Importance of ICT to gov't vision*	57	4.1
8.03	Government Online Service Index, 0–1 (best)	52	0.37
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	54	4.7
9.02	ICT PCT patents, applications/million pop.	31	3.0
9.03	Impact of ICT on new organizational models*	69	4.1
9.04	Knowledge-intensive jobs, % workforce	41	31.4
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	38	5.1
10.02	Internet access in schools*	38	5.0
10.03	ICT use & gov't efficiency*	49	4.5
10.04	E-Participation Index, 0–1 (best)	23	0.49

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Czech Republic

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**42**	**4.3**
A. Environment subindex	**50**	**4.1**
1st pillar: Political and regulatory environment	51	4.0
2nd pillar: Business and innovation environment	59	4.2
B. Readiness subindex	**45**	**5.2**
3rd pillar: Infrastructure and digital content	26	5.5
4th pillar: Affordability	93	4.7
5th pillar: Skills	44	5.3
C. Usage subindex	**38**	**4.2**
6th pillar: Individual usage	38	4.6
7th pillar: Business usage	29	4.2
8th pillar: Government usage	77	3.7
D. Impact subindex	**43**	**3.9**
9th pillar: Economic impacts	38	3.7
10th pillar: Social impacts	48	4.1



The Networked Readiness Index in detail

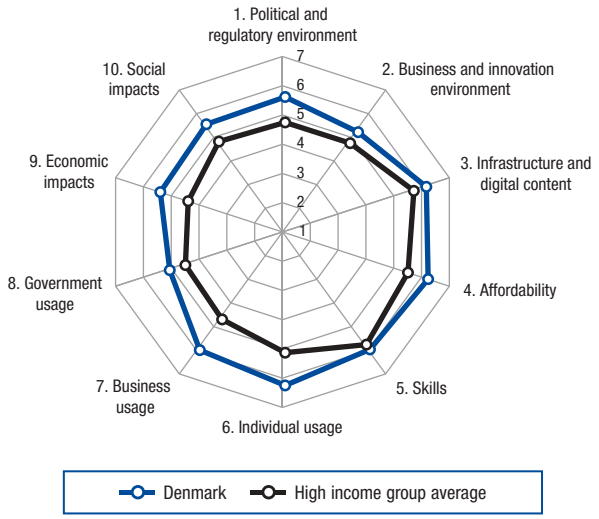
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	107	2.9
1.02	Laws relating to ICT*	44	4.5
1.03	Judicial independence*	74	3.7
1.04	Efficiency of legal system in settling disputes*	113	2.9
1.05	Efficiency of legal system in challenging regs*	108	2.9
1.06	Intellectual property protection*	58	3.7
1.07	Software piracy rate, % software installed	21	36
1.08	No. procedures to enforce a contract	9	27
1.09	No. days to enforce a contract	90	611
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	40	5.6
2.02	Venture capital availability*	85	2.4
2.03	Total tax rate, % profits	106	49.1
2.04	No. days to start a business	86	20
2.05	No. procedures to start a business	97	9
2.06	Intensity of local competition*	16	5.6
2.07	Tertiary education gross enrollment rate, %	34	60.7
2.08	Quality of management schools*	82	4.0
2.09	Gov't procurement of advanced tech*	81	3.5
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	26	7,825.9
3.02	Mobile network coverage, % pop.	37	99.8
3.03	Int'l Internet bandwidth, kb/s per user	19	69.2
3.04	Secure Internet servers/million pop.	28	318.2
3.05	Accessibility of digital content*	23	6.1
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	93	0.40
4.02	Fixed broadband Internet tariffs, PPP $/month	91	43.54
4.03	Internet & telephony competition, 0–2 (best)	73	1.81
	5th pillar: Skills		
5.01	Quality of educational system*	49	4.1
5.02	Quality of math & science education*	66	4.1
5.03	Secondary education gross enrollment rate, %	62	90.4
5.04	Adult literacy rate, %	15	99.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	22	137.2
6.02	Individuals using Internet, %	31	68.8
6.03	Households w/ personal computer, %	37	64.1
6.04	Households w/ Internet access, %	35	60.5
6.05	Broadband Internet subscriptions/100 pop.	40	14.5
6.06	Mobile broadband subscriptions/100 pop.	67	3.8
6.07	Use of virtual social networks*	36	5.8
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	45	5.2
7.02	Capacity for innovation*	25	4.0
7.03	PCT patents, applications/million pop.	28	18.3
7.04	Extent of business Internet use*	23	5.9
7.05	Extent of staff training*	39	4.3
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	105	4.1
8.02	Importance of ICT to gov't vision*	106	3.3
8.03	Government Online Service Index, 0–1 (best)	36	0.45
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	74	4.4
9.02	ICT PCT patents, applications/million pop.	30	3.2
9.03	Impact of ICT on new organizational models*	78	4.0
9.04	Knowledge-intensive jobs, % workforce	19	40.5
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	47	4.8
10.02	Internet access in schools*	21	5.8
10.03	ICT use & gov't efficiency*	82	4.0
10.04	E-Participation Index, 0–1 (best)	79	0.13

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Denmark

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**4**	**5.7**
A. Environment subindex	**5**	**5.4**
1st pillar: Political and regulatory environment	6	5.6
2nd pillar: Business and innovation environment	7	5.2
B. Readiness subindex	**9**	**6.0**
3rd pillar: Infrastructure and digital content	15	6.1
4th pillar: Affordability	18	6.1
5th pillar: Skills	14	5.9
C. Usage subindex	**3**	**5.8**
6th pillar: Individual usage	4	6.2
7th pillar: Business usage	4	6.0
8th pillar: Government usage	12	5.1
D. Impact subindex	**6**	**5.5**
9th pillar: Economic impacts	8	5.5
10th pillar: Social impacts	7	5.6



The Networked Readiness Index in detail

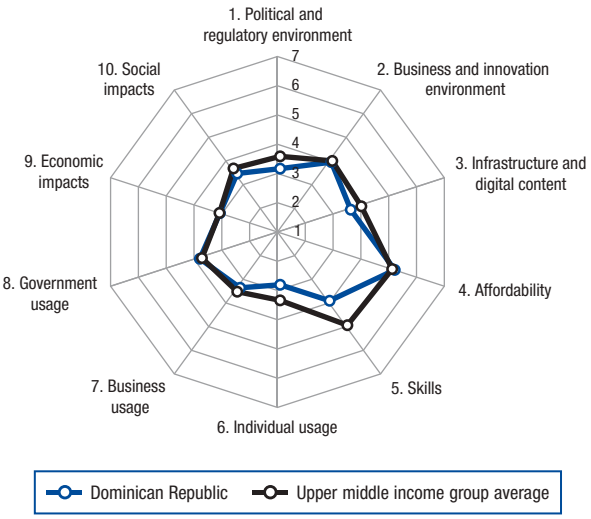
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	7	5.4
1.02	Laws relating to ICT*	4	5.8
1.03	Judicial independence*	2	6.6
1.04	Efficiency of legal system in settling disputes*	8	5.5
1.05	Efficiency of legal system in challenging regs*	9	5.2
1.06	Intellectual property protection*	6	5.9
1.07	Software piracy rate, % software installed	10	26
1.08	No. procedures to enforce a contract	47	35
1.09	No. days to enforce a contract	37	410
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	9	6.5
2.02	Venture capital availability*	24	3.4
2.03	Total tax rate, % profits	26	27.5
2.04	No. days to start a business	16	6
2.05	No. procedures to start a business	20	4
2.06	Intensity of local competition*	46	5.2
2.07	Tertiary education gross enrollment rate, %	14	74.4
2.08	Quality of management schools*	19	5.2
2.09	Gov't procurement of advanced tech*	20	4.3
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	31	6,553.6
3.02	Mobile network coverage, % pop.	n/a	n/a
3.03	Int'l Internet bandwidth, kb/s per user	8	142.2
3.04	Secure Internet servers/million pop.	3	1,873.3
3.05	Accessibility of digital content*	7	6.4
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	6	0.06
4.02	Fixed broadband Internet tariffs, PPP $/month	58	31.28
4.03	Internet & telephony competition, 0–2 (best)	66	1.89
	5th pillar: Skills		
5.01	Quality of educational system*	16	5.0
5.02	Quality of math & science education*	30	4.8
5.03	Secondary education gross enrollment rate, %	6	117.4
5.04	Adult literacy rate, %	15	99.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	34	124.7
6.02	Individuals using Internet, %	6	88.7
6.03	Households w/ personal computer, %	7	88.0
6.04	Households w/ Internet access, %	8	86.1
6.05	Broadband Internet subscriptions/100 pop.	3	37.7
6.06	Mobile broadband subscriptions/100 pop.	10	46.4
6.07	Use of virtual social networks*	2	6.6
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	9	6.0
7.02	Capacity for innovation*	9	5.1
7.03	PCT patents, applications/million pop.	5	209.4
7.04	Extent of business Internet use*	6	6.2
7.05	Extent of staff training*	3	5.5
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	22	5.5
8.02	Importance of ICT to gov't vision*	17	4.9
8.03	Government Online Service Index, 0–1 (best)	13	0.67
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	17	5.4
9.02	ICT PCT patents, applications/million pop.	11	44.1
9.03	Impact of ICT on new organizational models*	8	5.4
9.04	Knowledge-intensive jobs, % workforce	6	45.1
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	8	6.0
10.02	Internet access in schools*	8	6.2
10.03	ICT use & gov't efficiency*	19	5.3
10.04	E-Participation Index, 0–1 (best)	13	0.64

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Dominican Republic

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**87**	**3.6**
A. Environment subindex	**97**	**3.6**
1st pillar: Political and regulatory environment	104	3.2
2nd pillar: Business and innovation environment	73	4.0
B. Readiness subindex	**92**	**4.2**
3rd pillar: Infrastructure and digital content	84	3.5
4th pillar: Affordability	75	5.1
5th pillar: Skills	107	3.9
C. Usage subindex	**82**	**3.3**
6th pillar: Individual usage	87	2.8
7th pillar: Business usage	95	3.3
8th pillar: Government usage	65	3.9
D. Impact subindex	**80**	**3.3**
9th pillar: Economic impacts	76	3.2
10th pillar: Social impacts	86	3.5



The Networked Readiness Index in detail

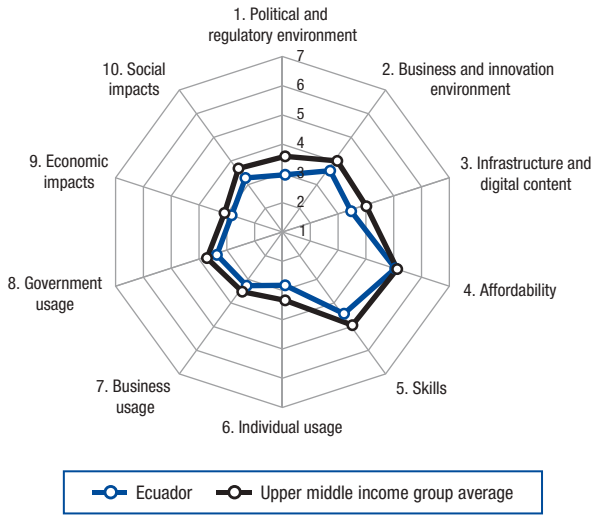
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	117	2.6
1.02	Laws relating to ICT*	67	3.9
1.03	Judicial independence*	115	2.7
1.04	Efficiency of legal system in settling disputes*	96	3.2
1.05	Efficiency of legal system in challenging regs*	112	2.9
1.06	Intellectual property protection*	124	2.5
1.07	Software piracy rate, % software installed	78	76
1.08	No. procedures to enforce a contract	41	34
1.09	No. days to enforce a contract	51	460
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	59	5.2
2.02	Venture capital availability*	113	2.1
2.03	Total tax rate, % profits	83	41.7
2.04	No. days to start a business	80	19
2.05	No. procedures to start a business	72	7
2.06	Intensity of local competition*	60	5.0
2.07	Tertiary education gross enrollment rate, %	72	34.0
2.08	Quality of management schools*	89	3.9
2.09	Gov't procurement of advanced tech*	94	3.3
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	86	1,594.8
3.02	Mobile network coverage, % pop.	115	81.2
3.03	Int'l Internet bandwidth, kb/s per user	73	10.2
3.04	Secure Internet servers/million pop.	74	15.2
3.05	Accessibility of digital content*	68	5.0
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	104	0.46
4.02	Fixed broadband Internet tariffs, PPP $/month	67	33.86
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	136	2.3
5.02	Quality of math & science education*	139	1.9
5.03	Secondary education gross enrollment rate, %	96	76.4
5.04	Adult literacy rate, %	92	88.2

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	89	89.6
6.02	Individuals using Internet, %	68	39.5
6.03	Households w/ personal computer, %	93	16.4
6.04	Households w/ Internet access, %	98	7.6
6.05	Broadband Internet subscriptions/100 pop.	78	3.6
6.06	Mobile broadband subscriptions/100 pop.	60	5.1
6.07	Use of virtual social networks*	63	5.3
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	57	5.0
7.02	Capacity for innovation*	126	2.3
7.03	PCT patents, applications/million pop.	83	0.4
7.04	Extent of business Internet use*	84	4.8
7.05	Extent of staff training*	99	3.6
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	74	4.6
8.02	Importance of ICT to gov't vision*	73	3.9
8.03	Government Online Service Index, 0–1 (best)	57	0.37
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	51	4.8
9.02	ICT PCT patents, applications/million pop.	72	0.1
9.03	Impact of ICT on new organizational models*	53	4.4
9.04	Knowledge-intensive jobs, % workforce	88	15.8
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	93	4.1
10.02	Internet access in schools*	103	3.3
10.03	ICT use & gov't efficiency*	57	4.4
10.04	E-Participation Index, 0–1 (best)	62	0.19

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Ecuador

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**96**	**3.5**
A. Environment subindex	**119**	**3.3**
1st pillar: Political and regulatory environment	120	3.0
2nd pillar: Business and innovation environment	110	3.6
B. Readiness subindex	**91**	**4.2**
3rd pillar: Infrastructure and digital content	90	3.4
4th pillar: Affordability	81	5.0
5th pillar: Skills	96	4.4
C. Usage subindex	**97**	**3.2**
6th pillar: Individual usage	86	2.8
7th pillar: Business usage	100	3.2
8th pillar: Government usage	96	3.5
D. Impact subindex	**95**	**3.1**
9th pillar: Economic impacts	97	2.9
10th pillar: Social impacts	95	3.3



The Networked Readiness Index in detail

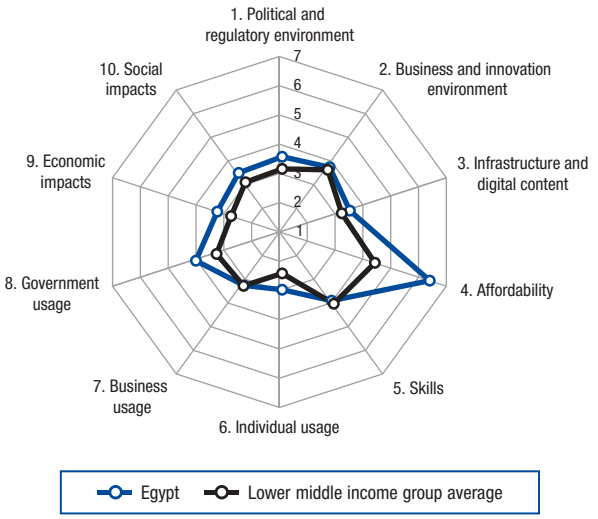
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	127	2.3
1.02	Laws relating to ICT*	90	3.6
1.03	Judicial independence*	130	2.3
1.04	Efficiency of legal system in settling disputes*	135	2.5
1.05	Efficiency of legal system in challenging regs*	137	2.4
1.06	Intellectual property protection*	106	2.7
1.07	Software piracy rate, % software installed	66	67
1.08	No. procedures to enforce a contract	87	39
1.09	No. days to enforce a contract	83	588
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	104	4.4
2.02	Venture capital availability*	96	2.2
2.03	Total tax rate, % profits	58	35.3
2.04	No. days to start a business	126	56
2.05	No. procedures to start a business	129	13
2.06	Intensity of local competition*	109	4.2
2.07	Tertiary education gross enrollment rate, %	60	39.8
2.08	Quality of management schools*	93	3.8
2.09	Gov't procurement of advanced tech*	83	3.4
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	89	1,323.8
3.02	Mobile network coverage, % pop.	92	93.3
3.03	Int'l Internet bandwidth, kb/s per user	82	8.3
3.04	Secure Internet servers/million pop.	75	14.6
3.05	Accessibility of digital content*	110	4.1
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	92	0.39
4.02	Fixed broadband Internet tariffs, PPP $/month	85	40.12
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	105	3.2
5.02	Quality of math & science education*	107	3.3
5.03	Secondary education gross enrollment rate, %	89	80.4
5.04	Adult literacy rate, %	101	84.2

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	69	102.2
6.02	Individuals using Internet, %	84	29.0
6.03	Households w/ personal computer, %	76	27.0
6.04	Households w/ Internet access, %	87	11.5
6.05	Broadband Internet subscriptions/100 pop.	97	1.4
6.06	Mobile broadband subscriptions/100 pop.	47	8.3
6.07	Use of virtual social networks*	101	4.7
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	103	4.3
7.02	Capacity for innovation*	87	2.8
7.03	PCT patents, applications/million pop.	93	0.2
7.04	Extent of business Internet use*	105	4.5
7.05	Extent of staff training*	93	3.6
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	117	3.9
8.02	Importance of ICT to gov't vision*	86	3.6
8.03	Government Online Service Index, 0–1 (best)	70	0.32
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	95	4.1
9.02	ICT PCT patents, applications/million pop.	91	0.0
9.03	Impact of ICT on new organizational models*	83	3.9
9.04	Knowledge-intensive jobs, % workforce	82	18.1
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	100	3.9
10.02	Internet access in schools*	108	3.2
10.03	ICT use & gov't efficiency*	77	4.1
10.04	E-Participation Index, 0–1 (best)	73	0.16

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Egypt

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**79**	**3.8**
A. Environment subindex	**85**	**3.7**
1st pillar: Political and regulatory environment	76	3.6
2nd pillar: Business and innovation environment	94	3.8
B. Readiness subindex	**79**	**4.5**
3rd pillar: Infrastructure and digital content	89	3.4
4th pillar: Affordability	12	6.3
5th pillar: Skills	108	3.9
C. Usage subindex	**74**	**3.4**
6th pillar: Individual usage	79	2.9
7th pillar: Business usage	103	3.2
8th pillar: Government usage	51	4.1
D. Impact subindex	**74**	**3.4**
9th pillar: Economic impacts	62	3.3
10th pillar: Social impacts	83	3.5



The Networked Readiness Index in detail

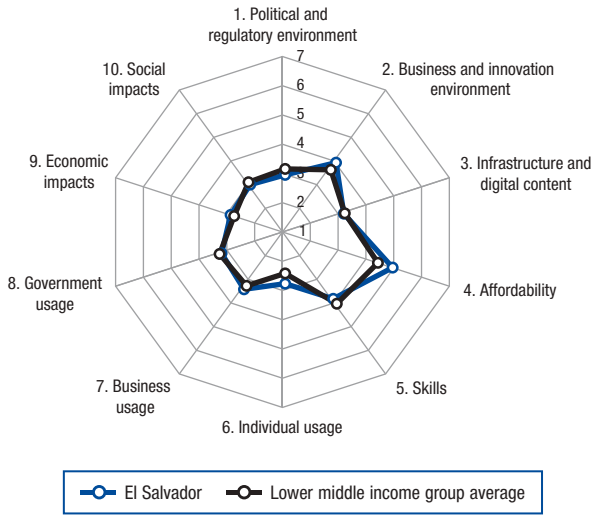
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	102	2.9
1.02	Laws relating to ICT*	83	3.7
1.03	Judicial independence*	41	4.8
1.04	Efficiency of legal system in settling disputes*	60	3.9
1.05	Efficiency of legal system in challenging regs*	86	3.2
1.06	Intellectual property protection*	80	3.3
1.07	Software piracy rate, % software installed	53	60
1.08	No. procedures to enforce a contract	106	41
1.09	No. days to enforce a contract	129	1,010
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	110	4.3
2.02	Venture capital availability*	41	3.0
2.03	Total tax rate, % profits	86	43.6
2.04	No. days to start a business	24	7
2.05	No. procedures to start a business	46	6
2.06	Intensity of local competition*	114	4.1
2.07	Tertiary education gross enrollment rate, %	75	30.4
2.08	Quality of management schools*	133	3.0
2.09	Gov't procurement of advanced tech*	104	3.3
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	85	1,673.1
3.02	Mobile network coverage, % pop.	42	99.7
3.03	Int'l Internet bandwidth, kb/s per user	89	6.6
3.04	Secure Internet servers/million pop.	106	2.3
3.05	Accessibility of digital content*	100	4.5
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	13	0.09
4.02	Fixed broadband Internet tariffs, PPP $/month	15	18.63
4.03	Internet & telephony competition, 0–2 (best)	95	1.40
	5th pillar: Skills		
5.01	Quality of educational system*	135	2.3
5.02	Quality of math & science education*	132	2.4
5.03	Secondary education gross enrollment rate, %	80	84.7
5.04	Adult literacy rate, %	112	74.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	91	87.1
6.02	Individuals using Internet, %	89	26.7
6.03	Households w/ personal computer, %	68	34.0
6.04	Households w/ Internet access, %	60	31.2
6.05	Broadband Internet subscriptions/100 pop.	91	1.8
6.06	Mobile broadband subscriptions/100 pop.	91	0.7
6.07	Use of virtual social networks*	56	5.4
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	78	4.7
7.02	Capacity for innovation*	83	2.8
7.03	PCT patents, applications/million pop.	73	0.6
7.04	Extent of business Internet use*	96	4.6
7.05	Extent of staff training*	131	3.0
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	71	4.6
8.02	Importance of ICT to gov't vision*	96	3.5
8.03	Government Online Service Index, 0–1 (best)	23	0.53
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	86	4.2
9.02	ICT PCT patents, applications/million pop.	78	0.1
9.03	Impact of ICT on new organizational models*	74	4.1
9.04	Knowledge-intensive jobs, % workforce	43	30.3
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	85	4.2
10.02	Internet access in schools*	107	3.3
10.03	ICT use & gov't efficiency*	87	3.9
10.04	E-Participation Index, 0–1 (best)	41	0.29

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

El Salvador

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**103**	**3.4**
A. Environment subindex	**103**	**3.5**
1st pillar: Political and regulatory environment	121	3.0
2nd pillar: Business and innovation environment	74	4.0
B. Readiness subindex	**102**	**3.9**
3rd pillar: Infrastructure and digital content	104	3.1
4th pillar: Affordability	84	4.9
5th pillar: Skills	113	3.8
C. Usage subindex	**100**	**3.1**
6th pillar: Individual usage	88	2.7
7th pillar: Business usage	88	3.4
8th pillar: Government usage	110	3.3
D. Impact subindex	**102**	**3.0**
9th pillar: Economic impacts	93	3.0
10th pillar: Social impacts	113	3.0



The Networked Readiness Index in detail

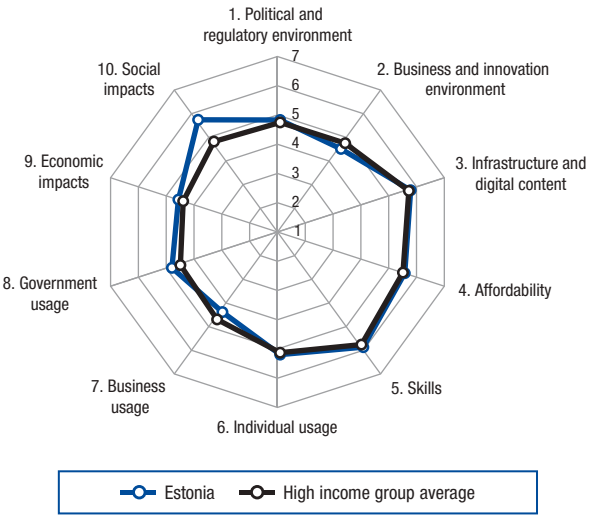
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	122	2.5
1.02	Laws relating to ICT*	107	3.2
1.03	Judicial independence*	106	2.9
1.04	Efficiency of legal system in settling disputes*	114	2.9
1.05	Efficiency of legal system in challenging regs*	111	2.9
1.06	Intellectual property protection*	113	2.6
1.07	Software piracy rate, % software installed	87	80
1.08	No. procedures to enforce a contract	41	34
1.09	No. days to enforce a contract	113	786
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	73	4.9
2.02	Venture capital availability*	89	2.3
2.03	Total tax rate, % profits	55	35.0
2.04	No. days to start a business	75	17
2.05	No. procedures to start a business	86	8
2.06	Intensity of local competition*	40	5.3
2.07	Tertiary education gross enrollment rate, %	85	23.0
2.08	Quality of management schools*	88	3.9
2.09	Gov't procurement of advanced tech*	119	2.9
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	96	972.3
3.02	Mobile network coverage, % pop.	81	95.0
3.03	Int'l Internet bandwidth, kb/s per user	121	1.5
3.04	Secure Internet servers/million pop.	82	13.4
3.05	Accessibility of digital content*	74	4.9
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	59	0.29
4.02	Fixed broadband Internet tariffs, PPP $/month	95	47.27
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	125	2.7
5.02	Quality of math & science education*	129	2.6
5.03	Secondary education gross enrollment rate, %	107	63.1
5.04	Adult literacy rate, %	104	84.1

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	35	124.3
6.02	Individuals using Internet, %	100	15.9
6.03	Households w/ personal computer, %	99	13.3
6.04	Households w/ Internet access, %	94	8.0
6.05	Broadband Internet subscriptions/100 pop.	85	2.8
6.06	Mobile broadband subscriptions/100 pop.	71	3.6
6.07	Use of virtual social networks*	62	5.3
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	85	4.6
7.02	Capacity for innovation*	115	2.5
7.03	PCT patents, applications/million pop.	79	0.4
7.04	Extent of business Internet use*	65	5.0
7.05	Extent of staff training*	77	3.9
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	132	3.4
8.02	Importance of ICT to gov't vision*	124	2.9
8.03	Government Online Service Index, 0–1 (best)	39	0.43
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	72	4.4
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	57	4.3
9.04	Knowledge-intensive jobs, % workforce	97	12.5
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	98	4.0
10.02	Internet access in schools*	114	3.1
10.03	ICT use & gov't efficiency*	108	3.6
10.04	E-Participation Index, 0–1 (best)	105	0.07

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Estonia

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**24**	**5.1**
A. Environment subindex	**32**	**4.7**
1st pillar: Political and regulatory environment	25	4.8
2nd pillar: Business and innovation environment	36	4.5
B. Readiness subindex	**23**	**5.7**
3rd pillar: Infrastructure and digital content	24	5.7
4th pillar: Affordability	54	5.5
5th pillar: Skills	18	5.8
C. Usage subindex	**24**	**4.8**
6th pillar: Individual usage	22	5.2
7th pillar: Business usage	28	4.4
8th pillar: Government usage	16	4.9
D. Impact subindex	**15**	**5.2**
9th pillar: Economic impacts	21	4.7
10th pillar: Social impacts	4	5.8



The Networked Readiness Index in detail

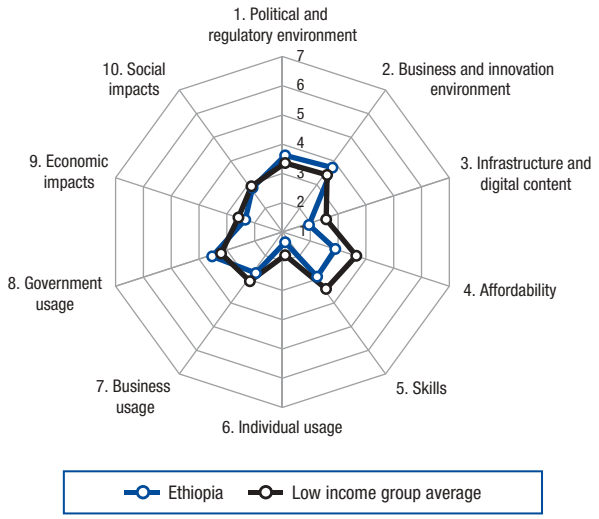
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	32	4.4
1.02	Laws relating to ICT*	3	5.8
1.03	Judicial independence*	23	5.5
1.04	Efficiency of legal system in settling disputes*	40	4.3
1.05	Efficiency of legal system in challenging regs*	35	4.3
1.06	Intellectual property protection*	32	4.8
1.07	Software piracy rate, % software installed	38	50
1.08	No. procedures to enforce a contract	47	35
1.09	No. days to enforce a contract	42	425
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	34	5.9
2.02	Venture capital availability*	31	3.2
2.03	Total tax rate, % profits	120	58.6
2.04	No. days to start a business	24	7
2.05	No. procedures to start a business	28	5
2.06	Intensity of local competition*	29	5.4
2.07	Tertiary education gross enrollment rate, %	29	62.7
2.08	Quality of management schools*	48	4.6
2.09	Gov't procurement of advanced tech*	25	4.2
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	24	7,883.6
3.02	Mobile network coverage, % pop.	22	100.0
3.03	Int'l Internet bandwidth, kb/s per user	43	23.1
3.04	Secure Internet servers/million pop.	25	434.4
3.05	Accessibility of digital content*	11	6.3
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	88	0.36
4.02	Fixed broadband Internet tariffs, PPP $/month	59	31.52
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	42	4.3
5.02	Quality of math & science education*	20	5.1
5.03	Secondary education gross enrollment rate, %	17	103.6
5.04	Adult literacy rate, %	1	99.8

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	38	123.2
6.02	Individuals using Internet, %	21	74.1
6.03	Households w/ personal computer, %	32	69.2
6.04	Households w/ Internet access, %	29	67.8
6.05	Broadband Internet subscriptions/100 pop.	20	25.1
6.06	Mobile broadband subscriptions/100 pop.	19	25.9
6.07	Use of virtual social networks*	17	6.1
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	36	5.5
7.02	Capacity for innovation*	34	3.7
7.03	PCT patents, applications/million pop.	26	34.2
7.04	Extent of business Internet use*	3	6.3
7.05	Extent of staff training*	46	4.2
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	13	5.7
8.02	Importance of ICT to gov't vision*	18	4.9
8.03	Government Online Service Index, 0–1 (best)	27	0.50
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	7	5.7
9.02	ICT PCT patents, applications/million pop.	21	16.4
9.03	Impact of ICT on new organizational models*	10	5.3
9.04	Knowledge-intensive jobs, % workforce	24	38.8
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	9	5.9
10.02	Internet access in schools*	3	6.4
10.03	ICT use & gov't efficiency*	9	5.6
10.04	E-Participation Index, 0–1 (best)	9	0.69

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Ethiopia

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**130**	**2.9**
A. Environment subindex	**84**	**3.7**
1st pillar: Political and regulatory environment	72	3.6
2nd pillar: Business and innovation environment	99	3.7
B. Readiness subindex	**138**	**2.5**
3rd pillar: Infrastructure and digital content	140	1.9
4th pillar: Affordability	132	2.8
5th pillar: Skills	132	2.9
C. Usage subindex	**133**	**2.6**
6th pillar: Individual usage	142	1.3
7th pillar: Business usage	136	2.7
8th pillar: Government usage	85	3.6
D. Impact subindex	**125**	**2.7**
9th pillar: Economic impacts	128	2.4
10th pillar: Social impacts	121	2.9



The Networked Readiness Index in detail

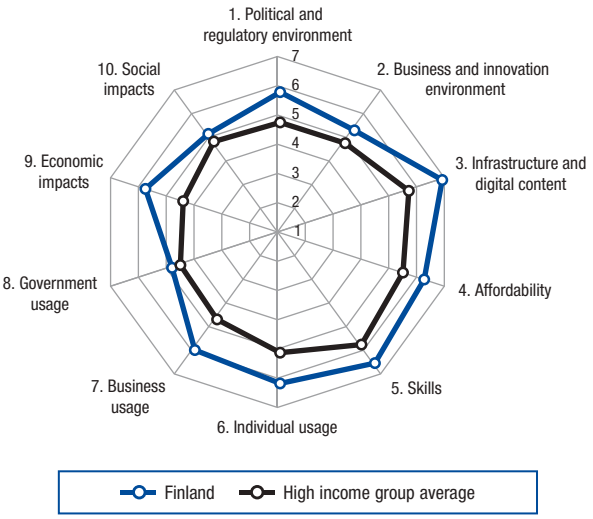
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	52	3.8
1.02	Laws relating to ICT*	116	3.1
1.03	Judicial independence*	93	3.1
1.04	Efficiency of legal system in settling disputes*	62	3.8
1.05	Efficiency of legal system in challenging regs*	72	3.6
1.06	Intellectual property protection*	66	3.6
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	69	37
1.09	No. days to enforce a contract	91	620
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	131	3.8
2.02	Venture capital availability*	120	2.0
2.03	Total tax rate, % profits	37	31.1
2.04	No. days to start a business	42	9
2.05	No. procedures to start a business	28	5
2.06	Intensity of local competition*	125	4.0
2.07	Tertiary education gross enrollment rate, %	123	5.5
2.08	Quality of management schools*	91	3.8
2.09	Gov't procurement of advanced tech*	55	3.8
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	135	47.5
3.02	Mobile network coverage, % pop.	136	10.0
3.03	Int'l Internet bandwidth, kb/s per user	99	5.4
3.04	Secure Internet servers/million pop.	139	0.1
3.05	Accessibility of digital content*	139	3.1
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	32	0.17
4.02	Fixed broadband Internet tariffs, PPP $/month	138	1,248.33
4.03	Internet & telephony competition, 0–2 (best)	138	0.00
	5th pillar: Skills		
5.01	Quality of educational system*	59	3.9
5.02	Quality of math & science education*	86	3.6
5.03	Secondary education gross enrollment rate, %	128	35.7
5.04	Adult literacy rate, %	137	35.9

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	142	8.3
6.02	Individuals using Internet, %	141	0.8
6.03	Households w/ personal computer, %	137	1.4
6.04	Households w/ Internet access, %	134	0.3
6.05	Broadband Internet subscriptions/100 pop.	139	0.0
6.06	Mobile broadband subscriptions/100 pop.	113	0.0
6.07	Use of virtual social networks*	139	3.2
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	135	3.7
7.02	Capacity for innovation*	125	2.3
7.03	PCT patents, applications/million pop.	119	0.0
7.04	Extent of business Internet use*	138	3.6
7.05	Extent of staff training*	134	2.9
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	77	4.5
8.02	Importance of ICT to gov't vision*	55	4.2
8.03	Government Online Service Index, 0–1 (best)	104	0.20
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	127	3.5
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	125	3.2
9.04	Knowledge-intensive jobs, % workforce	98	12.4
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	119	3.6
10.02	Internet access in schools*	121	2.7
10.03	ICT use & gov't efficiency*	81	4.1
10.04	E-Participation Index, 0–1 (best)	117	0.04

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Finland

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**3**	**5.8**
A. Environment subindex	**2**	**5.6**
1st pillar: Political and regulatory environment	4	5.8
2nd pillar: Business and innovation environment	4	5.3
B. Readiness subindex	**2**	**6.5**
3rd pillar: Infrastructure and digital content	5	6.8
4th pillar: Affordability	16	6.2
5th pillar: Skills	1	6.5
C. Usage subindex	**4**	**5.7**
6th pillar: Individual usage	5	6.2
7th pillar: Business usage	5	6.0
8th pillar: Government usage	17	4.9
D. Impact subindex	**7**	**5.5**
9th pillar: Economic impacts	5	5.8
10th pillar: Social impacts	18	5.2



