"Never before in history has innovation offered promise of so much to so many in so short a time."

— Bill Gates

Chapter 1.1

The Innovation Capacity Index: Factors, Policies, and Institutions Driving Country Innovation

Augusto López-Claros,
EFD–Global Consulting Network

Yasmina N. Mata,
Consultant

Introduction

The relative importance of various drivers of economic growth and prosperity has evolved over time and, for a growing number of countries, innovation, in its many dimensions, is emerging now as a leading factor.[1] This chapter discusses the role of innovation in enhancing the development process. In particular, it features the Innovation Capacity Index, a methodological tool that examines a broad array of factors, policies, and institutions that have a bearing on strengthening innovation in a large number of countries, including their institutional environment, their human capital endowment, the presence of social inclusion, the regulatory and legal framework, the infrastructure for research and development, and the adoption and use of information and communication technologies, among others. The primary aim is to offer a didactic tool for policy dialogue on various dimensions of innovation. As will be shown, the methodologies developed allow the formulation of policy prescriptions that are country-specific, based on a nation's stage of development, and the nature of its political regime.

This chapter is divided as follows: Section 1 presents a brief historical overview of the role of innovation in economic and social development, with particular emphasis on its role in boosting factor productivity. In Section 2, we examine some of the factors which appear to be essential for the creation of an environment that will encourage innovation and the types of initiatives that will contribute in some way to boosting productivity and, hence, economic growth. Implicit in Section 2 is the idea that as countries have managed to sort out some of the more basic building blocks of development (macroeconomic stability, reasonably working institutions, and the creation of predictable mechanisms for social protection), they have had to give increasing attention to the role of technology and innovation as the primary engines of productivity growth.[2] The content of this section, which draws on insights

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[2] In this respect, our approach and arguments have some of the flavor found in Rostow (1960) and Porter (1990) and of their analysis and discussion of the central themes of the stages of economic growth. A thoughtful application of these concepts can also be found in Sala-i-Martin and Artadi (2004).

in economic theory and practice accumulated during the past half century, will be central to determining the major building blocks of the Innovation Capacity Index (ICI) featured later in the chapter. Section 3 presents a brief overview of international benchmarking as a means of enhancing analysis and policy dialogue in a number of important areas. Against the background of this discussion and the vast international experience acquired thus far with benchmarking exercises, Section 4 goes on to present the Innovation Capacity Index and to discuss various dimensions of its architecture. Section 5 presents the main results of the ICI for 2009, with particular reference to a handful of countries: Sweden, Chile, India, Russia, and Taiwan, which are seen as exhibiting some especially interesting features, or as suggesting patterns that may be of broader interest. Finally, we present our main conclusions and discuss the way forward.

1. Innovation: A brief historical overview

David Landes (1998) gives several examples of scientific innovation in Europe of the Middle Ages which contributed to substantially enhancing labor productivity. Eyeglasses significantly lengthened the working life of skilled workers. He notes that a medieval craftsman of 40 years of age could realistically expect—provided he could see well—to work for another 20 years, a development made possible by the invention of spectacles, which greatly boosted the productivity of toolmakers, weavers, metalworkers, scribes, and others who depended on their eyesight to do fine work. The first eyeglasses appeared in Pisa around the end of the 13th century. Although these early spectacles were initially not particularly accurate, by the middle of the 15th century, "Florentines at least understood that visual acuity declines with age and so made the convex lenses in five-year strengths and the concave in two, enabling users to buy in batches and change with time" (p. 47). More significantly, eyeglasses not only prolonged the productive working life of large numbers of people, but, in doing so—in a fascinating case of reverse causation—they also encouraged the invention of a whole battery of new precision instruments (e.g., gauges and micrometers), which could not have been invented, had workers not been able to see particularly well, thus laying "the basis for articulated machines with fitted parts" (p. 47).[3]

The mechanical clock is characterized by Landes as "the greatest achievement of medieval mechanical ingenuity" (p. 49), both for its revolutionary conception (the first instance of a digital as opposed to an analog device) but, equally important, because it permitted the ordering of life in the cities in ways that had a major impact on productivity. "Indeed, the very notion of productivity is a by-product of the clock: once one can relate performance to uniform time units, work is never the same" (p. 49–50). It was the invention of the mechanical clock which in turn led to one of Adam Smith's seminal insights: wealth and prosperity depend directly—to use Smith's language—on the "productive powers of labor."[4]

Printing was a Chinese invention in the ninth century, but it did not take off in a major way until it made its way to Europe several centuries later. Landes notes that "much publication depended on government initiative, and the Confucian mandarinate discouraged dissent and new ideas (p. 51)." In Europe, in contrast, written manuscripts had been much in demand for centuries before Gutenberg printed the first Bible in 1452–55, and after the arrival of movable type had led to an explosion of printed materials. In Italy alone, more than 2 million books were printed before 1501. Other cultures, however, took longer to accept this new technological innovation. According to Landes, the Muslim countries found the idea of a printed Koran unacceptable, leaving the operation of printing presses in Istanbul to Jews and Christians, but not Muslims. Indians, likewise, did not adopt the new technology until the early 19th century when the first printing presses made their appearance. In Europe, in sharp contrast, not even the Church was able to restrain the new technology and all its uses. In all of these examples, one sees innovations spreading gradually, sometimes over several decades, "diffusing across countries and regions as people moved up learning curves and gained efficiency through practicing and improving the new techniques" (Goldstone, 1996).

An interesting question concerns the factors that may help create an environment that nurtures the capacity for inno-

[3] Indeed, Adam Smith himself had noted this feedback mechanism in his *Wealth of Nations*. "This great increase in the quantity of work, which, in consequence of the division of labor, the same number of people are capable of performing, is owing to three different circumstances; first, to the increase of dexterity in every particular workman; secondly, to the saving of the time which is commonly lost in passing from one species of work to another; and lastly, to the invention of the great number of machines which facilitate and abridge labor, and enable one man to do the work of many" (p. 7). But then he adds that "the invention of all those machines by which labor is so much facilitated and abridged" is itself the result of the improvements in productivity made possible by the division of labor.

[4] Smith, 1994, p. 5.

vation. Two cultures that showed great promise of playing a leading role in advancing the cause of scientific discovery and innovation were those of Islam and China, and it is instructive to say a few words about each. There seems to be little doubt that in the 400-year period to 1100, as noted by Landes, "Islamic science and technology far surpassed those of Europe, which needed to recover its heritage and do so to some extent through contacts with Muslims in such frontier areas as Spain. Islam was Europe's teacher." [5, 6]

Gradually, after the year 1100, Islamic science came to a standstill as the faith was taken over by zealots, and the emphasis within the community shifted to one of conformity and obedience to its rulers, itself facilitated by the non-separation of the church and the state. Not surprisingly, "native springs of invention seem to have dried up."[7]

The case of China is equally fascinating because, at a time when Europe was a backwater of scientific enquiry, Chinese inventions—printing, paper, the compass, gunpowder, porcelain, silk, the use of coal and coke for smelting iron—suggested the existence of great technological potential. Why China failed to realize this potential and in the next several centuries fell hopelessly behind Europe is an intriguing question. Several explanations have been put forward by sinologists, among which the role of the state figures prominently. At one level, the lack of a well-defined framework for property rights and the absence of a free market seem to have been lethal. "The Chinese state was always interfering with private enterprise—taking over lucrative activities, prohibiting others, manipulating prices, exacting bribes, curtailing private enrichment."[8] During the Ming dynasty (1368–1644), serious attempts were made to shut down all trade with the outside world, efforts which in turn led to the proliferation of smuggling, rent-seeking, corruption, and violence.

The sinologist Etienne Balazs puts the blame for China's still-born technological prowess squarely on the emergence of totalitarian control:

> The word 'totalitarian' has a modern ring to it, but it serves well to describe the scholar-officials' state if it is understood to mean that the state has *complete control over all activities* (emphasis in original), absolute domination at all levels… Nothing escaped official regimentation. Trade, mining, building, ritual, music, schools, in fact the whole of public life and a great deal of private life as well, were subjected to it … A final totalitarian characteristic was the state's tendency to clamp down immediately on any form of private enterprise (and this in the long run kills not only initiative but even the slightest attempts at innovation), or, if it did not succeed in putting a stop to it in time, to take over and nationalize it … Most probably the main inhibiting cause was the intellectual climate of Confucianist orthodoxy, not at all favorable for any form of trial or experiment, for innovations of any kind, or for the free play of the mind. The bureaucracy was perfectly satisfied with traditional techniques. Since these satisfied its practical needs, there was nothing to stimulate any attempt to go beyond the concrete and the immediate.[9]

At least one author has suggested that an additional factor in explaining the abortive nature of China's technological potential stemmed from the confinement of women to the home, which severely restricted the employment of women outside of the household and limited the supply of workers to labor-intensive industries, such as textiles.[10]

Potential innovators in Europe were considerably less subject to such constraints. What was more important: Europe had entered an era of free enterprise. "Innovation worked and paid, and rulers and vested interests were limited in their ability to prevent or discourage innovation. Success bred imitation and emulation."[11] It led to the establishment of scientific societies and formal programs of scientific enquiry and, in time, created a culture of innovation and research which saw

[5] Landes, p. 54.

[6] An early example of Islamic innovation is provided by Sells (1999): "At the time Muhammad was reciting the first Qur'anic revelations to a skeptical audience in the town of Mecca, several developments were leading to a transformation of Arabia's place in the world. One was a technological revolution. Sometime around the period of Muhammad's life, the Bedouin developed a new kind of camel saddle that allowed their camels to carry previously unimagined weight. Camels, which had been used largely for milk and transport of individuals and small loads, became the center of a transportation revolution. Within a hundred years, the Hellenistic and Roman worlds of transport and commerce, based on donkey carts and the upkeep of roads, were replaced by camel caravans. And the Bedouin in Arabia, who had been traders with and raiders of the established civilizations, were to control the vehicle of trade and commerce in the Western world: the dromedary camel." (Sells, 1999, p. 7).

[7] Landes, p. 55.

[8] Idem, p. 56.

[9] Balazs, Etienne, 1964, pp. 13–27.

[10] Goldstone, 1996. He further states: "In northwest Europe, with its pattern of late marriages and nuclear families, there existed a stage in the life course of most women—between puberty in their early teens and marriage in their mid-twenties—when they were available for labor and routinely performed work for wages outside their natal households. *No such stage existed in the life course of Chinese women, at least from the Ming through the end of the Imperial era (to 1911)* (emphasis in original). This would have posed a great obstacle to the creation of textile factories along the lines of their development in Europe and North America at any time in China's late Imperial history" (p. 3).

[11] Landes, p. 59.

the progress of science and technology as powerful engines of economic and social development.[12]

2. Factors, policies and institutions fostering innovation[13]

The broader context

Development as a *global* objective for improving the economic well-being of ordinary people is a relatively recent concept. It was first embodied in the UN Charter, which said: "the United Nations shall promote higher standards of living, full employment, and conditions of economic and social progress and development."[14] While this may be the first instance of a specific commitment on the part of the international community to promoting "development," the UN Charter does not itself define what are to be the defining elements of economic and social progress. In time—at least among practicing economists in academia and policymakers in government—it was interpreted to imply improved economic opportunity through increased production of goods and services in ever more efficient ways or, to use economic jargon, capital formation and rising productivity. The implicit assumption was that growth would lead to rising living standards, increases in longevity, reduced mortality, improved nutrition and literacy, and so on.

Between 1950 and 2007, world GDP/capita expanded at an annual average rate of 2.1 percent and this expansion—although with considerable variation over different regions of the world [15]—was associated with a remarkable evolution in three key indicators of human welfare. In particular, in the near half-century between 1960 and 2007

- Infant mortality fell from 140 to 44 per 1000 live births;
- Average life expectancy at birth rose from 43 to 66 years;
- Illiteracy (percent of adults) fell from 53 to 18 percent.

