

Executive Summary

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The pace of technological innovation throughout the global community is relentlessly pushing forward. Ray Kurzweil, the American futurist, has observed that “In the nineteenth century, we saw more technological change than in the nine centuries preceding it. Then in the first twenty years of the twentieth century, we saw more advancement than in all of the nineteenth century. Now, paradigm shifts occur in only a few years time.... So we won’t experience 100 years of progress in the 21st century—it will be more like 20,000 years of progress (at today’s rate).”¹ Such a stunning assertion, assuming it proves true, has significant implications for how we lead our day-to-day lives and pursue our daily work. It means the capacity to adjust to unprecedented change at all levels of human experience will be the new paradigm not only for success but for survival. It means becoming constantly innovative individuals, workers, and citizens.

Technology has long had an important impact on innovation and the development of societies and economies. This impact can be visualized as occurring in three stages. In the first stage of “substitution,” new technology substitutes for the old. For example, with the invention of the mobile telephone, consumers start substituting their fixed telephone lines with mobile telephones. The second stage of impact is “diffusion,” which occurs when the new technology is adopted widely across society because it is cheaper, better, and in general more effective than the previous technology. Continuing with the example of the mobile telephone, there are many countries in the world today where the number of mobile telephones exceeds the population of the country. The final stage of impact is “transformation,” which occurs when new ways of living and working start emerging because the new technology is diffused so widely in society. For example, the widespread adoption of the mobile telephone has led to interesting innovations in the communication patterns of individuals—such as executives conducting business while waiting in airport lounges or traveling in trains.

Keeping the above three-stage model in mind, one can argue that we are at a critical stage of transformation in society and business with new (Internet-based) information and communication technologies (ICT). For example, mobile telephones are not only creating innovative patterns of social and business communication but are

also becoming sources of entrepreneurial business generation. Grameen phone is contributing to poverty reduction in Bangladesh by giving mobile telephones (with adequate training and backup system support) to women who turn into entrepreneurs by providing communications services to their respective village societies. The penetration of the Internet has reached a critical threshold, and even poor countries in Africa are moving actively to leverage the transformational potential of the global information architecture created by the Internet. Ethiopia, despite being one of the continent’s poorest countries, is spending nearly one tenth of its GDP on information technology every year. Hundreds of government offices and schools have already been equipped with broadband Internet connections, and more are yet to come. Both government and private sector leaders in Ethiopia—in an astonishing example of forging headlong into the “global village”—have committed huge resources to seeing that by 2007 all of Ethiopia’s 74 million people live no more than a few kilometers from a broadband connection. Mozambique is using information technology to improve governance and public administration while guarantying its citizens greater access to the benefits of a global knowledge base.

The Global Information Technology Report 2006–2007 makes its appearance at a critical juncture in the impact of ICT on the world economy. There is growing evidence that ICT is driving innovation by allowing creative thinking and responsive problem-solving to provide the promise of never-before-seen opportunities for all. Access to the global networked economy is becoming an important cornerstone of the development of economies and societies. It is against this background of optimism about the innovations and transformations induced by connecting to the global networked economy that this *Report* is being published. It builds on the work of the five previous editions, and thus it may be seen as part of a long-term commitment at both the World Economic Forum and INSEAD to the dissemination of business-relevant research on information technology issues with a strong practical focus.

The *Report* is composed of four thematic parts. Part 1 features the results of the Networked Readiness Index 2006–2007 and related analysis, together with a number of thoughtful essays on selected issues of networked readiness

of particular relevance for today's world, written by eminent academics and knowledgeable industry experts and practitioners. These essays cover topics ranging from the opportunities and challenges brought about by next-generation telecommunications networks, to the several ways in which networks impact our every day life, the e-readiness of cities, and the moral dilemma multilateral corporations experience when dealing with Internet filtering regimes. Part 2 groups together a series of insightful country or regional case-studies under the common theme of access to ICT, considering sub-Saharan Africa, Estonia, Japan, and China. The distinguished authors relate the ICT policies and practices implemented in the country/region covered and present the challenges ahead. Part 3 provides detailed profiles for each of the 122 economies covered in the *Report*, displaying valuable background information on each economy's current networked readiness status and allowing for international and historical comparison on specific variables or components of the NRI.