The Networked Readiness Index in detail

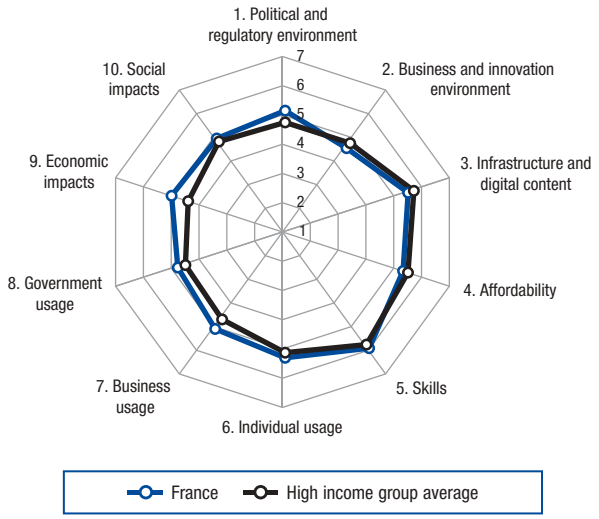
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	4	5.6
1.02	Laws relating to ICT*	6	5.7
1.03	Judicial independence*	4	6.4
1.04	Efficiency of legal system in settling disputes*	3	5.8
1.05	Efficiency of legal system in challenging regs*	1	5.7
1.06	Intellectual property protection*	1	6.2
1.07	Software piracy rate, % software installed	7	25
1.08	No. procedures to enforce a contract	36	33
1.09	No. days to enforce a contract	25	375
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	5	6.6
2.02	Venture capital availability*	9	4.2
2.03	Total tax rate, % profits	72	39.0
2.04	No. days to start a business	66	14
2.05	No. procedures to start a business	8	3
2.06	Intensity of local competition*	71	4.8
2.07	Tertiary education gross enrollment rate, %	2	91.6
2.08	Quality of management schools*	16	5.3
2.09	Gov't procurement of advanced tech*	8	4.7
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	9	13,398.2
3.02	Mobile network coverage, % pop.	45	99.5
3.03	Int'l Internet bandwidth, kb/s per user	13	107.3
3.04	Secure Internet servers/million pop.	13	1,245.4
3.05	Accessibility of digital content*	17	6.2
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	10	0.07
4.02	Fixed broadband Internet tariffs, PPP $/month	52	29.34
4.03	Internet & telephony competition, 0–2 (best)	71	1.83
	5th pillar: Skills		
5.01	Quality of educational system*	3	5.9
5.02	Quality of math & science education*	3	6.3
5.03	Secondary education gross enrollment rate, %	10	107.5
5.04	Adult literacy rate, %	15	99.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	10	156.4
6.02	Individuals using Internet, %	7	86.9
6.03	Households w/ personal computer, %	16	82.0
6.04	Households w/ Internet access, %	13	80.5
6.05	Broadband Internet subscriptions/100 pop.	15	28.6
6.06	Mobile broadband subscriptions/100 pop.	4	60.7
6.07	Use of virtual social networks*	14	6.1
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	11	6.0
7.02	Capacity for innovation*	5	5.6
7.03	PCT patents, applications/million pop.	3	276.1
7.04	Extent of business Internet use*	14	6.0
7.05	Extent of staff training*	8	5.3
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	10	5.9
8.02	Importance of ICT to gov't vision*	20	4.9
8.03	Government Online Service Index, 0–1 (best)	31	0.48
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	11	5.6
9.02	ICT PCT patents, applications/million pop.	1	125.0
9.03	Impact of ICT on new organizational models*	13	5.2
9.04	Knowledge-intensive jobs, % workforce	8	43.8
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	19	5.6
10.02	Internet access in schools*	4	6.4
10.03	ICT use & gov't efficiency*	21	5.2
10.04	E-Participation Index, 0–1 (best)	30	0.41

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

France

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**23**	**5.1**
A. Environment subindex	**25**	**4.9**
1st pillar: Political and regulatory environment	17	5.2
2nd pillar: Business and innovation environment	33	4.6
B. Readiness subindex	**28**	**5.5**
3rd pillar: Infrastructure and digital content	30	5.4
4th pillar: Affordability	69	5.2
5th pillar: Skills	16	5.9
C. Usage subindex	**21**	**5.1**
6th pillar: Individual usage	21	5.3
7th pillar: Business usage	17	5.1
8th pillar: Government usage	18	4.9
D. Impact subindex	**19**	**5.0**
9th pillar: Economic impacts	15	5.1
10th pillar: Social impacts	23	5.0



The Networked Readiness Index in detail

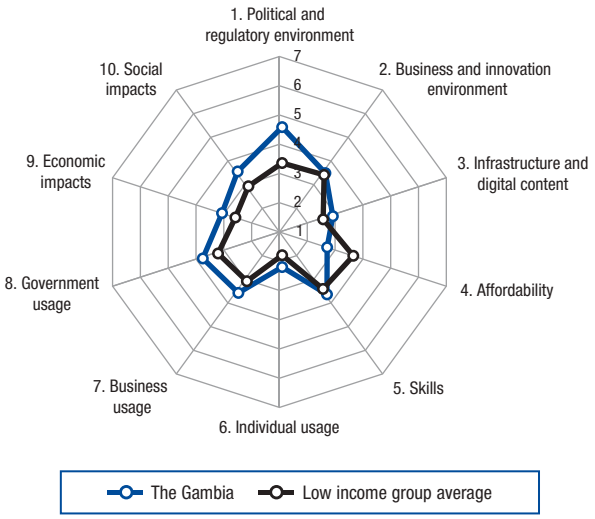
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	15	4.9
1.02	Laws relating to ICT*	22	5.2
1.03	Judicial independence*	37	4.9
1.04	Efficiency of legal system in settling disputes*	22	4.9
1.05	Efficiency of legal system in challenging regs*	17	4.8
1.06	Intellectual property protection*	7	5.8
1.07	Software piracy rate, % software installed	24	39
1.08	No. procedures to enforce a contract	15	29
1.09	No. days to enforce a contract	18	331
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	11	6.4
2.02	Venture capital availability*	36	3.0
2.03	Total tax rate, % profits	127	65.7
2.04	No. days to start a business	24	7
2.05	No. procedures to start a business	28	5
2.06	Intensity of local competition*	12	5.7
2.07	Tertiary education gross enrollment rate, %	41	54.5
2.08	Quality of management schools*	5	5.7
2.09	Gov't procurement of advanced tech*	48	4.0
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	19	8,600.0
3.02	Mobile network coverage, % pop.	49	99.0
3.03	Int'l Internet bandwidth, kb/s per user	18	69.6
3.04	Secure Internet servers/million pop.	31	297.1
3.05	Accessibility of digital content*	40	5.5
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	121	0.57
4.02	Fixed broadband Internet tariffs, PPP $/month	41	26.00
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	34	4.5
5.02	Quality of math & science education*	15	5.1
5.03	Secondary education gross enrollment rate, %	7	112.6
5.04	Adult literacy rate, %	15	99.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	71	100.7
6.02	Individuals using Internet, %	15	80.1
6.03	Households w/ personal computer, %	24	76.4
6.04	Households w/ Internet access, %	20	73.6
6.05	Broadband Internet subscriptions/100 pop.	7	34.0
6.06	Mobile broadband subscriptions/100 pop.	25	18.1
6.07	Use of virtual social networks*	26	5.9
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	25	5.6
7.02	Capacity for innovation*	8	5.1
7.03	PCT patents, applications/million pop.	14	110.0
7.04	Extent of business Internet use*	22	5.9
7.05	Extent of staff training*	35	4.4
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	43	5.1
8.02	Importance of ICT to gov't vision*	41	4.3
8.03	Government Online Service Index, 0–1 (best)	11	0.68
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	6	5.7
9.02	ICT PCT patents, applications/million pop.	15	31.5
9.03	Impact of ICT on new organizational models*	15	5.2
9.04	Knowledge-intensive jobs, % workforce	17	40.8
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	18	5.6
10.02	Internet access in schools*	51	4.6
10.03	ICT use & gov't efficiency*	26	5.1
10.04	E-Participation Index, 0–1 (best)	15	0.60

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Gambia, The

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**101**	**3.4**
A. Environment subindex	**54**	**4.1**
1st pillar: Political and regulatory environment	32	4.6
2nd pillar: Business and innovation environment	117	3.5
B. Readiness subindex	**126**	**3.0**
3rd pillar: Infrastructure and digital content	115	2.8
4th pillar: Affordability	133	2.6
5th pillar: Skills	121	3.6
C. Usage subindex	**95**	**3.2**
6th pillar: Individual usage	110	2.2
7th pillar: Business usage	65	3.5
8th pillar: Government usage	68	3.9
D. Impact subindex	**78**	**3.4**
9th pillar: Economic impacts	78	3.2
10th pillar: Social impacts	78	3.6



The Networked Readiness Index in detail

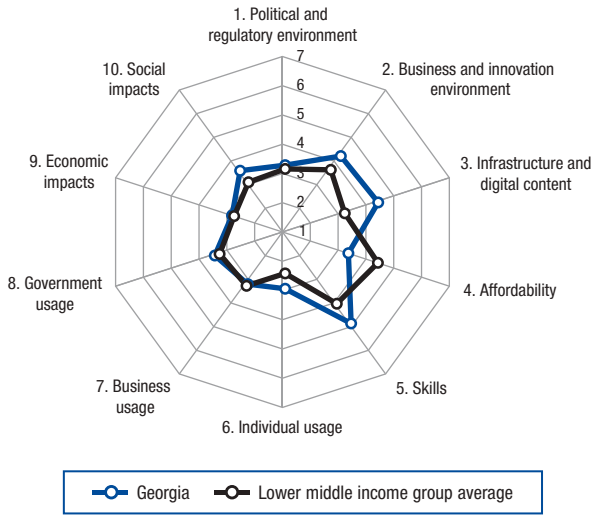
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	21	4.8
1.02	Laws relating to ICT*	75	3.9
1.03	Judicial independence*	46	4.5
1.04	Efficiency of legal system in settling disputes*	24	4.8
1.05	Efficiency of legal system in challenging regs*	31	4.4
1.06	Intellectual property protection*	33	4.7
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	36	33
1.09	No. days to enforce a contract	47	434
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	77	4.8
2.02	Venture capital availability*	63	2.7
2.03	Total tax rate, % profits	140	283.5
2.04	No. days to start a business	96	27
2.05	No. procedures to start a business	86	8
2.06	Intensity of local competition*	86	4.6
2.07	Tertiary education gross enrollment rate, %	129	4.1
2.08	Quality of management schools*	39	4.7
2.09	Gov't procurement of advanced tech*	21	4.3
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	126	134.5
3.02	Mobile network coverage, % pop.	106	85.0
3.03	Int'l Internet bandwidth, kb/s per user	127	1.1
3.04	Secure Internet servers/million pop.	103	2.9
3.05	Accessibility of digital content*	90	4.6
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	107	0.49
4.02	Fixed broadband Internet tariffs, PPP $/month	137	958.29
4.03	Internet & telephony competition, 0–2 (best)	114	1.13
	5th pillar: Skills		
5.01	Quality of educational system*	32	4.5
5.02	Quality of math & science education*	84	3.7
5.03	Secondary education gross enrollment rate, %	115	54.1
5.04	Adult literacy rate, %	135	46.5

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	94	85.5
6.02	Individuals using Internet, %	120	9.2
6.03	Households w/ personal computer, %	116	5.7
6.04	Households w/ Internet access, %	113	3.2
6.05	Broadband Internet subscriptions/100 pop.	133	0.0
6.06	Mobile broadband subscriptions/100 pop.	91	0.7
6.07	Use of virtual social networks*	83	5.1
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	87	4.6
7.02	Capacity for innovation*	62	3.1
7.03	PCT patents, applications/million pop.	119	0.0
7.04	Extent of business Internet use*	99	4.5
7.05	Extent of staff training*	31	4.5
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	25	5.4
8.02	Importance of ICT to gov't vision*	26	4.6
8.03	Government Online Service Index, 0–1 (best)	130	0.08
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	73	4.4
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	75	4.1
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	45	4.8
10.02	Internet access in schools*	80	3.8
10.03	ICT use & gov't efficiency*	43	4.6
10.04	E-Participation Index, 0–1 (best)	129	0.01

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Georgia

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**88**	**3.6**
A. Environment subindex	**74**	**3.8**
1st pillar: Political and regulatory environment	98	3.3
2nd pillar: Business and innovation environment	55	4.2
B. Readiness subindex	**93**	**4.1**
3rd pillar: Infrastructure and digital content	60	4.3
4th pillar: Affordability	116	3.3
5th pillar: Skills	79	4.8
C. Usage subindex	**94**	**3.2**
6th pillar: Individual usage	83	2.9
7th pillar: Business usage	109	3.2
8th pillar: Government usage	90	3.5
D. Impact subindex	**87**	**3.3**
9th pillar: Economic impacts	100	2.9
10th pillar: Social impacts	73	3.6



The Networked Readiness Index in detail

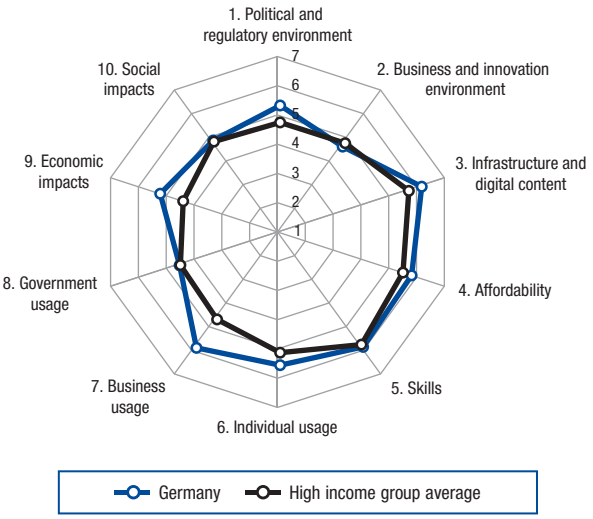
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	67	3.5
1.02	Laws relating to ICT*	78	3.7
1.03	Judicial independence*	91	3.2
1.04	Efficiency of legal system in settling disputes*	82	3.4
1.05	Efficiency of legal system in challenging regs*	92	3.1
1.06	Intellectual property protection*	105	2.8
1.07	Software piracy rate, % software installed	107	93
1.08	No. procedures to enforce a contract	55	36
1.09	No. days to enforce a contract	12	285
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	99	4.5
2.02	Venture capital availability*	97	2.2
2.03	Total tax rate, % profits	11	16.5
2.04	No. days to start a business	2	2
2.05	No. procedures to start a business	3	2
2.06	Intensity of local competition*	128	3.9
2.07	Tertiary education gross enrollment rate, %	77	28.2
2.08	Quality of management schools*	115	3.4
2.09	Gov't procurement of advanced tech*	76	3.5
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	81	1,921.0
3.02	Mobile network coverage, % pop.	49	99.0
3.03	Int'l Internet bandwidth, kb/s per user	45	21.4
3.04	Secure Internet servers/million pop.	85	11.9
3.05	Accessibility of digital content*	76	4.9
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	71	0.31
4.02	Fixed broadband Internet tariffs, PPP $/month	111	75.48
4.03	Internet & telephony competition, 0–2 (best)	83	1.72
	5th pillar: Skills		
5.01	Quality of educational system*	116	3.0
5.02	Quality of math & science education*	100	3.4
5.03	Secondary education gross enrollment rate, %	76	86.2
5.04	Adult literacy rate, %	3	99.7

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	85	91.4
6.02	Individuals using Internet, %	88	26.9
6.03	Households w/ personal computer, %	89	18.2
6.04	Households w/ Internet access, %	78	16.6
6.05	Broadband Internet subscriptions/100 pop.	66	5.8
6.06	Mobile broadband subscriptions/100 pop.	38	11.3
6.07	Use of virtual social networks*	54	5.5
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	115	4.1
7.02	Capacity for innovation*	103	2.6
7.03	PCT patents, applications/million pop.	60	1.5
7.04	Extent of business Internet use*	92	4.6
7.05	Extent of staff training*	106	3.5
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	78	4.5
8.02	Importance of ICT to gov't vision*	88	3.6
8.03	Government Online Service Index, 0–1 (best)	97	0.25
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	105	3.9
9.02	ICT PCT patents, applications/million pop.	59	0.2
9.03	Impact of ICT on new organizational models*	112	3.5
9.04	Knowledge-intensive jobs, % workforce	62	22.2
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	77	4.3
10.02	Internet access in schools*	67	4.1
10.03	ICT use & gov't efficiency*	40	4.7
10.04	E-Participation Index, 0–1 (best)	111	0.06

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Germany

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**16**	**5.3**
A. Environment subindex	**18**	**5.0**
1st pillar: Political and regulatory environment	13	5.3
2nd pillar: Business and innovation environment	32	4.6
B. Readiness subindex	**17**	**5.9**
3rd pillar: Infrastructure and digital content	14	6.1
4th pillar: Affordability	38	5.7
5th pillar: Skills	20	5.8
C. Usage subindex	**13**	**5.3**
6th pillar: Individual usage	14	5.5
7th pillar: Business usage	6	5.9
8th pillar: Government usage	30	4.6
D. Impact subindex	**18**	**5.1**
9th pillar: Economic impacts	13	5.3
10th pillar: Social impacts	27	4.9



The Networked Readiness Index in detail

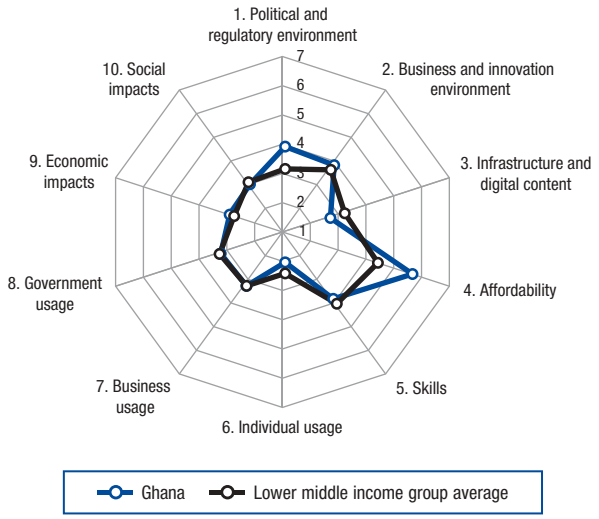
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	23	4.6
1.02	Laws relating to ICT*	31	5.0
1.03	Judicial independence*	7	6.3
1.04	Efficiency of legal system in settling disputes*	19	4.9
1.05	Efficiency of legal system in challenging regs*	12	5.0
1.06	Intellectual property protection*	13	5.6
1.07	Software piracy rate, % software installed	12	27
1.08	No. procedures to enforce a contract	18	30
1.09	No. days to enforce a contract	29	394
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	20	6.2
2.02	Venture capital availability*	37	3.0
2.03	Total tax rate, % profits	101	46.7
2.04	No. days to start a business	71	15
2.05	No. procedures to start a business	97	9
2.06	Intensity of local competition*	9	5.8
2.07	Tertiary education gross enrollment rate, %	n/a	n/a
2.08	Quality of management schools*	36	4.8
2.09	Gov't procurement of advanced tech*	29	4.2
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	29	7,168.7
3.02	Mobile network coverage, % pop.	49	99.0
3.03	Int'l Internet bandwidth, kb/s per user	15	74.1
3.04	Secure Internet servers/million pop.	17	872.8
3.05	Accessibility of digital content*	22	6.1
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	27	0.15
4.02	Fixed broadband Internet tariffs, PPP $/month	77	36.81
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	17	4.9
5.02	Quality of math & science education*	48	4.4
5.03	Secondary education gross enrollment rate, %	20	102.6
5.04	Adult literacy rate, %	15	99.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	30	127.0
6.02	Individuals using Internet, %	12	82.0
6.03	Households w/ personal computer, %	10	85.7
6.04	Households w/ Internet access, %	10	82.5
6.05	Broadband Internet subscriptions/100 pop.	10	31.7
6.06	Mobile broadband subscriptions/100 pop.	32	15.4
6.07	Use of virtual social networks*	40	5.8
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	14	5.9
7.02	Capacity for innovation*	3	5.7
7.03	PCT patents, applications/million pop.	7	202.5
7.04	Extent of business Internet use*	28	5.8
7.05	Extent of staff training*	16	4.9
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	36	5.3
8.02	Importance of ICT to gov't vision*	47	4.2
8.03	Government Online Service Index, 0–1 (best)	21	0.55
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	24	5.4
9.02	ICT PCT patents, applications/million pop.	10	45.6
9.03	Impact of ICT on new organizational models*	25	4.9
9.04	Knowledge-intensive jobs, % workforce	15	41.9
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	26	5.5
10.02	Internet access in schools*	41	4.9
10.03	ICT use & gov't efficiency*	46	4.6
10.04	E-Participation Index, 0–1 (best)	14	0.61

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Ghana

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**97**	**3.4**
A. Environment subindex	**63**	**3.9**
1st pillar: Political and regulatory environment	55	3.9
2nd pillar: Business and innovation environment	82	3.9
B. Readiness subindex	**99**	**4.0**
3rd pillar: Infrastructure and digital content	124	2.6
4th pillar: Affordability	46	5.6
5th pillar: Skills	112	3.8
C. Usage subindex	**114**	**2.9**
6th pillar: Individual usage	116	2.0
7th pillar: Business usage	99	3.2
8th pillar: Government usage	109	3.3
D. Impact subindex	**100**	**3.0**
9th pillar: Economic impacts	88	3.0
10th pillar: Social impacts	111	3.0



The Networked Readiness Index in detail

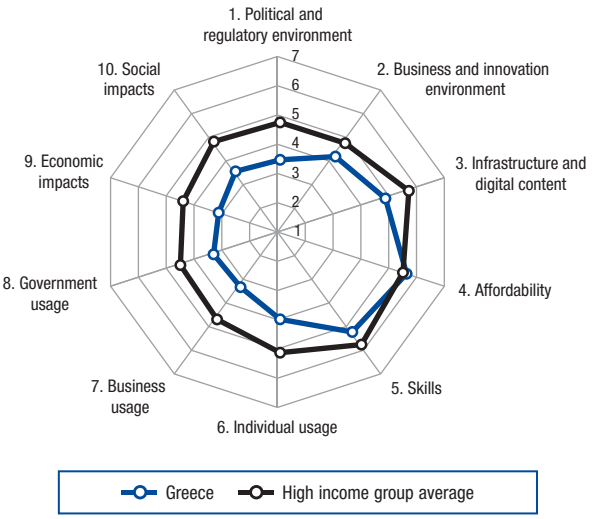
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	37	4.2
1.02	Laws relating to ICT*	104	3.3
1.03	Judicial independence*	59	4.1
1.04	Efficiency of legal system in settling disputes*	43	4.2
1.05	Efficiency of legal system in challenging regs*	62	3.8
1.06	Intellectual property protection*	88	3.1
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	55	36
1.09	No. days to enforce a contract	57	487
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	94	4.6
2.02	Venture capital availability*	123	2.0
2.03	Total tax rate, % profits	48	33.6
2.04	No. days to start a business	53	12
2.05	No. procedures to start a business	72	7
2.06	Intensity of local competition*	67	4.9
2.07	Tertiary education gross enrollment rate, %	115	8.8
2.08	Quality of management schools*	72	4.1
2.09	Gov't procurement of advanced tech*	95	3.3
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	115	359.3
3.02	Mobile network coverage, % pop.	117	77.0
3.03	Int'l Internet bandwidth, kb/s per user	122	1.5
3.04	Secure Internet servers/million pop.	111	1.7
3.05	Accessibility of digital content*	118	3.9
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	20	0.12
4.02	Fixed broadband Internet tariffs, PPP $/month	84	39.82
4.03	Internet & telephony competition, 0–2 (best)	65	1.90
	5th pillar: Skills		
5.01	Quality of educational system*	74	3.6
5.02	Quality of math & science education*	98	3.4
5.03	Secondary education gross enrollment rate, %	111	58.3
5.04	Adult literacy rate, %	119	66.6

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	106	71.5
6.02	Individuals using Internet, %	119	9.6
6.03	Households w/ personal computer, %	107	9.1
6.04	Households w/ Internet access, %	131	0.4
6.05	Broadband Internet subscriptions/100 pop.	115	0.2
6.06	Mobile broadband subscriptions/100 pop.	96	0.6
6.07	Use of virtual social networks*	112	4.5
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	109	4.2
7.02	Capacity for innovation*	93	2.7
7.03	PCT patents, applications/million pop.	108	0.0
7.04	Extent of business Internet use*	103	4.5
7.05	Extent of staff training*	81	3.8
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	87	4.4
8.02	Importance of ICT to gov't vision*	85	3.7
8.03	Government Online Service Index, 0–1 (best)	119	0.15
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	79	4.3
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	101	3.7
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	103	3.9
10.02	Internet access in schools*	110	3.2
10.03	ICT use & gov't efficiency*	110	3.6
10.04	E-Participation Index, 0–1 (best)	99	0.09

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Greece

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**59**	**4.0**
A. Environment subindex	**69**	**3.9**
1st pillar: Political and regulatory environment	87	3.5
2nd pillar: Business and innovation environment	60	4.2
B. Readiness subindex	**44**	**5.2**
3rd pillar: Infrastructure and digital content	42	4.8
4th pillar: Affordability	49	5.5
5th pillar: Skills	55	5.2
C. Usage subindex	**66**	**3.6**
6th pillar: Individual usage	49	4.0
7th pillar: Business usage	97	3.3
8th pillar: Government usage	102	3.4
D. Impact subindex	**77**	**3.4**
9th pillar: Economic impacts	73	3.2
10th pillar: Social impacts	77	3.6



The Networked Readiness Index in detail

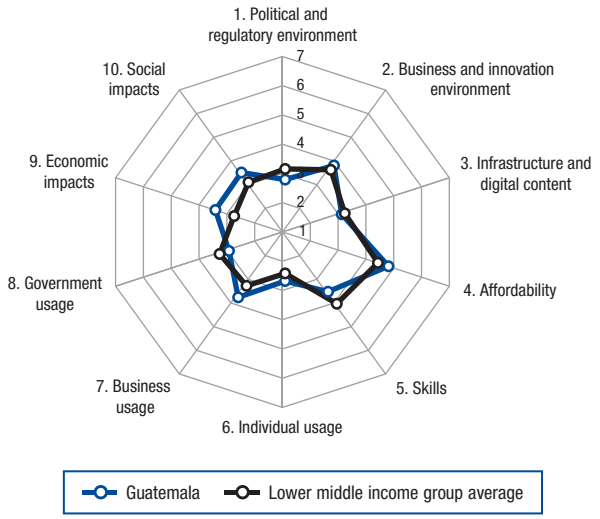
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	84	3.3
1.02	Laws relating to ICT*	85	3.7
1.03	Judicial independence*	85	3.3
1.04	Efficiency of legal system in settling disputes*	121	2.8
1.05	Efficiency of legal system in challenging regs*	121	2.8
1.06	Intellectual property protection*	52	3.8
1.07	Software piracy rate, % software installed	52	59
1.08	No. procedures to enforce a contract	87	39
1.09	No. days to enforce a contract	116	819
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	56	5.3
2.02	Venture capital availability*	103	2.2
2.03	Total tax rate, % profits	99	46.4
2.04	No. days to start a business	47	10
2.05	No. procedures to start a business	110	10
2.06	Intensity of local competition*	82	4.6
2.07	Tertiary education gross enrollment rate, %	3	89.4
2.08	Quality of management schools*	104	3.7
2.09	Gov't procurement of advanced tech*	113	3.0
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	44	4,848.4
3.02	Mobile network coverage, % pop.	25	99.9
3.03	Int'l Internet bandwidth, kb/s per user	35	31.0
3.04	Secure Internet servers/million pop.	44	124.2
3.05	Accessibility of digital content*	65	5.0
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	111	0.50
4.02	Fixed broadband Internet tariffs, PPP $/month	21	19.85
4.03	Internet & telephony competition, 0–2 (best)	80	1.75
	5th pillar: Skills		
5.01	Quality of educational system*	120	2.9
5.02	Quality of math & science education*	61	4.1
5.03	Secondary education gross enrollment rate, %	27	100.9
5.04	Adult literacy rate, %	56	97.2

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	58	108.2
6.02	Individuals using Internet, %	58	44.4
6.03	Households w/ personal computer, %	47	53.4
6.04	Households w/ Internet access, %	48	46.4
6.05	Broadband Internet subscriptions/100 pop.	32	19.9
6.06	Mobile broadband subscriptions/100 pop.	61	4.9
6.07	Use of virtual social networks*	84	5.0
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	89	4.6
7.02	Capacity for innovation*	96	2.7
7.03	PCT patents, applications/million pop.	36	9.2
7.04	Extent of business Internet use*	95	4.6
7.05	Extent of staff training*	114	3.4
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	106	4.0
8.02	Importance of ICT to gov't vision*	119	3.0
8.03	Government Online Service Index, 0–1 (best)	58	0.36
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	99	4.0
9.02	ICT PCT patents, applications/million pop.	36	1.9
9.03	Impact of ICT on new organizational models*	122	3.3
9.04	Knowledge-intensive jobs, % workforce	35	33.5
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	87	4.2
10.02	Internet access in schools*	78	3.9
10.03	ICT use & gov't efficiency*	96	3.8
10.04	E-Participation Index, 0–1 (best)	47	0.26

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Guatemala

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**98**	**3.4**
A. Environment subindex	**116**	**3.3**
1st pillar: Political and regulatory environment	128	2.8
2nd pillar: Business and innovation environment	86	3.8
B. Readiness subindex	**105**	**3.7**
3rd pillar: Infrastructure and digital content	110	3.0
4th pillar: Affordability	91	4.7
5th pillar: Skills	122	3.5
C. Usage subindex	**101**	**3.1**
6th pillar: Individual usage	91	2.7
7th pillar: Business usage	53	3.7
8th pillar: Government usage	121	3.0
D. Impact subindex	**67**	**3.5**
9th pillar: Economic impacts	48	3.5
10th pillar: Social impacts	81	3.5



The Networked Readiness Index in detail

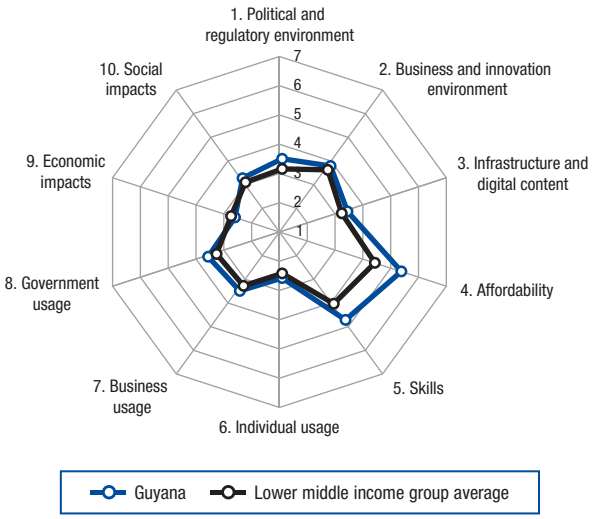
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	139	2.0
1.02	Laws relating to ICT*	73	3.9
1.03	Judicial independence*	117	2.6
1.04	Efficiency of legal system in settling disputes*	116	2.9
1.05	Efficiency of legal system in challenging regs*	110	2.9
1.06	Intellectual property protection*	123	2.5
1.07	Software piracy rate, % software installed	87	80
1.08	No. procedures to enforce a contract	27	31
1.09	No. days to enforce a contract	139	1,459
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	48	5.5
2.02	Venture capital availability*	64	2.6
2.03	Total tax rate, % profits	79	40.9
2.04	No. days to start a business	115	37
2.05	No. procedures to start a business	121	12
2.06	Intensity of local competition*	50	5.1
2.07	Tertiary education gross enrollment rate, %	97	17.8
2.08	Quality of management schools*	44	4.6
2.09	Gov't procurement of advanced tech*	118	3.0
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	108	636.7
3.02	Mobile network coverage, % pop.	118	76.0
3.03	Int'l Internet bandwidth, kb/s per user	103	4.0
3.04	Secure Internet servers/million pop.	88	9.9
3.05	Accessibility of digital content*	63	5.1
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	33	0.17
4.02	Fixed broadband Internet tariffs, PPP $/month	102	53.84
4.03	Internet & telephony competition, 0–2 (best)	70	1.85
	5th pillar: Skills		
5.01	Quality of educational system*	127	2.6
5.02	Quality of math & science education*	130	2.6
5.03	Secondary education gross enrollment rate, %	110	58.5
5.04	Adult literacy rate, %	111	74.5

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	31	125.6
6.02	Individuals using Internet, %	114	10.5
6.03	Households w/ personal computer, %	94	15.8
6.04	Households w/ Internet access, %	114	3.0
6.05	Broadband Internet subscriptions/100 pop.	90	1.8
6.06	Mobile broadband subscriptions/100 pop.	75	3.0
6.07	Use of virtual social networks*	61	5.3
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	47	5.2
7.02	Capacity for innovation*	69	3.0
7.03	PCT patents, applications/million pop.	76	0.5
7.04	Extent of business Internet use*	47	5.3
7.05	Extent of staff training*	47	4.2
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	133	3.4
8.02	Importance of ICT to gov't vision*	127	2.9
8.03	Government Online Service Index, 0–1 (best)	75	0.31
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	45	4.9
9.02	ICT PCT patents, applications/million pop.	85	0.0
9.03	Impact of ICT on new organizational models*	38	4.7
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	79	4.2
10.02	Internet access in schools*	102	3.3
10.03	ICT use & gov't efficiency*	101	3.7
10.04	E-Participation Index, 0–1 (best)	36	0.31

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Guyana

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**90**	**3.6**
A. Environment subindex	**86**	**3.7**
1st pillar: Political and regulatory environment	81	3.5
2nd pillar: Business and innovation environment	88	3.8
B. Readiness subindex	**81**	**4.4**
3rd pillar: Infrastructure and digital content	92	3.3
4th pillar: Affordability	66	5.3
5th pillar: Skills	88	4.7
C. Usage subindex	**92**	**3.2**
6th pillar: Individual usage	97	2.5
7th pillar: Business usage	82	3.5
8th pillar: Government usage	80	3.7
D. Impact subindex	**101**	**3.0**
9th pillar: Economic impacts	114	2.7
10th pillar: Social impacts	96	3.3



The Networked Readiness Index in detail

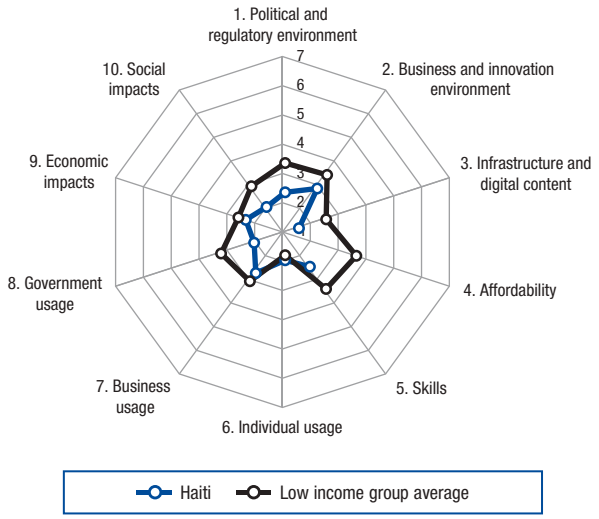
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	66	3.5
1.02	Laws relating to ICT*	114	3.1
1.03	Judicial independence*	87	3.3
1.04	Efficiency of legal system in settling disputes*	93	3.3
1.05	Efficiency of legal system in challenging regs*	89	3.2
1.06	Intellectual property protection*	83	3.2
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	55	36
1.09	No. days to enforce a contract	82	581
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	85	4.7
2.02	Venture capital availability*	83	2.4
2.03	Total tax rate, % profits	63	36.1
2.04	No. days to start a business	93	26
2.05	No. procedures to start a business	86	8
2.06	Intensity of local competition*	79	4.7
2.07	Tertiary education gross enrollment rate, %	105	11.9
2.08	Quality of management schools*	74	4.1
2.09	Gov't procurement of advanced tech*	74	3.5
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	94	1,091.0
3.02	Mobile network coverage, % pop.	81	95.0
3.03	Int'l Internet bandwidth, kb/s per user	91	6.4
3.04	Secure Internet servers/million pop.	97	6.6
3.05	Accessibility of digital content*	92	4.6
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	37	0.19
4.02	Fixed broadband Internet tariffs, PPP $/month	19	19.63
4.03	Internet & telephony competition, 0–2 (best)	134	0.50
	5th pillar: Skills		
5.01	Quality of educational system*	56	3.9
5.02	Quality of math & science education*	78	3.8
5.03	Secondary education gross enrollment rate, %	60	91.0
5.04	Adult literacy rate, %	n/a	n/a