It is perhaps equally impressive that there was a sharp drop in the incidence of poverty. Data from a comprehensive study done at the World Bank shows that, between 1981 and 2001, the globalization phase of the 20th century, the share of the world's population living in extreme poverty fell from 40.4 percent to 21.1 percent.[16] While this still left about 1.1 billion people living under harsh conditions,[17] the existence of a positive trend was undeniable and, against the low expectations of the late 1940s, was a welcome development. As noted by Richard Cooper,

> performance in the period 1950–2000 can only be described as fantastic in terms of the perspective of 1950, in the literal sense that if someone had forecast what actually happened he would have been dismissed by contemporaries as living in a world of fantasy…There is, to be sure, much work to be done, since too many people still live in poverty. But it is also necessary to note success when there has been success, to avoid drawing erroneous conclusions. [18]

[12] For an excellent overview of innovation in the financial world, from the early days of money lending in Venice in the 14th century, through the gradual emergence of credit and currency markets under the Medici, to the appearance of bond, insurance, and real estate markets elsewhere in Europe, see Ferguson, 2008.

[13] There have been some attempts to define "innovation." For the OECD, for instance, innovation is "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations." (OECD and European Communities, 2005, p. 46). We are sympathetic to the view that any definition is likely to be constraining and is unlikely to apply and be meaningful when seen in the context of several thousand years of recorded history. In the context of this study, we think of innovation as the creative use of knowledge to allow individuals (and, by extension, corporations and nation-states) "to go farther, faster, deeper and cheaper" (Friedman, 1999). In most instances, innovation will involve a rise in factor productivity and, hence, other things being equal, living standards.

[14] "Charter of the United Nations and Statute of the International Court of Justice" available at: http://www.un.org/aboutun/charter/ This is not to suggest that individual countries, particularly during the period of empire building which began in the 15th century and stretched to the second half of the 20th were not, in some fashion, committed to the development of those lands and peoples under their control. According to Landes (1998), even the East India Company recognized the need—for the company's sake—to protect the welfare of those it saw as having fallen under its care. "India was compared to a landed estate where the interests of tenant and landlord were the same" (p. 163). (See also Landes' fuller discussion of colonialism on pages 422–441).

[15] For instance, Asia grew at 3.4 percent, but sub-Saharan Africa at 1.0 percent. Other regions include Western Europe (2.8 percent), Latin America (1.6 percent), Eastern Europe (2 percent), former USSR (1 percent), U.S., Canada, and Australia (2.2 percent). For a comprehensive set of economic and social indicators see, for instance, World Bank, 2008b.

[16] See Chen and Ravallion, 2008.

[17] Poverty is defined by the World Bank as living on less than US$2 per day; for extreme poverty the threshold is lowered to US$1 per day. The number of people living in extreme poverty in 1981 was 1.5 billion, or 400 million more than in 2001. Nevertheless, while accepting these figures, Joseph Stiglitz makes the valid point that "life for people this poor is brutal," with malnutrition endemic, life expectancy well below the global average, and medical care scarce or non-existent. (Stiglitz, 2006, p. 10).

[18] Cooper, 2004b, p. 39. Many critics of development practices during the past half century will tend to focus on the unfinished agenda, the fact that, notwithstanding the gains made during this period, there is still too much poverty in the world and that this poverty coexists uncomfortably with rising income disparities. Some of these critics call into question the very approach to development taken by such institutions as the World Bank and the International Monetary Fund and the aid agencies of the large donor countries, which also happen to be the largest shareholders of these two development organizations. Often, calls are made for "a new development model," although it is not spelled out what that development model should consist of and, equally important, whether such calls have any practical, conceptual, and political underpinnings. For a particularly incisive, well thought out, non-dogmatic, and unusually pragmatic analysis of the problems of the 58 poorest countries in the world and what the international community can do about it, see Collier, 2007.

The observation that economic growth had been the main engine of poverty reduction and other improvements in human welfare led many to ask themselves what could be done to accelerate growth everywhere, particularly in Africa, where the incidence of poverty actually rose during this period.[19, 20] The question acquired particular urgency among policymakers in the developing world, given the pressing needs to continue to make progress in improving living standards, against the background of rising expectations among their respective populations.

These numbers led notable economists like William Easterly (2002) to say that a key priority for policymakers should be "to discover the means by which poor countries in the tropics could become rich like the rich countries in Europe and North America." In a highly influential book published in 2002, he said that he cared about economic growth because "it makes the lives of poor people better… [and] frees the poor from hunger and disease." He then proceeded to show that growth improves infant mortality, and that, for instance, in Africa 500,000 deaths could have been averted if growth in the decade of the 1980s had been 1.5 percent higher.

The above insights, in turn, have led to a remarkable re-examination among professional economists and policymakers about the relative importance of various factors in creating the conditions for sustainable growth, including the role of institutions, education and social inclusion, the quality of governance, of macroeconomic management, of public administration, the presence of economic opportunities, and the increasingly crucial role of technology and innovation in enhancing the efficiency of the development process.[21]

An increasingly important factor in explaining rising prosperity and economic efficiency concerns the agility with which an economy adopts existing technologies to enhance the productivity of its industries. As countries have made considerable progress in improving their institutional and macroeconomic framework, attention turned to other drivers of productivity, and, without doubt, technology and innovation have been at the top of the list. Economic output is no longer just a function of capital and labor but, increasingly, of knowledge and the acquisition of *new* knowledge.

Why are these issues critical? Because technological differences have been shown to explain much of the variation in productivity between countries. In fact, the relative importance of technology adoption and innovation for rising productivity has been increasing in recent years, as progress in the dissemination of knowledge and the increasing use of information and communications technologies (ICT) have become increasingly widespread. For example, the strong productivity growth recorded in the United States since 1995 has been linked to the improved performance of industries which have used the latest technologies intensively to transform key elements of their operations. This has been particularly the case with wholesaling, retailing, and financial services. High-tech producers such as Microsoft, with well-established traditions of heavy spending in research and development, are enabling those sectors of the economy using the latest information technologies to improve their productivity performance and thus contributing to an overall boost to productivity growth.[22]

The central questions which follow from this discussion are: What are the factors, policies and institutions which are conducive to the creation of an economic and social environment that boosts the capacity for innovation? What is their relative importance? How do they interact with each other? How successful have countries been in identifying and adopting them? Let us now consider some high-priority areas.

Education and social inclusion

Social inclusion refers to the arrangements in place for education and health care which influence the individual's freedom to live better. We want this for two reasons: First, because, as pointed out by Nobel Laureate Amartya Sen (1999), a

[19] A report prepared by the United Nations Development Program for the 2008 United Nations General Assembly shows that the Millennium Development Goal of halving world poverty between 2000 and 2015 is within reach, largely because between 1990 and 2005, China brought some 475 million people out of poverty, compared to an *increase* of some 100 million during the same period in sub-Saharan Africa. (See *The London Financial Times*, "Number of poor rises in developing countries—China bucks trend, UN figures show; targets for 2015 still within reach," September 12, 2008).

[20] In Latin America, using US$1 as poverty line, the reduction was from 9.7 to 9.5 percent. Using a US$2 poverty line, it was from 26.9 to 24.5 percent. In sub-Saharan Africa, the corresponding figures are an increase from 41.6 to 46.4 percent for the $1 line, and 73.3 to 76.6 percent, for the $2 line. In millions of people, the figures are: for Latin America: 35.6m to 49.8m for the $1 line and 98.9m to 128.2m for $2 line. For sub-Saharan Africa: 163.6m to 312.7m for the $1 line and 287.9m to 516m for the $2 line. Idem, p. 56.

[21] Indeed, this debate has intensified in the past year as a result of the ongoing international financial crisis and the soul-searching it has precipitated. Robert Shiller (2009), a leading observer of financial markets, who issued repeated warnings about the real estate bubble in the United States, thinks that "capitalist economies, left to their own devices, without the balancing of governments, are essentially unstable." Nobel Laureate Amartya Sen (2009) recently wrote that "the question that arises most forcefully now is not so much about the end of capitalism as about the nature of capitalism and the need for change."

[22] See for example the chapter by Alan Hughes: "Innovation Policy As Cargo Cult: Myth and Reality in Knowledge-Led Productivity Growth" in this volume.

healthy life prevents morbidity and premature mortality. But, perhaps just as importantly, because education and good public health allow for more effective participation in the economic and political life of the nation. Illiteracy, for instance, can be a major barrier to participation in economic activities and the use of, and access to, technological innovations. Lack of such basic skills severely limits the possibilities of citizens to participate in the development process, to be gainfully employed, to be well-informed judges of government policies and politicians, and to avoid falling prey to the manipulations of demagogues—as we have seen in recent years in various corners of the world. From a business perspective, as noted by Porter (1990),

> . . . the quality of human resources must be steadily rising if a nation's economy is to upgrade. Not only does achieving higher productivity require more skilled managers and employees, but improving human resources in other nations sets a rising standard even to maintain current competitive positions. [23]

Notwithstanding the progress achieved in reducing levels of illiteracy noted above, much work remains to be done. According to UNESCO, almost 40 percent of India's population—well over 400 million people—still cannot read or write, representing a staggering burden for Indian society. Furthermore, an undue focus on enrolment rates has disguised important differences in the quality of education and in the particular approach taken by governments and the private sector to improving the educational system and its supporting institutions. Education and training are emerging as key drivers of productivity growth. As the global economy has become more complex, it is now evident that in order to compete and maintain a presence in global markets, it is essential to boost the human capital endowments of the labor force, whose members must have access to new knowledge, be continually trained in new processes, and in the operation of the latest technologies. Porter provides useful insights in his discussion of the role of education in contributing to an upgrading of an economy's productive apparatus. We find his emphasis on high educational standards (which the state must take the lead in setting) to be well placed, as are his calls for an educational system that delivers education and training with a fair degree of practical orientation. Equally worth noting is his additional emphasis on the need to strengthen technical and vocational education, to facilitate interactions between educational institutions and firms, to empower the former to deliver graduates with good grounding on the needs of the business community, and on immigration policies that allow the movement of workers with specialized skills.[24]

As coverage of primary education has expanded rapidly in the developing world, higher education has gained importance. Thus, countries which have invested heavily in creating a well-developed infrastructure for tertiary education have reaped enormous benefits in terms of growth. Education has been a particularly important driver in the development of the capacity for technological innovation, as the experience of Japan, Finland, Sweden, Korea, Taiwan, and Israel clearly shows.[25] Without doubt, today's globalizing economy requires economies to create troops of well-educated workers, who are able to adapt rapidly to their changing environment. Conversely, as revealed by many innovation surveys, the absence of skilled personnel greatly hampers innovation (OECD, 2000).

Governments in many regions have made considerable progress in expanding social opportunities to their populations. The trend has definitely been in the right direction. However, the speed of progress has been at times adversely affected by the lack of a long-established tradition of fiscal discipline. Disorderly fiscal management has more often been the rule rather than the exception in much of the developing world, and this has curtailed the ability of governments to be more proactive in investing in education, public health, and infrastructure. [26] We will come back to this issue later, when we discuss the importance of macroeconomic management.

Institutions

According to Acemoglu, Johnson, and Robinson (2004), by institutions we mean the rules that establish the terms under which economic agents interact with each other in society and that also determine the incentives for such interactions.

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[23] Porter, 1990, p. 628.

[24] Porter, 1990, p. 628–630.

[25] On the role of education in the emergence of Israel as an ICT power, see López-Claros and Mia, 2006.

[26] The notable exception is, of course, Chile, and the data demonstrate this quite explicitly. According to a report in the weekly *The Economist*, "poverty has fallen further, faster, in Chile than anywhere else in Latin America. Sustained economic growth and job creation since the mid-1980s are the main explanation, though it helps that poorer Chileans are having fewer children than in the past." The data show that while poverty rates in Latin America fell from about 48 percent to 39 percent between 1990 and 2006, the drop in Chile over the same period, from 38 percent to 13 percent, was far more dramatic. The authors add: "Chile has a chance of all but abolishing poverty in the next few years." ("Chile: Destitute No More." *The Economist*. 18 August, 2007).