Last but not least, Part 4 provides detailed data tables for each of the 67 variables composing the NRI this year, with global rankings.

Part 1: Selected Issues of Networked Readiness

Each year, *The Global Information Technology Report* selects a few issues that have with a particular relevance for countries' networked readiness. This year we look closely at four special areas: (1) networks and changes in every day life, (2) generation networks in telecommunications, (3) cities' e-government and global competition, and (4) filtered Internet and the moral dilemma for multinational corporations.

The Networked Readiness Index

In Chapter 1.1, "Connecting the World to the Networked Economy: A Progress Report Based on the Findings of the Networked Readiness Index 2006–2007," we present the latest findings of a research project undertaken by the World Economic Forum in 2001—and jointly with INSEAD since 2002—aimed at gauging countries' capacity to leverage ICT for growth and development. This year's *Report* assesses a record number of 122 economies all over the world, 7 countries more than last year and almost the double the number of countries covered in the very first edition in 2000.

Based on a mixture of hard data, collected from well-respected international organizations such as the International Telecommunication Union (ITU) and the World Bank, and survey data coming from the Executive Opinion Survey conducted annually by the World Economic Forum in each of the economies covered by the *Report*, the Networked Readiness Index (NRI)

measures the level of ICT development of nations, looking at a large number of relevant variables—67 this year.

The networked readiness framework used for the analysis is constant from one year to the next. It rests on three main subindexes, capturing:

- the presence of an ICT-conducive environment in a given country by assessing a number of features of the broad business environment, some regulatory aspects, and the soft and hard infrastructure for ICT;
- the level of ICT readiness and propensity of the three main national stakeholders—individuals, the business sector, and the government; and
- the actual use of ICT by the above three stakeholders.

The NRI rankings for 2006–2007 are broadly in line with those of last year, published in *The Global Information Technology Report 2005–2006*. Denmark is emerging as the world's leader in networked readiness this year, culminating an upward trend observed since 2003. The same upward trend can be seen for all other Nordic countries but Iceland, with Finland, Sweden, and Norway all gaining positions this year.

Among the top 20, the United States loses its top position and drops to 7th place, overtaken not only by Denmark but also by Sweden, which comes in at 2nd place this year, with Singapore at 3rd place, Finland at 4th, Switzerland at 5th, and the Netherlands at 6th. The latter, in particular, realizes the greatest improvement from last year (6 positions up). Also Estonia, at 20th, for the first time enters the top-20 league.

With respect to the largest Asian emerging markets, China (59th) and India (44th) are both losing ground from previous year, with a 9- and 4-position drop respectively. Most Latin American and Caribbean countries register encouraging improvements this year, with Jamaica (45th), Mexico (49th), Costa Rica (56th), Uruguay (60th), Argentina (63rd), the Dominican Republic (66th), Peru (78th), and Guatemala (79th) all gaining several positions. Africa is unfortunately experiencing an opposite trend, with all countries but Nigeria, Tunisia, and Algeria going down in the rankings, while the Middle East, led by Israel (18th) posts a rather stable showing.

The chapter provides some analysis of the trends in networked readiness at the global level, comparing regions in terms of aggregate ICT performance. It also explores the links between networked readiness and overall competitiveness, looking at countries by stages of development—the principal methodological tool used by the Forum to gauge national competitiveness.

Networks and changes in everyday life

In their paper “Networks Changing the Way We Work, Live, Play, and Learn,” authors Roger Farnsworth, Lionel Gibbons, Tracey Lewis, and Marsha Powell (all at Cisco Systems, Inc.) relate the dramatic advancements in ICT that have created great opportunities for people around the world to change the way they work, live, play, and learn.

Each era of technological advancement since the Industrial Revolution—from steam engines and railways to steel and electricity, and oil and automobiles—has enabled businesses to expand their commerce and production globally. Today’s innovators, however, are using ICT to completely rethink how they use information, and they are designing new business models and new capabilities that integrate dispersed partners and coworkers who network closely with each other daily.