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	104	73.6
6.02	Individuals using Internet, %	83	29.9
6.03	Households w/ personal computer, %	112	6.5
6.04	Households w/ Internet access, %	102	5.1
6.05	Broadband Internet subscriptions/100 pop.	95	1.5
6.06	Mobile broadband subscriptions/100 pop.	n/a	n/a
6.07	Use of virtual social networks*	87	5.0
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	96	4.4
7.02	Capacity for innovation*	73	3.0
7.03	PCT patents, applications/million pop.	119	0.0
7.04	Extent of business Internet use*	80	4.9
7.05	Extent of staff training*	60	4.1
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	59	4.8
8.02	Importance of ICT to gov't vision*	63	4.1
8.03	Government Online Service Index, 0–1 (best)	108	0.18
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	101	4.0
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	97	3.7
9.04	Knowledge-intensive jobs, % workforce	96	12.7
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	74	4.3
10.02	Internet access in schools*	98	3.4
10.03	ICT use & gov't efficiency*	86	4.0
10.04	E-Participation Index, 0–1 (best)	99	0.09

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Haiti

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**142**	**2.3**
A. Environment subindex	**142**	**2.6**
1st pillar: Political and regulatory environment	140	2.4
2nd pillar: Business and innovation environment	139	2.9
B. Readiness subindex	**142**	**2.0**
3rd pillar: Infrastructure and digital content	142	1.5
4th pillar: Affordability	n/a	n/a
5th pillar: Skills	138	2.4
C. Usage subindex	**139**	**2.3**
6th pillar: Individual usage	121	1.9
7th pillar: Business usage	135	2.7
8th pillar: Government usage	141	2.1
D. Impact subindex	**138**	**2.2**
9th pillar: Economic impacts	129	2.4
10th pillar: Social impacts	140	2.1



The Networked Readiness Index in detail

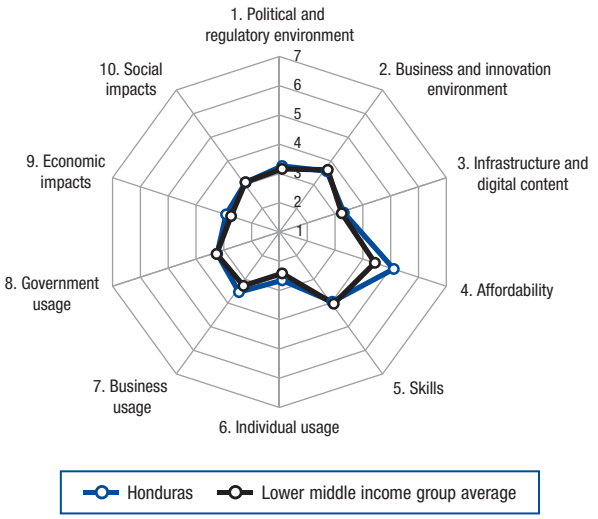
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	141	1.9
1.02	Laws relating to ICT*	139	2.1
1.03	Judicial independence*	140	1.7
1.04	Efficiency of legal system in settling disputes*	140	2.1
1.05	Efficiency of legal system in challenging regs*	141	2.1
1.06	Intellectual property protection*	142	1.6
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	47	35
1.09	No. days to enforce a contract	69	530
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	135	3.7
2.02	Venture capital availability*	141	1.4
2.03	Total tax rate, % profits	78	40.8
2.04	No. days to start a business	137	105
2.05	No. procedures to start a business	121	12
2.06	Intensity of local competition*	135	3.7
2.07	Tertiary education gross enrollment rate, %	n/a	n/a
2.08	Quality of management schools*	136	2.7
2.09	Gov't procurement of advanced tech*	138	2.4
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	134	49.9
3.02	Mobile network coverage, % pop.	n/a	n/a
3.03	Int'l Internet bandwidth, kb/s per user	139	0.1
3.04	Secure Internet servers/million pop.	120	1.0
3.05	Accessibility of digital content*	140	3.0
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	n/a	n/a
4.02	Fixed broadband Internet tariffs, PPP $/month	n/a	n/a
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	140	2.0
5.02	Quality of math & science education*	131	2.5
5.03	Secondary education gross enrollment rate, %	n/a	n/a
5.04	Adult literacy rate, %	134	48.7

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	132	40.0
6.02	Individuals using Internet, %	121	8.4
6.03	Households w/ personal computer, %	115	5.9
6.04	Households w/ Internet access, %	118	2.7
6.05	Broadband Internet subscriptions/100 pop.	142	0.0
6.06	Mobile broadband subscriptions/100 pop.	n/a	n/a
6.07	Use of virtual social networks*	99	4.7
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	132	3.8
7.02	Capacity for innovation*	130	2.3
7.03	PCT patents, applications/million pop.	111	0.0
7.04	Extent of business Internet use*	121	4.1
7.05	Extent of staff training*	142	2.3
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	140	2.9
8.02	Importance of ICT to gov't vision*	140	2.3
8.03	Government Online Service Index, 0–1 (best)	136	0.02
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	128	3.4
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	135	2.8
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	140	2.9
10.02	Internet access in schools*	138	1.7
10.03	ICT use & gov't efficiency*	139	2.6
10.04	E-Participation Index, 0–1 (best)	127	0.02

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Honduras

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**99**	**3.4**
A. Environment subindex	**107**	**3.4**
1st pillar: Political and regulatory environment	100	3.3
2nd pillar: Business and innovation environment	112	3.6
B. Readiness subindex	**96**	**4.0**
3rd pillar: Infrastructure and digital content	96	3.2
4th pillar: Affordability	80	5.0
5th pillar: Skills	105	3.9
C. Usage subindex	**98**	**3.2**
6th pillar: Individual usage	93	2.6
7th pillar: Business usage	73	3.5
8th pillar: Government usage	107	3.3
D. Impact subindex	**97**	**3.1**
9th pillar: Economic impacts	85	3.0
10th pillar: Social impacts	104	3.1



The Networked Readiness Index in detail

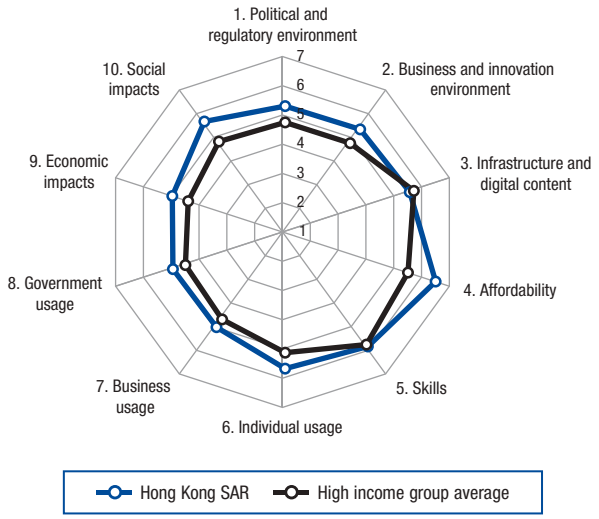
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	82	3.3
1.02	Laws relating to ICT*	97	3.5
1.03	Judicial independence*	77	3.6
1.04	Efficiency of legal system in settling disputes*	89	3.3
1.05	Efficiency of legal system in challenging regs*	74	3.5
1.06	Intellectual property protection*	77	3.3
1.07	Software piracy rate, % software installed	74	73
1.08	No. procedures to enforce a contract	130	47
1.09	No. days to enforce a contract	126	920
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	81	4.8
2.02	Venture capital availability*	80	2.4
2.03	Total tax rate, % profits	90	44.0
2.04	No. days to start a business	66	14
2.05	No. procedures to start a business	129	13
2.06	Intensity of local competition*	98	4.5
2.07	Tertiary education gross enrollment rate, %	93	18.8
2.08	Quality of management schools*	113	3.5
2.09	Gov't procurement of advanced tech*	80	3.5
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	98	895.1
3.02	Mobile network coverage, % pop.	104	89.9
3.03	Int'l Internet bandwidth, kb/s per user	94	5.9
3.04	Secure Internet servers/million pop.	91	8.3
3.05	Accessibility of digital content*	99	4.5
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	77	0.32
4.02	Fixed broadband Internet tariffs, PPP $/month	89	42.43
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	129	2.6
5.02	Quality of math & science education*	133	2.4
5.03	Secondary education gross enrollment rate, %	101	73.5
5.04	Adult literacy rate, %	105	83.6

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	32	125.1
6.02	Individuals using Internet, %	112	11.1
6.03	Households w/ personal computer, %	102	12.9
6.04	Households w/ Internet access, %	99	6.0
6.05	Broadband Internet subscriptions/100 pop.	99	1.0
6.06	Mobile broadband subscriptions/100 pop.	65	4.2
6.07	Use of virtual social networks*	70	5.2
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	67	4.8
7.02	Capacity for innovation*	88	2.8
7.03	PCT patents, applications/million pop.	119	0.0
7.04	Extent of business Internet use*	69	5.0
7.05	Extent of staff training*	70	4.0
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	116	3.9
8.02	Importance of ICT to gov't vision*	104	3.4
8.03	Government Online Service Index, 0–1 (best)	81	0.30
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	69	4.5
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	52	4.4
9.04	Knowledge-intensive jobs, % workforce	95	12.8
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	114	3.8
10.02	Internet access in schools*	112	3.2
10.03	ICT use & gov't efficiency*	94	3.8
10.04	E-Participation Index, 0–1 (best)	79	0.13

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Hong Kong SAR

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**13**	**5.5**
A. Environment subindex	**7**	**5.3**
1st pillar: Political and regulatory environment	15	5.3
2nd pillar: Business and innovation environment	3	5.4
B. Readiness subindex	**16**	**5.9**
3rd pillar: Infrastructure and digital content	28	5.5
4th pillar: Affordability	5	6.4
5th pillar: Skills	23	5.8
C. Usage subindex	**16**	**5.2**
6th pillar: Individual usage	12	5.6
7th pillar: Business usage	20	5.0
8th pillar: Government usage	15	5.0
D. Impact subindex	**10**	**5.4**
9th pillar: Economic impacts	16	5.1
10th pillar: Social impacts	5	5.7



The Networked Readiness Index in detail

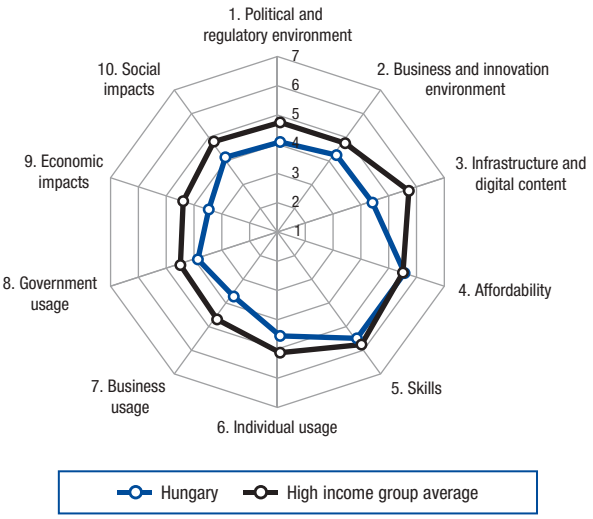
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	41	4.1
1.02	Laws relating to ICT*	8	5.5
1.03	Judicial independence*	15	6.1
1.04	Efficiency of legal system in settling disputes*	5	5.7
1.05	Efficiency of legal system in challenging regs*	3	5.5
1.06	Intellectual property protection*	14	5.5
1.07	Software piracy rate, % software installed	32	45
1.08	No. procedures to enforce a contract	5	26
1.09	No. days to enforce a contract	9	280
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	12	6.4
2.02	Venture capital availability*	5	4.4
2.03	Total tax rate, % profits	18	23.0
2.04	No. days to start a business	4	3
2.05	No. procedures to start a business	8	3
2.06	Intensity of local competition*	14	5.7
2.07	Tertiary education gross enrollment rate, %	40	57.2
2.08	Quality of management schools*	21	5.2
2.09	Gov't procurement of advanced tech*	27	4.2
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	41	5,485.4
3.02	Mobile network coverage, % pop.	1	100.0
3.03	Int'l Internet bandwidth, kb/s per user	1	776.6
3.04	Secure Internet servers/million pop.	24	453.5
3.05	Accessibility of digital content*	16	6.2
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	1	0.02
4.02	Fixed broadband Internet tariffs, PPP $/month	46	27.69
4.03	Internet & telephony competition, 0–2 (best)	n/a	n/a
	5th pillar: Skills		
5.01	Quality of educational system*	21	4.8
5.02	Quality of math & science education*	11	5.3
5.03	Secondary education gross enrollment rate, %	67	88.8
5.04	Adult literacy rate, %	15	99.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	1	195.6
6.02	Individuals using Internet, %	24	72.0
6.03	Households w/ personal computer, %	20	77.9
6.04	Households w/ Internet access, %	17	76.4
6.05	Broadband Internet subscriptions/100 pop.	13	29.9
6.06	Mobile broadband subscriptions/100 pop.	17	29.4
6.07	Use of virtual social networks*	7	6.2
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	15	5.9
7.02	Capacity for innovation*	39	3.5
7.03	PCT patents, applications/million pop.	n/a	n/a
7.04	Extent of business Internet use*	21	5.9
7.05	Extent of staff training*	26	4.7
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	24	5.5
8.02	Importance of ICT to gov't vision*	28	4.6
8.03	Government Online Service Index, 0–1 (best)	n/a	n/a
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	23	5.4
9.02	ICT PCT patents, applications/million pop.	n/a	n/a
9.03	Impact of ICT on new organizational models*	19	5.2
9.04	Knowledge-intensive jobs, % workforce	31	36.0
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	16	5.7
10.02	Internet access in schools*	14	6.1
10.03	ICT use & gov't efficiency*	17	5.3
10.04	E-Participation Index, 0–1 (best)	n/a	n/a

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Hungary

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**43**	**4.3**
A. Environment subindex	**45**	**4.2**
1st pillar: Political and regulatory environment	45	4.1
2nd pillar: Business and innovation environment	52	4.3
B. Readiness subindex	**49**	**5.1**
3rd pillar: Infrastructure and digital content	61	4.3
4th pillar: Affordability	55	5.5
5th pillar: Skills	40	5.5
C. Usage subindex	**42**	**4.1**
6th pillar: Individual usage	41	4.5
7th pillar: Business usage	54	3.7
8th pillar: Government usage	60	4.0
D. Impact subindex	**45**	**3.9**
9th pillar: Economic impacts	44	3.6
10th pillar: Social impacts	45	4.2



The Networked Readiness Index in detail

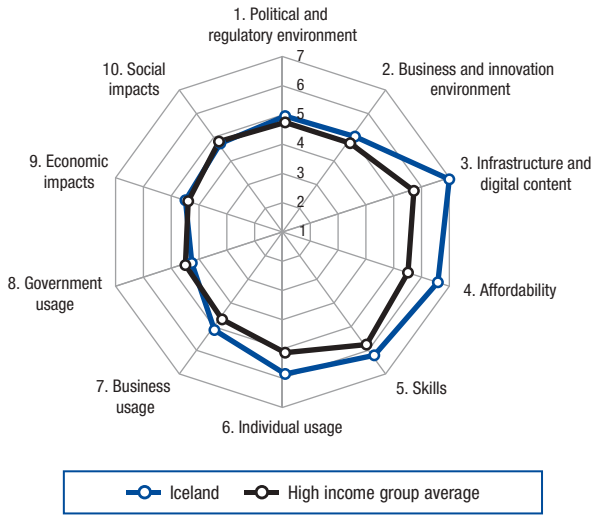
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	61	3.6
1.02	Laws relating to ICT*	49	4.4
1.03	Judicial independence*	64	3.9
1.04	Efficiency of legal system in settling disputes*	91	3.3
1.05	Efficiency of legal system in challenging regs*	119	2.8
1.06	Intellectual property protection*	45	4.1
1.07	Software piracy rate, % software installed	27	41
1.08	No. procedures to enforce a contract	47	35
1.09	No. days to enforce a contract	30	395
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	43	5.5
2.02	Venture capital availability*	117	2.1
2.03	Total tax rate, % profits	112	52.4
2.04	No. days to start a business	8	4
2.05	No. procedures to start a business	20	4
2.06	Intensity of local competition*	39	5.3
2.07	Tertiary education gross enrollment rate, %	33	61.7
2.08	Quality of management schools*	77	4.0
2.09	Gov't procurement of advanced tech*	90	3.4
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	56	3,590.0
3.02	Mobile network coverage, % pop.	49	99.0
3.03	Int'l Internet bandwidth, kb/s per user	74	10.0
3.04	Secure Internet servers/million pop.	38	166.1
3.05	Accessibility of digital content*	21	6.1
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	69	0.31
4.02	Fixed broadband Internet tariffs, PPP $/month	64	32.60
4.03	Internet & telephony competition, 0–2 (best)	67	1.88
	5th pillar: Skills		
5.01	Quality of educational system*	80	3.5
5.02	Quality of math & science education*	37	4.6
5.03	Secondary education gross enrollment rate, %	35	98.3
5.04	Adult literacy rate, %	13	99.4

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	41	120.3
6.02	Individuals using Internet, %	34	65.3
6.03	Households w/ personal computer, %	35	66.4
6.04	Households w/ Internet access, %	35	60.5
6.05	Broadband Internet subscriptions/100 pop.	33	19.6
6.06	Mobile broadband subscriptions/100 pop.	41	10.1
6.07	Use of virtual social networks*	81	5.1
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	59	4.9
7.02	Capacity for innovation*	41	3.4
7.03	PCT patents, applications/million pop.	27	22.0
7.04	Extent of business Internet use*	60	5.0
7.05	Extent of staff training*	111	3.4
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	89	4.4
8.02	Importance of ICT to gov't vision*	95	3.5
8.03	Government Online Service Index, 0–1 (best)	26	0.50
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	83	4.2
9.02	ICT PCT patents, applications/million pop.	27	6.3
9.03	Impact of ICT on new organizational models*	103	3.6
9.04	Knowledge-intensive jobs, % workforce	28	36.7
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	64	4.4
10.02	Internet access in schools*	31	5.4
10.03	ICT use & gov't efficiency*	84	4.0
10.04	E-Participation Index, 0–1 (best)	36	0.31

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Iceland

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**15**	**5.3**
A. Environment subindex	**16**	**5.0**
1st pillar: Political and regulatory environment	22	5.0
2nd pillar: Business and innovation environment	19	5.1
B. Readiness subindex	**1**	**6.5**
3rd pillar: Infrastructure and digital content	2	6.9
4th pillar: Affordability	4	6.5
5th pillar: Skills	7	6.2
C. Usage subindex	**19**	**5.1**
6th pillar: Individual usage	9	5.8
7th pillar: Business usage	15	5.1
8th pillar: Government usage	42	4.4
D. Impact subindex	**23**	**4.7**
9th pillar: Economic impacts	23	4.6
10th pillar: Social impacts	32	4.8



The Networked Readiness Index in detail

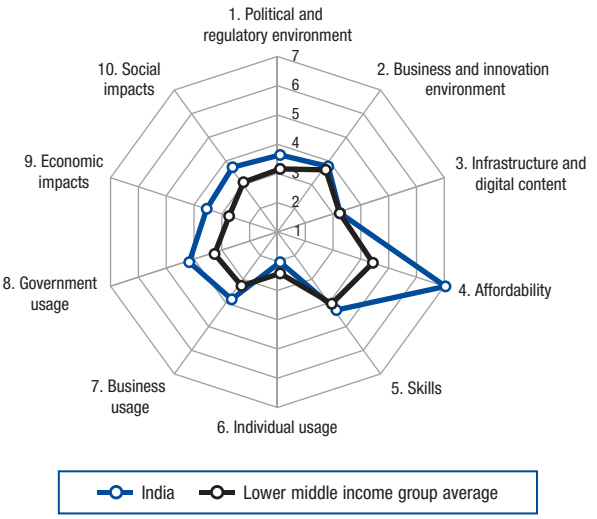
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	48	3.9
1.02	Laws relating to ICT*	16	5.3
1.03	Judicial independence*	19	5.8
1.04	Efficiency of legal system in settling disputes*	21	4.9
1.05	Efficiency of legal system in challenging regs*	21	4.6
1.06	Intellectual property protection*	23	5.2
1.07	Software piracy rate, % software installed	35	49
1.08	No. procedures to enforce a contract	9	27
1.09	No. days to enforce a contract	40	417
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	4	6.6
2.02	Venture capital availability*	70	2.6
2.03	Total tax rate, % profits	42	31.8
2.04	No. days to start a business	10	5
2.05	No. procedures to start a business	28	5
2.06	Intensity of local competition*	76	4.7
2.07	Tertiary education gross enrollment rate, %	15	74.1
2.08	Quality of management schools*	11	5.5
2.09	Gov't procurement of advanced tech*	18	4.4
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	1	53,352.5
3.02	Mobile network coverage, % pop.	49	99.0
3.03	Int'l Internet bandwidth, kb/s per user	2	291.0
3.04	Secure Internet servers/million pop.	1	2,529.9
3.05	Accessibility of digital content*	3	6.5
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	23	0.15
4.02	Fixed broadband Internet tariffs, PPP $/month	28	21.98
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	5	5.6
5.02	Quality of math & science education*	14	5.2
5.03	Secondary education gross enrollment rate, %	12	107.2
5.04	Adult literacy rate, %	15	99.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	60	106.5
6.02	Individuals using Internet, %	1	95.0
6.03	Households w/ personal computer, %	1	93.0
6.04	Households w/ Internet access, %	2	92.0
6.05	Broadband Internet subscriptions/100 pop.	6	34.1
6.06	Mobile broadband subscriptions/100 pop.	33	12.7
6.07	Use of virtual social networks*	1	6.7
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	2	6.3
7.02	Capacity for innovation*	18	4.4
7.03	PCT patents, applications/million pop.	17	96.0
7.04	Extent of business Internet use*	5	6.2
7.05	Extent of staff training*	21	4.8
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	40	5.2
8.02	Importance of ICT to gov't vision*	33	4.5
8.03	Government Online Service Index, 0–1 (best)	47	0.40
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	12	5.5
9.02	ICT PCT patents, applications/million pop.	25	8.4
9.03	Impact of ICT on new organizational models*	14	5.2
9.04	Knowledge-intensive jobs, % workforce	5	46.0
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	7	6.0
10.02	Internet access in schools*	1	6.6
10.03	ICT use & gov't efficiency*	18	5.3
10.04	E-Participation Index, 0–1 (best)	117	0.04

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

India

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**69**	**3.9**
A. Environment subindex	**78**	**3.7**
1st pillar: Political and regulatory environment	71	3.7
2nd pillar: Business and innovation environment	91	3.8
B. Readiness subindex	**64**	**4.8**
3rd pillar: Infrastructure and digital content	100	3.2
4th pillar: Affordability	1	6.9
5th pillar: Skills	100	4.3
C. Usage subindex	**78**	**3.4**
6th pillar: Individual usage	117	2.0
7th pillar: Business usage	47	3.8
8th pillar: Government usage	46	4.3
D. Impact subindex	**52**	**3.7**
9th pillar: Economic impacts	41	3.6
10th pillar: Social impacts	65	3.8



The Networked Readiness Index in detail

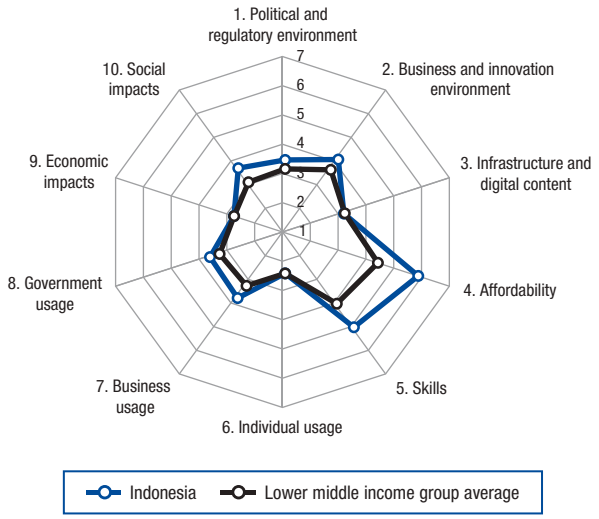
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	44	4.0
1.02	Laws relating to ICT*	48	4.4
1.03	Judicial independence*	51	4.3
1.04	Efficiency of legal system in settling disputes*	64	3.7
1.05	Efficiency of legal system in challenging regs*	51	3.9
1.06	Intellectual property protection*	68	3.5
1.07	Software piracy rate, % software installed	58	64
1.08	No. procedures to enforce a contract	126	46
1.09	No. days to enforce a contract	137	1,420
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	47	5.5
2.02	Venture capital availability*	27	3.4
2.03	Total tax rate, % profits	121	61.8
2.04	No. days to start a business	99	29
2.05	No. procedures to start a business	121	12
2.06	Intensity of local competition*	31	5.4
2.07	Tertiary education gross enrollment rate, %	101	16.2
2.08	Quality of management schools*	30	4.9
2.09	Gov't procurement of advanced tech*	78	3.5
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	102	697.1
3.02	Mobile network coverage, % pop.	111	83.0
3.03	Int'l Internet bandwidth, kb/s per user	96	5.8
3.04	Secure Internet servers/million pop.	107	2.2
3.05	Accessibility of digital content*	85	4.8
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	5	0.06
4.02	Fixed broadband Internet tariffs, PPP $/month	6	13.28
4.03	Internet & telephony competition, 0–2 (best)	60	1.93
	5th pillar: Skills		
5.01	Quality of educational system*	38	4.4
5.02	Quality of math & science education*	32	4.7
5.03	Secondary education gross enrollment rate, %	109	60.2
5.04	Adult literacy rate, %	122	62.8

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	117	61.4
6.02	Individuals using Internet, %	124	7.5
6.03	Households w/ personal computer, %	114	6.1
6.04	Households w/ Internet access, %	104	4.2
6.05	Broadband Internet subscriptions/100 pop.	101	0.9
6.06	Mobile broadband subscriptions/100 pop.	107	0.1
6.07	Use of virtual social networks*	90	4.9
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	41	5.3
7.02	Capacity for innovation*	35	3.6
7.03	PCT patents, applications/million pop.	63	1.2
7.04	Extent of business Internet use*	56	5.1
7.05	Extent of staff training*	63	4.0
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	42	5.1
8.02	Importance of ICT to gov't vision*	35	4.5
8.03	Government Online Service Index, 0–1 (best)	53	0.37
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	35	5.0
9.02	ICT PCT patents, applications/million pop.	56	0.3
9.03	Impact of ICT on new organizational models*	32	4.8
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	69	4.4
10.02	Internet access in schools*	74	4.0
10.03	ICT use & gov't efficiency*	53	4.5
10.04	E-Participation Index, 0–1 (best)	56	0.20

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Indonesia

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**80**	**3.7**
A. Environment subindex	**72**	**3.8**
1st pillar: Political and regulatory environment	88	3.5
2nd pillar: Business and innovation environment	64	4.1
B. Readiness subindex	**74**	**4.6**
3rd pillar: Infrastructure and digital content	103	3.1
4th pillar: Affordability	34	5.8
5th pillar: Skills	69	5.0
C. Usage subindex	**85**	**3.3**
6th pillar: Individual usage	103	2.4
7th pillar: Business usage	49	3.8
8th pillar: Government usage	75	3.7
D. Impact subindex	**86**	**3.3**
9th pillar: Economic impacts	106	2.8
10th pillar: Social impacts	66	3.7



The Networked Readiness Index in detail

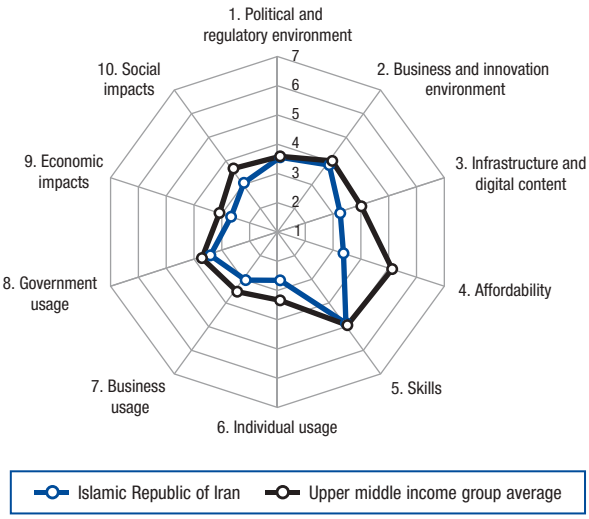
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	79	3.4
1.02	Laws relating to ICT*	71	3.9
1.03	Judicial independence*	76	3.6
1.04	Efficiency of legal system in settling disputes*	69	3.7
1.05	Efficiency of legal system in challenging regs*	61	3.8
1.06	Intellectual property protection*	62	3.6
1.07	Software piracy rate, % software installed	99	87
1.08	No. procedures to enforce a contract	97	40
1.09	No. days to enforce a contract	79	570
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	74	4.9
2.02	Venture capital availability*	17	3.7
2.03	Total tax rate, % profits	53	34.5
2.04	No. days to start a business	124	45
2.05	No. procedures to start a business	86	8
2.06	Intensity of local competition*	89	4.6
2.07	Tertiary education gross enrollment rate, %	87	22.4
2.08	Quality of management schools*	68	4.2
2.09	Gov't procurement of advanced tech*	34	4.1
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	109	636.0
3.02	Mobile network coverage, % pop.	97	90.0
3.03	Int'l Internet bandwidth, kb/s per user	109	2.9
3.04	Secure Internet servers/million pop.	109	2.0
3.05	Accessibility of digital content*	67	5.0
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	34	0.18
4.02	Fixed broadband Internet tariffs, PPP $/month	57	31.26
4.03	Internet & telephony competition, 0–2 (best)	75	1.79
	5th pillar: Skills		
5.01	Quality of educational system*	44	4.2
5.02	Quality of math & science education*	53	4.3
5.03	Secondary education gross enrollment rate, %	97	75.1
5.04	Adult literacy rate, %	78	92.2

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	83	91.7
6.02	Individuals using Internet, %	118	9.9
6.03	Households w/ personal computer, %	105	10.8
6.04	Households w/ Internet access, %	109	3.9
6.05	Broadband Internet subscriptions/100 pop.	103	0.8
6.06	Mobile broadband subscriptions/100 pop.	85	1.5
6.07	Use of virtual social networks*	48	5.7
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	54	5.0
7.02	Capacity for innovation*	30	3.8
7.03	PCT patents, applications/million pop.	100	0.1
7.04	Extent of business Internet use*	77	4.9
7.05	Extent of staff training*	52	4.1
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	80	4.5
8.02	Importance of ICT to gov't vision*	56	4.1
8.03	Government Online Service Index, 0–1 (best)	99	0.24
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	71	4.5
9.02	ICT PCT patents, applications/million pop.	94	0.0
9.03	Impact of ICT on new organizational models*	55	4.4
9.04	Knowledge-intensive jobs, % workforce	100	7.4
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	78	4.3
10.02	Internet access in schools*	49	4.7
10.03	ICT use & gov't efficiency*	69	4.2
10.04	E-Participation Index, 0–1 (best)	79	0.13

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Iran, Islamic Rep.