The institutional framework has a crucial bearing on growth and development. It plays a central role in the ways societies distribute the benefits and bear the burdens of development strategies and policies. Indeed, it is the case that "without property rights, individuals will not have the incentive to invest in physical or human capital or adopt more efficient technologies… Societies with economic institutions that facilitate and encourage factor accumulation, innovation and the efficient allocation of resources will prosper." [27]

It is of fundamental importance the extent to which governments are accountable to their respective populations. Investors care deeply whether judges and courts are reasonably independent, or whether they are subject to undue interference or, far worse, are for sale to the highest bidder. Do businesses have to pay bribes to settle their tax obligations? Are they under pressure to hire private security outfits because police services are unreliable or, in some cases, indistinguishable from, or even working with, criminal organizations? Are governments biased in their decisions, or are they even-handed in their relations with the business community, playing more the role of impartial formulators of transparent rules, rather than meddling arbiters? Are public resources being allocated to education and essential infrastructure, or spent on wasteful and unproductive projects or schemes, including the maintenance of military establishments?

Needless to say, laying a sound institutional foundation is far from an easy task. Nor is it a process which produces results quickly, as is often the case with purely macroeconomic measures—an interest rate hike here, a tax cut there. Attempts at institutional reform often run up against strong opposition, as they often challenge powerful and deeply entrenched vested interests.[28] Some of the institutional factors that come to mind are respect for property rights; the ethics of government behavior and the incidence of corruption; the independence of the judiciary; the extent to which the government gives the private sector freedom to operate or engages in interventionist discretionary practices; the levels of government inefficiency reflected in the waste of public resources; a heavy regulatory burden; and the ability to provide an environment for economic activity characterized by adequate levels of public safety, to name a few.

Governance

Over the last few decades, there has been a noticeable (and most welcome) broadening of the debate as to what constitutes successful economic development. One element of this concerns the role of government in general and, more to the point, the exercise of political authority in a society for the purpose of managing its resources. Governance is the term that is now used in the development community to underscore the fundamental role of the *quality* of government in this process. Because this is so fundamental for successful development, let us briefly examine a few basic elements:

Accountability. The exercise of power must be guided by the need to improve the standard of living and well-being of the population. Adequate safeguards must be introduced to prevent the emergence of situations where ruling elites use political power for personal gain rather than public benefit. Democracy and political pluralism should facilitate this task which, at a minimum, involves the periodic legitimization of governments through popular choice, in such a way that gives adequate voice to the opposition, making politicians more responsive to the needs of society. The issue of accountability is closely linked to that of participatory development. Unless people feel that they have a say about those who rule them, they cannot be expected to fully support the government's development strategies and policies. Without such public support, even well-designed plans will in the end amount to very little. Sen (1999) convincingly argues that those countries in which governments operate in an environment of political legitimacy tend to be much better at allowing the formation of vital understandings and beliefs among the population that directly impinge upon aspects of the development process—for example, the notion that female education, employment, and ownership rights exert powerful influences on women's ability to control their environment and improve their condition and thus better contribute to national prosperity.

Transparency. Societies operate better on some presumption of trust. Here, we refer to the need for openness, the freedom to deal with one another under what Sen calls guarantees of disclosure and honesty. This is tremendously im-

[27] Acemoglu et al., p. 2.

[28] My years as an economist at the International Monetary Fund, including several years as Resident Representative in Russia during the 1990s, persuaded me that well-meaning governments will always find it easier to frame economic policies in purely macroeconomic terms. It is far easier to agree to an interest rate hike or some other budgetary measure than to get on with the far more difficult task of improving the legal framework for property rights, which, of necessity, may well take a decade or longer. Part of the ineffectiveness of the organization over the past couple of decades is linked, in part, to this macro short-term bias. Of course, a short-term macro bias, de facto, becomes a permanent one, with deleterious effects for the evolution of the country: viz. the rapid descent of Russia into the bottom ranks of the most corrupt countries in the world.

portant for preventing corruption, and financial and other abuses. Experience has shown that where there is trust, citizens and businesses pay their taxes. This, in turn, enables the government to formulate policies to achieve various social ends—for example, to dramatically increase access to the internet in the schools—because the resources are available to invest in these areas. As societies see the fruits of these efforts, trust in the government is reinforced and the country enters into what one can call a "virtuous cycle" of development. Of course, "vicious cycles" are also possible, and we have seen these in many parts of the world more often than we would care to remember.

Daniel Kaufmann (2003) and a number of other researchers have shown the central importance of the establishment of an institutional environment characterized by openness and transparency in the management of public resources. Corruption poisons the development process. It leads to resource misallocation, as funds are no longer directed toward their most productive ends, but are instead captured for private gain. It undermines the credibility of those who are perceived as being its beneficiaries (e.g., public officials, government ministers, and business leaders) and thus sharply limits their ability to gain public support for economic and other reforms. Work done at the World Bank has shown that the benefits for income per capita associated with improvements in governance are very large—"an estimated 400 percent improvement in per capita income associated with an improvement in governance by one standard deviation."[29]

Lack of transparency in the workings of the global financial system has been very much at the heart of the present crisis. Had the authorities been more effective in monitoring the explosive growth of increasingly sophisticated and opaque financial instruments—the so-called "weapons of financial mass destruction," to use the term coined by Warren Buffett—it is quite conceivable that the current crisis might not have been so severe in its intensity. Sen notes that societies operate better under some presumption of trust and that, therefore, they will benefit from greater openness. In a *Financial Times* article of 11 March 2009, entitled "Adam Smith's market never stood alone," Sen observes, "the far-reaching consequences of mistrust and lack of confidence in others, which have contributed to generating this crisis and are making a recovery so very difficult, would not have puzzled him."

Justice. Closely linked to the issue of accountability is the need for the rule of law, the notion that the rules which govern a society—and hence those that regulate economic activity—are applicable to all. There is increasing recognition that without a reasonably objective, efficient, and predictable judicial system and legal framework, accountability will have no legal underpinnings, and the goals of good governance will be undermined. As regards the economy in particular, it has long been recognized that the absence of an adequate legal framework and judicial system will increase business costs, discourage investment, and introduce an element of uncertainty into economic activity which will be detrimental to the development process.

From the above discussion, it is clear that these various elements of good governance: accountability, transparency, and justice, are not independent of one another. Interactions are inevitable and conflicts can arise in the short run. Participatory processes implemented in an environment of political pluralism and openness may add an element of unpredictability to the decision-making process. It may take much longer to forge the necessary consensus around a particular strategy. But this does not detract from their intrinsic value and the overriding need to pursue them as essential ingredients of good governance.

The potential benefits of an approach to development that seeks to incorporate the above mutually reinforcing elements should not be underestimated. To take an example: in an environment of accountability and political legitimacy, people will be far more likely to become active participants in the economy. A broadly shared sense of entitlement to economic transactions will then become an engine of economic growth. A growing economy will boost private incomes and enable the state to collect taxes out of which it will be able to finance expenditures, including in vitally important social areas, such as education, research, and development. Higher levels of spending on education and health care have been shown to be associated with reductions in infant mortality and a fall in birth rates. Female literacy and improved schooling have profound effects on women's fertility behavior, with resulting widespread implications for the environment, the pressures on which are often linked to rapid population growth. Conversely, it is possible to attribute the often disappointing fruits of economic development in many countries during the last half century to the absence of the above building blocks.

[29] Kaufmann, 2003, p. 146.

Indeed, neglect of these building blocks of good governance will make it difficult to create an environment that will release people's creative potential, so vital for the construction of a culture of innovation. One cannot help agreeing with Easterly (2002) when he observes that in such a country "skilled people opt for activities that distribute income rather than create growth."[30]

The macroeconomic environment

However important the role of governance, education, and social inclusion are for enhancing countries' capacity for innovation, a stable financial environment is essential for the successful implementation of broad-based reforms and the establishment of a macroeconomic environment supportive of private sector activity. Countries should pursue prudent fiscal policies that allow adequate levels of private sector credit, while limiting the growth of total credit to levels consistent with non-inflationary growth in the money supply and a viable external position. Cautious fiscal and monetary policies that contribute to low inflation rates and a more stable domestic environment also contribute strongly to business confidence and the willingness of domestic and foreign investors to undertake investment projects. In this way, government economic policies that reduce inflation and encourage macroeconomic stability have played a critical role in fostering economic growth and, more generally, in creating an environment that will foster innovation.

Clearly, fiscal policy should give priority to public sector expenditures that contribute directly to growth, such as outlays for human capital and spending in essential infrastructure, as against, for instance, the maintenance of large military establishments, or other unproductive expenditures. One element of this is the quality of public administration itself, which has many dimensions: policy coordination and responsiveness, service delivery and operational efficiency, merit and ethics, pay adequacy and management of the wage bill, among others.

Although not a "macroeconomic stability" issue per se, the question of a country's integration with the global economy has acquired growing importance over the past decade, particularly in the context of discussion about the interactions between the process of globalization and economic development. In an increasingly interdependent world economy, a more outward-looking orientation has become an essential element of successful economic reforms. In addition to the well-known gains from international trade, it is clear that relative openness and strong links with the world economy impose on domestic producers the valuable discipline of international competition and provide opportunities for new exports. An open orientation can also attract much needed capital and expertise, thus enhancing the prospects for growth through increased efficiency and productivity. Greater integration with the world economy also serves as an important channel for absorbing technological advances from abroad, including improvements in management practice and positive effects on the build-up of human capital that derive from being able to tap into global systems of knowledge, as is evident from the experience of many outward-oriented economies that have developed strong export sectors based on new manufacturing industries.

Economic opportunities

These refer to the chances that individuals have to utilize economic resources for the purpose of consumption, production, or exchange. Freedom to enter markets can make a significant contribution to development. Indeed, not an inconsiderable share of the progress made in India and China in the past 20 years reflects a reorientation of policies which significantly relaxed the barriers to entry to goods, labor, and financial markets.

For several years now the World Bank has published the *Doing Business Report* (DBR), an excellent compendium of business regulation in 181 countries. The picture that emerges from that study for a large number of countries is not a pleasant one.[31] Recently, the scope of the DBR has expanded significantly, such that now, in addition to the usual indicators on opening a new business (number of procedures needed, time taken, cost), one can also look at such things as: which countries make it easy to pay taxes, or to get licenses; where is it easier or more difficult to enforce contracts; who regulates property registration most closely; where are investors provided the greatest protection; or which countries have the most restrictive labor legislation, making it very difficult, for instance, to adjust the size of the payroll.

The data in Table 1 eloquently highlight the extent to which many countries *discourage* the development of entrepreneurship and, hence, the capacity for innovation of their own private sectors. And it is clear from the data that these are

[30] Easterly, 2002, p. 8.

[31] The *Doing Business Report* is available free of charge, at: www.worldbank.org

Table 1. ***Doing Business Report*: An international perspective on regulation**

	Brazil	India	China	Russian Federation	Venezuela	Greece	New Zealand
Ease of doing business*	125	122	83	120	174	96	2
Starting a business*	127	121	151	65	142	133	1
Number of procedures	18	13	14	8	16	15	1
Time (days)	152	30	40	29	141	19	1
Dealing with construction permits*	108	136	176	180	96	45	2
Employing workers*	121	89	111	101	180	133	14
Registering property*	111	105	30	49	92	101	3
Time (days)	42	45	29	52	47	22	2
Protecting investors*	70	38	88	88	170	150	1
Paying taxes*	145	169	132	134	177	62	12
Enforcing contracts*	100	180	18	18	71	85	11
Time (days)	616	1420	406	281	510	819	216
Closing a business*	127	140	62	89	149	41	17
Time (years)	4	10	1.7	3.8	4	2	1.3

* Rank from 181 countries

Source: 2009 Doing Business Report

problems existing not only in developing countries.