In this new business environment, teams are formed not by traditional hierarchical organization or geography, but rather on an ad hoc footing based on the skills and expertise of individuals. Employees become members of fluid teams, empowered by collaborative tools and corresponding processes.

The impact on the individual is profound. Work is no longer a place to go but something people do. Network connectivity and collaboration tools give people the flexibility to work anytime from anywhere, for a better balance between their work and personal lives.

Governments worldwide are employing ICT to deliver more services to citizens at less cost and to improve their networking capabilities. The major challenges they face, especially in emerging countries, are finding investment capital, setting regulations for security and interoperability, and providing Internet access to and educating citizens. Citizens, at the same time, are seeking the same types of electronic entertainment they’ve sought for years—television, movies, games. Today’s technologies, such as IPTV and mobile TV, personalize that entertainment in ways that let consumers pick and choose what they want, when they want it. These new capabilities also make good business sense, providing fresh revenue opportunities for service providers, cheaper ways to distribute movies for theaters, and so on.

In education, IP networks are turning the traditional classroom into virtual schoolhouses that deliver education to remote students, life-long learners, and others. Essentially, education has been transformed from a teacher-led class to a student-centric experience accentuated by self-learning; peer-to-peer teaching; rich, readily available content; greater accessibility; and discovery-based learning.

The authors point out that this ICT revolution is still young. We can look forward to technology advances to change the way we work, live, play, and learn in exciting new ways far into the future.

Generation networks in telecommunications

In “Opportunities and Challenges of Next-Generation Networks in Telecommunications,” authors Scott Beardsley, Luis Enriquez, Mehmet Guvendi, Duarte Braga, Wim Torfs, and Sergio Sandoval (all at McKinsey & Company Inc.) discuss the opportunities and challenges of deploying next-generation networks (NGNs) for telecommunications providers.

Many telecommunications operators around the world are keen to capture the benefits of building NGNs—benefits such as reducing operational costs and increasing the speed of product development. However, NGNs also pose significant risks for operators, as they will require huge investments in infrastructure and could potentially erode fixed-voice revenues—on which the industry is still highly dependent—by changing the traditional way of pricing these services.

The urgency of capturing these benefits while at the same time weighing the risks has caused some of the regulatory and business battles we have seen over the conditions under which industry investments should be made. The authors argue that the prominence of this debate has obscured the fact that overall capital expenditure (CAPEX) investment in the telecommunications industry today is significantly higher than NGN investments alone. However, if the debate is not handled properly, it could affect the overall CAPEX investment of the industry.

Regulators will play a key role in mitigating or increasing the risks operators face. The authors argue that regulators should look for an alternative policy framework—one that recognizes the impact of NGN and regulation on the overall structure of the industry—instead of simply looking at the new issues through the same old regulatory lens. Operators, regulators, and other industry stakeholders must work together to manage the transition to NGNs successfully. This might be the only way that investors will be encouraged to invest, and that industry stakeholders and society can capture the full benefits NGNs have to offer.

Cities’ e-government and global competition

By 2050 some 6 billion people (two-thirds of the world population) will live in cities. Most of the growth will take place in developing countries, where the urban population will double in 30 years, from 2 billion in 2000 to 4 billion in 2030. In less than 10 years from now, most of the “mega-cities” emerging from that process will be located in developing countries.

In their paper “The Next Frontier of E-Government: Local Governments May Hold the Keys to Global Competition,” Bruno Lanvin and Anat Lewin (both at the World Bank) illustrate some of the main challenges brought about by the increasingly important role of cities, as opposed to central governments, all over the world.

Indeed, the above projections raise questions regarding the ability of the cities of the future to sustain extremely high growth rates while maintaining adequate levels of production and delivery of key public services such as water, transport, electricity, sanitation, education, and containment of crime and pollution. There is, however, another side to this equation, often overlooked. It relates to the emerging role of cities (and subnational entities generally) that are becoming global players—as attractors of foreign investment, as competitiveness hubs, and as platforms for the combination of local and international components of global production and supply chains.