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**104**	**3.4**
A. Environment subindex	**80**	**3.7**
1st pillar: Political and regulatory environment	78	3.6
2nd pillar: Business and innovation environment	81	3.9
B. Readiness subindex	**104**	**3.8**
3rd pillar: Infrastructure and digital content	99	3.2
4th pillar: Affordability	114	3.3
5th pillar: Skills	81	4.8
C. Usage subindex	**104**	**3.0**
6th pillar: Individual usage	92	2.6
7th pillar: Business usage	121	3.0
8th pillar: Government usage	92	3.5
D. Impact subindex	**113**	**2.9**
9th pillar: Economic impacts	107	2.8
10th pillar: Social impacts	107	3.1



The Networked Readiness Index in detail

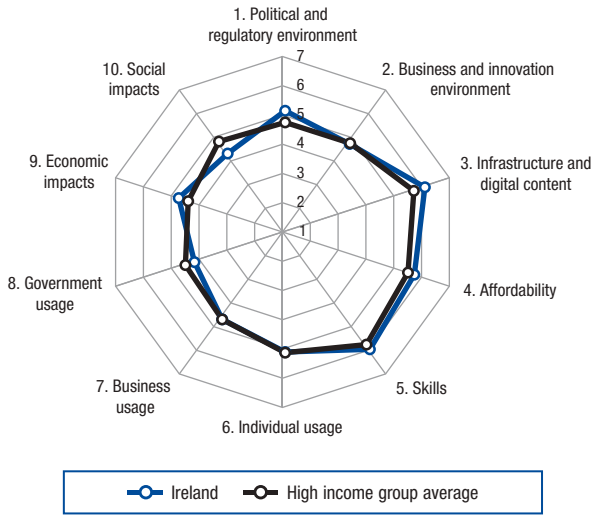
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	51	3.9
1.02	Laws relating to ICT*	105	3.2
1.03	Judicial independence*	66	3.8
1.04	Efficiency of legal system in settling disputes*	72	3.6
1.05	Efficiency of legal system in challenging regs*	105	3.0
1.06	Intellectual property protection*	111	2.7
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	87	39
1.09	No. days to enforce a contract	59	505
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	117	4.2
2.02	Venture capital availability*	133	1.8
2.03	Total tax rate, % profits	91	44.1
2.04	No. days to start a business	33	8
2.05	No. procedures to start a business	46	6
2.06	Intensity of local competition*	106	4.2
2.07	Tertiary education gross enrollment rate, %	57	42.8
2.08	Quality of management schools*	94	3.7
2.09	Gov't procurement of advanced tech*	61	3.7
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	64	2,967.7
3.02	Mobile network coverage, % pop.	81	95.0
3.03	Int'l Internet bandwidth, kb/s per user	106	3.1
3.04	Secure Internet servers/million pop.	126	0.7
3.05	Accessibility of digital content*	119	3.9
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	50	0.24
4.02	Fixed broadband Internet tariffs, PPP $/month	112	76.80
4.03	Internet & telephony competition, 0–2 (best)	101	1.33
	5th pillar: Skills		
5.01	Quality of educational system*	104	3.2
5.02	Quality of math & science education*	35	4.6
5.03	Secondary education gross enrollment rate, %	83	83.5
5.04	Adult literacy rate, %	99	85.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	86	91.2
6.02	Individuals using Internet, %	102	13.0
6.03	Households w/ personal computer, %	69	33.7
6.04	Households w/ Internet access, %	73	20.8
6.05	Broadband Internet subscriptions/100 pop.	104	0.7
6.06	Mobile broadband subscriptions/100 pop.	n/a	n/a
6.07	Use of virtual social networks*	140	3.1
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	120	4.0
7.02	Capacity for innovation*	67	3.0
7.03	PCT patents, applications/million pop.	99	0.1
7.04	Extent of business Internet use*	125	4.0
7.05	Extent of staff training*	133	2.9
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	97	4.2
8.02	Importance of ICT to gov't vision*	83	3.7
8.03	Government Online Service Index, 0–1 (best)	90	0.27
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	98	4.0
9.02	ICT PCT patents, applications/million pop.	92	0.0
9.03	Impact of ICT on new organizational models*	100	3.7
9.04	Knowledge-intensive jobs, % workforce	91	15.0
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	99	4.0
10.02	Internet access in schools*	118	2.9
10.03	ICT use & gov't efficiency*	78	4.1
10.04	E-Participation Index, 0–1 (best)	105	0.07

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Ireland

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**25**	**5.0**
A. Environment subindex	**20**	**5.0**
1st pillar: Political and regulatory environment	18	5.2
2nd pillar: Business and innovation environment	28	4.7
B. Readiness subindex	**18**	**5.9**
3rd pillar: Infrastructure and digital content	17	6.0
4th pillar: Affordability	44	5.6
5th pillar: Skills	15	5.9
C. Usage subindex	**28**	**4.7**
6th pillar: Individual usage	25	5.1
7th pillar: Business usage	25	4.7
8th pillar: Government usage	47	4.3
D. Impact subindex	**26**	**4.6**
9th pillar: Economic impacts	18	4.8
10th pillar: Social impacts	41	4.3



The Networked Readiness Index in detail

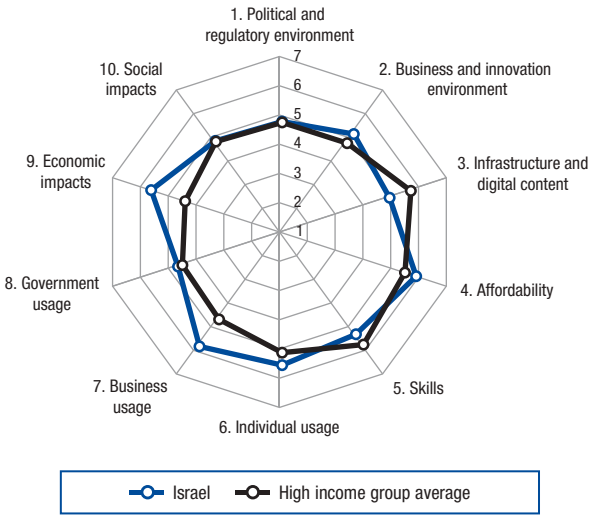
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	43	4.0
1.02	Laws relating to ICT*	34	4.8
1.03	Judicial independence*	10	6.3
1.04	Efficiency of legal system in settling disputes*	37	4.5
1.05	Efficiency of legal system in challenging regs*	29	4.5
1.06	Intellectual property protection*	10	5.7
1.07	Software piracy rate, % software installed	19	35
1.08	No. procedures to enforce a contract	1	21
1.09	No. days to enforce a contract	100	650
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	32	5.9
2.02	Venture capital availability*	106	2.2
2.03	Total tax rate, % profits	24	26.3
2.04	No. days to start a business	58	13
2.05	No. procedures to start a business	20	4
2.06	Intensity of local competition*	59	5.0
2.07	Tertiary education gross enrollment rate, %	30	62.5
2.08	Quality of management schools*	29	4.9
2.09	Gov't procurement of advanced tech*	82	3.4
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	34	6,188.5
3.02	Mobile network coverage, % pop.	49	99.0
3.03	Int'l Internet bandwidth, kb/s per user	22	64.1
3.04	Secure Internet servers/million pop.	16	997.9
3.05	Accessibility of digital content*	44	5.4
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	83	0.35
4.02	Fixed broadband Internet tariffs, PPP $/month	48	28.90
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	11	5.2
5.02	Quality of math & science education*	34	4.6
5.03	Secondary education gross enrollment rate, %	5	117.5
5.04	Adult literacy rate, %	15	99.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	63	105.2
6.02	Individuals using Internet, %	30	69.9
6.03	Households w/ personal computer, %	23	76.5
6.04	Households w/ Internet access, %	23	71.7
6.05	Broadband Internet subscriptions/100 pop.	29	21.1
6.06	Mobile broadband subscriptions/100 pop.	12	35.4
6.07	Use of virtual social networks*	35	5.8
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	35	5.5
7.02	Capacity for innovation*	33	3.8
7.03	PCT patents, applications/million pop.	19	89.8
7.04	Extent of business Internet use*	32	5.6
7.05	Extent of staff training*	22	4.7
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	63	4.7
8.02	Importance of ICT to gov't vision*	64	4.0
8.03	Government Online Service Index, 0–1 (best)	28	0.50
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	36	5.0
9.02	ICT PCT patents, applications/million pop.	13	33.8
9.03	Impact of ICT on new organizational models*	31	4.8
9.04	Knowledge-intensive jobs, % workforce	23	38.8
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	52	4.6
10.02	Internet access in schools*	60	4.3
10.03	ICT use & gov't efficiency*	39	4.7
10.04	E-Participation Index, 0–1 (best)	26	0.44

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Israel

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**20**	**5.2**
A. Environment subindex	**19**	**5.0**
1st pillar: Political and regulatory environment	28	4.8
2nd pillar: Business and innovation environment	10	5.2
B. Readiness subindex	**34**	**5.3**
3rd pillar: Infrastructure and digital content	38	4.9
4th pillar: Affordability	32	5.8
5th pillar: Skills	48	5.3
C. Usage subindex	**12**	**5.4**
6th pillar: Individual usage	15	5.5
7th pillar: Business usage	7	5.8
8th pillar: Government usage	24	4.7
D. Impact subindex	**12**	**5.3**
9th pillar: Economic impacts	6	5.7
10th pillar: Social impacts	28	4.9



The Networked Readiness Index in detail

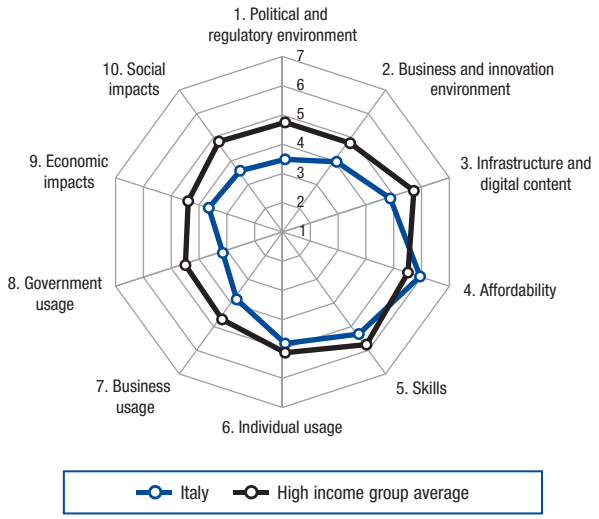
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	40	4.2
1.02	Laws relating to ICT*	25	5.1
1.03	Judicial independence*	12	6.2
1.04	Efficiency of legal system in settling disputes*	41	4.3
1.05	Efficiency of legal system in challenging regs*	49	3.9
1.06	Intellectual property protection*	35	4.6
1.07	Software piracy rate, % software installed	17	31
1.08	No. procedures to enforce a contract	47	35
1.09	No. days to enforce a contract	123	890
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	13	6.3
2.02	Venture capital availability*	2	4.5
2.03	Total tax rate, % profits	38	31.2
2.04	No. days to start a business	109	34
2.05	No. procedures to start a business	28	5
2.06	Intensity of local competition*	27	5.4
2.07	Tertiary education gross enrollment rate, %	31	62.5
2.08	Quality of management schools*	17	5.3
2.09	Gov't procurement of advanced tech*	6	4.8
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	23	7,955.1
3.02	Mobile network coverage, % pop.	1	100.0
3.03	Int'l Internet bandwidth, kb/s per user	84	8.0
3.04	Secure Internet servers/million pop.	26	396.6
3.05	Accessibility of digital content*	29	6.0
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	70	0.31
4.02	Fixed broadband Internet tariffs, PPP $/month	1	8.04
4.03	Internet & telephony competition, 0–2 (best)	106	1.27
	5th pillar: Skills		
5.01	Quality of educational system*	48	4.1
5.02	Quality of math & science education*	79	3.8
5.03	Secondary education gross enrollment rate, %	59	91.0
5.04	Adult literacy rate, %	15	99.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	24	133.1
6.02	Individuals using Internet, %	32	67.2
6.03	Households w/ personal computer, %	21	77.0
6.04	Households w/ Internet access, %	27	69.0
6.05	Broadband Internet subscriptions/100 pop.	19	25.1
6.06	Mobile broadband subscriptions/100 pop.	5	55.8
6.07	Use of virtual social networks*	43	5.7
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	6	6.1
7.02	Capacity for innovation*	6	5.3
7.03	PCT patents, applications/million pop.	4	234.4
7.04	Extent of business Internet use*	25	5.8
7.05	Extent of staff training*	20	4.8
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	32	5.3
8.02	Importance of ICT to gov't vision*	39	4.4
8.03	Government Online Service Index, 0–1 (best)	19	0.58
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	19	5.4
9.02	ICT PCT patents, applications/million pop.	3	91.6
9.03	Impact of ICT on new organizational models*	16	5.2
9.04	Knowledge-intensive jobs, % workforce	16	41.3
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	21	5.6
10.02	Internet access in schools*	33	5.3
10.03	ICT use & gov't efficiency*	25	5.1
10.04	E-Participation Index, 0–1 (best)	30	0.41

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Italy

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**48**	**4.2**
A. Environment subindex	**75**	**3.7**
1st pillar: Political and regulatory environment	85	3.5
2nd pillar: Business and innovation environment	70	4.0
B. Readiness subindex	**35**	**5.3**
3rd pillar: Infrastructure and digital content	43	4.8
4th pillar: Affordability	28	5.8
5th pillar: Skills	51	5.3
C. Usage subindex	**45**	**3.9**
6th pillar: Individual usage	29	4.8
7th pillar: Business usage	45	3.8
8th pillar: Government usage	113	3.2
D. Impact subindex	**54**	**3.7**
9th pillar: Economic impacts	36	3.7
10th pillar: Social impacts	74	3.6



The Networked Readiness Index in detail

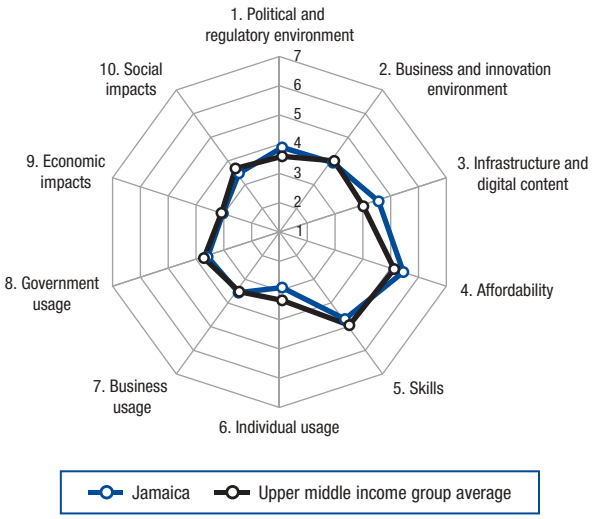
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	100	2.9
1.02	Laws relating to ICT*	61	4.1
1.03	Judicial independence*	60	4.0
1.04	Efficiency of legal system in settling disputes*	133	2.6
1.05	Efficiency of legal system in challenging regs*	125	2.7
1.06	Intellectual property protection*	59	3.7
1.07	Software piracy rate, % software installed	35	49
1.08	No. procedures to enforce a contract	106	41
1.09	No. days to enforce a contract	131	1,210
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	71	5.0
2.02	Venture capital availability*	98	2.2
2.03	Total tax rate, % profits	132	68.5
2.04	No. days to start a business	16	6
2.05	No. procedures to start a business	46	6
2.06	Intensity of local competition*	58	5.0
2.07	Tertiary education gross enrollment rate, %	23	66.0
2.08	Quality of management schools*	35	4.8
2.09	Gov't procurement of advanced tech*	114	3.0
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	46	4,742.1
3.02	Mobile network coverage, % pop.	49	99.0
3.03	Int'l Internet bandwidth, kb/s per user	23	61.5
3.04	Secure Internet servers/million pop.	39	154.4
3.05	Accessibility of digital content*	72	4.9
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	48	0.23
4.02	Fixed broadband Internet tariffs, PPP $/month	36	24.58
4.03	Internet & telephony competition, 0–2 (best)	88	1.62
	5th pillar: Skills		
5.01	Quality of educational system*	88	3.3
5.02	Quality of math & science education*	74	3.9
5.03	Secondary education gross enrollment rate, %	32	99.1
5.04	Adult literacy rate, %	40	98.9

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	11	149.6
6.02	Individuals using Internet, %	42	53.7
6.03	Households w/ personal computer, %	36	64.8
6.04	Households w/ Internet access, %	39	59.0
6.05	Broadband Internet subscriptions/100 pop.	28	21.9
6.06	Mobile broadband subscriptions/100 pop.	27	16.8
6.07	Use of virtual social networks*	51	5.6
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	102	4.3
7.02	Capacity for innovation*	26	4.0
7.03	PCT patents, applications/million pop.	24	51.6
7.04	Extent of business Internet use*	71	5.0
7.05	Extent of staff training*	120	3.3
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	120	3.8
8.02	Importance of ICT to gov't vision*	112	3.2
8.03	Government Online Service Index, 0–1 (best)	84	0.29
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	81	4.3
9.02	ICT PCT patents, applications/million pop.	24	8.8
9.03	Impact of ICT on new organizational models*	92	3.7
9.04	Knowledge-intensive jobs, % workforce	22	39.6
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	66	4.4
10.02	Internet access in schools*	79	3.8
10.03	ICT use & gov't efficiency*	88	3.9
10.04	E-Participation Index, 0–1 (best)	53	0.21

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Jamaica

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**74**	**3.9**
A. Environment subindex	**62**	**3.9**
1st pillar: Political and regulatory environment	56	3.9
2nd pillar: Business and innovation environment	75	4.0
B. Readiness subindex	**62**	**4.8**
3rd pillar: Infrastructure and digital content	54	4.5
4th pillar: Affordability	61	5.4
5th pillar: Skills	90	4.6
C. Usage subindex	**79**	**3.4**
6th pillar: Individual usage	84	2.9
7th pillar: Business usage	67	3.5
8th pillar: Government usage	78	3.7
D. Impact subindex	**82**	**3.3**
9th pillar: Economic impacts	81	3.1
10th pillar: Social impacts	84	3.5



The Networked Readiness Index in detail

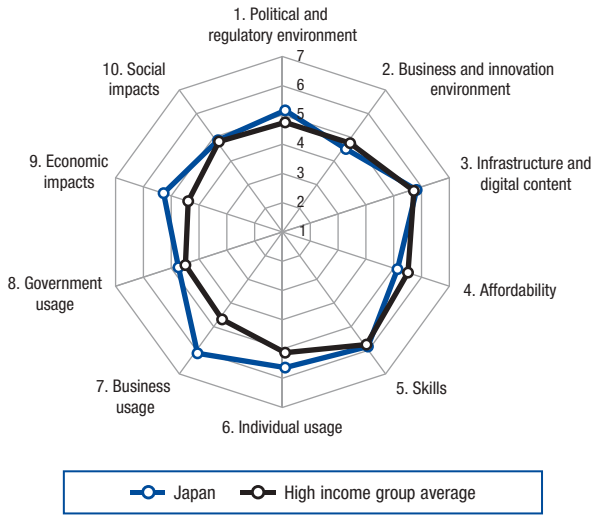
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	62	3.6
1.02	Laws relating to ICT*	62	4.0
1.03	Judicial independence*	48	4.4
1.04	Efficiency of legal system in settling disputes*	78	3.4
1.05	Efficiency of legal system in challenging regs*	82	3.3
1.06	Intellectual property protection*	75	3.4
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	47	35
1.09	No. days to enforce a contract	101	655
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	44	5.5
2.02	Venture capital availability*	127	1.9
2.03	Total tax rate, % profits	96	45.6
2.04	No. days to start a business	24	7
2.05	No. procedures to start a business	46	6
2.06	Intensity of local competition*	72	4.8
2.07	Tertiary education gross enrollment rate, %	81	25.0
2.08	Quality of management schools*	63	4.2
2.09	Gov't procurement of advanced tech*	102	3.3
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	65	2,860.4
3.02	Mobile network coverage, % pop.	81	95.0
3.03	Int'l Internet bandwidth, kb/s per user	48	21.0
3.04	Secure Internet servers/million pop.	60	39.2
3.05	Accessibility of digital content*	61	5.1
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	61	0.29
4.02	Fixed broadband Internet tariffs, PPP $/month	80	37.46
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	103	3.2
5.02	Quality of math & science education*	120	2.9
5.03	Secondary education gross enrollment rate, %	44	95.6
5.04	Adult literacy rate, %	97	86.4

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	46	116.1
6.02	Individuals using Internet, %	90	26.1
6.03	Households w/ personal computer, %	84	20.0
6.04	Households w/ Internet access, %	84	11.8
6.05	Broadband Internet subscriptions/100 pop.	76	4.3
6.06	Mobile broadband subscriptions/100 pop.	78	2.4
6.07	Use of virtual social networks*	71	5.2
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	72	4.7
7.02	Capacity for innovation*	97	2.7
7.03	PCT patents, applications/million pop.	71	0.7
7.04	Extent of business Internet use*	66	5.0
7.05	Extent of staff training*	48	4.2
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	55	4.9
8.02	Importance of ICT to gov't vision*	77	3.8
8.03	Government Online Service Index, 0–1 (best)	102	0.23
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	70	4.5
9.02	ICT PCT patents, applications/million pop.	68	0.2
9.03	Impact of ICT on new organizational models*	71	4.1
9.04	Knowledge-intensive jobs, % workforce	72	20.1
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	61	4.5
10.02	Internet access in schools*	84	3.8
10.03	ICT use & gov't efficiency*	64	4.3
10.04	E-Participation Index, 0–1 (best)	99	0.09

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Japan

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**18**	**5.3**
A. Environment subindex	**26**	**4.9**
1st pillar: Political and regulatory environment	16	5.2
2nd pillar: Business and innovation environment	39	4.5
B. Readiness subindex	**27**	**5.5**
3rd pillar: Infrastructure and digital content	22	5.7
4th pillar: Affordability	78	5.0
5th pillar: Skills	22	5.8
C. Usage subindex	**8**	**5.5**
6th pillar: Individual usage	13	5.6
7th pillar: Business usage	3	6.1
8th pillar: Government usage	21	4.8
D. Impact subindex	**17**	**5.1**
9th pillar: Economic impacts	10	5.4
10th pillar: Social impacts	26	4.9



The Networked Readiness Index in detail

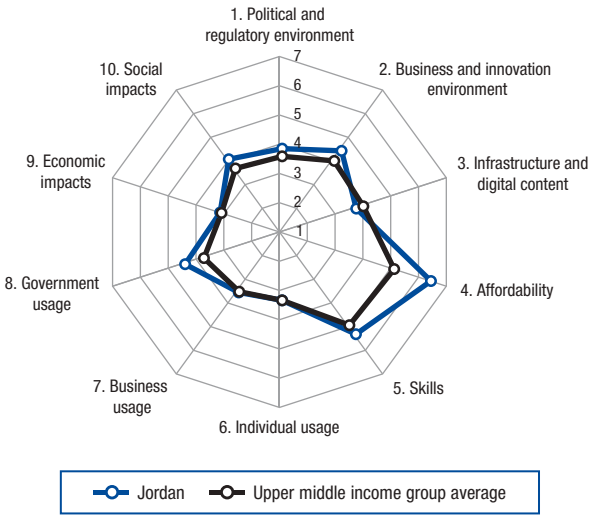
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	30	4.4
1.02	Laws relating to ICT*	36	4.7
1.03	Judicial independence*	18	5.8
1.04	Efficiency of legal system in settling disputes*	28	4.8
1.05	Efficiency of legal system in challenging regs*	32	4.3
1.06	Intellectual property protection*	22	5.3
1.07	Software piracy rate, % software installed	1	20
1.08	No. procedures to enforce a contract	18	30
1.09	No. days to enforce a contract	21	360
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	15	6.3
2.02	Venture capital availability*	47	2.9
2.03	Total tax rate, % profits	106	49.1
2.04	No. days to start a business	89	23
2.05	No. procedures to start a business	86	8
2.06	Intensity of local competition*	4	5.9
2.07	Tertiary education gross enrollment rate, %	38	59.0
2.08	Quality of management schools*	57	4.3
2.09	Gov't procurement of advanced tech*	32	4.1
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	21	8,215.8
3.02	Mobile network coverage, % pop.	25	99.9
3.03	Int'l Internet bandwidth, kb/s per user	59	15.8
3.04	Secure Internet servers/million pop.	20	649.8
3.05	Accessibility of digital content*	12	6.3
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	138	0.81
4.02	Fixed broadband Internet tariffs, PPP $/month	14	18.13
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	36	4.4
5.02	Quality of math & science education*	24	4.9
5.03	Secondary education gross enrollment rate, %	22	101.5
5.04	Adult literacy rate, %	15	99.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	79	95.4
6.02	Individuals using Internet, %	17	78.2
6.03	Households w/ personal computer, %	14	83.4
6.04	Households w/ Internet access, %	12	81.3
6.05	Broadband Internet subscriptions/100 pop.	18	26.9
6.06	Mobile broadband subscriptions/100 pop.	3	64.6
6.07	Use of virtual social networks*	68	5.2
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	3	6.3
7.02	Capacity for innovation*	1	5.8
7.03	PCT patents, applications/million pop.	6	207.4
7.04	Extent of business Internet use*	13	6.0
7.05	Extent of staff training*	6	5.3
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	44	5.1
8.02	Importance of ICT to gov't vision*	42	4.3
8.03	Government Online Service Index, 0–1 (best)	13	0.67
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	28	5.2
9.02	ICT PCT patents, applications/million pop.	4	88.1
9.03	Impact of ICT on new organizational models*	54	4.4
9.04	Knowledge-intensive jobs, % workforce	26	37.8
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	42	4.9
10.02	Internet access in schools*	39	4.9
10.03	ICT use & gov't efficiency*	66	4.2
10.04	E-Participation Index, 0–1 (best)	6	0.76

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Jordan

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**47**	**4.2**
A. Environment subindex	**48**	**4.2**
1st pillar: Political and regulatory environment	58	3.9
2nd pillar: Business and innovation environment	43	4.5
B. Readiness subindex	**47**	**5.1**
3rd pillar: Infrastructure and digital content	79	3.7
4th pillar: Affordability	9	6.3
5th pillar: Skills	49	5.3
C. Usage subindex	**55**	**3.8**
6th pillar: Individual usage	67	3.3
7th pillar: Business usage	69	3.5
8th pillar: Government usage	37	4.5
D. Impact subindex	**57**	**3.7**
9th pillar: Economic impacts	70	3.2
10th pillar: Social impacts	49	4.1



The Networked Readiness Index in detail

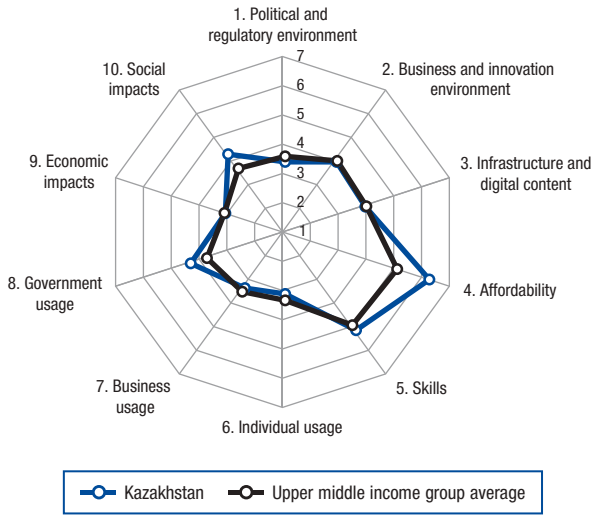
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	110	2.8
1.02	Laws relating to ICT*	74	3.9
1.03	Judicial independence*	49	4.4
1.04	Efficiency of legal system in settling disputes*	49	4.1
1.05	Efficiency of legal system in challenging regs*	67	3.6
1.06	Intellectual property protection*	40	4.2
1.07	Software piracy rate, % software installed	49	57
1.08	No. procedures to enforce a contract	78	38
1.09	No. days to enforce a contract	103	689
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	42	5.5
2.02	Venture capital availability*	62	2.7
2.03	Total tax rate, % profits	27	27.7
2.04	No. days to start a business	53	12
2.05	No. procedures to start a business	72	7
2.06	Intensity of local competition*	34	5.4
2.07	Tertiary education gross enrollment rate, %	58	41.8
2.08	Quality of management schools*	85	3.9
2.09	Gov't procurement of advanced tech*	70	3.6
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	74	2,365.9
3.02	Mobile network coverage, % pop.	49	99.0
3.03	Int'l Internet bandwidth, kb/s per user	92	6.4
3.04	Secure Internet servers/million pop.	70	19.8
3.05	Accessibility of digital content*	50	5.3
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	24	0.15
4.02	Fixed broadband Internet tariffs, PPP $/month	33	23.80
4.03	Internet & telephony competition, 0–2 (best)	58	1.94
	5th pillar: Skills		
5.01	Quality of educational system*	51	4.0
5.02	Quality of math & science education*	44	4.5
5.03	Secondary education gross enrollment rate, %	58	91.1
5.04	Adult literacy rate, %	77	92.2

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	59	107.0
6.02	Individuals using Internet, %	70	38.0
6.03	Households w/ personal computer, %	50	51.4
6.04	Households w/ Internet access, %	70	22.1
6.05	Broadband Internet subscriptions/100 pop.	81	3.2
6.06	Mobile broadband subscriptions/100 pop.	102	0.3
6.07	Use of virtual social networks*	49	5.6
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	37	5.4
7.02	Capacity for innovation*	92	2.7
7.03	PCT patents, applications/million pop.	75	0.5
7.04	Extent of business Internet use*	76	4.9
7.05	Extent of staff training*	103	3.5
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	47	5.0
8.02	Importance of ICT to gov't vision*	51	4.2
8.03	Government Online Service Index, 0–1 (best)	22	0.53
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	67	4.5
9.02	ICT PCT patents, applications/million pop.	60	0.2
9.03	Impact of ICT on new organizational models*	67	4.2
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	58	4.6
10.02	Internet access in schools*	52	4.6
10.03	ICT use & gov't efficiency*	48	4.5
10.04	E-Participation Index, 0–1 (best)	41	0.29

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Kazakhstan

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**55**	**4.0**
A. Environment subindex	**81**	**3.7**
1st pillar: Political and regulatory environment	92	3.4
2nd pillar: Business and innovation environment	71	4.0
B. Readiness subindex	**52**	**5.1**
3rd pillar: Infrastructure and digital content	71	3.9
4th pillar: Affordability	15	6.2
5th pillar: Skills	60	5.1
C. Usage subindex	**65**	**3.6**
6th pillar: Individual usage	74	3.1
7th pillar: Business usage	93	3.3
8th pillar: Government usage	41	4.4
D. Impact subindex	**49**	**3.7**
9th pillar: Economic impacts	80	3.1
10th pillar: Social impacts	43	4.3



The Networked Readiness Index in detail

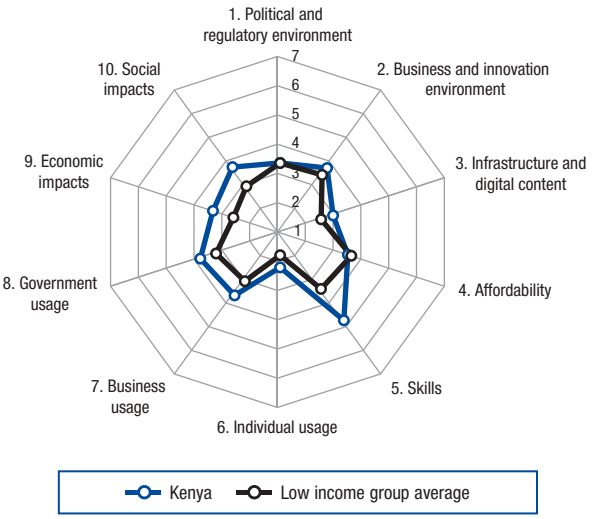
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	54	3.8
1.02	Laws relating to ICT*	66	4.0
1.03	Judicial independence*	111	2.7
1.04	Efficiency of legal system in settling disputes*	87	3.4
1.05	Efficiency of legal system in challenging regs*	91	3.1
1.06	Intellectual property protection*	116	2.6
1.07	Software piracy rate, % software installed	78	76
1.08	No. procedures to enforce a contract	55	36
1.09	No. days to enforce a contract	26	390
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	103	4.4
2.02	Venture capital availability*	92	2.3
2.03	Total tax rate, % profits	31	28.6
2.04	No. days to start a business	80	19
2.05	No. procedures to start a business	46	6
2.06	Intensity of local competition*	117	4.1
2.07	Tertiary education gross enrollment rate, %	63	38.5
2.08	Quality of management schools*	109	3.6
2.09	Gov't procurement of advanced tech*	93	3.4
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	43	5,130.9
3.02	Mobile network coverage, % pop.	81	95.0
3.03	Int'l Internet bandwidth, kb/s per user	79	8.6
3.04	Secure Internet servers/million pop.	98	5.2
3.05	Accessibility of digital content*	78	4.8
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	64	0.29
4.02	Fixed broadband Internet tariffs, PPP $/month	13	18.01
4.03	Internet & telephony competition, 0–2 (best)	73	1.81
	5th pillar: Skills		
5.01	Quality of educational system*	112	3.0
5.02	Quality of math & science education*	85	3.7
5.03	Secondary education gross enrollment rate, %	41	97.0
5.04	Adult literacy rate, %	7	99.7

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	40	121.1
6.02	Individuals using Internet, %	78	34.0
6.03	Households w/ personal computer, %	78	25.1
6.04	Households w/ Internet access, %	68	23.2
6.05	Broadband Internet subscriptions/100 pop.	55	8.9
6.06	Mobile broadband subscriptions/100 pop.	113	0.0
6.07	Use of virtual social networks*	115	4.4
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	113	4.1
7.02	Capacity for innovation*	101	2.6
7.03	PCT patents, applications/million pop.	64	1.1
7.04	Extent of business Internet use*	44	5.3
7.05	Extent of staff training*	96	3.6
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	50	4.9
8.02	Importance of ICT to gov't vision*	60	4.1
8.03	Government Online Service Index, 0–1 (best)	24	0.53
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	106	3.9
9.02	ICT PCT patents, applications/million pop.	57	0.2
9.03	Impact of ICT on new organizational models*	87	3.8
9.04	Knowledge-intensive jobs, % workforce	48	28.3
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	51	4.7
10.02	Internet access in schools*	72	4.0
10.03	ICT use & gov't efficiency*	68	4.2
10.04	E-Participation Index, 0–1 (best)	18	0.56

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Kenya

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**93**	**3.5**
A. Environment subindex	**99**	**3.6**
1st pillar: Political and regulatory environment	94	3.4
2nd pillar: Business and innovation environment	101	3.7
B. Readiness subindex	**108**	**3.7**
3rd pillar: Infrastructure and digital content	112	2.9
4th pillar: Affordability	109	3.4
5th pillar: Skills	87	4.7
C. Usage subindex	**91**	**3.2**
6th pillar: Individual usage	109	2.2
7th pillar: Business usage	56	3.6
8th pillar: Government usage	67	3.9
D. Impact subindex	**59**	**3.6**
9th pillar: Economic impacts	56	3.4
10th pillar: Social impacts	64	3.8



The Networked Readiness Index in detail

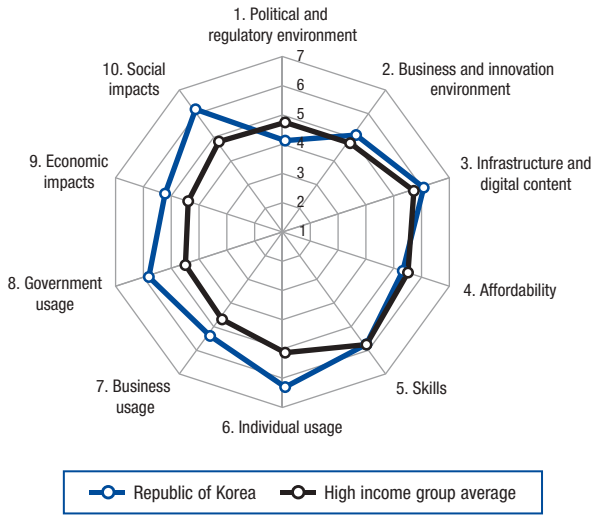
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	81	3.4
1.02	Laws relating to ICT*	56	4.2
1.03	Judicial independence*	103	2.9
1.04	Efficiency of legal system in settling disputes*	74	3.5
1.05	Efficiency of legal system in challenging regs*	76	3.4
1.06	Intellectual property protection*	99	2.9
1.07	Software piracy rate, % software installed	82	79
1.08	No. procedures to enforce a contract	97	40
1.09	No. days to enforce a contract	53	465
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	72	4.9
2.02	Venture capital availability*	28	3.3
2.03	Total tax rate, % profits	109	49.6
2.04	No. days to start a business	108	33
2.05	No. procedures to start a business	119	11
2.06	Intensity of local competition*	66	4.9
2.07	Tertiary education gross enrollment rate, %	130	4.0
2.08	Quality of management schools*	46	4.6
2.09	Gov't procurement of advanced tech*	63	3.7
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	123	183.5
3.02	Mobile network coverage, % pop.	105	89.0
3.03	Int'l Internet bandwidth, kb/s per user	116	1.9
3.04	Secure Internet servers/million pop.	105	2.6
3.05	Accessibility of digital content*	96	4.5
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	63	0.29
4.02	Fixed broadband Internet tariffs, PPP $/month	114	79.81
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	27	4.7
5.02	Quality of math & science education*	56	4.2
5.03	Secondary education gross enrollment rate, %	108	60.2
5.04	Adult literacy rate, %	94	87.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	116	61.6
6.02	Individuals using Internet, %	91	25.9
6.03	Households w/ personal computer, %	124	4.1
6.04	Households w/ Internet access, %	105	4.0
6.05	Broadband Internet subscriptions/100 pop.	136	0.0
6.06	Mobile broadband subscriptions/100 pop.	89	0.9
6.07	Use of virtual social networks*	69	5.2
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	60	4.9
7.02	Capacity for innovation*	47	3.3
7.03	PCT patents, applications/million pop.	95	0.1
7.04	Extent of business Internet use*	70	5.0
7.05	Extent of staff training*	62	4.0
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	69	4.6
8.02	Importance of ICT to gov't vision*	31	4.5
8.03	Government Online Service Index, 0–1 (best)	100	0.24
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	56	4.7
9.02	ICT PCT patents, applications/million pop.	87	0.0
9.03	Impact of ICT on new organizational models*	47	4.5
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	56	4.6
10.02	Internet access in schools*	89	3.7
10.03	ICT use & gov't efficiency*	56	4.4
10.04	E-Participation Index, 0–1 (best)	51	0.23

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Korea, Rep.