The sobering irony of the DBR is that those countries with the greatest need for entrepreneurship and private sector development are those that generally create the greatest obstacles for the creation of new enterprises, or that otherwise intervene in ways that retard the emergence of entrepreneurial capacities which are so central to the development of an enabling environment for innovation. Here, the critical factor is political will. Red tape, excessive regulation, and bureaucracy are self-imposed evils, which are potentially amenable to speedy elimination.

Other factors

The list of other factors which contribute to create an enabling environment for innovation is long. Without additional comment, let us quickly add a few more:

- What is the legal basis for secure property (including intellectual) and contract rights?
- What are the overall patterns of revenue mobilization, both as regards tax structure and equity?
- Is there timely and accurate accounting and reporting?
- What is the structure and level of sophistication of the financial sector, and of the policies and regulations that affect it? Is the financial sector deep enough to allow reasonably free access to finance and the emergence of venture capital?
- Is the trade regime unduly restrictive, or it is reasonably open, encouraging competition and gains in efficiency?
- What are the levels of spending in education, both in absolute terms (percent of GDP) and in relative terms (as percent of total government expenditure)?
- How freely are women able to engage in the labor market, and how well are they represented in decision-making bodies, whether in parliament, cabinet, or the board room?
- Is there an adequate safety net to provide workers with some degree of financial security in times of economic stress?
- Is regulation of the labor market appropriate, or does it provide perverse incentives for both employers and workers?
- What is the level of expenditure in research and development?
- What is level of expenditure in information and communication technologies?
- What is the proportion of university students enrolled in science and engineering?

- How prevalent is knowledge of English?
- What are the penetration rates of the latest technologies?
- How effective is the government in providing information and public services for the people, and is this done through an electronic platform?
- Are public procurement policies and systems open and transparent and do they encourage the adoption of new technologies and reward innovation?
- To what extent do environmental policies foster the protection and sustainable use of natural resources and the management of pollution?
- What is the degree of collaboration between industry and the universities? Do they work independently from each other, or do they consult and give each other feedback?
- Where they exist, are government tax incentives well targeted, limited in duration, and applied transparently, or do they distort the incentives system?
- Do government immigration policies encourage the arrival of skilled workers and other highly qualified professionals?
- Is there public funding for long-term research?

3. Measuring innovation: Composite indicators

"What we measure affects what we do. We will never have perfect measures—and we need different measures for different purposes."

— Joseph Stiglitz[32]

A composite indicator can be thought of as the result of aggregating a set of statistical data in order to measure the overall performance of a certain phenomenon or issue (e.g., environmental sustainability, gender equity, competitiveness, etc.) that is directly or indirectly affected by its components. This definition highlights at least two key areas that influence the development of an effective indicator: a) choosing a proper data set, and b) the method of aggregation. However, there seems to be broad consensus that such indicators will be more credible if their construction is underpinned by a sound theoretical framework that enlightens in a plausible way the choice of variables and the ways in which these are combined. There has been wide debate with respect to the usefulness of these types of measures. The debate has been limited not only to technical aspects and methodological questions, but also to subjective perceptions of the public at large and, more specifically, to whether their advantages outweigh their potential disadvantages. It is not our intention to enter into this debate. Suffice it to say that the past decade has seen a remarkable increase in the number of credible organizations that have opted for the development of composite indicators, scoring mechanisms, and associated rankings.

The *Handbook on Constructing Composite Indicators* by the OECD and the European Commission Joint Research Centre (EC JRC) lists some of their main advantages and disadvantages (Table 2). Some of the functionalities implied are: i) support for decision-makers, since such indicators may allow more considered judgements as to various policy options available; ii) the ability to assess progress over time and to make meaningful international comparisons; and iii) contribute to public debate and the promotion of greater accountability. According to the *Handbook*, the two main criteria for evaluating composite indicators are ease of interpretation and the transparency of the methodology used. In other words, synthesis and construction. In view of the disadvantages, perhaps one of the main conclusions of this analysis is that composite indicators must be used with caution and as useful complements to other information and analysis, including well-informed judgements and common sense.

As a source of information, composite indicators can influence policymaking from a variety of perspectives. For instance, composite indicators can be useful for quantifying and outlining numerical goals and benchmarks. International benchmarking as a means of providing incentives for "changing behavior" has a well-established record. For example, the *Human Development Index* (HDI)[33] rankings have encouraged many countries to invest in preparing better and updated statistical series. The practice of synthesizing large volumes of information into a scoring system which can be translated into an index and an associated set of rankings can provide considerable value-added, particularly where efforts have been made to identify the critical factors deemed to affect the dependent variable. For instance, Transparency International (TI) has been associated with the *Corruption Perceptions Index* (CPI) since 1993. Despite occasional criticism—mainly from countries which do not wish attention to be drawn to a broad range of institutional

[32] Stiglitz, 2009, p. 28.
[33] Available at: http://www.undp.org

Table 2. Advantages and disadvantages of composite indicators

Advantages	Disadvantages
• Can summarize complex, multi-dimensional realities with a view to supporting decisionmakers; • Are easier to interpret than a battery of many separate indicators; • Can assess progress of countries over time; • Reduce the visible size of a set of indicators without dropping the underlying information base, thus making it possible to include more information within the existing size limit; • Place issues of country performance and progress at the centre of the policy arena; • Facilitate communication with general public (i.e., citizens, media) and promote accountability; • Help to construct/underpin narratives for lay and literate audiences; • Enable users to compare complex dimensions effectively.	• May send misleading policy messages if poorly constructed or misinterpreted; • May invite simplistic policy conclusions; • May be misused, e.g., to support a desired policy, if the construction process is not transparent and/or lacks sound statistical or conceptual principles; • The selection of indicators and weights could be the subject of political dispute; • May disguise serious failings in some dimensions and increase the difficulty of identifying proper remedial action, if the construction process is not transparent; • May lead to inappropriate policies if dimensions of performance that are difficult to measure are ignored.

Source: OECD and European Community Joint Research Centre, *Handbook on constructing composite indicators: Methodology and user guide*, 2008.

weaknesses[34]—the CPI has come to be accepted by civil society, the business community, and the media as a valuable tool, providing relevant data about the prevalence of corruption and corrupt practices in a large number of countries.

Composite indicators can also contribute to developing a common discourse and values when framing a problem in the light of public debate. Indexes and the associated rankings are useful benchmarking tools to focus public attention on a particular set of policy issues. When supported by detailed data, they can provide valuable information about underlying strengths and weaknesses, which can then become a catalyst for enhanced policy debate and efforts to improve particular areas of deficiency. For instance, the *Human Development Index* is an alternative measure of human welfare that captures a social dimension not existing in conventional GDP measures. The United Nations Development Program also publishes gender-related indices which attempt to assess the extent to which countries have succeeded in empowering women and reducing gender disparities.[35]

Finally, they can also help to highlight priority areas for policy reform and existing areas of achievement. For instance, the World Bank has developed the *Country Policy and Institutional Assessments*, a rating system that captures a broad array of factors affecting the policy environment in a large number of developing countries. The CPIA encompass such concepts as the quality of public sector management, the extent to which authorities have improved the policy framework through various structural policies aimed at enhancing resource use, as well as various elements of social policy, including aspects of social protection and poverty reduction, among others.[36]

The International Monetary Fund has published the *Trade Restrictiveness Index*, which nicely captures tariff and non-tariff barriers to trade. As noted by the IMF at the time of its release, "the index was constructed to provide a baseline of each country's overall trade policy stance" and "to provide policy handles for discussions with national authorities."[37]

The Innovation Capacity Index was built against the background of this large body of work which sees indexes—with all their limitations—as working tools to generate debate on key policy issues, and to track progress over time in the evolution of

[34] For a recent example, see "Transparency Group Fears for Staff in Bosnia" (*Financial Times*, 22 July 2008) in which it is reported that "The New York-based Human Rights Watch last week condemned [Prime Minister] Dodik's 'campaign of intimidation' against TI."

[35] See, for instance, the UNDP's *Gender Empowerment Measure* (GEM) and the *Gender-related Development Index* (GDI), both at www.undp.org

[36] According to the World Bank "The CPIA consists of a set of criteria representing the different policy and institutional dimensions of an effective poverty reduction and growth strategy. The criteria have evolved over time, reflecting lessons learned and mirroring the evolution of the development paradigm. In 1998, the criteria were substantially revised and coverage was expanded to include governance and social policies. The number of criteria was set at 20 (where it remained until 2004), and the ratings scale was changed from a 5- to a 6-point scale. To strengthen the comparability of country scores, specifically across regions, the ratings process was revised to include the benchmarking step." (World Bank, 2005, available at: www.worldbank.org).

[37] International Monetary Fund, 2005, available at: www.imf.org

those factors which help explain national performance. A well-designed composite indicator could thus provide a useful frame of reference for evaluation, the effectiveness of which will be enhanced if greater attention is placed on ways to improve national performance than on the relative rankings themselves.

4. The Innovation Capacity Index

"I have no data yet. It is a capital mistake to theorize before one has data. Insensibly one begins to twist facts to suit theories, instead of theories to suit facts."

— Sherlock Holmes, in "A Scandal in Bohemia"
(Arthur Conan Doyle, 1891)

The construction of the ICI was a response to three interrelated questions: What are the factors, policies, and institutions which are conducive to the creation of an economic and social environment that boosts the capacity for innovation? What is their relative importance, how do they interact with each other, and how are they dependent on a country's given stage of development and political system? Can we develop a methodology that will suggest, on a country-specific basis, the priority areas for strengthening the capacity for innovation? These three questions, in turn, suggested a work agenda that would involve two distinct components: first, a comprehensive assessment and identification of the factors that play a role in boosting the capacity for innovation; and second, the need to incorporate in the measurement of innovation capacity the country's stage of development—as captured by its income per capita—and the nature of its political regime. These, in turn, would lead to the development of a methodological tool that would allow policymakers to track progress in a country's capacity for innovation, both in relation to other countries and with respect to its own history. The result was the construction of the Innovation Capacity Index (ICI), which in its 2009 edition covers 131 countries and identifies over 60 factors that are seen to have a bearing on a country's ability to create an environment that will encourage innovation. The ICI is not the first attempt at the complex task of measuring innovation. There are several examples of innovation analyses consisting of "scoreboards" of non-aggregated indicators, variables, and/or benchmarks, which track the performance of a particular region, nation, or groups of nations, including, for instance, the *Oregon Innovation Index*,[38] the *Mississippi Innovation Index*, [39] the *Index of the Massachussetts Innovation Economy*, [40] and the *OECD Science, Technology and Industry scoreboard*. [41] The composite indicator approach that generates cross-country rankings allowing international comparisons on the basis of comparable data is less common. Among these one may find the following examples:

- *Summary Innovation Index*.[42] Part of the *European Innovation Scoreboard*, created to examine the strengths and weaknesses and convergence in innovation of the European member states and their gap with respect to the U.S. and Japan. It measures innovation from an input/output perspective. Sample inputs include: tertiary education, ICT penetration, R&D and ICT expenditures, and small and medium-sized firm policies. Sample outputs include: high-tech exports and employment, sales of new market products, and patents and trademarks;
- *Innovation Index*.[43] Created to measure US innovative capacity with respect to other OECD countries over a 25-year period. Indicators include: personnel employed in R&D, expenditures on R&D, openness to international trade and investment, strength of protection for intellectual property, share of GDP spent on secondary and tertiary education, share of total R&D expenditure funded by private industry, and share of total R&D outlays carried out by universities;
- *National Innovative Capacity Index*.[44] Research derived from the US Innovation Index described above was expanded to cover other countries, using data from the World Economic Forum's 2001 Executive Opinion Survey (EOS). Qualitative measures were selected from the survey to construct different subindexes around the main areas of patents and number of scientists and engineers, including concepts such as intellectual property protection, market sophistication, quality of scientific research institutions, and venture capital availability. This work was further expanded in 2003 to cover 78 countries, by aggregat-

[38] Oregon Innovation Council, 2007. Available at:. http://www.oregoninc.org/
[39] Mississippi Technology Alliance. Available at: http://www.innovationindex.ms/
[40] Massachussetts Technology Collaborative, 2008. Available at: http://www.masstech.org/
[41] Available at: http://www.sourceoecd.org/scoreboard
[42] European Innovation Scoreboard, 2007.
[43] Porter and Stern, 1999.
[44] Porter and Stern, 2002.

ing science and engineering manpower, innovation policy, the cluster innovation environment, innovation linkages, and company operations and strategy subindexes;[45]

- *Global Innovation Index*.[46] Created by INSEAD in collaboration with the Confederation of Indian Industries, groups over 90 indicators combining quantitative data with a large number of indicators drawn from the World Economic Forum's (WEF) Executive Opinion Survey.