The next few years will see the convergence of three major trends: (1) the continuing delegation of functions and responsibilities from central to local governments; (2) the maturation of outsourcing strategies, both domestically (from the public to the private sector, including through PPPs) and internationally (through off-shoring and near-shoring); and (3) the emergence of local global players (LGPs), such as major cities and economic centers, as global competitors and magnets for talents and investments. The chapter outlines some of the foreseeable consequences of such a convergence, and their implications for decision makers, public and private, central and local.

Based on some of the most recent data available, it offers a world mapping of e-government performance, comparing the performances of LGPs with those of their respective countries. Some unexpected results emerge from that analysis, calling for a radically new way to consider, analyze, and build competitiveness at the local and central levels. However, the results obtained also point to the need for a significant effort (locally, centrally, and at the international level) to collect relevant data and build relevant indicators. A strong call is made by the authors to build internationally comparable indicators of networked readiness and e-readiness at the local level, in particular for cities.

Filtered Internet and the moral dilemma for multinational corporations

In his paper “Reluctant Gatekeepers: Corporate Ethics on a Filtered Internet,” Harvard Law School professor John G. Palfrey, Jr., deals with the issue of Internet filtering and the ethical issues multinational corporations doing business related to the Internet face.

As multinational corporations enter new markets, they come across states that practice sophisticated forms of online censorship and surveillance. The number of states with such regimes in place has risen sharply over the past five years, from a small handful to roughly three dozen as of 2007. The job of online censorship and surveillance is difficult for the state to manage itself, if not altogether impossible. In order to carry out these regimes, then, states turn to private firms that can provide the tools necessary

to effect the censorship and surveillance. These private firms—which should not be lumped together in terms of their ethical obligations, but rather disaggregated—include hardware manufacturers, software firms, online service providers, and local access providers, among others. The ethical problem arises when the corporation is asked to do something at odds with the ethical framework of the corporation’s home state. Should a search engine firm agree to censor its search results as a condition of doing business in a new place? Should an email service provider turn over the names of its subscribers to the government of a foreign state without knowing what that government is looking for? Should a blog service provider code its application so as to disallow someone from typing a “banned” term into a subject line?

These questions—prompted by the hard cases that lie between simple acts of law enforcement and clear violations of international norms—are not easily answered through legislation or international treaty. Law is most likely not the primary answer. Traditional legal mechanisms will take so long to put in place that the contours of the problem will have changed beyond recognition by the time of enactment. Changes to the statute or treaty may be equally hard-won. Laws fashioned in this fast-moving environment will function as a hopelessly trailing indicator. The corporations themselves, as an industry, are best placed to work together to resolve this tension by adopting a code of conduct to govern their activities in these increasingly common situations. Palfrey argues that the corporations should call upon the knowledge and goodwill of NGOs, academics, states, and others to help to frame this code of conduct and to make it a meaningful, flexible, and lasting solution.

Part 2: Access to ICT: Selected Case Studies

This year’s *Report* presents four case studies of the impact of ICT in different parts of the world. Estonia, sub-Saharan Africa, Japan, and China were chosen because each represents a clear instance of the dramatic effect of and access to ICT, and each can provide guidelines or lessons learned that can prove helpful to both developed and emerging economies.

E-ready Estonia and the challenges ahead

In his chapter “Estonia: A Sustainable Success in Networked Readiness?” Soumitra Dutta provides a compelling account of the accomplishments of Estonia’s e-leadership strategy in recent times—which propelled the country to find itself among the top 20 performers in the NRI this year—considering the factors for its success as well as the challenges that it faces in sustaining its success over the next years. Indeed, an astonishing amount of innovation has

emerged from Estonia, a country of 1.4 million inhabitants that has regained independence less than 20 years ago.

E-leadership has proven to be instrumental in helping Estonia through the painful transition from centralized state planning to the model of modern governance it is today. Estonia has pioneered and developed unique solutions and systems that have become an integral part of the life of most Estonians. Estonia's clear vision and leadership in ICT have led to results that often surpass those achieved by the older democracies of Western Europe. This is especially remarkable when one notes that the nation was ruled by foreign powers—including Denmark, Germany, Sweden, and Russia—for centuries. The merger of e-leadership and political vision has been one of the critical factors in its economic growth, its embrace of democracy, and its resulting accession to the European Union.