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**12**	**5.5**
A. Environment subindex	**35**	**4.6**
1st pillar: Political and regulatory environment	43	4.1
2nd pillar: Business and innovation environment	15	5.1
B. Readiness subindex	**24**	**5.6**
3rd pillar: Infrastructure and digital content	18	6.0
4th pillar: Affordability	70	5.2
5th pillar: Skills	27	5.7
C. Usage subindex	**2**	**5.8**
6th pillar: Individual usage	2	6.3
7th pillar: Business usage	12	5.4
8th pillar: Government usage	1	5.9
D. Impact subindex	**4**	**5.8**
9th pillar: Economic impacts	12	5.3
10th pillar: Social impacts	1	6.2



The Networked Readiness Index in detail

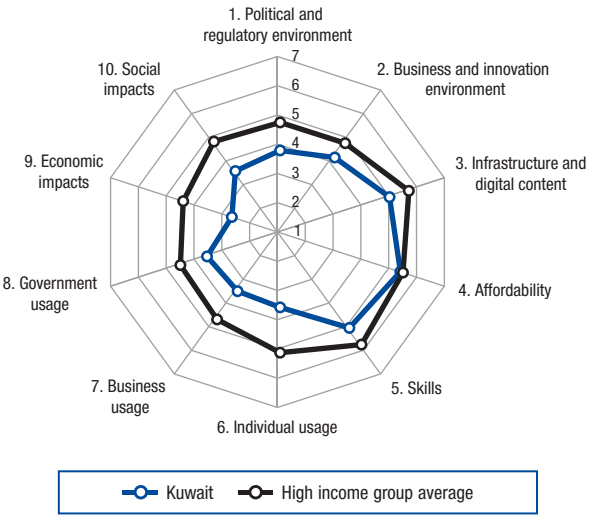
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	123	2.4
1.02	Laws relating to ICT*	18	5.3
1.03	Judicial independence*	69	3.8
1.04	Efficiency of legal system in settling disputes*	84	3.4
1.05	Efficiency of legal system in challenging regs*	97	3.1
1.06	Intellectual property protection*	46	4.1
1.07	Software piracy rate, % software installed	25	40
1.08	No. procedures to enforce a contract	36	33
1.09	No. days to enforce a contract	3	230
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	24	6.1
2.02	Venture capital availability*	100	2.2
2.03	Total tax rate, % profits	34	29.7
2.04	No. days to start a business	24	7
2.05	No. procedures to start a business	28	5
2.06	Intensity of local competition*	15	5.6
2.07	Tertiary education gross enrollment rate, %	1	103.9
2.08	Quality of management schools*	50	4.5
2.09	Gov't procurement of advanced tech*	31	4.1
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	14	9,239.7
3.02	Mobile network coverage, % pop.	25	99.9
3.03	Int'l Internet bandwidth, kb/s per user	66	11.9
3.04	Secure Internet servers/million pop.	15	1,140.4
3.05	Accessibility of digital content*	15	6.2
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	84	0.35
4.02	Fixed broadband Internet tariffs, PPP $/month	68	33.90
4.03	Internet & telephony competition, 0–2 (best)	79	1.76
	5th pillar: Skills		
5.01	Quality of educational system*	55	3.9
5.02	Quality of math & science education*	12	5.2
5.03	Secondary education gross enrollment rate, %	39	97.1
5.04	Adult literacy rate, %	15	99.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	62	105.4
6.02	Individuals using Internet, %	10	83.7
6.03	Households w/ personal computer, %	17	81.8
6.04	Households w/ Internet access, %	1	96.8
6.05	Broadband Internet subscriptions/100 pop.	4	35.7
6.06	Mobile broadband subscriptions/100 pop.	1	78.0
6.07	Use of virtual social networks*	32	5.8
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	8	6.0
7.02	Capacity for innovation*	20	4.3
7.03	PCT patents, applications/million pop.	9	160.9
7.04	Extent of business Internet use*	2	6.4
7.05	Extent of staff training*	41	4.3
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	15	5.7
8.02	Importance of ICT to gov't vision*	15	5.0
8.03	Government Online Service Index, 0–1 (best)	1	1.00
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	2	5.9
9.02	ICT PCT patents, applications/million pop.	6	68.4
9.03	Impact of ICT on new organizational models*	20	5.1
9.04	Knowledge-intensive jobs, % workforce	61	22.4
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	6	6.0
10.02	Internet access in schools*	10	6.2
10.03	ICT use & gov't efficiency*	6	5.7
10.04	E-Participation Index, 0–1 (best)	1	1.00

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Kuwait

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**62**	**3.9**
A. Environment subindex	**56**	**4.0**
1st pillar: Political and regulatory environment	60	3.8
2nd pillar: Business and innovation environment	61	4.2
B. Readiness subindex	**48**	**5.1**
3rd pillar: Infrastructure and digital content	37	4.9
4th pillar: Affordability	62	5.3
5th pillar: Skills	66	5.0
C. Usage subindex	**67**	**3.5**
6th pillar: Individual usage	60	3.6
7th pillar: Business usage	80	3.5
8th pillar: Government usage	84	3.6
D. Impact subindex	**93**	**3.2**
9th pillar: Economic impacts	110	2.7
10th pillar: Social impacts	76	3.6



The Networked Readiness Index in detail

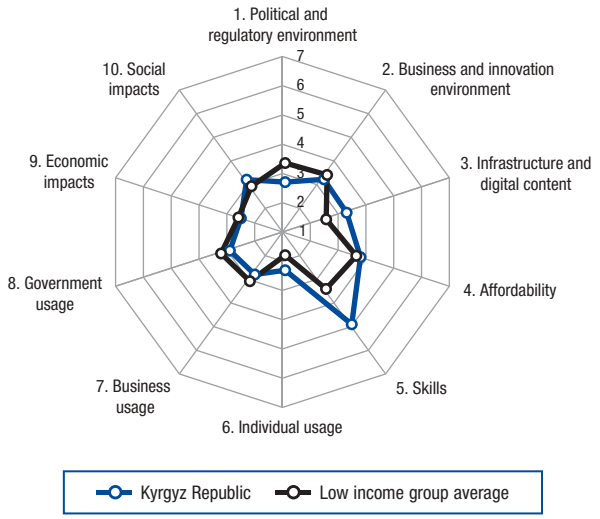
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	64	3.5
1.02	Laws relating to ICT*	110	3.2
1.03	Judicial independence*	32	5.1
1.04	Efficiency of legal system in settling disputes*	48	4.2
1.05	Efficiency of legal system in challenging regs*	50	3.9
1.06	Intellectual property protection*	51	3.9
1.07	Software piracy rate, % software installed	53	60
1.08	No. procedures to enforce a contract	136	50
1.09	No. days to enforce a contract	78	566
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	58	5.2
2.02	Venture capital availability*	25	3.4
2.03	Total tax rate, % profits	9	15.5
2.04	No. days to start a business	105	32
2.05	No. procedures to start a business	121	12
2.06	Intensity of local competition*	80	4.7
2.07	Tertiary education gross enrollment rate, %	89	21.9
2.08	Quality of management schools*	99	3.7
2.09	Gov't procurement of advanced tech*	97	3.3
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	3	20,306.9
3.02	Mobile network coverage, % pop.	1	100.0
3.03	Int'l Internet bandwidth, kb/s per user	76	9.6
3.04	Secure Internet servers/million pop.	41	138.9
3.05	Accessibility of digital content*	70	5.0
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	21	0.14
4.02	Fixed broadband Internet tariffs, PPP $/month	7	14.89
4.03	Internet & telephony competition, 0–2 (best)	136	0.23
	5th pillar: Skills		
5.01	Quality of educational system*	108	3.1
5.02	Quality of math & science education*	94	3.5
5.03	Secondary education gross enrollment rate, %	26	101.0
5.04	Adult literacy rate, %	69	93.9

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	9	160.8
6.02	Individuals using Internet, %	69	38.3
6.03	Households w/ personal computer, %	62	37.5
6.04	Households w/ Internet access, %	59	31.6
6.05	Broadband Internet subscriptions/100 pop.	92	1.7
6.06	Mobile broadband subscriptions/100 pop.	58	5.9
6.07	Use of virtual social networks*	59	5.4
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	39	5.4
7.02	Capacity for innovation*	90	2.8
7.03	PCT patents, applications/million pop.	82	0.4
7.04	Extent of business Internet use*	91	4.7
7.05	Extent of staff training*	102	3.5
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	114	3.9
8.02	Importance of ICT to gov't vision*	109	3.2
8.03	Government Online Service Index, 0–1 (best)	35	0.46
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	120	3.6
9.02	ICT PCT patents, applications/million pop.	55	0.3
9.03	Impact of ICT on new organizational models*	114	3.5
9.04	Knowledge-intensive jobs, % workforce	78	18.7
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	90	4.1
10.02	Internet access in schools*	65	4.2
10.03	ICT use & gov't efficiency*	102	3.7
10.04	E-Participation Index, 0–1 (best)	51	0.23

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Kyrgyz Republic

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**115**	**3.1**
A. Environment subindex	**132**	**3.0**
1st pillar: Political and regulatory environment	131	2.7
2nd pillar: Business and innovation environment	131	3.3
B. Readiness subindex	**101**	**3.9**
3rd pillar: Infrastructure and digital content	98	3.2
4th pillar: Affordability	106	3.7
5th pillar: Skills	75	4.9
C. Usage subindex	**122**	**2.7**
6th pillar: Individual usage	106	2.3
7th pillar: Business usage	134	2.8
8th pillar: Government usage	126	3.0
D. Impact subindex	**114**	**2.9**
9th pillar: Economic impacts	120	2.6
10th pillar: Social impacts	100	3.2



The Networked Readiness Index in detail

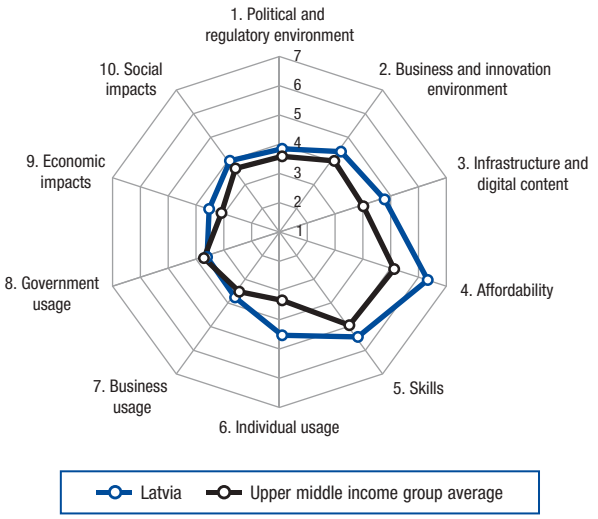
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	135	2.2
1.02	Laws relating to ICT*	133	2.5
1.03	Judicial independence*	135	1.9
1.04	Efficiency of legal system in settling disputes*	132	2.6
1.05	Efficiency of legal system in challenging regs*	131	2.5
1.06	Intellectual property protection*	138	2.0
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	78	38
1.09	No. days to enforce a contract	6	260
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	138	3.5
2.02	Venture capital availability*	136	1.8
2.03	Total tax rate, % profits	133	69.0
2.04	No. days to start a business	47	10
2.05	No. procedures to start a business	3	2
2.06	Intensity of local competition*	127	3.9
2.07	Tertiary education gross enrollment rate, %	52	48.8
2.08	Quality of management schools*	132	3.0
2.09	Gov't procurement of advanced tech*	136	2.4
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	76	2,282.2
3.02	Mobile network coverage, % pop.	79	96.0
3.03	Int'l Internet bandwidth, kb/s per user	137	0.3
3.04	Secure Internet servers/million pop.	117	1.1
3.05	Accessibility of digital content*	58	5.2
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	35	0.18
4.02	Fixed broadband Internet tariffs, PPP $/month	125	142.65
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	95	3.3
5.02	Quality of math & science education*	93	3.5
5.03	Secondary education gross enrollment rate, %	82	84.0
5.04	Adult literacy rate, %	14	99.2

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	76	98.9
6.02	Individuals using Internet, %	95	20.0
6.03	Households w/ personal computer, %	125	4.0
6.04	Households w/ Internet access, %	112	3.2
6.05	Broadband Internet subscriptions/100 pop.	112	0.3
6.06	Mobile broadband subscriptions/100 pop.	113	0.0
6.07	Use of virtual social networks*	104	4.6
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	138	3.6
7.02	Capacity for innovation*	139	2.0
7.03	PCT patents, applications/million pop.	101	0.1
7.04	Extent of business Internet use*	120	4.2
7.05	Extent of staff training*	130	3.1
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	126	3.6
8.02	Importance of ICT to gov't vision*	136	2.5
8.03	Government Online Service Index, 0–1 (best)	70	0.32
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	129	3.4
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	124	3.2
9.04	Knowledge-intensive jobs, % workforce	81	18.3
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	129	3.3
10.02	Internet access in schools*	101	3.4
10.03	ICT use & gov't efficiency*	135	2.7
10.04	E-Participation Index, 0–1 (best)	28	0.43

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Latvia

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**41**	**4.3**
A. Environment subindex	**49**	**4.1**
1st pillar: Political and regulatory environment	59	3.9
2nd pillar: Business and innovation environment	44	4.4
B. Readiness subindex	**29**	**5.4**
3rd pillar: Infrastructure and digital content	47	4.7
4th pillar: Affordability	13	6.2
5th pillar: Skills	43	5.4
C. Usage subindex	**44**	**4.0**
6th pillar: Individual usage	42	4.5
7th pillar: Business usage	52	3.7
8th pillar: Government usage	76	3.7
D. Impact subindex	**46**	**3.8**
9th pillar: Economic impacts	42	3.6
10th pillar: Social impacts	53	4.0



The Networked Readiness Index in detail

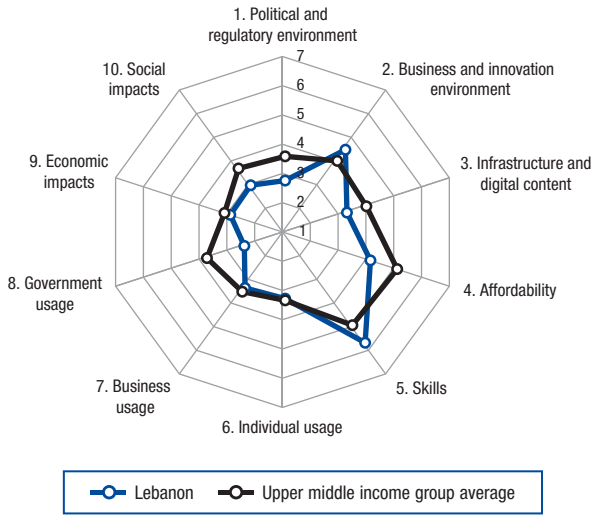
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	98	3.0
1.02	Laws relating to ICT*	59	4.1
1.03	Judicial independence*	67	3.8
1.04	Efficiency of legal system in settling disputes*	104	3.1
1.05	Efficiency of legal system in challenging regs*	99	3.0
1.06	Intellectual property protection*	65	3.6
1.07	Software piracy rate, % software installed	46	56
1.08	No. procedures to enforce a contract	9	27
1.09	No. days to enforce a contract	22	369
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	69	5.0
2.02	Venture capital availability*	55	2.7
2.03	Total tax rate, % profits	69	37.9
2.04	No. days to start a business	74	16
2.05	No. procedures to start a business	20	4
2.06	Intensity of local competition*	81	4.7
2.07	Tertiary education gross enrollment rate, %	22	66.1
2.08	Quality of management schools*	67	4.2
2.09	Gov't procurement of advanced tech*	87	3.4
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	75	2,322.1
3.02	Mobile network coverage, % pop.	67	98.8
3.03	Int'l Internet bandwidth, kb/s per user	37	30.0
3.04	Secure Internet servers/million pop.	36	173.0
3.05	Accessibility of digital content*	45	5.4
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	44	0.22
4.02	Fixed broadband Internet tariffs, PPP $/month	20	19.84
4.03	Internet & telephony competition, 0–2 (best)	77	1.77
	5th pillar: Skills		
5.01	Quality of educational system*	70	3.7
5.02	Quality of math & science education*	49	4.4
5.03	Secondary education gross enrollment rate, %	50	94.1
5.04	Adult literacy rate, %	2	99.8

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	68	102.4
6.02	Individuals using Internet, %	26	71.1
6.03	Households w/ personal computer, %	38	62.8
6.04	Households w/ Internet access, %	37	59.8
6.05	Broadband Internet subscriptions/100 pop.	34	19.3
6.06	Mobile broadband subscriptions/100 pop.	29	15.9
6.07	Use of virtual social networks*	64	5.3
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	94	4.5
7.02	Capacity for innovation*	43	3.4
7.03	PCT patents, applications/million pop.	30	12.5
7.04	Extent of business Internet use*	43	5.4
7.05	Extent of staff training*	64	4.0
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	98	4.2
8.02	Importance of ICT to gov't vision*	103	3.4
8.03	Government Online Service Index, 0–1 (best)	41	0.42
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	84	4.2
9.02	ICT PCT patents, applications/million pop.	42	1.1
9.03	Impact of ICT on new organizational models*	76	4.0
9.04	Knowledge-intensive jobs, % workforce	20	40.2
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	63	4.4
10.02	Internet access in schools*	34	5.3
10.03	ICT use & gov't efficiency*	98	3.8
10.04	E-Participation Index, 0–1 (best)	44	0.27

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Lebanon

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**95**	**3.5**
A. Environment subindex	**92**	**3.6**
1st pillar: Political and regulatory environment	129	2.8
2nd pillar: Business and innovation environment	42	4.5
B. Readiness subindex	**89**	**4.3**
3rd pillar: Infrastructure and digital content	95	3.2
4th pillar: Affordability	99	4.1
5th pillar: Skills	33	5.6
C. Usage subindex	**105**	**3.0**
6th pillar: Individual usage	68	3.3
7th pillar: Business usage	94	3.3
8th pillar: Government usage	138	2.5
D. Impact subindex	**104**	**3.0**
9th pillar: Economic impacts	92	3.0
10th pillar: Social impacts	114	3.0



The Networked Readiness Index in detail

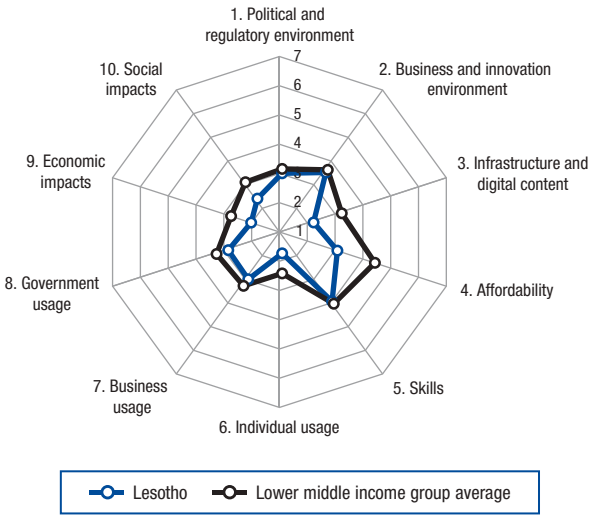
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	132	2.3
1.02	Laws relating to ICT*	138	2.2
1.03	Judicial independence*	127	2.5
1.04	Efficiency of legal system in settling disputes*	105	3.0
1.05	Efficiency of legal system in challenging regs*	132	2.5
1.06	Intellectual property protection*	112	2.7
1.07	Software piracy rate, % software installed	71	72
1.08	No. procedures to enforce a contract	69	37
1.09	No. days to enforce a contract	105	721
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	79	4.8
2.02	Venture capital availability*	60	2.7
2.03	Total tax rate, % profits	36	30.2
2.04	No. days to start a business	42	9
2.05	No. procedures to start a business	28	5
2.06	Intensity of local competition*	28	5.4
2.07	Tertiary education gross enrollment rate, %	43	54.0
2.08	Quality of management schools*	18	5.3
2.09	Gov't procurement of advanced tech*	141	2.3
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	71	2,550.1
3.02	Mobile network coverage, % pop.	81	95.0
3.03	Int'l Internet bandwidth, kb/s per user	117	1.9
3.04	Secure Internet servers/million pop.	61	28.6
3.05	Accessibility of digital content*	94	4.5
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	119	0.54
4.02	Fixed broadband Internet tariffs, PPP $/month	71	34.46
4.03	Internet & telephony competition, 0–2 (best)	131	0.67
	5th pillar: Skills		
5.01	Quality of educational system*	12	5.1
5.02	Quality of math & science education*	6	5.7
5.03	Secondary education gross enrollment rate, %	87	81.4
5.04	Adult literacy rate, %	88	89.6

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	108	68.0
6.02	Individuals using Internet, %	81	31.0
6.03	Households w/ personal computer, %	72	31.7
6.04	Households w/ Internet access, %	61	29.7
6.05	Broadband Internet subscriptions/100 pop.	73	4.7
6.06	Mobile broadband subscriptions/100 pop.	n/a	n/a
6.07	Use of virtual social networks*	38	5.8
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	68	4.8
7.02	Capacity for innovation*	106	2.6
7.03	PCT patents, applications/million pop.	67	0.9
7.04	Extent of business Internet use*	90	4.7
7.05	Extent of staff training*	98	3.6
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	142	2.6
8.02	Importance of ICT to gov't vision*	141	2.2
8.03	Government Online Service Index, 0–1 (best)	90	0.27
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	125	3.6
9.02	ICT PCT patents, applications/million pop.	51	0.4
9.03	Impact of ICT on new organizational models*	128	3.1
9.04	Knowledge-intensive jobs, % workforce	40	31.9
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	136	3.1
10.02	Internet access in schools*	85	3.8
10.03	ICT use & gov't efficiency*	140	2.5
10.04	E-Participation Index, 0–1 (best)	44	0.27

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Lesotho

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**133**	**2.8**
A. Environment subindex	**120**	**3.3**
1st pillar: Political and regulatory environment	115	3.0
2nd pillar: Business and innovation environment	115	3.5
B. Readiness subindex	**127**	**3.0**
3rd pillar: Infrastructure and digital content	133	2.1
4th pillar: Affordability	123	3.0
5th pillar: Skills	106	3.9
C. Usage subindex	**134**	**2.5**
6th pillar: Individual usage	130	1.7
7th pillar: Business usage	125	3.0
8th pillar: Government usage	129	2.9
D. Impact subindex	**136**	**2.3**
9th pillar: Economic impacts	139	2.1
10th pillar: Social impacts	134	2.4



The Networked Readiness Index in detail

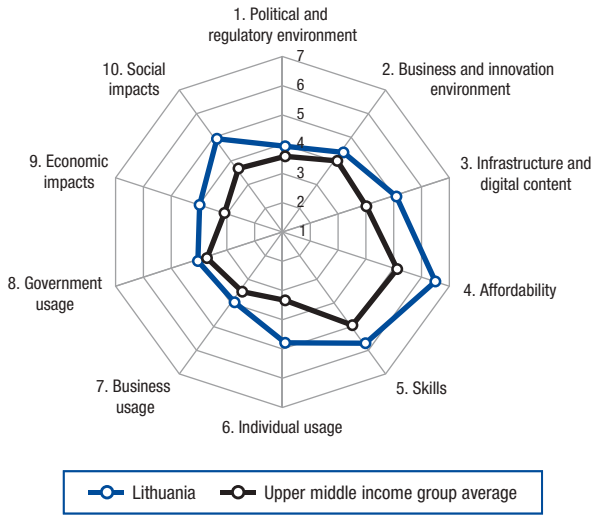
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	101	2.9
1.02	Laws relating to ICT*	134	2.5
1.03	Judicial independence*	107	2.9
1.04	Efficiency of legal system in settling disputes*	94	3.3
1.05	Efficiency of legal system in challenging regs*	122	2.7
1.06	Intellectual property protection*	101	2.8
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	97	40
1.09	No. days to enforce a contract	112	785
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	126	3.9
2.02	Venture capital availability*	130	1.9
2.03	Total tax rate, % profits	10	16.0
2.04	No. days to start a business	119	40
2.05	No. procedures to start a business	72	7
2.06	Intensity of local competition*	108	4.2
2.07	Tertiary education gross enrollment rate, %	133	3.5
2.08	Quality of management schools*	134	2.9
2.09	Gov't procurement of advanced tech*	123	2.8
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	131	92.1
3.02	Mobile network coverage, % pop.	127	55.0
3.03	Int'l Internet bandwidth, kb/s per user	135	0.3
3.04	Secure Internet servers/million pop.	131	0.5
3.05	Accessibility of digital content*	136	3.2
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	98	0.42
4.02	Fixed broadband Internet tariffs, PPP $/month	113	78.91
4.03	Internet & telephony competition, 0–2 (best)	85	1.67
	5th pillar: Skills		
5.01	Quality of educational system*	91	3.3
5.02	Quality of math & science education*	112	3.2
5.03	Secondary education gross enrollment rate, %	117	46.4
5.04	Adult literacy rate, %	87	89.7

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	129	45.5
6.02	Individuals using Internet, %	129	3.9
6.03	Households w/ personal computer, %	120	5.0
6.04	Households w/ Internet access, %	124	1.3
6.05	Broadband Internet subscriptions/100 pop.	134	0.0
6.06	Mobile broadband subscriptions/100 pop.	98	0.5
6.07	Use of virtual social networks*	125	4.1
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	122	4.0
7.02	Capacity for innovation*	136	2.1
7.03	PCT patents, applications/million pop.	87	0.2
7.04	Extent of business Internet use*	123	4.1
7.05	Extent of staff training*	88	3.7
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	130	3.4
8.02	Importance of ICT to gov't vision*	130	2.8
8.03	Government Online Service Index, 0–1 (best)	92	0.26
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	137	3.1
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	132	3.0
9.04	Knowledge-intensive jobs, % workforce	106	6.0
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	131	3.2
10.02	Internet access in schools*	136	2.0
10.03	ICT use & gov't efficiency*	130	3.0
10.04	E-Participation Index, 0–1 (best)	99	0.09

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Lithuania

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**31**	**4.7**
A. Environment subindex	**46**	**4.2**
1st pillar: Political and regulatory environment	53	4.0
2nd pillar: Business and innovation environment	49	4.4
B. Readiness subindex	**22**	**5.7**
3rd pillar: Infrastructure and digital content	35	5.0
4th pillar: Affordability	6	6.4
5th pillar: Skills	30	5.7
C. Usage subindex	**35**	**4.3**
6th pillar: Individual usage	32	4.8
7th pillar: Business usage	38	3.9
8th pillar: Government usage	49	4.1
D. Impact subindex	**27**	**4.5**
9th pillar: Economic impacts	30	4.1
10th pillar: Social impacts	24	5.0



The Networked Readiness Index in detail

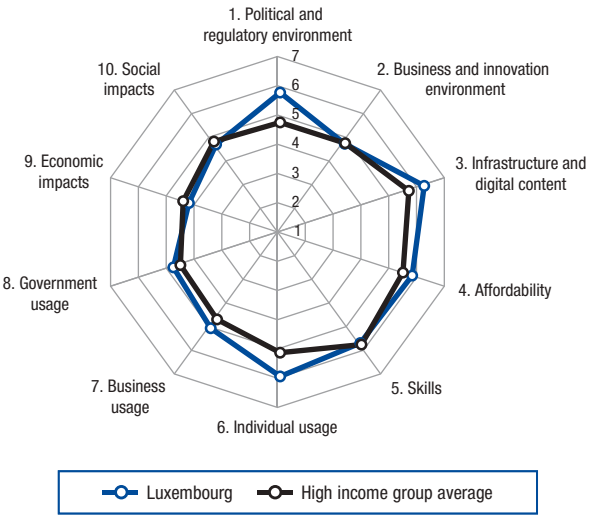
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	96	3.0
1.02	Laws relating to ICT*	38	4.6
1.03	Judicial independence*	84	3.4
1.04	Efficiency of legal system in settling disputes*	83	3.4
1.05	Efficiency of legal system in challenging regs*	63	3.7
1.06	Intellectual property protection*	73	3.5
1.07	Software piracy rate, % software installed	40	54
1.08	No. procedures to enforce a contract	18	30
1.09	No. days to enforce a contract	8	275
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	38	5.7
2.02	Venture capital availability*	101	2.2
2.03	Total tax rate, % profits	89	43.9
2.04	No. days to start a business	88	22
2.05	No. procedures to start a business	46	6
2.06	Intensity of local competition*	64	5.0
2.07	Tertiary education gross enrollment rate, %	11	77.4
2.08	Quality of management schools*	66	4.2
2.09	Gov't procurement of advanced tech*	96	3.3
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	52	3,966.3
3.02	Mobile network coverage, % pop.	1	100.0
3.03	Int'l Internet bandwidth, kb/s per user	30	45.4
3.04	Secure Internet servers/million pop.	34	175.9
3.05	Accessibility of digital content*	18	6.2
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	55	0.26
4.02	Fixed broadband Internet tariffs, PPP $/month	10	17.17
4.03	Internet & telephony competition, 0–2 (best)	62	1.92
	5th pillar: Skills		
5.01	Quality of educational system*	64	3.8
5.02	Quality of math & science education*	21	5.0
5.03	Secondary education gross enrollment rate, %	36	98.0
5.04	Adult literacy rate, %	4	99.7

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	12	147.2
6.02	Individuals using Internet, %	37	62.1
6.03	Households w/ personal computer, %	44	59.2
6.04	Households w/ Internet access, %	34	60.6
6.05	Broadband Internet subscriptions/100 pop.	30	20.6
6.06	Mobile broadband subscriptions/100 pop.	35	12.0
6.07	Use of virtual social networks*	30	5.8
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	53	5.0
7.02	Capacity for innovation*	48	3.3
7.03	PCT patents, applications/million pop.	39	6.2
7.04	Extent of business Internet use*	7	6.2
7.05	Extent of staff training*	65	4.0
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	70	4.6
8.02	Importance of ICT to gov't vision*	71	3.9
8.03	Government Online Service Index, 0–1 (best)	29	0.48
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	26	5.2
9.02	ICT PCT patents, applications/million pop.	43	0.9
9.03	Impact of ICT on new organizational models*	23	4.9
9.04	Knowledge-intensive jobs, % workforce	21	39.6
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	37	5.1
10.02	Internet access in schools*	27	5.7
10.03	ICT use & gov't efficiency*	33	4.8
10.04	E-Participation Index, 0–1 (best)	19	0.53

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Luxembourg

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**21**	**5.2**
A. Environment subindex	**13**	**5.3**
1st pillar: Political and regulatory environment	5	5.8
2nd pillar: Business and innovation environment	27	4.8
B. Readiness subindex	**19**	**5.9**
3rd pillar: Infrastructure and digital content	13	6.2
4th pillar: Affordability	36	5.7
5th pillar: Skills	31	5.7
C. Usage subindex	**15**	**5.3**
6th pillar: Individual usage	7	5.9
7th pillar: Business usage	18	5.0
8th pillar: Government usage	20	4.8
D. Impact subindex	**28**	**4.5**
9th pillar: Economic impacts	27	4.3
10th pillar: Social impacts	34	4.7



The Networked Readiness Index in detail

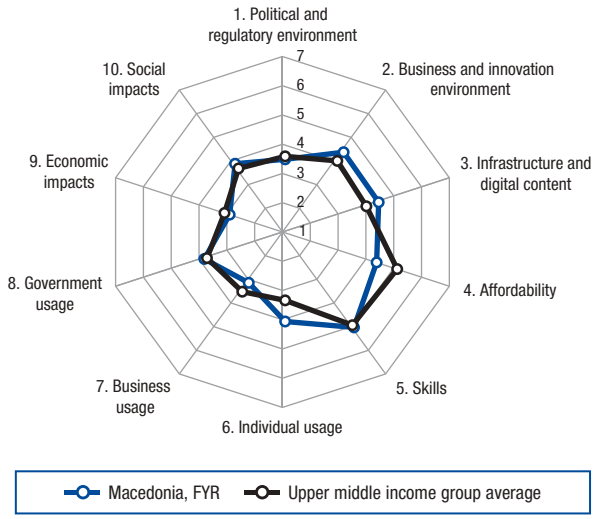
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	5	5.6
1.02	Laws relating to ICT*	5	5.7
1.03	Judicial independence*	14	6.1
1.04	Efficiency of legal system in settling disputes*	12	5.3
1.05	Efficiency of legal system in challenging regs*	5	5.4
1.06	Intellectual property protection*	5	5.9
1.07	Software piracy rate, % software installed	1	20
1.08	No. procedures to enforce a contract	5	26
1.09	No. days to enforce a contract	17	321
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	19	6.3
2.02	Venture capital availability*	11	4.1
2.03	Total tax rate, % profits	14	20.8
2.04	No. days to start a business	80	19
2.05	No. procedures to start a business	46	6
2.06	Intensity of local competition*	41	5.2
2.07	Tertiary education gross enrollment rate, %	109	10.5
2.08	Quality of management schools*	58	4.3
2.09	Gov't procurement of advanced tech*	7	4.7
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	33	6,293.7
3.02	Mobile network coverage, % pop.	25	99.9
3.03	Int'l Internet bandwidth, kb/s per user	14	87.6
3.04	Secure Internet servers/million pop.	9	1,415.5
3.05	Accessibility of digital content*	20	6.1
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	53	0.25
4.02	Fixed broadband Internet tariffs, PPP $/month	61	31.66
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	35	4.5
5.02	Quality of math & science education*	47	4.4
5.03	Secondary education gross enrollment rate, %	37	97.6
5.04	Adult literacy rate, %	15	99.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	17	143.3
6.02	Individuals using Internet, %	4	90.0
6.03	Households w/ personal computer, %	4	90.2
6.04	Households w/ Internet access, %	4	90.3
6.05	Broadband Internet subscriptions/100 pop.	8	33.2
6.06	Mobile broadband subscriptions/100 pop.	26	17.6
6.07	Use of virtual social networks*	22	6.0
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	24	5.7
7.02	Capacity for innovation*	16	4.5
7.03	PCT patents, applications/million pop.	15	103.3
7.04	Extent of business Internet use*	30	5.7
7.05	Extent of staff training*	7	5.3
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	5	6.1
8.02	Importance of ICT to gov't vision*	12	5.2
8.03	Government Online Service Index, 0–1 (best)	51	0.38
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	31	5.2
9.02	ICT PCT patents, applications/million pop.	20	17.1
9.03	Impact of ICT on new organizational models*	28	4.9
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	10	5.9
10.02	Internet access in schools*	22	5.8
10.03	ICT use & gov't efficiency*	23	5.1
10.04	E-Participation Index, 0–1 (best)	66	0.17

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Macedonia, FYR

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**66**	**3.9**
A. Environment subindex	**60**	**4.0**
1st pillar: Political and regulatory environment	83	3.5
2nd pillar: Business and innovation environment	47	4.4
B. Readiness subindex	**78**	**4.5**
3rd pillar: Infrastructure and digital content	59	4.4
4th pillar: Affordability	96	4.3
5th pillar: Skills	68	5.0
C. Usage subindex	**61**	**3.7**
6th pillar: Individual usage	46	4.0
7th pillar: Business usage	113	3.1
8th pillar: Government usage	63	3.9
D. Impact subindex	**71**	**3.5**
9th pillar: Economic impacts	87	3.0
10th pillar: Social impacts	56	3.9



The Networked Readiness Index in detail

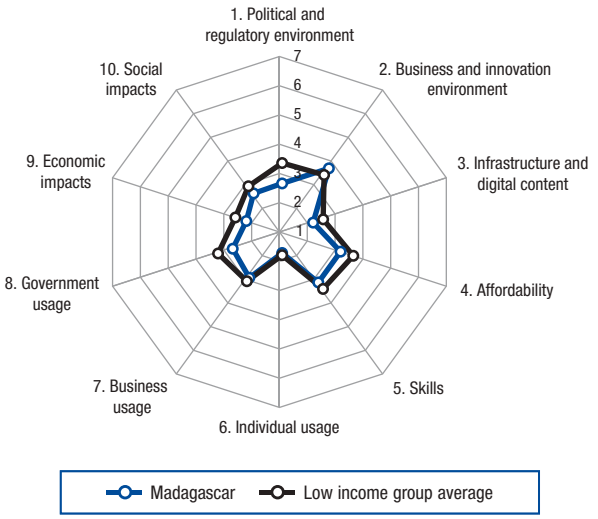
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	80	3.4
1.02	Laws relating to ICT*	63	4.0
1.03	Judicial independence*	105	2.9
1.04	Efficiency of legal system in settling disputes*	99	3.1
1.05	Efficiency of legal system in challenging regs*	102	3.0
1.06	Intellectual property protection*	89	3.1
1.07	Software piracy rate, % software installed	63	66
1.08	No. procedures to enforce a contract	69	37
1.09	No. days to enforce a contract	23	370
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	89	4.6
2.02	Venture capital availability*	65	2.6
2.03	Total tax rate, % profits	2	9.7
2.04	No. days to start a business	4	3
2.05	No. procedures to start a business	8	3
2.06	Intensity of local competition*	110	4.2
2.07	Tertiary education gross enrollment rate, %	59	40.4
2.08	Quality of management schools*	100	3.7
2.09	Gov't procurement of advanced tech*	110	3.1
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	60	3,074.8
3.02	Mobile network coverage, % pop.	25	99.9
3.03	Int'l Internet bandwidth, kb/s per user	58	16.8
3.04	Secure Internet servers/million pop.	65	24.3
3.05	Accessibility of digital content*	53	5.2
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	125	0.58
4.02	Fixed broadband Internet tariffs, PPP $/month	62	32.24
4.03	Internet & telephony competition, 0–2 (best)	117	1.00
	5th pillar: Skills		
5.01	Quality of educational system*	75	3.6
5.02	Quality of math & science education*	75	3.9
5.03	Secondary education gross enrollment rate, %	84	82.8
5.04	Adult literacy rate, %	57	97.1