The ICI is an attempt to extend and build upon the work done by others in a number of specific ways. It is worthwhile to mention at least three areas in which the work underlying the construction of the ICI makes this a novel and, in our view, a far-reaching policy instrument. We discuss these in turn.

A. Overwhelming use of hard data

The ICI makes overwhelming use of hard data indicators. A full 90 percent of the variables used in the construction of the Index can be regarded as hard, that is, measuring directly some underlying factor (e.g., the budget deficit, expenditure in education, cumbersome regulations, etc.), and, therefore, not dependent on some survey instrument capturing (typically), business *perceptions*. This is not to suggest that there is no place for surveys in the construction of indexes. However, over the past decade or so, we have seen considerable improvement in the ability of various international organizations to develop indicators for a large number of countries that capture factors that had previously not been easily measured. An excellent example of this is the work done at the World Bank on business regulation and obstacles to the creation of new enterprises. Most of the concepts captured in the *Doing Business Report* published by the World Bank were in the past "measured" only through some opinion survey, such as the one carried out annually by the World Economic Forum. Many of these concepts, however, are now available through the comprehensive field work done by the Bank to examine the actual—as opposed to *perceived*—obstacles faced by the business community in a large number of countries. While this may perhaps be the best example, it is by no means the only one. In recent years, the International Telecommunications Union has broadened the scope of the variables which they track that attempt to capture various indicators of the breadth and use of the latest technologies. As noted earlier, the IMF has compiled a measure of trade openness and the World Bank has put together at least two impressive scoring mechanisms: one is the Worldwide Governance Indicators which capture a large number of governance and rule-of-law measures; the second is the Country Policy and Institutional Assessment (CPIA), which examines various elements of a country's policy environment, such as the quality of public administration, the efficiency of the financial sector, and so on.[47] All of these have been used in the construction of the ICI.

B. Explicit incorporation of a "stages-of-development" theoretical framework

The construction of the Index explicitly incorporates the notion that while there are many factors which will have a bearing on countries' innovation capacity, the relative importance of these will vary depending on their stage of development and the particular political regime against which policies are being implemented. As regards the stages of development, our work is close in spirit to that done by Porter (1990), who divides countries and their respective industries into three broad categories: factor-driven, investment-driven, and innovation-driven. These categories, in turn, are highly correlated with rising economic prosperity, as captured by the growth of per capita income. Porter highlights some of the features of each of these stages and it will be useful to provide here a brief summary.

Factor-driven

Countries are in this stage when they derive advantages from basic factors of production, such as natural resources, plentiful and inexpensive labor, and, in some cases, a benign climate which may create favorable conditions for agriculture. These factors may impose some constraints on the kinds of industries that can develop and, thus, may limit a country's presence in the global economy. At the factor-driven stage, countries will compete on the basis of price advantage, and technologies will

[45] The authors limit themselves to the use of survey data, as these are "the only alternative because there are no quantitative data at all available on most of the areas measured, much less for a meaningful number of countries, so that Survey data are the only alternative." (Porter and Stern, 2003, p. 96).

[46] INSEAD, Global Innovation Index 2008–2009. Available at: http://elab.insead.edu

[47] One area where we are likely to continue to rely on survey instruments is the measurement of corruption. Transparency International's *Corruption Perceptions Index* is survey-based, and it is unlikely that, due to the nature of this problem, we will be able to dispense with opinion surveys any time soon. In such cases, we are firmly of the view that it is far better to use surveys—with all their limitations—than to fail to measure, however inadequately, the problem in question. There is no doubt whatever that TI has succeeded well in calling the attention of the international community to a serious problem, which has a grievous impact on development and, in the case of our subject, the development of the capacity for innovation.

usually be adopted from other countries, as opposed to created from within. Typically, human capital resources will not be particularly well developed, a feature that will constrain a country's ability to innovate and to see sustained productivity growth. Because countries will be largely price-takers in international markets, they will be vulnerable to business cycle fluctuations, exchange rate movements, or other external shocks that may lead to sharp changes in the terms of trade. At this stage, countries will have institutions in the early stages of development and one may see high levels of corruption, weaknesses in the legal framework and the rule of law, relatively low levels in the quality of the public administration and, as a result, a poor macroeconomic situation, characterized, for instance, by high inflation or loose public finances. In light of these observations, for nations in the factor-driven stage, the focus of policies should be the achievement of macroeconomic stability and the establishment and improvement of the basic institutions underpinning the modern market economy. To the extent that policies are not geared to these ends, nations may get stuck at this stage for decades, if not, in fact, much longer.

Investment-driven

At this stage, we witness heavy investment aimed at modernizing the economy's infrastructure. According to Porter, firms will invest to "construct modern, efficient, and often large-scale facilities equipped with the best technology available on global markets."[48] Technologies and processes discovered or developed elsewhere will not simply be adopted but may also be improved upon. The range of technologies imported from abroad may also widen to include not only basic ones, but also the most sophisticated. The main underlying theme of this stage is the willingness of firms to invest to upgrade factors to enhance productivity growth. This may include improvements in education and training, which create a pool of skilled workers who are able to assimilate and improve upon imported technologies or, in any case, adapt them to local conditions. Cost factors are still important and economies operating at this level are not immune from shifts in the global business cycle (or the exchange rate). But at this stage, investment aimed at a more efficient use of resources will often bring about a diversification in the economy's sources of wealth creation, and, thus, the emergence of a greater degree of resilience to changes in the terms of trade. As a result of the above, one may also see a fairly sustained increase in wages and labor costs. At this stage, the focus of policies broadens somewhat. While macrostability and institutional development are still important, these policies must be supplemented by policies aimed at further structural reforms, increasingly formulated in a medium-term framework. At this stage, for instance, governments may focus on fiscal sustainability issues and may implement pension reform to establish a sounder financial basis for the social security system, may aim to significantly improve the infrastructure for higher education, and find ways to change the nature of public administration so that it plays a more supportive role for private sector development.

Innovation-driven

Consumers in countries operating at this stage of development have high levels of income per capita, sophisticated and demanding tastes, and, on average, higher levels of education than at the factor-driven or investment-driven stages, all of which create a demand for improvement and innovation. At this stage, firms may continue to use and improve existing technologies, but, increasingly, they create them. "Favorable demand conditions, a supplier base, specialized factors, and the presence of related industries in the nation allow firms to innovate and to sustain innovation."[49] This stage may also see countries essentially ceding to nations in earlier stages of development those industries that are less-sophisticated, or where demand is highly price-sensitive. Firms operating in innovation-driven countries will have their own marketing and supply networks and will have, in many cases, established recognizable brands. They will also become important investors abroad and become truly global players, not only in terms of markets for sale and sources of inputs, but also in terms of sources of funding, labor supply and the location of production. This stage also sees a further upgrade in the training of the labor force and the emergence of highly-skilled workers with specialized know-how and able to command high wages. The role of public policy at the innovation stage is more subdued than at the previous two stages. Governments—overwhelmingly in the context of democratic institutions and processes—are called upon to preserve the gains made over the previous decades in terms of macro management and in-

[48] Porter, 1990, p. 548.
[49] Porter, 1990, p. 554.

stitutional development. Above all, governments are expected to do no harm to the policy environment, and the prospect that they can always be voted out of office generally tends to explain a certain level of policy stability. In these countries "the impetus to innovate, the skills to do so, and the signals that guide its directions must come largely from the private sector."[50, 51]

The above stages are not meant to be interpreted in a rigid way. It may be possible, for instance, for a country to be in the factor-driven stage, while some of its industries, in specialized niche sectors, may be operating at a higher stage of development. Neither should countries be seen as steadily and gradually progressing from the factor-driven to the innovation-driven stage. Korea, Singapore, and Taiwan are examples of economies that have made the transition to the innovation stage in a relatively short span of time; indeed, Taiwan has made the transition from an agricultural economy with low income per capita to a prosperous global industrial ICT powerhouse in less than 40 years, an impressive achievement. By way of contrast, Argentina was a G10 power in the first part of the 20th century and had the best scientific and higher education infrastructure in Latin America by the 1950s, but has since *regressed*, in the wake of decades of economic mismanagement, to an economy with all the characteristics of the factor-driven stage.[52] This regression was caused, in particular, by an undue reliance on exports of primary commodities as the primary source of economic growth, high levels of corruption and, in an unusual turn, the gradual disappearance of reliable statistics, as a result of authoritarian, state-sponsored tampering and manipulation.[53]

In all cases, as should be evident, the role of policy matters enormously for how quickly and efficiently countries are able to make the transition through these three stages. Table 3 presents World Bank data on average income per capita for 2007, on the basis of which countries are classified as being high-income, upper-middle and lower-middle-income, and low-income. One may apply Porter's stages-of-development framework to suggest that low-income countries are at the factor-driven stage,

Table 3. Average GNI per capita, current US dollars, 2007 (World Bank Atlas Method)

High-income	GNI per capita > $11,456		Average: $34,907
Full democracies	Flawed democracies	Hybrid regimes	Authoritarian regimes
$40,066	$16,292	$32,040	$34,362
Upper-middle-income	GNI per capita: $3,706–$11,455		Average: $6,662
Full democracies	Flawed democracies	Hybrid regimes	Authoritarian regimes
$5,797	$6,790	$7,168	$5,060
Lower-middle-income	GNI per capita: $936–$3,705		Average: $2,374
Full democracies	Flawed democracies	Hybrid regimes	Authoritarian regimes
–	$2,328	$2,849	$2,288
Low-income	GNI per capita < $935		Average: $536
Full democracies	Flawed democracies	Hybrid regimes	Authoritarian regimes
–	$850	$501	$555

Source: World Bank.

[50] Porter, 1990, p. 555. Porter also identifies a "wealth-driven" stage which, in essence, is one of decline, where "the motivations of investors, managers, and individuals shift in ways that undermine sustained investment and innovation, and hence upgrading…and where malaise and an eroding sense of purpose may set in." It is conceivable that countries may enter periods of decline, and it is certainly the case that industries may also do so, partly through the failure of managers to anticipate technological change. But there is nothing to suggest that the entire collectivity of nations will go through a period of decadence and decline. The more likely scenario would appear to be one where nations gradually progress through the three stages identified above. Although some may remain in a given stage for a very long time—perhaps lasting even many decades, if not longer—a few may see temporary regression (e.g., Argentina and many of the poorest nations in Africa which can degrade to failed states). But the majority find themselves in a path of gradual forward, though at times uneven, progress.

[51] For an application of Porter's stages-of-development approach to the measurement of competitiveness see Sala-i-Martin and Artadi, 2004.

[52] Argentina remains to this day the only country in Latin America to have earned three Nobel prizes in science, with the awards going to Messrs. Houssay (Physiology or Medicine), Leloir (Chemistry), and Milstein (Physiology or Medicine).