Leadership from the top has been vital for the success of Estonia. Maart Laar, the Prime Minister of Estonia from 1992 to 2002, and his key advisers spearheaded the development of ICT in the country. Not only has the government created a supportive policy environment for ICT, it has also been a pioneer in using ICT for its own processes. In 2000, the Estonian parliament approved a proposal to guarantee Internet access to each of its citizens, just like any other constitutional right. People all over the country can access the Internet free of charge from hundreds of public access points.

Nevertheless, Dutta notices that all is not perfect in the land of e-cabinets, Skype, mobile payments, and electronic ID cards. Despite many major and very visible successes, Estonia still faces a number of challenges and must overcome certain weaknesses. The question that remains open today is whether the country can leverage its knowledge and best practices and turn this advance into a truly a sustainable model. For example, Estonia's business environment is dominated by small- and medium-sized businesses that are often suppliers to international companies and do not invest sufficiently in basic research and development (R&D). The success of everyday mobile applications in Estonia masks the low level of R&D investment (0.8 percent of GDP 2005) in the country. Further, about three-quarters of this R&D funding comes from public sources (compared with about two-thirds of R&D funding from private sources in other European nations).

Communications services in sub-Saharan Africa

The impact of ICT on economic development and growth is well documented in the literature, yet there is the perception that sub-Saharan Africa may have missed the boat vis-à-vis other regions, such as Asia, which have been more successful in reaping the gains from the relocation and globalization of activities enabled by ICT. In his chapter "Access to Communications Services in Sub-Saharan

Africa," IMF economist Markus Haacker sheds lights on the real contribution ICT is making to economic development in the region, focusing specifically on the determinants of access to communications services and their implications for doing business in the region and for sub-Saharan Africa's advantageous insertion in the global economy.

Starting with an analysis of what drives investment decisions for mobile telephone services providers in the region, the author observes that there is a role for policy (a license is required for market entry), but that the value of such a license and the decision about entry is driven by market size. He then introduces data on the number of providers and discusses some aspects of market structure (such as the increase of the number of providers since the age of "fixed-lines only" and the presence of international providers).

For the determinants of access to communications services, Haacker suggests that the higher extent of competition introduced by mobile telephone services has resulted in lower prices for these services while also providing improved access to them. He also discusses the viability of mobile telephone services in an environment characterized by less-developed financial services and weak contract enforcement. Mobile telephone technology, which facilitates use of pre-paid services, works where fee-based subscriptions may not work (because of the ease of financial transfers and the absence of contract-enforcement issues, for example); indeed, mobile telephone technologies sometimes enable financial transactions ("e-payments") other than payment for telephone services.

In conclusion, the chapter finds that sub-Saharan Africa has indeed not benefited to the same extent as some Asian countries from the global transformations directly enabled by improved communications technologies (with the exception of some sectors, such as textiles). However, from a microeconomic standpoint, Africa *disproportionally* benefits from advances in ICT, in terms of improved access to these services. Consequently, advances in ICT have substantially contributed to the ease of doing business in Africa, with direct implications for productivity and growth, and have greatly enhanced the potential for growth through enhanced participation in the global economy.

Information and communications policy in Japan

Although ICT usage in Japan lagged behind that of other advanced nations in the 1990s, Japan has recently emerged as one of the world's most advanced broadband communications societies. This is primarily a consequence of the high penetration of broadband technologies such as fiber optic cable for household use. As a result of competition, a number of DSL customers switched to fiber optic cable. In addition, Japan's mobile telephones have the highest

Internet access rate (87 percent) in the world, and over 60 percent of these mobile telephones are 3rd-generation telephones. Mobile telephones in Japan can be used not only for e-mail, downloading music, and playing games, but also for taking high-resolution photos and movies, watching television, using electronic money, and purchasing electronic tickets. Finally, broadband fees in Japan are the lowest in the world (100 kilobytes cost US\$0.07 a month).

In their chapter “Information and Communications Technologies Policy in Japan: Meeting the Challenges Ahead,” Hideo Shiimizu, Kuniko Ogawa, and Koichi Fujinuma (all at the Ministry of Internal Affairs and Communications, Japan) explore the ICT strategy adopted by the Japanese government in 2000. This strategy enabled and triggered the above advancements, significantly raising the country’s level of networked readiness. The authors also consider the direction in which ICT is heading in that country.