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	65	104.5
6.02	Individuals using Internet, %	46	51.9
6.03	Households w/ personal computer, %	41	60.3
6.04	Households w/ Internet access, %	47	49.2
6.05	Broadband Internet subscriptions/100 pop.	44	12.5
6.06	Mobile broadband subscriptions/100 pop.	54	6.5
6.07	Use of virtual social networks*	47	5.7
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	121	4.0
7.02	Capacity for innovation*	86	2.8
7.03	PCT patents, applications/million pop.	59	1.5
7.04	Extent of business Internet use*	101	4.5
7.05	Extent of staff training*	124	3.2
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	52	4.9
8.02	Importance of ICT to gov't vision*	69	3.9
8.03	Government Online Service Index, 0–1 (best)	69	0.32
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	110	3.8
9.02	ICT PCT patents, applications/million pop.	53	0.3
9.03	Impact of ICT on new organizational models*	104	3.6
9.04	Knowledge-intensive jobs, % workforce	52	25.5
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	62	4.4
10.02	Internet access in schools*	46	4.8
10.03	ICT use & gov't efficiency*	76	4.1
10.04	E-Participation Index, 0–1 (best)	53	0.21

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Madagascar

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**134**	**2.7**
A. Environment subindex	**124**	**3.2**
1st pillar: Political and regulatory environment	134	2.7
2nd pillar: Business and innovation environment	103	3.7
B. Readiness subindex	**135**	**2.8**
3rd pillar: Infrastructure and digital content	134	2.1
4th pillar: Affordability	117	3.1
5th pillar: Skills	130	3.1
C. Usage subindex	**136**	**2.5**
6th pillar: Individual usage	132	1.7
7th pillar: Business usage	128	2.9
8th pillar: Government usage	130	2.8
D. Impact subindex	**129**	**2.5**
9th pillar: Economic impacts	134	2.3
10th pillar: Social impacts	128	2.7



The Networked Readiness Index in detail

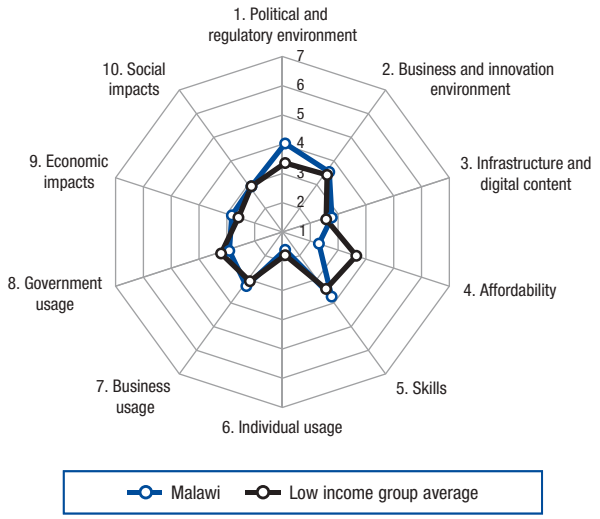
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	125	2.4
1.02	Laws relating to ICT*	132	2.5
1.03	Judicial independence*	131	2.3
1.04	Efficiency of legal system in settling disputes*	127	2.7
1.05	Efficiency of legal system in challenging regs*	115	2.8
1.06	Intellectual property protection*	137	2.1
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	78	38
1.09	No. days to enforce a contract	121	871
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	130	3.9
2.02	Venture capital availability*	72	2.6
2.03	Total tax rate, % profits	64	36.6
2.04	No. days to start a business	33	8
2.05	No. procedures to start a business	8	3
2.06	Intensity of local competition*	112	4.2
2.07	Tertiary education gross enrollment rate, %	132	3.7
2.08	Quality of management schools*	103	3.7
2.09	Gov't procurement of advanced tech*	101	3.3
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	133	56.8
3.02	Mobile network coverage, % pop.	134	23.0
3.03	Int'l Internet bandwidth, kb/s per user	98	5.5
3.04	Secure Internet servers/million pop.	130	0.5
3.05	Accessibility of digital content*	131	3.5
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	99	0.43
4.02	Fixed broadband Internet tariffs, PPP $/month	133	204.35
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	118	3.0
5.02	Quality of math & science education*	92	3.5
5.03	Secondary education gross enrollment rate, %	133	31.1
5.04	Adult literacy rate, %	121	64.5

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	134	37.2
6.02	Individuals using Internet, %	137	1.7
6.03	Households w/ personal computer, %	138	1.4
6.04	Households w/ Internet access, %	127	1.1
6.05	Broadband Internet subscriptions/100 pop.	131	0.0
6.06	Mobile broadband subscriptions/100 pop.	110	0.1
6.07	Use of virtual social networks*	91	4.9
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	131	3.8
7.02	Capacity for innovation*	113	2.5
7.03	PCT patents, applications/million pop.	119	0.0
7.04	Extent of business Internet use*	131	3.9
7.05	Extent of staff training*	115	3.3
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	125	3.6
8.02	Importance of ICT to gov't vision*	131	2.8
8.03	Government Online Service Index, 0–1 (best)	115	0.17
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	116	3.7
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	118	3.4
9.04	Knowledge-intensive jobs, % workforce	111	2.4
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	108	3.9
10.02	Internet access in schools*	132	2.4
10.03	ICT use & gov't efficiency*	128	3.0
10.04	E-Participation Index, 0–1 (best)	111	0.06

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Malawi

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**116**	**3.1**
A. Environment subindex	**70**	**3.8**
1st pillar: Political and regulatory environment	47	4.0
2nd pillar: Business and innovation environment	114	3.6
B. Readiness subindex	**132**	**2.9**
3rd pillar: Infrastructure and digital content	123	2.7
4th pillar: Affordability	138	2.2
5th pillar: Skills	115	3.7
C. Usage subindex	**129**	**2.6**
6th pillar: Individual usage	137	1.6
7th pillar: Business usage	98	3.3
8th pillar: Government usage	124	3.0
D. Impact subindex	**112**	**2.9**
9th pillar: Economic impacts	99	2.9
10th pillar: Social impacts	117	3.0



The Networked Readiness Index in detail

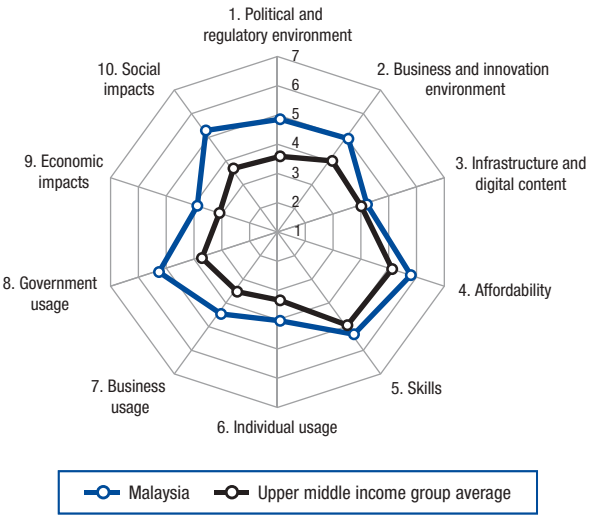
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	53	3.8
1.02	Laws relating to ICT*	91	3.6
1.03	Judicial independence*	52	4.3
1.04	Efficiency of legal system in settling disputes*	50	4.1
1.05	Efficiency of legal system in challenging regs*	45	4.0
1.06	Intellectual property protection*	53	3.8
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	112	42
1.09	No. days to enforce a contract	15	312
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	111	4.3
2.02	Venture capital availability*	131	1.8
2.03	Total tax rate, % profits	30	28.2
2.04	No. days to start a business	117	39
2.05	No. procedures to start a business	110	10
2.06	Intensity of local competition*	101	4.4
2.07	Tertiary education gross enrollment rate, %	139	0.5
2.08	Quality of management schools*	81	4.0
2.09	Gov't procurement of advanced tech*	73	3.6
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	127	119.7
3.02	Mobile network coverage, % pop.	106	85.0
3.03	Int'l Internet bandwidth, kb/s per user	140	0.1
3.04	Secure Internet servers/million pop.	136	0.3
3.05	Accessibility of digital content*	109	4.2
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	130	0.67
4.02	Fixed broadband Internet tariffs, PPP $/month	139	1,252.34
4.03	Internet & telephony competition, 0–2 (best)	114	1.13
	5th pillar: Skills		
5.01	Quality of educational system*	47	4.1
5.02	Quality of math & science education*	73	3.9
5.03	Secondary education gross enrollment rate, %	131	32.1
5.04	Adult literacy rate, %	113	73.7

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	140	20.4
6.02	Individuals using Internet, %	135	2.3
6.03	Households w/ personal computer, %	121	4.5
6.04	Households w/ Internet access, %	116	2.9
6.05	Broadband Internet subscriptions/100 pop.	130	0.0
6.06	Mobile broadband subscriptions/100 pop.	104	0.2
6.07	Use of virtual social networks*	111	4.5
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	104	4.2
7.02	Capacity for innovation*	81	2.9
7.03	PCT patents, applications/million pop.	119	0.0
7.04	Extent of business Internet use*	115	4.2
7.05	Extent of staff training*	71	3.9
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	102	4.2
8.02	Importance of ICT to gov't vision*	79	3.8
8.03	Government Online Service Index, 0–1 (best)	138	0.02
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	102	4.0
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	90	3.8
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	82	4.2
10.02	Internet access in schools*	123	2.7
10.03	ICT use & gov't efficiency*	93	3.8
10.04	E-Participation Index, 0–1 (best)	127	0.02

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Malaysia

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**29**	**4.8**
A. Environment subindex	**23**	**4.9**
1st pillar: Political and regulatory environment	24	4.9
2nd pillar: Business and innovation environment	24	5.0
B. Readiness subindex	**55**	**5.0**
3rd pillar: Infrastructure and digital content	65	4.1
4th pillar: Affordability	41	5.7
5th pillar: Skills	47	5.3
C. Usage subindex	**29**	**4.6**
6th pillar: Individual usage	47	4.0
7th pillar: Business usage	27	4.4
8th pillar: Government usage	6	5.4
D. Impact subindex	**24**	**4.6**
9th pillar: Economic impacts	31	4.0
10th pillar: Social impacts	15	5.3



The Networked Readiness Index in detail

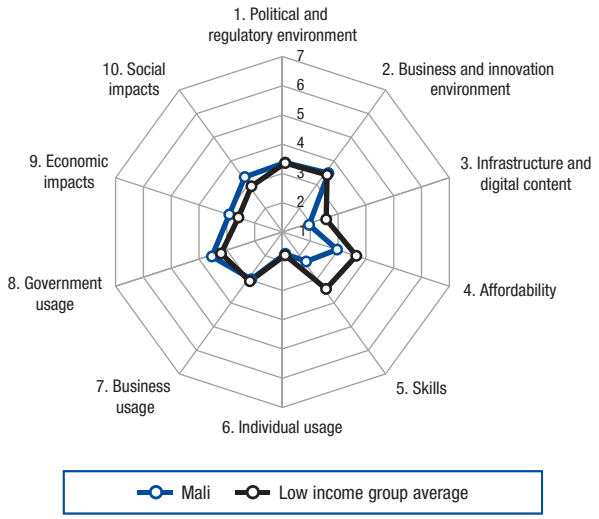
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	12	5.1
1.02	Laws relating to ICT*	23	5.2
1.03	Judicial independence*	43	4.7
1.04	Efficiency of legal system in settling disputes*	17	5.0
1.05	Efficiency of legal system in challenging regs*	14	4.9
1.06	Intellectual property protection*	31	4.9
1.07	Software piracy rate, % software installed	46	56
1.08	No. procedures to enforce a contract	15	29
1.09	No. days to enforce a contract	42	425
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	35	5.8
2.02	Venture capital availability*	10	4.1
2.03	Total tax rate, % profits	49	34.0
2.04	No. days to start a business	16	6
2.05	No. procedures to start a business	20	4
2.06	Intensity of local competition*	26	5.4
2.07	Tertiary education gross enrollment rate, %	65	37.5
2.08	Quality of management schools*	27	5.0
2.09	Gov't procurement of advanced tech*	4	4.9
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	58	3,541.3
3.02	Mobile network coverage, % pop.	81	95.0
3.03	Int'l Internet bandwidth, kb/s per user	69	11.4
3.04	Secure Internet servers/million pop.	57	41.5
3.05	Accessibility of digital content*	36	5.7
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	36	0.19
4.02	Fixed broadband Internet tariffs, PPP $/month	75	35.71
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	14	5.1
5.02	Quality of math & science education*	23	5.0
5.03	Secondary education gross enrollment rate, %	104	69.1
5.04	Adult literacy rate, %	75	92.5

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	43	119.2
6.02	Individuals using Internet, %	40	56.3
6.03	Households w/ personal computer, %	58	41.0
6.04	Households w/ Internet access, %	41	55.6
6.05	Broadband Internet subscriptions/100 pop.	61	7.3
6.06	Mobile broadband subscriptions/100 pop.	40	10.4
6.07	Use of virtual social networks*	25	5.9
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	28	5.6
7.02	Capacity for innovation*	19	4.3
7.03	PCT patents, applications/million pop.	34	9.5
7.04	Extent of business Internet use*	27	5.8
7.05	Extent of staff training*	9	5.2
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	9	5.9
8.02	Importance of ICT to gov't vision*	10	5.4
8.03	Government Online Service Index, 0–1 (best)	16	0.63
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	13	5.5
9.02	ICT PCT patents, applications/million pop.	29	4.0
9.03	Impact of ICT on new organizational models*	9	5.3
9.04	Knowledge-intensive jobs, % workforce	51	26.8
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	20	5.6
10.02	Internet access in schools*	36	5.2
10.03	ICT use & gov't efficiency*	10	5.5
10.04	E-Participation Index, 0–1 (best)	12	0.66

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Mali

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**126**	**2.9**
A. Environment subindex	**104**	**3.5**
1st pillar: Political and regulatory environment	93	3.4
2nd pillar: Business and innovation environment	118	3.5
B. Readiness subindex	**140**	**2.3**
3rd pillar: Infrastructure and digital content	139	1.9
4th pillar: Affordability	130	2.9
5th pillar: Skills	141	2.2
C. Usage subindex	**118**	**2.8**
6th pillar: Individual usage	129	1.7
7th pillar: Business usage	124	3.0
8th pillar: Government usage	83	3.6
D. Impact subindex	**92**	**3.2**
9th pillar: Economic impacts	86	3.0
10th pillar: Social impacts	94	3.3



The Networked Readiness Index in detail

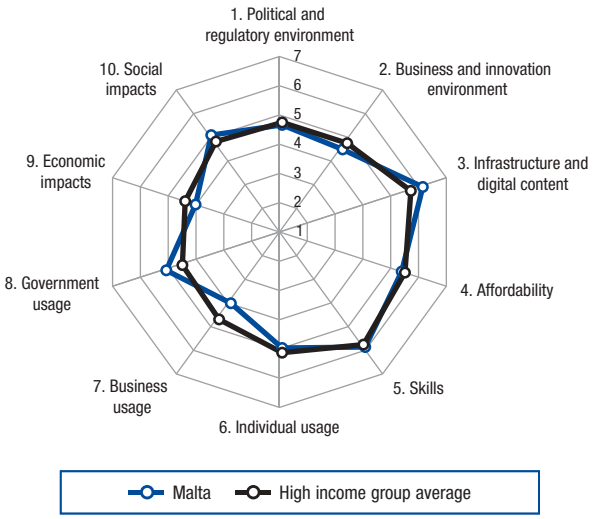
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	70	3.4
1.02	Laws relating to ICT*	108	3.2
1.03	Judicial independence*	112	2.7
1.04	Efficiency of legal system in settling disputes*	76	3.5
1.05	Efficiency of legal system in challenging regs*	70	3.6
1.06	Intellectual property protection*	103	2.8
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	55	36
1.09	No. days to enforce a contract	91	620
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	118	4.1
2.02	Venture capital availability*	119	2.0
2.03	Total tax rate, % profits	111	51.8
2.04	No. days to start a business	33	8
2.05	No. procedures to start a business	20	4
2.06	Intensity of local competition*	95	4.5
2.07	Tertiary education gross enrollment rate, %	121	5.8
2.08	Quality of management schools*	118	3.4
2.09	Gov't procurement of advanced tech*	65	3.6
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	137	33.9
3.02	Mobile network coverage, % pop.	135	20.0
3.03	Int'l Internet bandwidth, kb/s per user	118	1.9
3.04	Secure Internet servers/million pop.	127	0.7
3.05	Accessibility of digital content*	128	3.5
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	91	0.39
4.02	Fixed broadband Internet tariffs, PPP $/month	118	88.62
4.03	Internet & telephony competition, 0–2 (best)	113	1.19
	5th pillar: Skills		
5.01	Quality of educational system*	119	2.9
5.02	Quality of math & science education*	128	2.7
5.03	Secondary education gross enrollment rate, %	125	37.7
5.04	Adult literacy rate, %	140	26.2

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	124	48.4
6.02	Individuals using Internet, %	133	2.7
6.03	Households w/ personal computer, %	128	3.0
6.04	Households w/ Internet access, %	125	1.2
6.05	Broadband Internet subscriptions/100 pop.	135	0.0
6.06	Mobile broadband subscriptions/100 pop.	n/a	n/a
6.07	Use of virtual social networks*	135	3.6
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	112	4.2
7.02	Capacity for innovation*	105	2.6
7.03	PCT patents, applications/million pop.	119	0.0
7.04	Extent of business Internet use*	133	3.8
7.05	Extent of staff training*	122	3.3
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	54	4.9
8.02	Importance of ICT to gov't vision*	68	3.9
8.03	Government Online Service Index, 0–1 (best)	107	0.18
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	90	4.2
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	86	3.9
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	92	4.1
10.02	Internet access in schools*	109	3.2
10.03	ICT use & gov't efficiency*	60	4.4
10.04	E-Participation Index, 0–1 (best)	88	0.11

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Malta

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**26**	**4.9**
A. Environment subindex	**37**	**4.6**
1st pillar: Political and regulatory environment	30	4.7
2nd pillar: Business and innovation environment	41	4.5
B. Readiness subindex	**21**	**5.7**
3rd pillar: Infrastructure and digital content	16	6.1
4th pillar: Affordability	65	5.3
5th pillar: Skills	19	5.8
C. Usage subindex	**27**	**4.7**
6th pillar: Individual usage	27	4.9
7th pillar: Business usage	35	4.0
8th pillar: Government usage	11	5.2
D. Impact subindex	**25**	**4.6**
9th pillar: Economic impacts	28	4.1
10th pillar: Social impacts	19	5.1



The Networked Readiness Index in detail

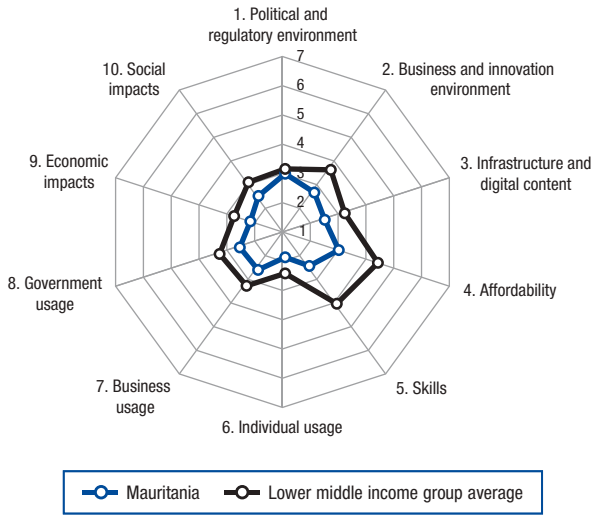
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	24	4.6
1.02	Laws relating to ICT*	15	5.3
1.03	Judicial independence*	31	5.1
1.04	Efficiency of legal system in settling disputes*	46	4.2
1.05	Efficiency of legal system in challenging regs*	55	3.8
1.06	Intellectual property protection*	36	4.6
1.07	Software piracy rate, % software installed	30	43
1.08	No. procedures to enforce a contract	n/a	n/a
1.09	No. days to enforce a contract	n/a	n/a
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	21	6.2
2.02	Venture capital availability*	39	3.0
2.03	Total tax rate, % profits	n/a	n/a
2.04	No. days to start a business	n/a	n/a
2.05	No. procedures to start a business	n/a	n/a
2.06	Intensity of local competition*	11	5.8
2.07	Tertiary education gross enrollment rate, %	73	33.4
2.08	Quality of management schools*	32	4.8
2.09	Gov't procurement of advanced tech*	19	4.3
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	39	5,585.3
3.02	Mobile network coverage, % pop.	1	100.0
3.03	Int'l Internet bandwidth, kb/s per user	51	19.2
3.04	Secure Internet servers/million pop.	11	1,380.3
3.05	Accessibility of digital content*	27	6.0
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	122	0.57
4.02	Fixed broadband Internet tariffs, PPP $/month	37	24.71
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	18	4.9
5.02	Quality of math & science education*	22	5.0
5.03	Secondary education gross enrollment rate, %	14	104.8
5.04	Adult literacy rate, %	76	92.4

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	55	109.3
6.02	Individuals using Internet, %	35	63.0
6.03	Households w/ personal computer, %	28	73.1
6.04	Households w/ Internet access, %	26	70.4
6.05	Broadband Internet subscriptions/100 pop.	16	28.0
6.06	Mobile broadband subscriptions/100 pop.	37	11.7
6.07	Use of virtual social networks*	18	6.1
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	34	5.5
7.02	Capacity for innovation*	63	3.1
7.03	PCT patents, applications/million pop.	29	12.9
7.04	Extent of business Internet use*	24	5.8
7.05	Extent of staff training*	57	4.1
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	4	6.1
8.02	Importance of ICT to gov't vision*	4	5.6
8.03	Government Online Service Index, 0–1 (best)	34	0.47
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	21	5.4
9.02	ICT PCT patents, applications/million pop.	28	4.4
9.03	Impact of ICT on new organizational models*	22	4.9
9.04	Knowledge-intensive jobs, % workforce	33	35.9
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	14	5.7
10.02	Internet access in schools*	16	6.0
10.03	ICT use & gov't efficiency*	7	5.6
10.04	E-Participation Index, 0–1 (best)	34	0.34

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Mauritania

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**139**	**2.5**
A. Environment subindex	**135**	**2.9**
1st pillar: Political and regulatory environment	117	3.0
2nd pillar: Business and innovation environment	140	2.7
B. Readiness subindex	**137**	**2.6**
3rd pillar: Infrastructure and digital content	128	2.4
4th pillar: Affordability	124	2.9
5th pillar: Skills	139	2.4
C. Usage subindex	**138**	**2.3**
6th pillar: Individual usage	124	1.8
7th pillar: Business usage	141	2.6
8th pillar: Government usage	136	2.6
D. Impact subindex	**134**	**2.4**
9th pillar: Economic impacts	137	2.3
10th pillar: Social impacts	130	2.6



The Networked Readiness Index in detail

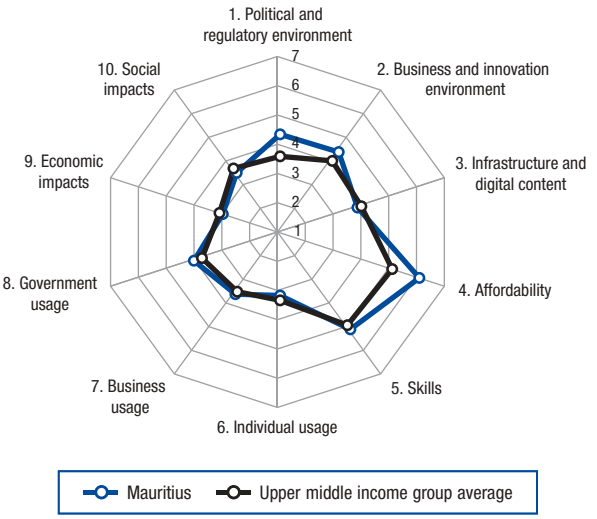
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	130	2.3
1.02	Laws relating to ICT*	125	2.7
1.03	Judicial independence*	120	2.6
1.04	Efficiency of legal system in settling disputes*	80	3.4
1.05	Efficiency of legal system in challenging regs*	71	3.6
1.06	Intellectual property protection*	109	2.7
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	126	46
1.09	No. days to enforce a contract	23	370
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	124	4.0
2.02	Venture capital availability*	135	1.8
2.03	Total tax rate, % profits	131	68.3
2.04	No. days to start a business	80	19
2.05	No. procedures to start a business	97	9
2.06	Intensity of local competition*	137	3.4
2.07	Tertiary education gross enrollment rate, %	127	4.4
2.08	Quality of management schools*	139	2.5
2.09	Gov't procurement of advanced tech*	131	2.7
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	124	166.0
3.02	Mobile network coverage, % pop.	124	62.0
3.03	Int'l Internet bandwidth, kb/s per user	111	2.7
3.04	Secure Internet servers/million pop.	108	2.0
3.05	Accessibility of digital content*	129	3.5
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	110	0.50
4.02	Fixed broadband Internet tariffs, PPP $/month	123	118.95
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	139	2.0
5.02	Quality of math & science education*	125	2.8
5.03	Secondary education gross enrollment rate, %	139	24.4
5.04	Adult literacy rate, %	126	57.5

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	100	79.3
6.02	Individuals using Internet, %	132	3.0
6.03	Households w/ personal computer, %	129	3.0
6.04	Households w/ Internet access, %	123	1.4
6.05	Broadband Internet subscriptions/100 pop.	117	0.2
6.06	Mobile broadband subscriptions/100 pop.	117	0.0
6.07	Use of virtual social networks*	133	3.7
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	140	3.6
7.02	Capacity for innovation*	118	2.4
7.03	PCT patents, applications/million pop.	119	0.0
7.04	Extent of business Internet use*	139	3.5
7.05	Extent of staff training*	141	2.4
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	129	3.5
8.02	Importance of ICT to gov't vision*	126	2.9
8.03	Government Online Service Index, 0–1 (best)	128	0.09
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	138	3.0
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	136	2.7
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	134	3.1
10.02	Internet access in schools*	135	2.1
10.03	ICT use & gov't efficiency*	124	3.3
10.04	E-Participation Index, 0–1 (best)	88	0.11

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Mauritius

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**53**	**4.1**
A. Environment subindex	**41**	**4.4**
1st pillar: Political and regulatory environment	39	4.4
2nd pillar: Business and innovation environment	46	4.4
B. Readiness subindex	**58**	**5.0**
3rd pillar: Infrastructure and digital content	73	3.8
4th pillar: Affordability	23	6.0
5th pillar: Skills	63	5.1
C. Usage subindex	**64**	**3.6**
6th pillar: Individual usage	73	3.1
7th pillar: Business usage	62	3.6
8th pillar: Government usage	52	4.1
D. Impact subindex	**83**	**3.3**
9th pillar: Economic impacts	83	3.1
10th pillar: Social impacts	82	3.5



The Networked Readiness Index in detail

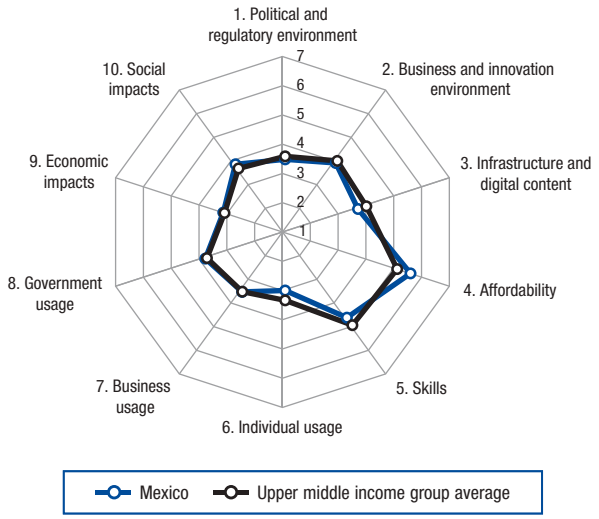
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	20	4.8
1.02	Laws relating to ICT*	51	4.3
1.03	Judicial independence*	40	4.9
1.04	Efficiency of legal system in settling disputes*	33	4.6
1.05	Efficiency of legal system in challenging regs*	33	4.3
1.06	Intellectual property protection*	55	3.8
1.07	Software piracy rate, % software installed	46	56
1.08	No. procedures to enforce a contract	55	36
1.09	No. days to enforce a contract	99	645
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	55	5.4
2.02	Venture capital availability*	53	2.8
2.03	Total tax rate, % profits	21	25.0
2.04	No. days to start a business	16	6
2.05	No. procedures to start a business	28	5
2.06	Intensity of local competition*	57	5.0
2.07	Tertiary education gross enrollment rate, %	82	24.9
2.08	Quality of management schools*	87	3.9
2.09	Gov't procurement of advanced tech*	62	3.7
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	84	1,870.9
3.02	Mobile network coverage, % pop.	49	99.0
3.03	Int'l Internet bandwidth, kb/s per user	77	9.2
3.04	Secure Internet servers/million pop.	48	86.6
3.05	Accessibility of digital content*	75	4.9
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	39	0.20
4.02	Fixed broadband Internet tariffs, PPP $/month	49	28.98
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	50	4.0
5.02	Quality of math & science education*	63	4.1
5.03	Secondary education gross enrollment rate, %	66	89.4
5.04	Adult literacy rate, %	93	87.9

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	84	91.7
6.02	Individuals using Internet, %	86	28.3
6.03	Households w/ personal computer, %	61	37.7
6.04	Households w/ Internet access, %	62	29.0
6.05	Broadband Internet subscriptions/100 pop.	65	6.1
6.06	Mobile broadband subscriptions/100 pop.	49	7.9
6.07	Use of virtual social networks*	74	5.2
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	56	5.0
7.02	Capacity for innovation*	89	2.8
7.03	PCT patents, applications/million pop.	102	0.1
7.04	Extent of business Internet use*	75	4.9
7.05	Extent of staff training*	40	4.3
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	35	5.3
8.02	Importance of ICT to gov't vision*	50	4.2
8.03	Government Online Service Index, 0–1 (best)	81	0.30
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	62	4.6
9.02	ICT PCT patents, applications/million pop.	79	0.1
9.03	Impact of ICT on new organizational models*	68	4.1
9.04	Knowledge-intensive jobs, % workforce	89	15.8
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	73	4.3
10.02	Internet access in schools*	75	4.0
10.03	ICT use & gov't efficiency*	54	4.4
10.04	E-Participation Index, 0–1 (best)	111	0.06

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Mexico

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**76**	**3.8**
A. Environment subindex	**79**	**3.7**
1st pillar: Political and regulatory environment	86	3.5
2nd pillar: Business and innovation environment	77	3.9
B. Readiness subindex	**76**	**4.6**
3rd pillar: Infrastructure and digital content	81	3.6
4th pillar: Affordability	52	5.5
5th pillar: Skills	91	4.6
C. Usage subindex	**72**	**3.4**
6th pillar: Individual usage	77	3.0
7th pillar: Business usage	75	3.5
8th pillar: Government usage	66	3.9
D. Impact subindex	**65**	**3.6**
9th pillar: Economic impacts	71	3.2
10th pillar: Social impacts	58	3.9



The Networked Readiness Index in detail

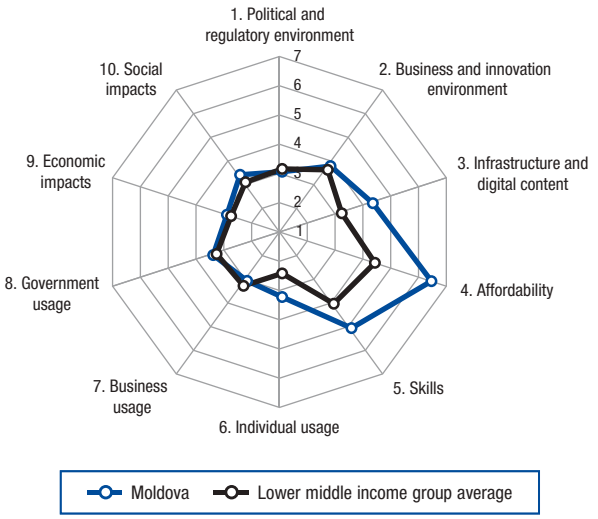
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	128	2.3
1.02	Laws relating to ICT*	54	4.2
1.03	Judicial independence*	89	3.2
1.04	Efficiency of legal system in settling disputes*	101	3.1
1.05	Efficiency of legal system in challenging regs*	80	3.3
1.06	Intellectual property protection*	85	3.2
1.07	Software piracy rate, % software installed	50	58
1.08	No. procedures to enforce a contract	78	38
1.09	No. days to enforce a contract	39	415
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	61	5.2
2.02	Venture capital availability*	78	2.5
2.03	Total tax rate, % profits	113	52.7
2.04	No. days to start a business	42	9
2.05	No. procedures to start a business	46	6
2.06	Intensity of local competition*	84	4.6
2.07	Tertiary education gross enrollment rate, %	79	27.0
2.08	Quality of management schools*	49	4.5
2.09	Gov't procurement of advanced tech*	75	3.5
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	77	2,256.2
3.02	Mobile network coverage, % pop.	25	99.9
3.03	Int'l Internet bandwidth, kb/s per user	87	7.3
3.04	Secure Internet servers/million pop.	67	20.6
3.05	Accessibility of digital content*	82	4.8
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	100	0.43
4.02	Fixed broadband Internet tariffs, PPP $/month	43	27.53
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	107	3.1
5.02	Quality of math & science education*	126	2.8
5.03	Secondary education gross enrollment rate, %	75	86.9
5.04	Adult literacy rate, %	72	93.4

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	98	80.6
6.02	Individuals using Internet, %	80	31.1
6.03	Households w/ personal computer, %	75	29.8
6.04	Households w/ Internet access, %	69	22.2
6.05	Broadband Internet subscriptions/100 pop.	51	10.0
6.06	Mobile broadband subscriptions/100 pop.	87	1.5
6.07	Use of virtual social networks*	78	5.1
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	81	4.6
7.02	Capacity for innovation*	76	3.0
7.03	PCT patents, applications/million pop.	58	1.6
7.04	Extent of business Internet use*	62	5.0
7.05	Extent of staff training*	80	3.8
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	96	4.2
8.02	Importance of ICT to gov't vision*	80	3.7
8.03	Government Online Service Index, 0–1 (best)	38	0.44
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	58	4.7
9.02	ICT PCT patents, applications/million pop.	63	0.2
9.03	Impact of ICT on new organizational models*	51	4.4
9.04	Knowledge-intensive jobs, % workforce	80	18.4
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	86	4.2
10.02	Internet access in schools*	82	3.8
10.03	ICT use & gov't efficiency*	62	4.3
10.04	E-Participation Index, 0–1 (best)	32	0.37

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Moldova

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**78**	**3.8**
A. Environment subindex	**106**	**3.4**
1st pillar: Political and regulatory environment	109	3.1
2nd pillar: Business and innovation environment	89	3.8
B. Readiness subindex	**41**	**5.2**
3rd pillar: Infrastructure and digital content	63	4.3
4th pillar: Affordability	8	6.4
5th pillar: Skills	65	5.0
C. Usage subindex	**90**	**3.2**
6th pillar: Individual usage	71	3.2
7th pillar: Business usage	120	3.0
8th pillar: Government usage	94	3.5
D. Impact subindex	**89**	**3.2**
9th pillar: Economic impacts	91	3.0
10th pillar: Social impacts	87	3.4