[53] See, for instance, "Hocus-pocus: The real world consequences of producing unreal inflation figures." *The Economist*, 14 June 2008, p. 56. A more recent assessment by *The Economist*, commenting on mid-term elections, suggests that inflation figures are worth little because: "Mr Kischner put stooges in the statistics office and they massage the numbers." (See: "A chance to change course," 20 June 2009)

middle-income countries would have moved to the investment-driven stage, and high-income countries would have entered the innovation-driven stage. While there will be exceptions to this categorization (e.g., a rich oil exporter in the Gulf region), we find that, in general, countries broadly possess the characteristics identified by Porter for each of the levels of income. A further sobering feature of this table is the relatively huge income gaps across the various categories: for instance, from an average of US$6,662 for upper-middle-income to US$34,907 for high-income, or from US$2,374 for lower-middle-income to US$536 for low-income, displaying well known, large, and growing, income disparities.

C. The nature of a country's political regime matters for innovation

The above theoretical (and practical) considerations, as explained further below, have had a direct bearing on the choice of weights for the various factors which have been used to construct the Innovation Capacity Index. In addition to the embedding of a formal stages-of-development framework into the determination of key elements of the Index structure, we have also seen the benefits of establishing a further distinguishing criterion for nations: namely the type of political regime under which policies are implemented. For these purposes we have used the four categories developed in The Economist's Democracy Index: *full democracies, flawed democracies, hybrid regimes,* and *authoritarian regimes*. There is ample empirical evidence suggesting that democracies are much better at creating the sorts of conditions in a country that are conducive to the nurturing of creativity and independence of thought that are so essential for innovation. Therefore, our work attaches to the nature of a country's political regime a significance that is not captured by purely looking at the level of income per capita as a proxy for the country's stage of development.

The question of the relationship between democracy and development has been amply debated in the economics and political science literature. Without entering into this debate—which is outside the scope of this paper—there is overwhelming empirical support for the thesis that, for instance, poor democracies do much better than poor autocracies, arguably the most relevant comparison to cast light on this subject.[54] Siegle, Weinstein, and Halperin (2004) look at annual data drawn from the World Bank's *World Development Indicators* for the period 1960–2003 to show that the median per capita growth rates of poor democracies have been 50 percent higher than those of autocracies.[55] Citizens in poor democracies live, on average, nine years longer than in low-income autocracies, have a 40 percent higher chance of attending secondary school, will enjoy higher levels of agricultural productivity, and much lower infant mortality rates.

The latter statistic is particularly relevant as it reflects, in turn, better prenatal care for pregnant women, higher levels of nutrition, higher quality drinking water, and more opportunities for the education of girls. It turns out that poor democracies are also far better than poor autocracies in avoiding severe economic contractions—annual drops of 10 percent or higher in real GDP. "Seventy percent of autocracies have experienced at least one such episode since 1980, whereas only 5 of the 80 worst examples of economic contraction over the last 40 years have occurred in democracies."[56] In a nutshell: "poor democracies outperform authoritarian countries because their institutions enable power to be shared and because they encourage openness and adaptability. …An integral virtue of democracies, therefore, is that they provide a sphere of private space, which, protected by law, nurtures inventiveness, independent action, and civic activity. …Democracies are open: they spur the flow of information. …The free flow of ideas, every bit as much as the flow of goods, fosters efficient, customized, and effective policies." [57]

Index structure and formulation

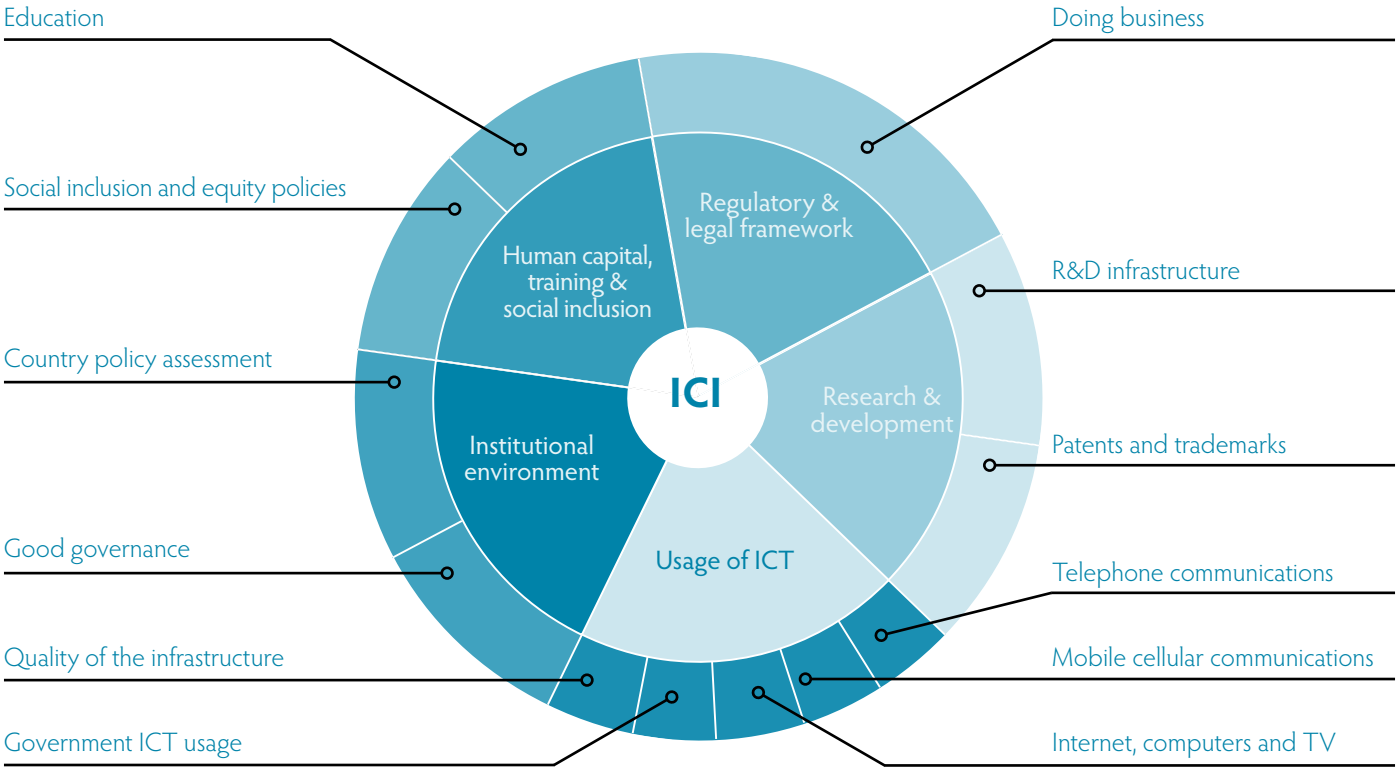
In constructing the Index, we have tried to strike a balance between reasonably broad coverage of those factors which affect the capacity for innovation, on the one hand, and a certain degree of economy, on the other, as there is, in principle, a potentially large number of variables which could conceivably have a bearing on a nation's ability to innovate. Once these factors had been identified, an early priority was to organize them in a sensible way, bringing similar variables—for instance, those pertaining to a country's human capital endowment—under one category or pillar. Obviously, there is no unique way to do this, nor is there a "magic" number of pillars that may be used.

[54] To compare like with like; it makes no sense to compare, for instance, high-income democracies with poor autocracies.
[55] Indeed, the true gap is probably larger, because the data excludes figures for Cuba, North Korea, and Somalia, among the worst-performing authoritarian regimes.
[56] Siegle et al., 2004, p. 60.
[57] Siegle et al., pp. 63–64.

We feel comfortable with the following formulation which identifies five pillars:

1. Institutional environment
2. Human capital, training and social inclusion
3. Regulatory and legal framework
4. Research and development
5. Adoption and use of information and communication technologies

Figure 1. The Innovation Capacity Index



A more detailed representation can be seen in Figure 1 and in Box 1.

The choice of pillars and variables is based on the theoretical and empirical considerations discussed in detail in Section 2. It is worthwhile at this point to make several additional remarks to cast some light on some methodological issues which arose in the construction of the ICI.

Missing variables

One constraint faced by researchers in the construction of such indexes is the lack of reliable or internationally comparable data. The absence of data may prevent the inclusion of some variables which, a priori, theoretical, or empirical considerations might suggest are relevant. This was the case, for instance, with knowledge of the English language. English being the most widely used language of science and technology, global finance, and the Internet, common sense would suggest that, other things being equal, knowledge of English would have a tangible impact on boosting a nation's capacity to innovate. But there appear to be no data on English literacy for the large number of countries that figure in this study. However, since these omissions were mostly exceptional, we were not greatly hampered by lack of data, a fact partly to be attributed to the progress that has been made over the past decade in quantifying a growing number of previously "soft" variables.[58]

Data sources

Because a key virtue of an index is its ability to make meaningful international comparisons, we have gone to sources which compile the data on a comparable basis, using a common methodology. These include: the International Telecommunication Union, which provides the most up-to-date

[58] See the Technical Note (at: www.innovationfordevelopmentreport.org) which addresses the issue of how we deal with missing data for individual indicators for a small set of countries. The Technical Note also touches upon other data issues, including normalization, weighing and aggregation, and sensitivity analysis.

Box 1. Structure of the Innovation Capacity Index (ICI)

The ICI is built upon five pillars composed of a total of 61 variables. For synthetic purposes only, the variables are grouped into conceptual subsections, which may be thought of as subindexes. The ICI ranks countries according to their overall performance and also provides scores by pillars and subindexes which give a general idea of performance in those areas. Variable definitions are presented in the Appendix.

1st Pillar: Institutional environment

A. Good governance
- 1.01 Voice and accountability
- 1.02 Political stability
- 1.03 Government effectiveness
- 1.04 Rule of law
- 1.05 Property rights framework
- 1.06 Transparency and judicial independence
- 1.07 *Corruption Perceptions Index* (TI)

B. Country policy assessment

1. Public sector management
   - 1.08 Quality of budgetary and financial management
   - 1.09 Quality of public administration
2. Structural policies
   - 1.10 Financial sector efficiency
   - 1.11 Trade openness
   - 1.12 Foreign direct investment gross inflows (as % of GDP)
3. Macroeconomy
   - 1.13 Debt levels
   - 1.14 Fiscal balance
   - 1.15 Macro stability

2nd Pillar: Human capital, training and social inclusion

A. Education
- 2.01 Adult literacy rate (% aged 15 and older)
- 2.02 Secondary gross enrolment ratio (%)
- 2.03 Tertiary gross enrolment ratio (%)
- 2.04 Expenditure in education (as % of GDP)

B. Social inclusion and equity policies
- 2.05 Gender Equity
- 2.06 Environmental sustainability
- 2.07 Health worker density
- 2.08 Inequality measure: ratio of richest 20% to poorest 20%

3rd Pillar: Regulatory and legal framework

A. Doing business

1. Starting a business
   - 3.01 Number of procedures
   - 3.02 Time (days)
   - 3.03 Cost (as % of income per capita)
2. Ease of employing workers
   - 3.04 Ease of employing workers
3. Paying taxes
   - 3.05 Paying taxes
4. Protecting investors
   - 3.06 Strength of investor protection
5. Registering property
   - 3.07 Number of procedures
   - 3.08 Time (days)
   - 3.09 Cost (as % of property value)

4th Pillar: Research and development

A. R&D infrastructure
- 4.01 Research and development expenditure (as % of GDP)
- 4.02 Information and communication technology expenditure (as % of GDP)
- 4.03 R&D worker density
- 4.04 Students in science and engineering (as % of tertiary students)
- 4.05 Scientific and technical journal articles (per million people)
- 4.06 Schools connected to the internet (%)

B. Patents and trademarks
- 4.07 Patents granted to residents (per million people)
- 4.08 Trademark applications filed by residents (per million people)
- 4.09 Receipts of royalty and license fees (US$ per person)
- 4.10 Payments of royalty and license fees (US$ per person)

5th Pillar: Adoption and use of information and communication technologies

A. Telephone communications
- 5.01 Main (fixed) telephone lines per 100 inhabitants
- 5.02 Waiting list for main (fixed) lines per 1000 inhabitants
- 5.03 Business connection charge (as % of GDP/capita)
- 5.04 Business monthly subscription (as % of GDP/capita)
- 5.05 Residential connection charge (as % of GDP/capita)
- 5.06 Residential monthly subscription (as % of GDP/capita)

B. Mobile cellular communications
- 5.07 Subscribers per 100 inhabitants
- 5.08 Prepaid subscribers per 100 inhabitants
- 5.09 Population coverage (%)
- 5.10 Connection charge (as % of GDP/capita)

C. Internet, computers and TV
- 5.11 Total fixed internet subscribers per 100 inhabitants
- 5.12 Total fixed broadband subscribers per 100 inhabitants
- 5.13 Internet users per 100 inhabitants
- 5.14 Personal computers per 100 inhabitants
- 5.15 Television receivers per 100 inhabitants

D. Government ICT usage
- 5.16 E-government readiness index

E. Quality of the infrastructure
- 5.17 Electrification rate (%)
- 5.18 Electric power transmission and distribution losses (as % of output)
- 5.19 Roads paved (as % of total roads)

and complete database of ICT and telecommunication statistics;[59] the World Bank's *World Development Indicators* (WDI), which makes available data on some 800 indicators covering different dimensions of economic and social development; [60] the World Bank/International Finance Corporation's *Doing Business Report* (DBR), which contains objective measures of business regulations and their enforcement across 181 economies;[61] the United Nations Development Programme's Human Development Report (HDR), with its ample database on critical issues for human development worldwide;[62] and the World Economic Outlook (WEO), the main instrument for the IMF's global surveillance activities,[63] among others.