Acknowledging the importance of ICT for economic growth, in 2000 the Japanese government adopted a framework IT law setting specific targets with the aim of turning Japan into the most advanced ICT country in the world. This law enabled the adoption of different e-Japan strategies that fostered ICT use and penetration in different areas. In December 2004, building on the achievements of the previous e-strategies, a u-Japan Policy was adopted in order to create an ubiquitous networked society by 2010. The u-Japan Policy is focused on ensuring broadband access for everybody and on making Japan’s communications infrastructure totally broadband capable.

As Japan evolves into an increasingly networked society, some challenges—such as Internet privacy and security issues and the need to upgrade competition laws, among others—have emerged that will need to be addressed urgently in the near future,

The rise of China as an ICT giant

One of the most remarkable developments observed in recent years has to do with China’s extraordinary rise as a world leader in the production and use of ICT. In “Made in China: Information Technologies and the Internet,” Graham Vickery and Sacha Wunsch-Vincent (both at the OECD) give an exhaustive account of China’s ICT success story, looking also at future trends and main challenges in the years to come.

Starting from the supply side, the authors point out that China has become one of the most important locations in the world for the assembly and production of ICT, a feature mainly driven by foreign firms. Since 2004, China has been the biggest exporter of ICT goods, surpassing Japan and the European Union in 2003 and taking the lead from the United States. Since then, Chinese ICT exports have continued to grow at an astonishing pace, and its strong ICT exports continued until early 2006.

China continues to import electronic components—now increasingly from other Asian countries—while exporting computers and related equipment. The increase in ICT exports can mostly be traced to the transfer to China of foreign companies’ often low-value-added assembly and production activities. Recently, even ICT firms from Taiwan and Hong Kong have moved manufacturing to mainland China to reduce costs. OECD countries are benefiting from low-cost ICT assembly in China, which is adding to lower global ICT prices—and thus to increased ICT use and associated productivity gains across industries.

However, there is mounting evidence that ICT-related foreign affiliates are evolving from simple assembly and manufacturing to more complex original design and production and to fulfilling more important roles in global innovation networks. In spite of their relatively limited size and technological know-how, Chinese ICT firms are rapidly developing their production and export capacities (especially in the area of telecommunications equipment). The Chinese ICT industry faces the challenge of making a successful transition from being low-cost manufacturers to becoming global providers of higher-value-added products and services. The Chinese government has recently begun to encourage Chinese companies to invest overseas to gain technology, brands, and distribution channels.

On the demand and use side, China is now the sixth most important global ICT market, although it still lags in the area of ICT services. Personal computer penetration and Internet access and use (including e-commerce) are developing rapidly, albeit from low per capita levels. In general, ICT spending as a percentage of GDP is lower in China (about 4.5 percent of GDP in 2005) than in leading OECD economies (where it was about 9 percent of GDP in 2005), but it is catching up rapidly as Chinese firms increase their IT capital stock—especially in sectors outside manufacturing, and as household consumption increases. The sheer scale of the Chinese ICT market and its potential to serve as a self-supporting base for industrial development are a key difference from other countries that have climbed the ICT value ladder. But, as highlighted by the authors, the production of ICT is not helping China to reap its full benefits. ICT uptake in Chinese firms, its efficient integration in value chains, and complementary innovations (such as organizational restructuring and investment in skills) are lagging. To benefit fully from ICT, its integration in the Chinese economy and society should be high on the Chinese policy agenda.

Parts 3 and 4: Country/Economy Profiles and Data Presentation

Parts 3 and 4 include detailed profiles for each of the 122 economies covered in the *Report* and data tables for each of the 67 variables composing the NRI, with global

rankings. Each part is preceded by a description of how to interpret the data provided. Technical notes and sources, included at the end of Part 4, provide details on the characteristics and sources of the individual hard variables included in the *Report*.

Notes

1 See Kurzweil (2001).

References

Kurzweil, R. 2001. "The Law of Accelerating Returns." *KurzweilAI.net*. Available at www.kurzweilai.net/articles/art0134.html?printable=1.