The Networked Readiness Index in detail

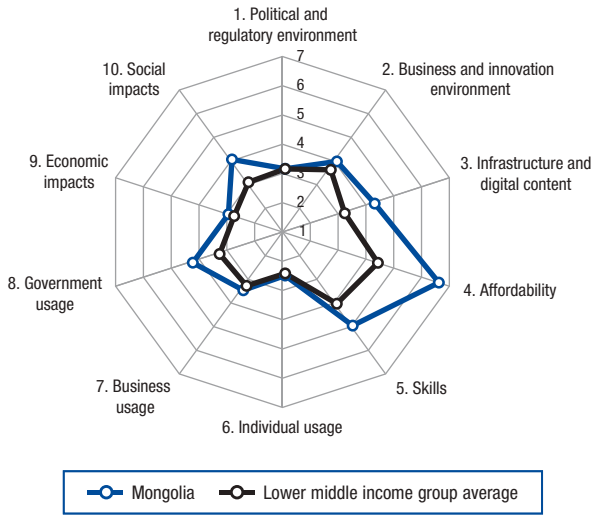
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	99	3.0
1.02	Laws relating to ICT*	101	3.4
1.03	Judicial independence*	132	2.2
1.04	Efficiency of legal system in settling disputes*	108	3.0
1.05	Efficiency of legal system in challenging regs*	100	3.0
1.06	Intellectual property protection*	110	2.7
1.07	Software piracy rate, % software installed	103	90
1.08	No. procedures to enforce a contract	18	30
1.09	No. days to enforce a contract	20	352
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	112	4.3
2.02	Venture capital availability*	126	1.9
2.03	Total tax rate, % profits	39	31.3
2.04	No. days to start a business	42	9
2.05	No. procedures to start a business	72	7
2.06	Intensity of local competition*	104	4.4
2.07	Tertiary education gross enrollment rate, %	64	38.1
2.08	Quality of management schools*	124	3.3
2.09	Gov't procurement of advanced tech*	132	2.6
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	95	997.5
3.02	Mobile network coverage, % pop.	72	98.0
3.03	Int'l Internet bandwidth, kb/s per user	20	65.8
3.04	Secure Internet servers/million pop.	81	13.5
3.05	Accessibility of digital content*	73	4.9
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	76	0.32
4.02	Fixed broadband Internet tariffs, PPP $/month	5	12.24
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	102	3.2
5.02	Quality of math & science education*	69	4.0
5.03	Secondary education gross enrollment rate, %	70	88.0
5.04	Adult literacy rate, %	44	98.5

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	90	88.6
6.02	Individuals using Internet, %	65	40.0
6.03	Households w/ personal computer, %	63	36.9
6.04	Households w/ Internet access, %	56	34.7
6.05	Broadband Internet subscriptions/100 pop.	60	7.5
6.06	Mobile broadband subscriptions/100 pop.	74	3.2
6.07	Use of virtual social networks*	96	4.8
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	126	3.9
7.02	Capacity for innovation*	107	2.6
7.03	PCT patents, applications/million pop.	70	0.7
7.04	Extent of business Internet use*	109	4.4
7.05	Extent of staff training*	118	3.3
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	86	4.4
8.02	Importance of ICT to gov't vision*	108	3.2
8.03	Government Online Service Index, 0–1 (best)	81	0.30
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	123	3.6
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	111	3.5
9.04	Knowledge-intensive jobs, % workforce	49	28.2
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	112	3.8
10.02	Internet access in schools*	63	4.3
10.03	ICT use & gov't efficiency*	114	3.5
10.04	E-Participation Index, 0–1 (best)	56	0.20

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Mongolia

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**63**	**3.9**
A. Environment subindex	**95**	**3.6**
1st pillar: Political and regulatory environment	105	3.2
2nd pillar: Business and innovation environment	69	4.0
B. Readiness subindex	**40**	**5.2**
3rd pillar: Infrastructure and digital content	64	4.2
4th pillar: Affordability	3	6.5
5th pillar: Skills	71	4.9
C. Usage subindex	**75**	**3.4**
6th pillar: Individual usage	101	2.5
7th pillar: Business usage	84	3.4
8th pillar: Government usage	44	4.3
D. Impact subindex	**62**	**3.6**
9th pillar: Economic impacts	84	3.0
10th pillar: Social impacts	51	4.1



The Networked Readiness Index in detail

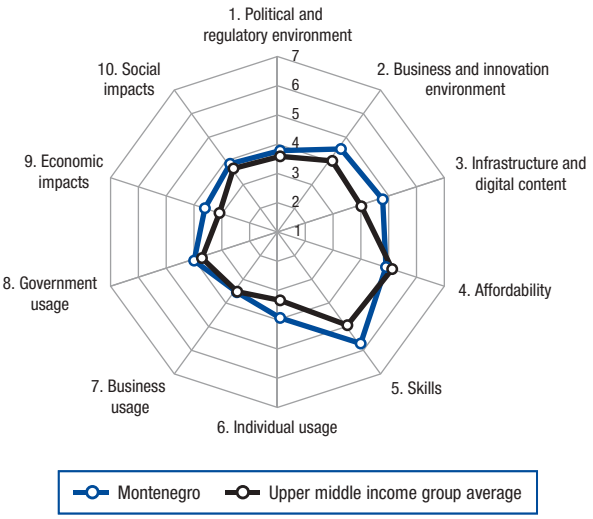
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	111	2.8
1.02	Laws relating to ICT*	118	3.0
1.03	Judicial independence*	122	2.6
1.04	Efficiency of legal system in settling disputes*	106	3.0
1.05	Efficiency of legal system in challenging regs*	114	2.9
1.06	Intellectual property protection*	136	2.2
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	31	32
1.09	No. days to enforce a contract	16	314
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	120	4.1
2.02	Venture capital availability*	137	1.8
2.03	Total tax rate, % profits	20	24.6
2.04	No. days to start a business	58	13
2.05	No. procedures to start a business	72	7
2.06	Intensity of local competition*	96	4.5
2.07	Tertiary education gross enrollment rate, %	45	52.1
2.08	Quality of management schools*	135	2.8
2.09	Gov't procurement of advanced tech*	89	3.4
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	87	1,553.9
3.02	Mobile network coverage, % pop.	106	85.0
3.03	Int'l Internet bandwidth, kb/s per user	28	48.3
3.04	Secure Internet servers/million pop.	86	10.5
3.05	Accessibility of digital content*	55	5.2
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	19	0.10
4.02	Fixed broadband Internet tariffs, PPP $/month	8	16.01
4.03	Internet & telephony competition, 0–2 (best)	90	1.56
	5th pillar: Skills		
5.01	Quality of educational system*	132	2.4
5.02	Quality of math & science education*	67	4.0
5.03	Secondary education gross enrollment rate, %	53	92.9
5.04	Adult literacy rate, %	55	97.5

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	87	91.1
6.02	Individuals using Internet, %	104	12.9
6.03	Households w/ personal computer, %	81	22.3
6.04	Households w/ Internet access, %	97	7.7
6.05	Broadband Internet subscriptions/100 pop.	87	2.6
6.06	Mobile broadband subscriptions/100 pop.	79	2.3
6.07	Use of virtual social networks*	100	4.7
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	90	4.5
7.02	Capacity for innovation*	72	3.0
7.03	PCT patents, applications/million pop.	89	0.2
7.04	Extent of business Internet use*	93	4.6
7.05	Extent of staff training*	68	4.0
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	53	4.9
8.02	Importance of ICT to gov't vision*	82	3.7
8.03	Government Online Service Index, 0–1 (best)	20	0.56
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	66	4.5
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	95	3.7
9.04	Knowledge-intensive jobs, % workforce	71	20.2
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	57	4.6
10.02	Internet access in schools*	69	4.1
10.03	ICT use & gov't efficiency*	75	4.1
10.04	E-Participation Index, 0–1 (best)	28	0.43

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Montenegro

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**46**	**4.2**
A. Environment subindex	**47**	**4.2**
1st pillar: Political and regulatory environment	61	3.8
2nd pillar: Business and innovation environment	38	4.5
B. Readiness subindex	**53**	**5.1**
3rd pillar: Infrastructure and digital content	46	4.7
4th pillar: Affordability	87	4.8
5th pillar: Skills	28	5.7
C. Usage subindex	**50**	**3.8**
6th pillar: Individual usage	50	3.9
7th pillar: Business usage	70	3.5
8th pillar: Government usage	53	4.1
D. Impact subindex	**47**	**3.8**
9th pillar: Economic impacts	39	3.7
10th pillar: Social impacts	57	3.9



The Networked Readiness Index in detail

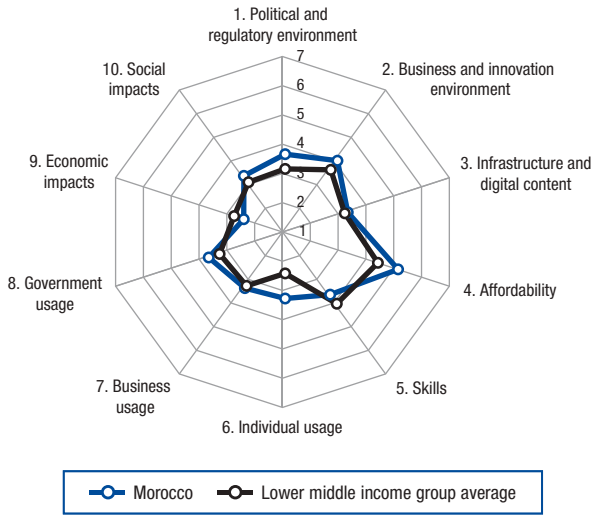
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	42	4.1
1.02	Laws relating to ICT*	43	4.5
1.03	Judicial independence*	56	4.2
1.04	Efficiency of legal system in settling disputes*	45	4.2
1.05	Efficiency of legal system in challenging regs*	36	4.3
1.06	Intellectual property protection*	57	3.7
1.07	Software piracy rate, % software installed	82	79
1.08	No. procedures to enforce a contract	133	49
1.09	No. days to enforce a contract	72	545
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	90	4.6
2.02	Venture capital availability*	29	3.3
2.03	Total tax rate, % profits	16	22.3
2.04	No. days to start a business	47	10
2.05	No. procedures to start a business	46	6
2.06	Intensity of local competition*	121	4.0
2.07	Tertiary education gross enrollment rate, %	55	44.9
2.08	Quality of management schools*	45	4.6
2.09	Gov't procurement of advanced tech*	33	4.1
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	50	4,227.7
3.02	Mobile network coverage, % pop.	1	100.0
3.03	Int'l Internet bandwidth, kb/s per user	46	21.3
3.04	Secure Internet servers/million pop.	64	25.3
3.05	Accessibility of digital content*	47	5.4
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	116	0.52
4.02	Fixed broadband Internet tariffs, PPP $/month	78	37.05
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	39	4.4
5.02	Quality of math & science education*	39	4.5
5.03	Secondary education gross enrollment rate, %	16	104.0
5.04	Adult literacy rate, %	52	97.7

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	3	185.3
6.02	Individuals using Internet, %	44	52.0
6.03	Households w/ personal computer, %	71	32.0
6.04	Households w/ Internet access, %	72	21.2
6.05	Broadband Internet subscriptions/100 pop.	56	8.3
6.06	Mobile broadband subscriptions/100 pop.	22	22.0
6.07	Use of virtual social networks*	39	5.8
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	99	4.4
7.02	Capacity for innovation*	53	3.2
7.03	PCT patents, applications/million pop.	119	0.0
7.04	Extent of business Internet use*	68	5.0
7.05	Extent of staff training*	66	4.0
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	64	4.7
8.02	Importance of ICT to gov't vision*	24	4.6
8.03	Government Online Service Index, 0–1 (best)	72	0.31
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	61	4.7
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	46	4.5
9.04	Knowledge-intensive jobs, % workforce	32	35.9
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	65	4.4
10.02	Internet access in schools*	55	4.5
10.03	ICT use & gov't efficiency*	38	4.7
10.04	E-Participation Index, 0–1 (best)	73	0.16

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Morocco

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**91**	**3.6**
A. Environment subindex	**66**	**3.9**
1st pillar: Political and regulatory environment	68	3.7
2nd pillar: Business and innovation environment	66	4.0
B. Readiness subindex	**100**	**4.0**
3rd pillar: Infrastructure and digital content	94	3.2
4th pillar: Affordability	77	5.1
5th pillar: Skills	119	3.6
C. Usage subindex	**73**	**3.4**
6th pillar: Individual usage	69	3.2
7th pillar: Business usage	92	3.3
8th pillar: Government usage	70	3.7
D. Impact subindex	**109**	**2.9**
9th pillar: Economic impacts	127	2.5
10th pillar: Social impacts	92	3.4



The Networked Readiness Index in detail

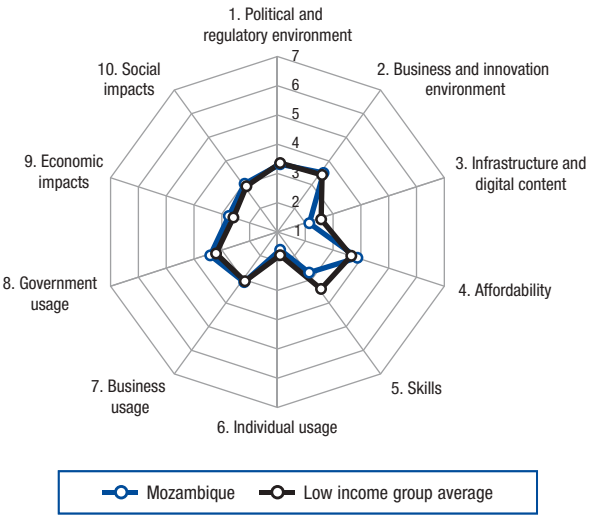
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	60	3.6
1.02	Laws relating to ICT*	87	3.6
1.03	Judicial independence*	80	3.6
1.04	Efficiency of legal system in settling disputes*	57	3.9
1.05	Efficiency of legal system in challenging regs*	53	3.9
1.06	Intellectual property protection*	71	3.5
1.07	Software piracy rate, % software installed	60	65
1.08	No. procedures to enforce a contract	97	40
1.09	No. days to enforce a contract	62	510
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	65	5.1
2.02	Venture capital availability*	30	3.3
2.03	Total tax rate, % profits	109	49.6
2.04	No. days to start a business	53	12
2.05	No. procedures to start a business	46	6
2.06	Intensity of local competition*	53	5.1
2.07	Tertiary education gross enrollment rate, %	103	13.2
2.08	Quality of management schools*	51	4.5
2.09	Gov't procurement of advanced tech*	59	3.7
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	105	664.8
3.02	Mobile network coverage, % pop.	68	98.4
3.03	Int'l Internet bandwidth, kb/s per user	100	4.8
3.04	Secure Internet servers/million pop.	102	3.0
3.05	Accessibility of digital content*	93	4.6
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	135	0.77
4.02	Fixed broadband Internet tariffs, PPP $/month	18	19.56
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	93	3.3
5.02	Quality of math & science education*	65	4.1
5.03	Secondary education gross enrollment rate, %	114	56.1
5.04	Adult literacy rate, %	127	56.1

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	74	100.1
6.02	Individuals using Internet, %	49	49.0
6.03	Households w/ personal computer, %	67	34.2
6.04	Households w/ Internet access, %	65	25.5
6.05	Broadband Internet subscriptions/100 pop.	94	1.6
6.06	Mobile broadband subscriptions/100 pop.	76	2.8
6.07	Use of virtual social networks*	44	5.7
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	74	4.7
7.02	Capacity for innovation*	108	2.6
7.03	PCT patents, applications/million pop.	74	0.6
7.04	Extent of business Internet use*	102	4.5
7.05	Extent of staff training*	74	3.9
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	73	4.6
8.02	Importance of ICT to gov't vision*	52	4.2
8.03	Government Online Service Index, 0–1 (best)	100	0.24
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	113	3.8
9.02	ICT PCT patents, applications/million pop.	64	0.2
9.03	Impact of ICT on new organizational models*	102	3.6
9.04	Knowledge-intensive jobs, % workforce	104	6.8
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	95	4.1
10.02	Internet access in schools*	87	3.8
10.03	ICT use & gov't efficiency*	83	4.0
10.04	E-Participation Index, 0–1 (best)	79	0.13

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Mozambique

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**120**	**3.0**
A. Environment subindex	**108**	**3.4**
1st pillar: Political and regulatory environment	97	3.3
2nd pillar: Business and innovation environment	116	3.5
B. Readiness subindex	**134**	**2.8**
3rd pillar: Infrastructure and digital content	136	2.0
4th pillar: Affordability	105	3.8
5th pillar: Skills	134	2.7
C. Usage subindex	**121**	**2.7**
6th pillar: Individual usage	138	1.6
7th pillar: Business usage	115	3.1
8th pillar: Government usage	91	3.5
D. Impact subindex	**108**	**3.0**
9th pillar: Economic impacts	104	2.8
10th pillar: Social impacts	109	3.1



The Networked Readiness Index in detail

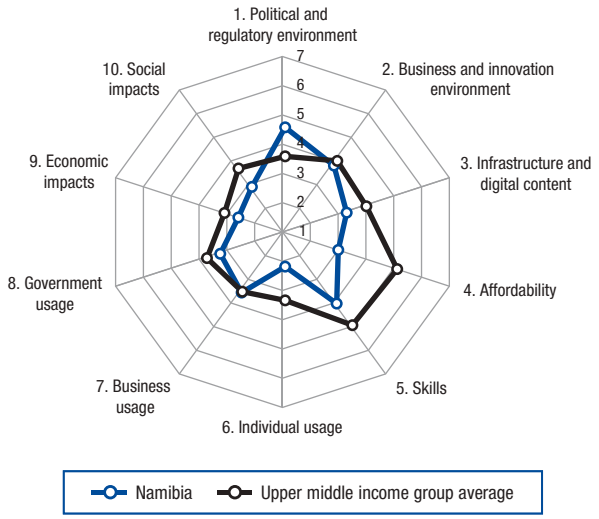
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	69	3.4
1.02	Laws relating to ICT*	109	3.2
1.03	Judicial independence*	114	2.7
1.04	Efficiency of legal system in settling disputes*	90	3.3
1.05	Efficiency of legal system in challenging regs*	94	3.1
1.06	Intellectual property protection*	125	2.5
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	18	30
1.09	No. days to enforce a contract	106	730
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	113	4.3
2.02	Venture capital availability*	122	2.0
2.03	Total tax rate, % profits	51	34.3
2.04	No. days to start a business	58	13
2.05	No. procedures to start a business	97	9
2.06	Intensity of local competition*	129	3.9
2.07	Tertiary education gross enrollment rate, %	138	1.5
2.08	Quality of management schools*	121	3.3
2.09	Gov't procurement of advanced tech*	60	3.7
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	103	677.3
3.02	Mobile network coverage, % pop.	132	32.2
3.03	Int'l Internet bandwidth, kb/s per user	124	1.3
3.04	Secure Internet servers/million pop.	125	0.9
3.05	Accessibility of digital content*	123	3.6
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	114	0.51
4.02	Fixed broadband Internet tariffs, PPP $/month	98	50.39
4.03	Internet & telephony competition, 0–2 (best)	105	1.29
	5th pillar: Skills		
5.01	Quality of educational system*	99	3.2
5.02	Quality of math & science education*	123	2.8
5.03	Secondary education gross enrollment rate, %	137	25.5
5.04	Adult literacy rate, %	131	55.1

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	137	30.9
6.02	Individuals using Internet, %	127	4.2
6.03	Households w/ personal computer, %	110	7.5
6.04	Households w/ Internet access, %	129	1.1
6.05	Broadband Internet subscriptions/100 pop.	125	0.1
6.06	Mobile broadband subscriptions/100 pop.	101	0.4
6.07	Use of virtual social networks*	132	3.8
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	98	4.4
7.02	Capacity for innovation*	127	2.3
7.03	PCT patents, applications/million pop.	119	0.0
7.04	Extent of business Internet use*	104	4.5
7.05	Extent of staff training*	119	3.3
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	66	4.7
8.02	Importance of ICT to gov't vision*	75	3.8
8.03	Government Online Service Index, 0–1 (best)	113	0.17
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	104	4.0
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	106	3.6
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	97	4.0
10.02	Internet access in schools*	122	2.7
10.03	ICT use & gov't efficiency*	90	3.9
10.04	E-Participation Index, 0–1 (best)	88	0.11

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Namibia

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**105**	**3.3**
A. Environment subindex	**44**	**4.2**
1st pillar: Political and regulatory environment	33	4.6
2nd pillar: Business and innovation environment	87	3.8
B. Readiness subindex	**113**	**3.4**
3rd pillar: Infrastructure and digital content	97	3.2
4th pillar: Affordability	126	2.9
5th pillar: Skills	104	4.0
C. Usage subindex	**106**	**3.0**
6th pillar: Individual usage	111	2.2
7th pillar: Business usage	68	3.5
8th pillar: Government usage	108	3.3
D. Impact subindex	**119**	**2.8**
9th pillar: Economic impacts	116	2.7
10th pillar: Social impacts	118	2.9



The Networked Readiness Index in detail

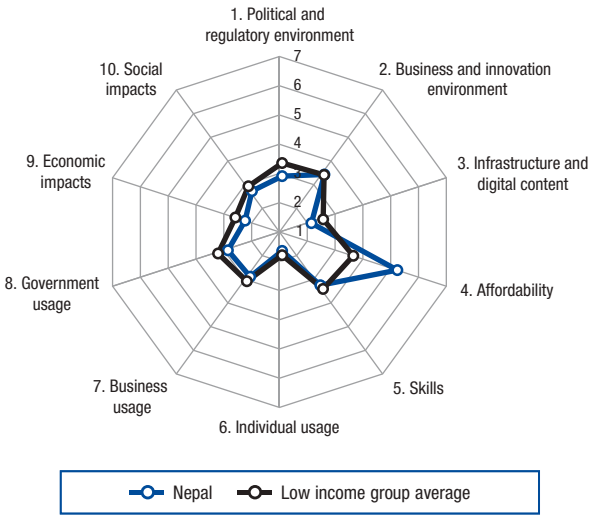
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	35	4.4
1.02	Laws relating to ICT*	92	3.6
1.03	Judicial independence*	39	4.9
1.04	Efficiency of legal system in settling disputes*	29	4.8
1.05	Efficiency of legal system in challenging regs*	27	4.6
1.06	Intellectual property protection*	37	4.6
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	36	33
1.09	No. days to enforce a contract	7	270
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	54	5.4
2.02	Venture capital availability*	76	2.5
2.03	Total tax rate, % profits	3	9.8
2.04	No. days to start a business	130	66
2.05	No. procedures to start a business	110	10
2.06	Intensity of local competition*	87	4.6
2.07	Tertiary education gross enrollment rate, %	113	9.0
2.08	Quality of management schools*	129	3.1
2.09	Gov't procurement of advanced tech*	67	3.6
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	97	953.0
3.02	Mobile network coverage, % pop.	81	95.0
3.03	Int'l Internet bandwidth, kb/s per user	101	4.4
3.04	Secure Internet servers/million pop.	80	14.0
3.05	Accessibility of digital content*	95	4.5
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	58	0.28
4.02	Fixed broadband Internet tariffs, PPP $/month	122	113.43
4.03	Internet & telephony competition, 0–2 (best)	130	0.73
	5th pillar: Skills		
5.01	Quality of educational system*	122	2.8
5.02	Quality of math & science education*	121	2.8
5.03	Secondary education gross enrollment rate, %	106	64.0
5.04	Adult literacy rate, %	91	88.5

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	109	67.2
6.02	Individuals using Internet, %	125	6.5
6.03	Households w/ personal computer, %	96	15.4
6.04	Households w/ Internet access, %	107	3.9
6.05	Broadband Internet subscriptions/100 pop.	108	0.4
6.06	Mobile broadband subscriptions/100 pop.	46	8.8
6.07	Use of virtual social networks*	105	4.6
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	51	5.1
7.02	Capacity for innovation*	102	2.6
7.03	PCT patents, applications/million pop.	85	0.3
7.04	Extent of business Internet use*	83	4.8
7.05	Extent of staff training*	50	4.2
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	56	4.9
8.02	Importance of ICT to gov't vision*	81	3.7
8.03	Government Online Service Index, 0–1 (best)	131	0.07
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	124	3.6
9.02	ICT PCT patents, applications/million pop.	61	0.2
9.03	Impact of ICT on new organizational models*	110	3.5
9.04	Knowledge-intensive jobs, % workforce	87	16.9
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	91	4.1
10.02	Internet access in schools*	111	3.2
10.03	ICT use & gov't efficiency*	121	3.3
10.04	E-Participation Index, 0–1 (best)	129	0.01

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Nepal

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**128**	**2.9**
A. Environment subindex	**125**	**3.2**
1st pillar: Political and regulatory environment	123	2.9
2nd pillar: Business and innovation environment	122	3.5
B. Readiness subindex	**111**	**3.5**
3rd pillar: Infrastructure and digital content	135	2.1
4th pillar: Affordability	74	5.1
5th pillar: Skills	128	3.2
C. Usage subindex	**135**	**2.5**
6th pillar: Individual usage	136	1.6
7th pillar: Business usage	130	2.9
8th pillar: Government usage	128	2.9
D. Impact subindex	**128**	**2.5**
9th pillar: Economic impacts	132	2.3
10th pillar: Social impacts	126	2.8



The Networked Readiness Index in detail

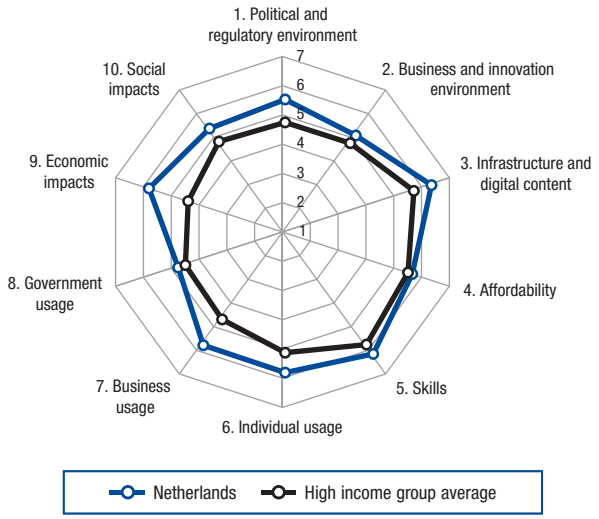
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	133	2.2
1.02	Laws relating to ICT*	127	2.7
1.03	Judicial independence*	92	3.2
1.04	Efficiency of legal system in settling disputes*	117	2.9
1.05	Efficiency of legal system in challenging regs*	96	3.1
1.06	Intellectual property protection*	115	2.6
1.07	Software piracy rate, % software installed	n/a	n/a
1.08	No. procedures to enforce a contract	87	39
1.09	No. days to enforce a contract	125	910
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	114	4.2
2.02	Venture capital availability*	99	2.2
2.03	Total tax rate, % profits	41	31.5
2.04	No. days to start a business	99	29
2.05	No. procedures to start a business	72	7
2.06	Intensity of local competition*	123	4.0
2.07	Tertiary education gross enrollment rate, %	122	5.6
2.08	Quality of management schools*	126	3.2
2.09	Gov't procurement of advanced tech*	133	2.6
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	128	106.7
3.02	Mobile network coverage, % pop.	131	35.1
3.03	Int'l Internet bandwidth, kb/s per user	120	1.7
3.04	Secure Internet servers/million pop.	113	1.5
3.05	Accessibility of digital content*	125	3.6
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	8	0.07
4.02	Fixed broadband Internet tariffs, PPP $/month	100	52.61
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	100	3.2
5.02	Quality of math & science education*	108	3.3
5.03	Secondary education gross enrollment rate, %	122	43.5
5.04	Adult literacy rate, %	125	59.1

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	138	30.7
6.02	Individuals using Internet, %	123	7.9
6.03	Households w/ personal computer, %	123	4.2
6.04	Households w/ Internet access, %	125	1.2
6.05	Broadband Internet subscriptions/100 pop.	116	0.2
6.06	Mobile broadband subscriptions/100 pop.	113	0.0
6.07	Use of virtual social networks*	127	4.1
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	116	4.1
7.02	Capacity for innovation*	129	2.3
7.03	PCT patents, applications/million pop.	112	0.0
7.04	Extent of business Internet use*	122	4.1
7.05	Extent of staff training*	136	2.9
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	124	3.6
8.02	Importance of ICT to gov't vision*	115	3.2
8.03	Government Online Service Index, 0–1 (best)	114	0.17
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	122	3.6
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	116	3.4
9.04	Knowledge-intensive jobs, % workforce	107	4.8
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	127	3.4
10.02	Internet access in schools*	115	3.1
10.03	ICT use & gov't efficiency*	127	3.2
10.04	E-Participation Index, 0–1 (best)	111	0.06

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Netherlands

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**6**	**5.6**
A. Environment subindex	**9**	**5.3**
1st pillar: Political and regulatory environment	8	5.5
2nd pillar: Business and innovation environment	17	5.1
B. Readiness subindex	**11**	**6.0**
3rd pillar: Infrastructure and digital content	10	6.3
4th pillar: Affordability	47	5.6
5th pillar: Skills	8	6.1
C. Usage subindex	**9**	**5.5**
6th pillar: Individual usage	11	5.8
7th pillar: Business usage	8	5.8
8th pillar: Government usage	19	4.8
D. Impact subindex	**5**	**5.6**
9th pillar: Economic impacts	4	5.9
10th pillar: Social impacts	13	5.4



The Networked Readiness Index in detail

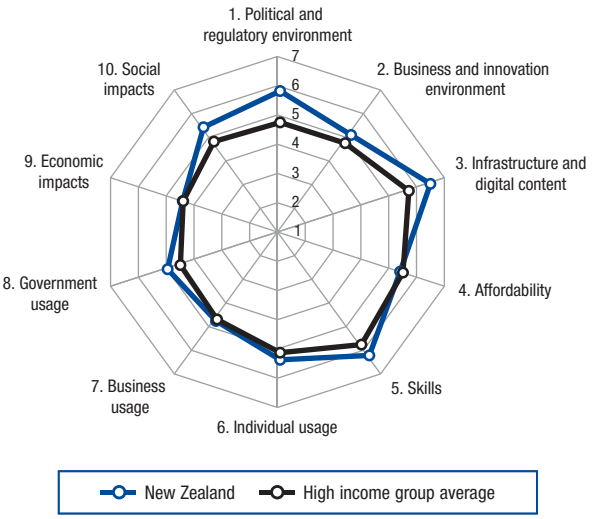
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	17	4.9
1.02	Laws relating to ICT*	11	5.4
1.03	Judicial independence*	6	6.3
1.04	Efficiency of legal system in settling disputes*	9	5.5
1.05	Efficiency of legal system in challenging regs*	7	5.3
1.06	Intellectual property protection*	9	5.8
1.07	Software piracy rate, % software installed	14	28
1.08	No. procedures to enforce a contract	5	26
1.09	No. days to enforce a contract	66	514
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	6	6.5
2.02	Venture capital availability*	14	3.9
2.03	Total tax rate, % profits	76	40.5
2.04	No. days to start a business	33	8
2.05	No. procedures to start a business	46	6
2.06	Intensity of local competition*	6	5.9
2.07	Tertiary education gross enrollment rate, %	28	62.7
2.08	Quality of management schools*	10	5.5
2.09	Gov't procurement of advanced tech*	22	4.3
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	30	6,777.5
3.02	Mobile network coverage, % pop.	70	98.0
3.03	Int'l Internet bandwidth, kb/s per user	6	154.3
3.04	Secure Internet servers/million pop.	2	2,277.1
3.05	Accessibility of digital content*	6	6.4
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	87	0.36
4.02	Fixed broadband Internet tariffs, PPP $/month	54	29.82
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	10	5.2
5.02	Quality of math & science education*	9	5.4
5.03	Secondary education gross enrollment rate, %	3	120.2
5.04	Adult literacy rate, %	15	99.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	50	115.4
6.02	Individuals using Internet, %	3	90.7
6.03	Households w/ personal computer, %	2	92.0
6.04	Households w/ Internet access, %	3	90.9
6.05	Broadband Internet subscriptions/100 pop.	1	38.1
6.06	Mobile broadband subscriptions/100 pop.	50	7.5
6.07	Use of virtual social networks*	9	6.2
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	21	5.7
7.02	Capacity for innovation*	10	5.0
7.03	PCT patents, applications/million pop.	8	202.5
7.04	Extent of business Internet use*	15	6.0
7.05	Extent of staff training*	10	5.1
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	45	5.1
8.02	Importance of ICT to gov't vision*	43	4.3
8.03	Government Online Service Index, 0–1 (best)	12	0.68
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	16	5.4
9.02	ICT PCT patents, applications/million pop.	5	69.3
9.03	Impact of ICT on new organizational models*	11	5.3
9.04	Knowledge-intensive jobs, % workforce	3	47.2
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	17	5.7
10.02	Internet access in schools*	5	6.3
10.03	ICT use & gov't efficiency*	28	5.0
10.04	E-Participation Index, 0–1 (best)	15	0.60

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

New Zealand

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**14**	**5.4**
A. Environment subindex	**4**	**5.5**
1st pillar: Political and regulatory environment	3	5.8
2nd pillar: Business and innovation environment	14	5.1
B. Readiness subindex	**12**	**6.0**
3rd pillar: Infrastructure and digital content	9	6.4
4th pillar: Affordability	63	5.3
5th pillar: Skills	6	6.2
C. Usage subindex	**22**	**5.0**
6th pillar: Individual usage	19	5.3
7th pillar: Business usage	24	4.7
8th pillar: Government usage	14	5.0
D. Impact subindex	**21**	**5.0**
9th pillar: Economic impacts	25	4.5
10th pillar: Social impacts	10	5.5



The Networked Readiness Index in detail

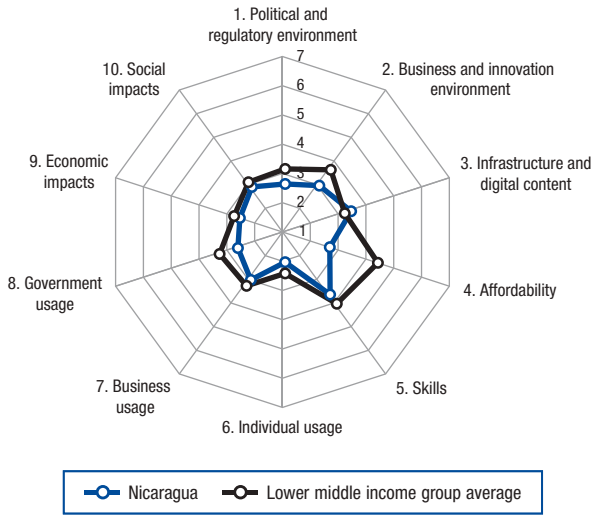
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	3	5.8
1.02	Laws relating to ICT*	13	5.4
1.03	Judicial independence*	1	6.7
1.04	Efficiency of legal system in settling disputes*	4	5.8
1.05	Efficiency of legal system in challenging regs*	6	5.3
1.06	Intellectual property protection*	8	5.8
1.07	Software piracy rate, % software installed	4	22
1.08	No. procedures to enforce a contract	18	30
1.09	No. days to enforce a contract	2	216
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	29	6.0
2.02	Venture capital availability*	26	3.4
2.03	Total tax rate, % profits	52	34.4
2.04	No. days to start a business	1	1
2.05	No. procedures to start a business	1	1
2.06	Intensity of local competition*	45	5.2
2.07	Tertiary education gross enrollment rate, %	7	82.7
2.08	Quality of management schools*	24	5.1
2.09	Gov't procurement of advanced tech*	71	3.6
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	12	10,035.6
3.02	Mobile network coverage, % pop.	76	97.0
3.03	Int'l Internet bandwidth, kb/s per user	50	19.3
3.04	Secure Internet servers/million pop.	7	1,489.5
3.05	Accessibility of digital content*	31	5.9
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	120	0.55
4.02	Fixed broadband Internet tariffs, PPP $/month	16	18.66
4.03	Internet & telephony competition, 0–2 (best)	91	1.53
	5th pillar: Skills		
5.01	Quality of educational system*	9	5.3
5.02	Quality of math & science education*	7	5.5
5.03	Secondary education gross enrollment rate, %	2	124.6
5.04	Adult literacy rate, %	15	99.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	51	114.9
6.02	Individuals using Internet, %	11	83.0
6.03	Households w/ personal computer, %	13	83.9
6.04	Households w/ Internet access, %	15	79.0
6.05	Broadband Internet subscriptions/100 pop.	22	24.9
6.06	Mobile broadband subscriptions/100 pop.	24	18.3
6.07	Use of virtual social networks*	12	6.2
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	17	5.9
7.02	Capacity for innovation*	29	3.8
7.03	PCT patents, applications/million pop.	22	75.2
7.04	Extent of business Internet use*	17	6.0
7.05	Extent of staff training*	23	4.7
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	27	5.4
8.02	Importance of ICT to gov't vision*	19	4.9
8.03	Government Online Service Index, 0–1 (best)	15	0.64
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	32	5.2
9.02	ICT PCT patents, applications/million pop.	22	14.8
9.03	Impact of ICT on new organizational models*	29	4.9
9.04	Knowledge-intensive jobs, % workforce	11	42.9
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	33	5.3
10.02	Internet access in schools*	23	5.8
10.03	ICT use & gov't efficiency*	24	5.1
10.04	E-Participation Index, 0–1 (best)	4	0.77