Country categories

For operational and analytical purposes, countries were divided into two different categories by income level and political system, according to the following criteria:

Income levels: Gross National Income (GNI) per capita based on the World Bank 2007 country classifications:[64]
High-income: GNI per capita > $11,456
Upper-middle-income: GNI per capita: $3,706 – 11,455
Lower-middle-income: GNI per capita: $936 – 3,705
Low-income: GNI per capita < $935

Average incomes per capita for each country grouping are shown in Table 3.

Political systems: The Economist Intelligence Unit's *Index of Democracy* 2008 [65] analyzes electoral process and pluralism, prevalence of civil liberties, the functioning of government, issues of political participation, and political culture, and classifies countries as:
Full democracies: scores 8–10
Flawed democracies: scores 6–7.9
Hybrid regimes: scores 4–5.9
Authoritarian regimes: scores < 4

The 131 countries included in the ICI may thus be presented as shown in Table 4.

Weights

We have given considerable thought to the issue of how to weight the five pillars of the Index across the 131 countries. In choosing the weights, our starting point has been the theoretical considerations put forward by Rostow (1960) and Porter (1990, as highlighted in the section above), which we find intuitively appealing and in conformity with extensive empirical observation over the post-World War II period, particularly in the context of the work carried out by organizations such as the World Bank and the International Monetary Fund. Such work suggests that the relative importance of factors affecting innovation will be a function of a country's stage of development. Countries in earlier stages—Rostow called them "traditional societies" but, as in Porter, we may think of them as countries with relatively under-developed institutions and human capital, which act as constraints on the level of attainable output per capita—will need to prioritize those areas which are essential prerequisites for the next stage.[66] Thus, before it can join the group of nations doing innovation, a low-income country in sub-Saharan Africa will need to focus reform efforts and resources in developing the institutional infrastructure and in building up its human resource endowments. At the other end of the development spectrum, an innovator such as Sweden—already endowed with efficiently working institutions and with a highly skilled labor force—will have to focus its energies on improving those factors which more directly sustain and further boost an established capacity for innovation, for example, ensuring that the system of higher education is able to provide training immediately relevant for industry, or ensuring that the government makes further improvements in the regulatory environment and provides the incentives that underpin the creation of new businesses.[67] An alternative way to see this is to say that those pillars which more fundamentally have to do with people, institutions, and

[59] International Telecommunication Union (ITU), available at: http://www.itu.int
[60] World Bank, 2008b, available at: http://www.worldbank.org
[61] World Bank, 2008a, available at: http://www.doingbusiness.org
[62] United Nations Development Programme (UNDP), available at: http://www.undp.org
[63] International Monetary Fund (IMF), 2009a, available at: http://www.imf.org
[64] Available at: http://www.worldbank.org
[65] The Economist Intelligence Unit's *Index of Democracy*, available at: http://www.eiu.com
[66] This is how Rostow (1960) expressed it: "The second stage of growth embraces societies in the process of transition; that is, the period when the preconditions for take-off are developed; for it takes time to transform a traditional society in the ways necessary for it to exploit the fruits of modern science, to fend off diminishing returns, and thus to enjoy the blessings and choices opened up by the march of compound interest" (p. 6).

Table 4. ICI Country clusters according to income level and political regime

High-income: GNI per capita > US$11,456			
Full democracies	Flawed democracies	Hybrid regimes	Authoritarian regimes
Australia Austria Belgium Canada Czech Republic Denmark Finland France Germany Greece Iceland Ireland Italy Japan Korea, Republic of Luxembourg Malta Netherlands New Zealand Norway Portugal Slovenia, Republic of Spain Sweden Switzerland United Kingdom United States	Cyprus Estonia, Republic of Hungary Israel Slovak Republic Taiwan Trinidad and Tobago	Hong Kong SAR Singapore	Bahrain, Kingdom of Kuwait Oman Qatar Saudi Arabia United Arab Emirates

Upper-middle-income: GNI per capita: US$3,706–US$11,455			
Full democracies	Flawed democracies	Hybrid regimes	Authoritarian regimes
Costa Rica Mauritius Uruguay	Argentina Belize Botswana Brazil Bulgaria Chile Croatia, Republic of Jamaica Latvia, Republic of Lithuania, Republic of Malaysia Mexico Panama Poland Romania South Africa Suriname	Lebanon Russian Federation Turkey Venezuela	Kazakhstan, Republic of

Lower-middle-income: GNI per capita: US$936–US$3,705			
Full democracies	Flawed democracies	Hybrid regimes	Authoritarian regimes
	Bolivia Colombia Dominican Republic El Salvador Guatemala Honduras India Indonesia Macedonia, FYR Namibia Nicaragua Paraguay Peru Philippines Sri Lanka Thailand Ukraine	Bosnia and Herzegovina Ecuador Georgia Iraq	Algeria Angola Azerbaijan, Republic of Cameroon China, People's Republic of Congo, Republic of Egypt, Arab Republic of Iran, Islamic Republic of Jordan Morocco Sudan Syrian Arab Republic Tunisia

Low-income: GNI per capita < US$935			
Full democracies	Flawed democracies	Hybrid regimes	Authoritarian regimes
	Papua New Guinea	Bangladesh Cambodia Ethiopia Ghana Haiti Kenya Madagascar Malawi Mali Mozambique, Republic of Nepal Pakistan Senegal Tanzania Uganda Zambia	Afghanistan, Islamic Republic of Chad Côte d'Ivoire Guinea Lao PDR Mauritania Niger Nigeria Rwanda Togo Vietnam Yemen, Republic of Zimbabwe

social networks (pillars 1 and 2) are seen as the foundations for the pillars which deal with means and other enabling factors (pillars 3, 4, and 5). Innovation would be the last frontier, provided that the foundations of governance and human resources are well on their way to being broadly secured.

These theoretical considerations have been further complemented by extensive data analysis which is described in greater detail in a Technical Note (available at www.innovationfordevelopmentreport.org). Nevertheless, it is useful to provide here the gist of that analysis, which largely corroborates the above observations derived from the work of Rostow and Porter. A first step was to determine the influence of the three country categories chosen (income levels, type of political regime, and geographical location[68]) on the raw index scores. This was achieved in two stages: first, we obtained a set of raw pillar and index scores without imposing any prior organizational principle on the data with respect to a country's level of income, its political regime, or its geographical location; second, we used statistical techniques developed by Pavlidis and Noble (2001) to create a template for a correlation analysis with respect to numerical values assigned to each category;[69] that is, income levels were given a number from 1 to 4, from lowest to highest income, and political regimes from 1 to 4, from least democratic to most democratic, and so on, thus generating three category data sets. In this way the raw index and pillar scores were used as templates and compared with the category data, in order to find if there was a correlation between the different categories and scores. Only those correlations with p-values equal or lower than 0.05 were deemed significant.[70] According to these tests (see Figure 2), the two main categories with the greatest influence on the index and pillar scores were income levels followed by political regime. In the age of globalization, geographic location appears to play a role of declining importance. This created 16 possible country clusters based on four income categories and four different types of political regime (Table 4). The final weight allocation is shown in Table 5.

5. Innovation Capacity Index rankings 2009–2010

The results for this year's rankings for the 131 countries covered by the Innovation Capacity Index are presented in Table 6. Table 7 presents a more detailed version of the results, identifying individual pillar scores and ranks and the corresponding scores and ranks for the subindexes that make up the various pillar components, such as "good governance" and "country policy assessment" for pillar 1, on a country's institutional environment. Table 8, on the other hand, present Index ranks and scores for the various country clusters, depending on each country's income per capita (e.g., stage of development) and political regime. This Table is useful, as it addresses the occasional criticism against rankings involving a relatively large number of countries, namely, that they force comparisons between markedly different sets of countries, possibly at very different stages of development or having other important structural differences. From this Table one can see, for instance, that although Jordan has a rank of 44 in the ICI, it is first among lower-middle-income authoritarian regimes, ahead of Tunisia and China. Likewise, Ghana's rank of 77 among all 131 countries highlights a large number of weaknesses across all the pillars of the ICI, but the country does much better when the comparator group includes only low-income countries with either a hybrid or an authoritarian regime.

While these tables provide a good overview of the main results, we direct the attention of the reader to the inno-

[67] Again, Rostow provides useful insights: "This is the stage in which an economy demonstrates that it has the technological and entrepreneurial skills to produce not everything, but anything that it chooses to produce. It may lack (like contemporary Sweden and Switzerland, for example) the raw materials or other supply conditions required to produce a given type of output economically; but its dependence is a matter of economic choice or political priority rather than a technological or institutional necessity" (Rostow, op. cit., p. 10).

[68] The choice of geographic location was not induced by any sense of geographic determinism, that is, the notion, as discussed by Diamond (1999), that differences across countries and cultures are largely determined by climate, fauna, and flora. Rather, the idea was in keeping with Diamond's sensible observation that "all human societies contain inventive people. It's just that some environments provide more starting materials, and more favorable conditions for utilizing inventions, than do other environments" (p. 408).