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Nicaragua

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**131**	**2.8**
A. Environment subindex	**137**	**2.8**
1st pillar: Political and regulatory environment	136	2.7
2nd pillar: Business and innovation environment	134	3.0
B. Readiness subindex	**119**	**3.2**
3rd pillar: Infrastructure and digital content	91	3.4
4th pillar: Affordability	134	2.6
5th pillar: Skills	120	3.6
C. Usage subindex	**132**	**2.6**
6th pillar: Individual usage	118	2.0
7th pillar: Business usage	122	3.0
8th pillar: Government usage	132	2.7
D. Impact subindex	**120**	**2.8**
9th pillar: Economic impacts	118	2.6
10th pillar: Social impacts	119	2.9



The Networked Readiness Index in detail

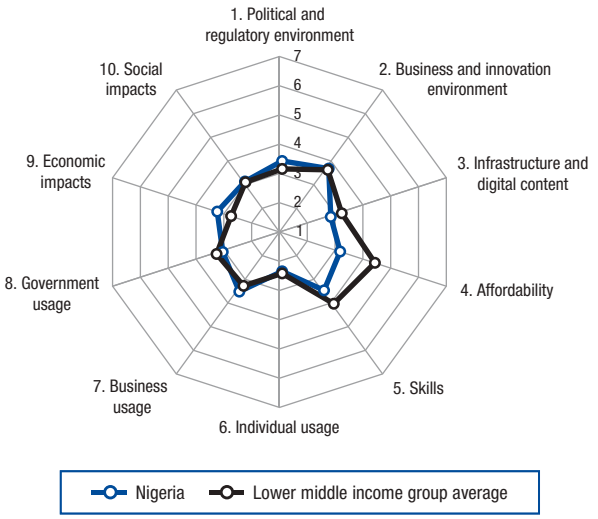
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	138	2.0
1.02	Laws relating to ICT*	128	2.7
1.03	Judicial independence*	136	1.8
1.04	Efficiency of legal system in settling disputes*	134	2.5
1.05	Efficiency of legal system in challenging regs*	139	2.2
1.06	Intellectual property protection*	119	2.6
1.07	Software piracy rate, % software installed	82	79
1.08	No. procedures to enforce a contract	69	37
1.09	No. days to enforce a contract	36	409
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	127	3.9
2.02	Venture capital availability*	111	2.1
2.03	Total tax rate, % profits	129	66.8
2.04	No. days to start a business	117	39
2.05	No. procedures to start a business	86	8
2.06	Intensity of local competition*	118	4.1
2.07	Tertiary education gross enrollment rate, %	95	18.0
2.08	Quality of management schools*	111	3.6
2.09	Gov't procurement of advanced tech*	134	2.6
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	110	596.4
3.02	Mobile network coverage, % pop.	1	100.0
3.03	Int'l Internet bandwidth, kb/s per user	78	8.6
3.04	Secure Internet servers/million pop.	93	7.8
3.05	Accessibility of digital content*	115	4.0
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	127	0.62
4.02	Fixed broadband Internet tariffs, PPP $/month	117	84.96
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	134	2.3
5.02	Quality of math & science education*	136	2.2
5.03	Secondary education gross enrollment rate, %	103	69.4
5.04	Adult literacy rate, %	106	78.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	112	65.1
6.02	Individuals using Internet, %	115	10.0
6.03	Households w/ personal computer, %	109	8.2
6.04	Households w/ Internet access, %	120	2.6
6.05	Broadband Internet subscriptions/100 pop.	102	0.8
6.06	Mobile broadband subscriptions/100 pop.	82	1.8
6.07	Use of virtual social networks*	114	4.4
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	118	4.0
7.02	Capacity for innovation*	111	2.5
7.03	PCT patents, applications/million pop.	119	0.0
7.04	Extent of business Internet use*	129	3.9
7.05	Extent of staff training*	104	3.5
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	137	3.1
8.02	Importance of ICT to gov't vision*	137	2.5
8.03	Government Online Service Index, 0–1 (best)	95	0.25
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	121	3.6
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	109	3.5
9.04	Knowledge-intensive jobs, % workforce	92	14.8
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	125	3.4
10.02	Internet access in schools*	124	2.6
10.03	ICT use & gov't efficiency*	132	2.9
10.04	E-Participation Index, 0–1 (best)	38	0.30

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Nigeria

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**112**	**3.2**
A. Environment subindex	**98**	**3.6**
1st pillar: Political and regulatory environment	91	3.4
2nd pillar: Business and innovation environment	104	3.7
B. Readiness subindex	**123**	**3.1**
3rd pillar: Infrastructure and digital content	119	2.7
4th pillar: Affordability	118	3.1
5th pillar: Skills	123	3.4
C. Usage subindex	**109**	**3.0**
6th pillar: Individual usage	105	2.3
7th pillar: Business usage	77	3.5
8th pillar: Government usage	116	3.1
D. Impact subindex	**88**	**3.2**
9th pillar: Economic impacts	60	3.3
10th pillar: Social impacts	102	3.2



The Networked Readiness Index in detail

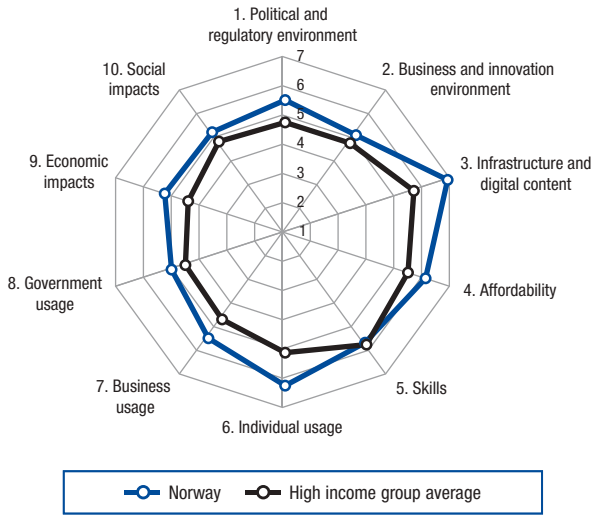
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	77	3.4
1.02	Laws relating to ICT*	81	3.7
1.03	Judicial independence*	73	3.7
1.04	Efficiency of legal system in settling disputes*	55	3.9
1.05	Efficiency of legal system in challenging regs*	58	3.8
1.06	Intellectual property protection*	104	2.8
1.07	Software piracy rate, % software installed	90	82
1.08	No. procedures to enforce a contract	97	40
1.09	No. days to enforce a contract	50	457
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	107	4.4
2.02	Venture capital availability*	104	2.2
2.03	Total tax rate, % profits	44	32.7
2.04	No. days to start a business	109	34
2.05	No. procedures to start a business	86	8
2.06	Intensity of local competition*	73	4.8
2.07	Tertiary education gross enrollment rate, %	110	10.3
2.08	Quality of management schools*	80	4.0
2.09	Gov't procurement of advanced tech*	105	3.2
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	125	140.1
3.02	Mobile network coverage, % pop.	97	90.0
3.03	Int'l Internet bandwidth, kb/s per user	138	0.1
3.04	Secure Internet servers/million pop.	115	1.2
3.05	Accessibility of digital content*	108	4.3
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	101	0.43
4.02	Fixed broadband Internet tariffs, PPP $/month	120	102.88
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	65	3.8
5.02	Quality of math & science education*	102	3.4
5.03	Secondary education gross enrollment rate, %	121	44.0
5.04	Adult literacy rate, %	124	60.8

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	122	55.1
6.02	Individuals using Internet, %	85	28.4
6.03	Households w/ personal computer, %	97	15.4
6.04	Households w/ Internet access, %	93	9.0
6.05	Broadband Internet subscriptions/100 pop.	124	0.1
6.06	Mobile broadband subscriptions/100 pop.	88	1.0
6.07	Use of virtual social networks*	66	5.2
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	79	4.7
7.02	Capacity for innovation*	54	3.2
7.03	PCT patents, applications/million pop.	116	0.0
7.04	Extent of business Internet use*	107	4.5
7.05	Extent of staff training*	58	4.1
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	111	4.0
8.02	Importance of ICT to gov't vision*	72	3.9
8.03	Government Online Service Index, 0–1 (best)	127	0.10
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	53	4.8
9.02	ICT PCT patents, applications/million pop.	95	0.0
9.03	Impact of ICT on new organizational models*	61	4.2
9.04	Knowledge-intensive jobs, % workforce	n/a	n/a
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	60	4.5
10.02	Internet access in schools*	104	3.3
10.03	ICT use & gov't efficiency*	95	3.8
10.04	E-Participation Index, 0–1 (best)	129	0.01

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Norway

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**7**	**5.6**
A. Environment subindex	**10**	**5.3**
1st pillar: Political and regulatory environment	9	5.5
2nd pillar: Business and innovation environment	16	5.1
B. Readiness subindex	**6**	**6.2**
3rd pillar: Infrastructure and digital content	4	6.8
4th pillar: Affordability	20	6.0
5th pillar: Skills	34	5.6
C. Usage subindex	**6**	**5.6**
6th pillar: Individual usage	3	6.2
7th pillar: Business usage	9	5.5
8th pillar: Government usage	13	5.1
D. Impact subindex	**13**	**5.3**
9th pillar: Economic impacts	11	5.3
10th pillar: Social impacts	17	5.2



The Networked Readiness Index in detail

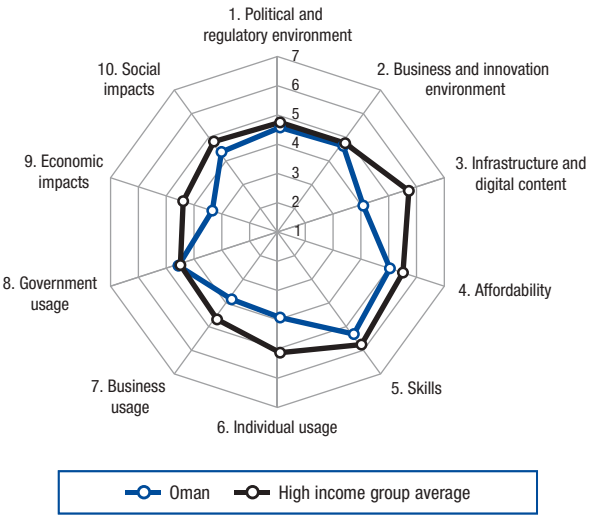
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	10	5.3
1.02	Laws relating to ICT*	9	5.5
1.03	Judicial independence*	9	6.3
1.04	Efficiency of legal system in settling disputes*	6	5.6
1.05	Efficiency of legal system in challenging regs*	10	5.2
1.06	Intellectual property protection*	12	5.6
1.07	Software piracy rate, % software installed	16	29
1.08	No. procedures to enforce a contract	41	34
1.09	No. days to enforce a contract	9	280
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	3	6.6
2.02	Venture capital availability*	3	4.4
2.03	Total tax rate, % profits	82	41.6
2.04	No. days to start a business	24	7
2.05	No. procedures to start a business	28	5
2.06	Intensity of local competition*	32	5.4
2.07	Tertiary education gross enrollment rate, %	16	73.8
2.08	Quality of management schools*	28	5.0
2.09	Gov't procurement of advanced tech*	43	4.0
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	2	27,298.9
3.02	Mobile network coverage, % pop.	76	97.0
3.03	Int'l Internet bandwidth, kb/s per user	12	109.6
3.04	Secure Internet servers/million pop.	6	1,652.5
3.05	Accessibility of digital content*	8	6.4
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	17	0.10
4.02	Fixed broadband Internet tariffs, PPP $/month	66	33.18
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	22	4.8
5.02	Quality of math & science education*	76	3.9
5.03	Secondary education gross enrollment rate, %	9	110.2
5.04	Adult literacy rate, %	15	99.0

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	49	115.7
6.02	Individuals using Internet, %	2	93.4
6.03	Households w/ personal computer, %	3	90.9
6.04	Households w/ Internet access, %	5	89.8
6.05	Broadband Internet subscriptions/100 pop.	5	35.3
6.06	Mobile broadband subscriptions/100 pop.	7	52.5
6.07	Use of virtual social networks*	6	6.2
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	5	6.1
7.02	Capacity for innovation*	17	4.5
7.03	PCT patents, applications/million pop.	11	143.8
7.04	Extent of business Internet use*	11	6.1
7.05	Extent of staff training*	5	5.4
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	34	5.3
8.02	Importance of ICT to gov't vision*	32	4.5
8.03	Government Online Service Index, 0–1 (best)	7	0.74
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	8	5.6
9.02	ICT PCT patents, applications/million pop.	12	36.6
9.03	Impact of ICT on new organizational models*	5	5.4
9.04	Knowledge-intensive jobs, % workforce	9	43.5
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	11	5.9
10.02	Internet access in schools*	17	5.9
10.03	ICT use & gov't efficiency*	22	5.2
10.04	E-Participation Index, 0–1 (best)	21	0.50

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Oman

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**40**	**4.4**
A. Environment subindex	**36**	**4.6**
1st pillar: Political and regulatory environment	34	4.6
2nd pillar: Business and innovation environment	31	4.7
B. Readiness subindex	**70**	**4.7**
3rd pillar: Infrastructure and digital content	69	4.0
4th pillar: Affordability	82	4.9
5th pillar: Skills	50	5.3
C. Usage subindex	**40**	**4.1**
6th pillar: Individual usage	51	3.9
7th pillar: Business usage	46	3.8
8th pillar: Government usage	29	4.7
D. Impact subindex	**42**	**3.9**
9th pillar: Economic impacts	55	3.4
10th pillar: Social impacts	38	4.4



The Networked Readiness Index in detail

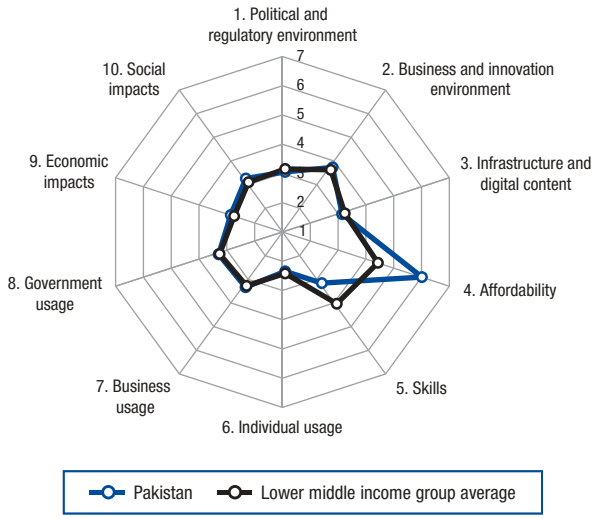
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	8	5.3
1.02	Laws relating to ICT*	30	5.0
1.03	Judicial independence*	33	5.1
1.04	Efficiency of legal system in settling disputes*	15	5.0
1.05	Efficiency of legal system in challenging regs*	26	4.6
1.06	Intellectual property protection*	21	5.3
1.07	Software piracy rate, % software installed	55	62
1.08	No. procedures to enforce a contract	137	51
1.09	No. days to enforce a contract	88	598
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	45	5.5
2.02	Venture capital availability*	16	3.9
2.03	Total tax rate, % profits	15	22.0
2.04	No. days to start a business	33	8
2.05	No. procedures to start a business	28	5
2.06	Intensity of local competition*	54	5.1
2.07	Tertiary education gross enrollment rate, %	83	24.5
2.08	Quality of management schools*	97	3.7
2.09	Gov't procurement of advanced tech*	12	4.5
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	36	5,961.8
3.02	Mobile network coverage, % pop.	73	97.6
3.03	Int'l Internet bandwidth, kb/s per user	93	6.1
3.04	Secure Internet servers/million pop.	62	27.7
3.05	Accessibility of digital content*	41	5.5
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	51	0.24
4.02	Fixed broadband Internet tariffs, PPP $/month	96	47.90
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	46	4.2
5.02	Quality of math & science education*	68	4.0
5.03	Secondary education gross enrollment rate, %	25	101.3
5.04	Adult literacy rate, %	96	86.6

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	8	165.5
6.02	Individuals using Internet, %	38	62.0
6.03	Households w/ personal computer, %	55	45.6
6.04	Households w/ Internet access, %	63	27.7
6.05	Broadband Internet subscriptions/100 pop.	93	1.6
6.06	Mobile broadband subscriptions/100 pop.	28	16.7
6.07	Use of virtual social networks*	72	5.2
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	49	5.2
7.02	Capacity for innovation*	57	3.2
7.03	PCT patents, applications/million pop.	78	0.4
7.04	Extent of business Internet use*	42	5.4
7.05	Extent of staff training*	42	4.3
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	19	5.5
8.02	Importance of ICT to gov't vision*	11	5.2
8.03	Government Online Service Index, 0–1 (best)	53	0.37
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	47	4.8
9.02	ICT PCT patents, applications/million pop.	82	0.0
9.03	Impact of ICT on new organizational models*	44	4.5
9.04	Knowledge-intensive jobs, % workforce	54	24.3
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	24	5.5
10.02	Internet access in schools*	44	4.8
10.03	ICT use & gov't efficiency*	16	5.3
10.04	E-Participation Index, 0–1 (best)	73	0.16

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Pakistan

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**102**	**3.4**
A. Environment subindex	**112**	**3.4**
1st pillar: Political and regulatory environment	110	3.1
2nd pillar: Business and innovation environment	96	3.8
B. Readiness subindex	**97**	**4.0**
3rd pillar: Infrastructure and digital content	108	3.0
4th pillar: Affordability	26	5.9
5th pillar: Skills	129	3.1
C. Usage subindex	**107**	**3.0**
6th pillar: Individual usage	104	2.3
7th pillar: Business usage	96	3.3
8th pillar: Government usage	103	3.4
D. Impact subindex	**94**	**3.1**
9th pillar: Economic impacts	94	3.0
10th pillar: Social impacts	99	3.3



The Networked Readiness Index in detail

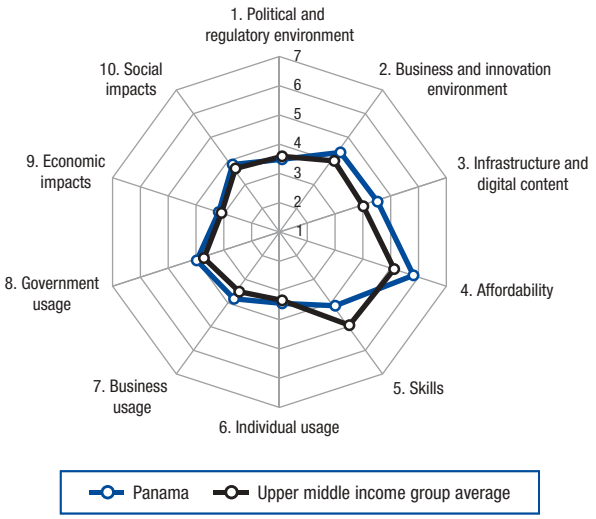
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	93	3.0
1.02	Laws relating to ICT*	112	3.2
1.03	Judicial independence*	62	3.9
1.04	Efficiency of legal system in settling disputes*	102	3.1
1.05	Efficiency of legal system in challenging regs*	79	3.4
1.06	Intellectual property protection*	93	3.1
1.07	Software piracy rate, % software installed	96	84
1.08	No. procedures to enforce a contract	126	46
1.09	No. days to enforce a contract	128	976
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	93	4.6
2.02	Venture capital availability*	45	2.9
2.03	Total tax rate, % profits	58	35.3
2.04	No. days to start a business	87	21
2.05	No. procedures to start a business	110	10
2.06	Intensity of local competition*	91	4.5
2.07	Tertiary education gross enrollment rate, %	124	5.4
2.08	Quality of management schools*	79	4.0
2.09	Gov't procurement of advanced tech*	91	3.4
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	111	547.2
3.02	Mobile network coverage, % pop.	94	92.0
3.03	Int'l Internet bandwidth, kb/s per user	112	2.6
3.04	Secure Internet servers/million pop.	121	1.0
3.05	Accessibility of digital content*	86	4.7
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	4	0.05
4.02	Fixed broadband Internet tariffs, PPP $/month	79	37.37
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	79	3.5
5.02	Quality of math & science education*	87	3.6
5.03	Secondary education gross enrollment rate, %	129	34.2
5.04	Adult literacy rate, %	129	55.5

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	121	57.1
6.02	Individuals using Internet, %	98	16.8
6.03	Households w/ personal computer, %	101	13.0
6.04	Households w/ Internet access, %	95	8.0
6.05	Broadband Internet subscriptions/100 pop.	111	0.3
6.06	Mobile broadband subscriptions/100 pop.	n/a	n/a
6.07	Use of virtual social networks*	95	4.8
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	92	4.5
7.02	Capacity for innovation*	51	3.3
7.03	PCT patents, applications/million pop.	113	0.0
7.04	Extent of business Internet use*	111	4.3
7.05	Extent of staff training*	109	3.5
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	103	4.1
8.02	Importance of ICT to gov't vision*	92	3.5
8.03	Government Online Service Index, 0–1 (best)	97	0.25
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	97	4.0
9.02	ICT PCT patents, applications/million pop.	93	0.0
9.03	Impact of ICT on new organizational models*	81	3.9
9.04	Knowledge-intensive jobs, % workforce	75	19.5
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	113	3.8
10.02	Internet access in schools*	90	3.7
10.03	ICT use & gov't efficiency*	105	3.6
10.04	E-Participation Index, 0–1 (best)	66	0.17

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Panama

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**57**	**4.0**
A. Environment subindex	**61**	**3.9**
1st pillar: Political and regulatory environment	84	3.5
2nd pillar: Business and innovation environment	48	4.4
B. Readiness subindex	**69**	**4.7**
3rd pillar: Infrastructure and digital content	55	4.4
4th pillar: Affordability	39	5.7
5th pillar: Skills	102	4.1
C. Usage subindex	**56**	**3.8**
6th pillar: Individual usage	64	3.4
7th pillar: Business usage	48	3.8
8th pillar: Government usage	55	4.1
D. Impact subindex	**61**	**3.6**
9th pillar: Economic impacts	65	3.3
10th pillar: Social impacts	59	3.9



The Networked Readiness Index in detail

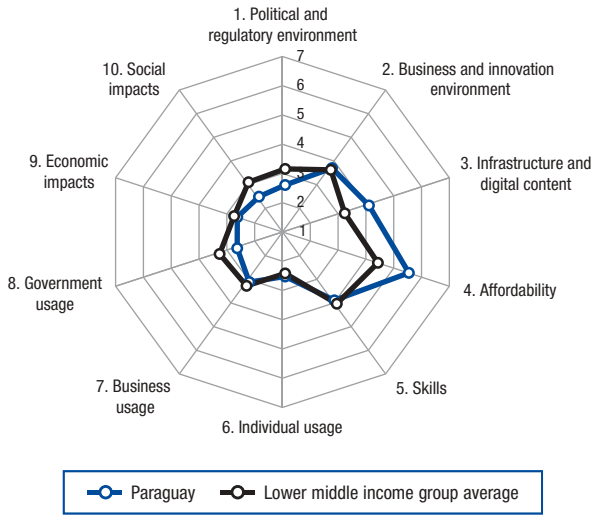
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	124	2.4
1.02	Laws relating to ICT*	37	4.7
1.03	Judicial independence*	133	2.1
1.04	Efficiency of legal system in settling disputes*	61	3.8
1.05	Efficiency of legal system in challenging regs*	95	3.1
1.06	Intellectual property protection*	39	4.2
1.07	Software piracy rate, % software installed	71	72
1.08	No. procedures to enforce a contract	27	31
1.09	No. days to enforce a contract	102	686
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	28	6.0
2.02	Venture capital availability*	33	3.2
2.03	Total tax rate, % profits	94	45.2
2.04	No. days to start a business	33	8
2.05	No. procedures to start a business	46	6
2.06	Intensity of local competition*	43	5.2
2.07	Tertiary education gross enrollment rate, %	56	44.6
2.08	Quality of management schools*	105	3.6
2.09	Gov't procurement of advanced tech*	46	4.0
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	82	1,887.6
3.02	Mobile network coverage, % pop.	96	90.7
3.03	Int'l Internet bandwidth, kb/s per user	47	21.3
3.04	Secure Internet servers/million pop.	43	126.8
3.05	Accessibility of digital content*	62	5.1
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	47	0.23
4.02	Fixed broadband Internet tariffs, PPP $/month	56	30.89
4.03	Internet & telephony competition, 0–2 (best)	68	1.86
	5th pillar: Skills		
5.01	Quality of educational system*	131	2.4
5.02	Quality of math & science education*	134	2.4
5.03	Secondary education gross enrollment rate, %	100	74.1
5.04	Adult literacy rate, %	70	93.6

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	4	184.7
6.02	Individuals using Internet, %	61	42.8
6.03	Households w/ personal computer, %	86	19.8
6.04	Households w/ Internet access, %	84	11.8
6.05	Broadband Internet subscriptions/100 pop.	59	7.8
6.06	Mobile broadband subscriptions/100 pop.	84	1.6
6.07	Use of virtual social networks*	27	5.9
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	32	5.5
7.02	Capacity for innovation*	98	2.7
7.03	PCT patents, applications/million pop.	77	0.4
7.04	Extent of business Internet use*	41	5.5
7.05	Extent of staff training*	43	4.3
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	48	5.0
8.02	Importance of ICT to gov't vision*	34	4.5
8.03	Government Online Service Index, 0–1 (best)	85	0.28
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	44	4.9
9.02	ICT PCT patents, applications/million pop.	70	0.1
9.03	Impact of ICT on new organizational models*	43	4.5
9.04	Knowledge-intensive jobs, % workforce	84	17.7
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	46	4.8
10.02	Internet access in schools*	56	4.5
10.03	ICT use & gov't efficiency*	45	4.6
10.04	E-Participation Index, 0–1 (best)	92	0.11

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Paraguay

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**111**	**3.3**
A. Environment subindex	**126**	**3.2**
1st pillar: Political and regulatory environment	138	2.6
2nd pillar: Business and innovation environment	102	3.7
B. Readiness subindex	**82**	**4.4**
3rd pillar: Infrastructure and digital content	67	4.0
4th pillar: Affordability	56	5.4
5th pillar: Skills	109	3.9
C. Usage subindex	**119**	**2.8**
6th pillar: Individual usage	100	2.5
7th pillar: Business usage	116	3.1
8th pillar: Government usage	131	2.7
D. Impact subindex	**126**	**2.6**
9th pillar: Economic impacts	112	2.7
10th pillar: Social impacts	131	2.5



The Networked Readiness Index in detail

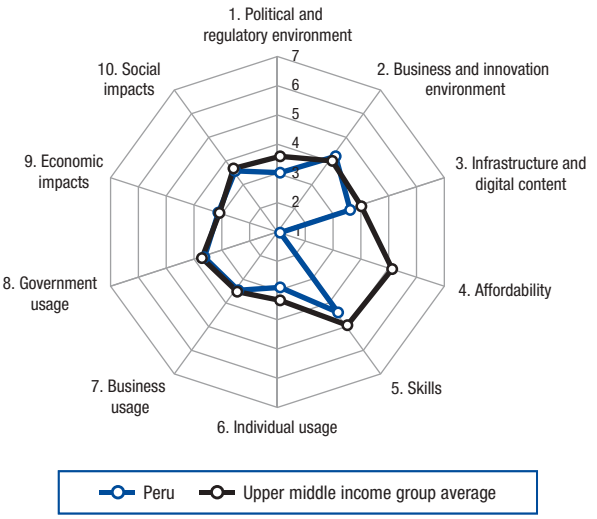
	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	134	2.2
1.02	Laws relating to ICT*	123	2.8
1.03	Judicial independence*	138	1.8
1.04	Efficiency of legal system in settling disputes*	125	2.7
1.05	Efficiency of legal system in challenging regs*	124	2.7
1.06	Intellectual property protection*	133	2.3
1.07	Software piracy rate, % software installed	93	83
1.08	No. procedures to enforce a contract	78	38
1.09	No. days to enforce a contract	85	591
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	109	4.3
2.02	Venture capital availability*	69	2.6
2.03	Total tax rate, % profits	55	35.0
2.04	No. days to start a business	112	35
2.05	No. procedures to start a business	72	7
2.06	Intensity of local competition*	100	4.4
2.07	Tertiary education gross enrollment rate, %	67	36.6
2.08	Quality of management schools*	130	3.1
2.09	Gov't procurement of advanced tech*	128	2.8
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	15	8,902.4
3.02	Mobile network coverage, % pop.	91	94.0
3.03	Int'l Internet bandwidth, kb/s per user	81	8.3
3.04	Secure Internet servers/million pop.	96	6.7
3.05	Accessibility of digital content*	117	3.9
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	75	0.32
4.02	Fixed broadband Internet tariffs, PPP $/month	70	34.22
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	138	2.2
5.02	Quality of math & science education*	137	2.2
5.03	Secondary education gross enrollment rate, %	105	66.9
5.04	Adult literacy rate, %	67	94.6

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	82	91.7
6.02	Individuals using Internet, %	97	19.8
6.03	Households w/ personal computer, %	87	19.3
6.04	Households w/ Internet access, %	81	13.8
6.05	Broadband Internet subscriptions/100 pop.	107	0.4
6.06	Mobile broadband subscriptions/100 pop.	63	4.3
6.07	Use of virtual social networks*	113	4.5
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	110	4.2
7.02	Capacity for innovation*	116	2.4
7.03	PCT patents, applications/million pop.	98	0.1
7.04	Extent of business Internet use*	112	4.3
7.05	Extent of staff training*	101	3.5
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	141	2.9
8.02	Importance of ICT to gov't vision*	132	2.7
8.03	Government Online Service Index, 0–1 (best)	92	0.26
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	107	3.9
9.02	ICT PCT patents, applications/million pop.	84	0.0
9.03	Impact of ICT on new organizational models*	94	3.7
9.04	Knowledge-intensive jobs, % workforce	94	14.0
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	130	3.3
10.02	Internet access in schools*	133	2.3
10.03	ICT use & gov't efficiency*	119	3.4
10.04	E-Participation Index, 0–1 (best)	129	0.01

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.

Peru

	Rank (out of 142)	Score (1–7)
Networked Readiness Index 2012	**106**	**3.3**
A. Environment subindex	**93**	**3.6**
1st pillar: Political and regulatory environment	114	3.0
2nd pillar: Business and innovation environment	56	4.2
B. Readiness subindex	**129**	**3.0**
3rd pillar: Infrastructure and digital content	86	3.5
4th pillar: Affordability	141	1.0
5th pillar: Skills	99	4.4
C. Usage subindex	**81**	**3.3**
6th pillar: Individual usage	85	2.9
7th pillar: Business usage	85	3.4
8th pillar: Government usage	73	3.7
D. Impact subindex	**76**	**3.4**
9th pillar: Economic impacts	72	3.2
10th pillar: Social impacts	75	3.6



The Networked Readiness Index in detail

	INDICATOR	RANK /142	VALUE
	1st pillar: Political and regulatory environment		
1.01	Effectiveness of law-making bodies*	140	1.9
1.02	Laws relating to ICT*	79	3.7
1.03	Judicial independence*	119	2.6
1.04	Efficiency of legal system in settling disputes*	107	3.0
1.05	Efficiency of legal system in challenging regs*	90	3.2
1.06	Intellectual property protection*	122	2.5
1.07	Software piracy rate, % software installed	67	68
1.08	No. procedures to enforce a contract	106	41
1.09	No. days to enforce a contract	45	428
	2nd pillar: Business and innovation environment		
2.01	Availability of latest technologies*	64	5.1
2.02	Venture capital availability*	38	3.0
2.03	Total tax rate, % profits	77	40.7
2.04	No. days to start a business	93	26
2.05	No. procedures to start a business	28	5
2.06	Intensity of local competition*	55	5.1
2.07	Tertiary education gross enrollment rate, %	70	35.0
2.08	Quality of management schools*	43	4.7
2.09	Gov't procurement of advanced tech*	98	3.3
	3rd pillar: Infrastructure and digital content		
3.01	Electricity production, kWh/capita	93	1,139.4
3.02	Mobile network coverage, % pop.	75	97.1
3.03	Int'l Internet bandwidth, kb/s per user	80	8.5
3.04	Secure Internet servers/million pop.	77	14.2
3.05	Accessibility of digital content*	91	4.6
	4th pillar: Affordability		
4.01	Mobile cellular tariffs, PPP $/min.	141	1.27
4.02	Fixed broadband Internet tariffs, PPP $/month	110	75.40
4.03	Internet & telephony competition, 0–2 (best)	1	2.00
	5th pillar: Skills		
5.01	Quality of educational system*	128	2.6
5.02	Quality of math & science education*	135	2.4
5.03	Secondary education gross enrollment rate, %	56	91.6
5.04	Adult literacy rate, %	89	89.6

	INDICATOR	RANK /142	VALUE
	6th pillar: Individual usage		
6.01	Mobile phone subscriptions/100 pop.	73	100.1
6.02	Individuals using Internet, %	76	34.3
6.03	Households w/ personal computer, %	80	22.7
6.04	Households w/ Internet access, %	80	14.0
6.05	Broadband Internet subscriptions/100 pop.	82	3.1
6.06	Mobile broadband subscriptions/100 pop.	62	4.5
6.07	Use of virtual social networks*	79	5.1
	7th pillar: Business usage		
7.01	Firm-level technology absorption*	62	4.9
7.02	Capacity for innovation*	99	2.7
7.03	PCT patents, applications/million pop.	88	0.2
7.04	Extent of business Internet use*	88	4.7
7.05	Extent of staff training*	75	3.9
	8th pillar: Government usage		
8.01	Gov't prioritization of ICT*	101	4.2
8.02	Importance of ICT to gov't vision*	93	3.5
8.03	Government Online Service Index, 0–1 (best)	44	0.41
	9th pillar: Economic impacts		
9.01	Impact of ICT on new services and products*	52	4.8
9.02	ICT PCT patents, applications/million pop.	96	0.0
9.03	Impact of ICT on new organizational models*	56	4.4
9.04	Knowledge-intensive jobs, % workforce	79	18.5
	10th pillar: Social impacts		
10.01	Impact of ICT on access to basic services*	71	4.3
10.02	Internet access in schools*	76	3.9
10.03	ICT use & gov't efficiency*	72	4.1
10.04	E-Participation Index, 0–1 (best)	66	0.17

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale. For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 171.