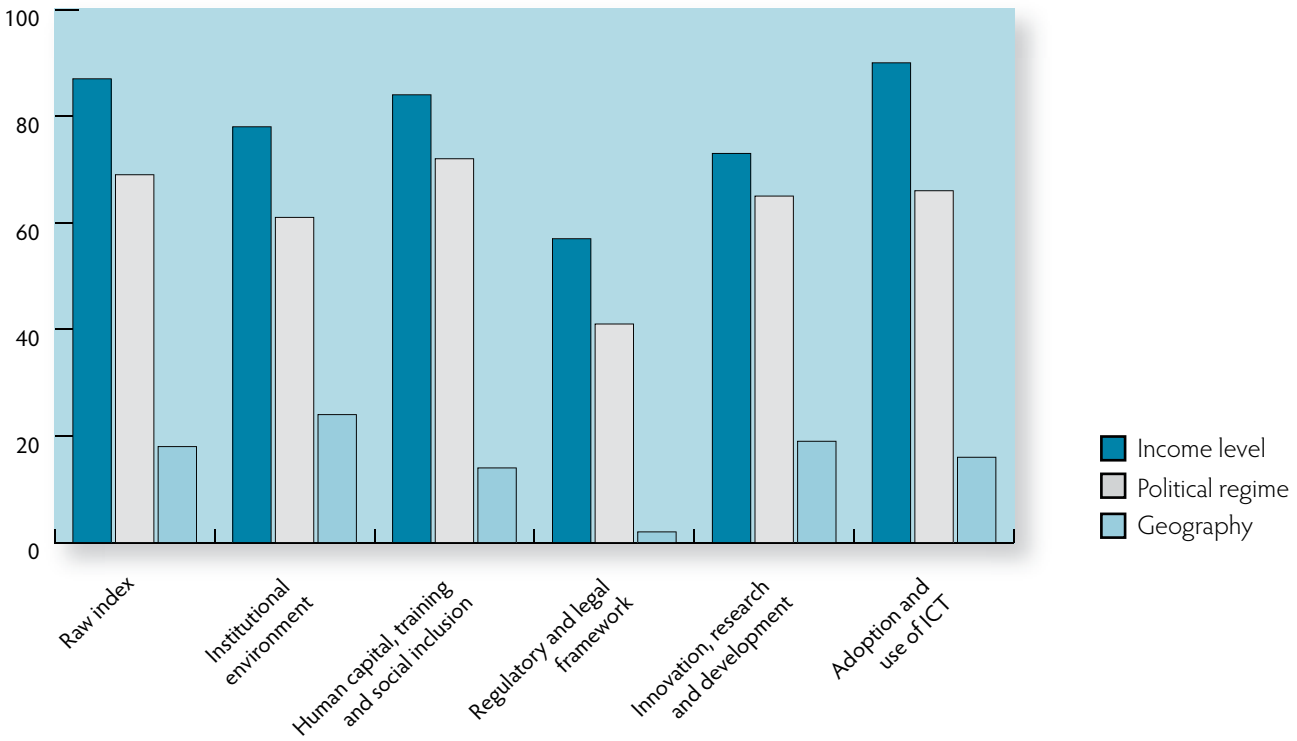
[69] Pavlidis and Noble, 2001. In this paper, the authors demonstrated the ease and feasibility of using this type of correlation analysis when dealing with large data sets, and applied in their case to array expression patterns of DNA. They note that the advantages of template matching (that is, using a set of data as a pattern in order to find correlations with other data sets) are that this feature selection method is simple, can be used to differentiate between any number of categories, and permits rankings according to different levels of differentiation. In fact, the large data set generated by our study was managed and analyzed with the aid of a free open-source DNA microarray analysis suite, the Multiexperiment Viewer, developed at the Institute for Genomic Research (TIGR) in California. For more information see: Saeed et al., 2003. Available at: http://www.tm4.org/mev.html

[70] The p-value determines to what extent the different correlations obtained were due to chance. It is a probability value that varies from 0 to 1. A significance level of 0.05 indicates that the there is only a 5 percent probability that the correlation value was determined purely by chance.

vation profiles contained in Part 3 of the Report, which provide additional information on individual country performance. Part 3 includes profiles for a total of 68 countries, with the remaining 63 innovation profiles available at: www.innovationfordevelopmentreport.org

To highlight the type of analysis which is made possible through the Innovation Capacity Index we discuss here this year's results for Sweden, Chile, India, Russia, and Taiwan. These countries are interesting for a variety of reasons: Sweden, because it is this year's top-ranked nation and provides an impressive benchmark against which to assess other countries' performance. Chile is not only the highest-ranked country in Latin America, but is far ahead (20 places) from the next best performer in the region, Uruguay. What are the factors that account for this significantly better performance, which puts Chile at levels above the EU average? India is arguably the country with one of the highest potentials to become a leading center for technological innovation. Yet, it is a country whose innovation potential is saddled by major shortcomings in education and human capital accumulation, inadequate infrastructure, mind-boggling levels of bureaucracy and red tape, an unreformed budget, and correspondingly high levels of public debt. Russia is a country with an impressive human capital endowment which during the time of the Soviet Union had made substantial inroads in such areas as space exploration, nuclear power, and basic sciences. Yet today, it is operating well below its capacity, largely confined to acquiring advanced technologies from abroad, and not providing any homegrown innovations. What are the challenges which are now preventing the development of its latent innovation capacities and what is needed for a better interaction between private sector strategies and public sector policies that will release the country's untapped potential? Taiwan, as noted earlier, has made impressive progress over the past decades in transforming itself into a leading player in the ICT industry, and the ingredients for its success are well worth studying, as key components of Taiwan's strategy have international relevance.

Figure 2. Correlation coefficients (R in %) of the different country category groups with respect to raw index and pillar scores*



* Pillars 2, 3 and 5 with respect to geography showed p-values above 0.05. These were 0.12, 0.07 and 0.85 respectively.

Table 5. Weighting of pillars in the Innovation Capacity Index (in percent)

	High-income: GNI per capita > US$11,456			
	Full democracies	Flawed democracies	Hybrid regimes	Authoritarian regimes
Institutional environment	10	15	20	20
Human capital, training and social inclusion	10	15	20	20
Regulatory and legal framework	20	20	20	20
Research and development	30	25	20	20
Adoption and use of ICT	30	25	20	20
Total	100	100	100	100
	Upper-middle-income: GNI per capita: US$3,706–US$11,455			
	Full democracies	Flawed democracies	Hybrid regimes	Authoritarian regimes
Institutional environment	25	25	25	25
Human capital, training and social inclusion	25	25	25	25
Regulatory and legal framework	20	20	20	20
Research and development	15	15	15	15
Adoption and use of ICT	15	15	15	15
Total	100	100	100	100
	Lower-middle-income: GNI per capita: US$936–US$3,705			
	Full democracies	Flawed democracies	Hybrid regimes	Authoritarian regimes
Institutional environment	-	30	30	30
Human capital, training and social inclusion	-	30	30	30
Regulatory and legal framework	-	20	20	20
Research and development	-	10	10	10
Adoption and use of ICT	-	10	10	10
Total	-	100	100	100
	Low-income: GNI per capita < US$935			
	Full democracies	Flawed democracies	Hybrid regimes	Authoritarian regimes
Institutional environment	-	30	30	30
Human capital, training and social inclusion	-	30	30	30
Regulatory and legal framework	-	20	20	20
Research and development	-	10	10	10
Adoption and use of ICT	-	10	10	10
Total	-	100	100	100

Table 6. Innovation Capacity Index rankings 2009–2010*

Country	ICI rank	ICI score
Sweden	1	82.2
Finland	2	77.8
United States	3	77.5
Switzerland	4	77.0
Netherlands	5	76.6
Singapore	6	76.5
Canada	7	74.8
United Kingdom	8	74.6
Norway	9	73.5
New Zealand	10	73.4
Luxembourg	11	73.3
Denmark	11	73.3
Taiwan	13	72.9
Iceland	14	72.6
Japan	15	72.1
Hong Kong SAR	16	71.3
Australia	17	71.2
Ireland	18	70.5
Korea, Republic of	19	70.0
Germany	20	68.8
Israel	21	68.2
Belgium	22	67.6
Austria	23	66.7
France	24	65.4
Estonia, Republic of	25	62.7
Lithuania, Republic of	26	60.7
Latvia, Republic of	27	60.5
Spain	28	60.3
Chile	29	59.4
Italy	30	59.1
Slovenia, Republic of	31	58.6
Czech Republic	32	58.0
Bulgaria	33	57.7
Malaysia	34	57.3
Portugal	35	57.2
Bahrain, Kingdom of	36	56.6
United Arab Emirates	37	56.2
Croatia, Republic of	38	56.0
Slovak Republic	39	55.8
Poland	40	55.7
Hungary	41	55.6
Georgia	42	55.1
Thailand	43	54.6
Jordan	44	53.9
Qatar	45	53.8
South Africa	46	53.3
Macedonia, FYR	47	53.1
Romania	47	53.1
Uruguay	49	52.8
Russian Federation	49	52.8
Mauritius	49	52.8
Malta	52	52.4
Cyprus	53	52.3
Ukraine	54	52.0
Saudi Arabia	55	51.9
Tunisia	56	51.8
Kazakhstan, Republic of	57	51.6
Costa Rica	58	51.5
Turkey	59	50.8
Peru	60	50.6
Mexico	61	50.5
Oman	62	50.2
Greece	62	50.2
Kuwait	64	50.1
China, People's Republic of	65	49.5
Argentina	66	49.2
Botswana	67	49.1
Panama	68	48.9
Trinidad and Tobago	69	48.7
Bosnia and Herzegovina	70	48.3
El Salvador	70	48.3
Colombia	72	48.0
Namibia	73	47.5
Azerbaijan, Republic of	74	47.3
Philippines	75	47.0
Algeria	76	46.7
Ghana	77	46.6
Vietnam	78	46.4
Dominican Republic	79	46.3
Egypt, Arab Republic of	79	46.3
Jamaica	81	46.2
Honduras	82	46.0
Lebanon	83	45.8
Iran, Islamic Republic of	84	45.7
India	85	45.6
Sri Lanka	86	45.5
Brazil	87	45.2
Indonesia	88	44.9
Guatemala	89	44.5
Paraguay	90	44.3
Ecuador	91	44.2
Tanzania	92	43.7
Nicaragua	93	43.4
Madagascar	93	43.4
Morocco	95	43.3
Kenya	95	43.3
Pakistan	97	42.7
Belize	98	42.1
Zambia	99	41.8
Bolivia	100	41.5
Papua New Guinea	101	41.3
Venezuela	102	40.9
Nepal	103	40.3
Nigeria	104	40.2
Suriname	105	40.1
Bangladesh	106	39.8
Syrian Arab Republic	107	39.4
Mozambique, Republic of	108	39.1
Uganda	109	38.3
Cameroon	109	38.3
Senegal	111	38.1
Cambodia	112	37.5
Malawi	112	37.5
Ethiopia	114	37.3
Mauritania	115	37.1
Lao PDR	116	36.8
Yemen, Republic of	117	35.1
Sudan	118	35.0
Iraq	119	34.2
Mali	120	33.8
Angola	121	33.4
Rwanda	122	33.3
Congo, Republic of	123	33.0
Côte d'Ivoire	124	32.4
Zimbabwe	125	31.8
Niger	126	30.6
Togo	127	30.1
Guinea	128	29.1
Haiti	129	28.7
Chad	130	25.6
Afghanistan, Islamic Republic of	131	24.0

*All rankings and scores are after rounding.

Table 7. Innovation Capacity Index 2009–2010: Pillar rankings*

	Pillar 1: Institutional environment						Pillar 2: Human capital, training, and social inclusion			
	Pillar		Good governance		Country policy assessment		Pillar		Education	
COUNTRY	RANKING	SCORE	RANKING	SCORE	RANKING	SCORE	RANKING	SCORE	RANKING	SCORE
Afghanistan, Islamic Republic of	127	26.6	130	14.3	116	40.3	131	12.7	129	16.1
Algeria	70	46.5	102	33.0	30	59.9	82	51.4	66	59.5
Angola	104	38.2	121	24.5	58	53.5	128	27.8	121	26.9
Argentina	104	38.2	81	38.8	125	37.6	41	63.6	30	70.4
Australia	11	79.4	8	88.7	12	70.2	9	79.9	11	79.1
Austria	15	71.7	13	86.6	45	56.7	22	74.0	33	68.9
Azerbaijan, Republic of	96	40.9	112	28.5	59	53.3	58	59.0	67	59.4
Bahrain, Kingdom of	27	64.1	49	55.5	9	72.7	42	62.9	45	67.3
Bangladesh	111	37.0	115	27.8	95	46.3	104	41.6	107	36.8
Belgium	20	69.9	18	79.2	26	60.5	8	81.7	18	75.7
Belize	95	41.2	66	43.5	123	38.1	91	47.7	92	48.1
Bolivia	85	43.2	92	35.5	77	51.0	88	49.7	51	65.5
Bosnia and Herzegovina	68	47.1	82	38.3	40	57.0	47	61.0	79	56.2
Botswana	26	65.3	34	63.9	18	66.7	93	46.9	91	48.9
Brazil	81	44.5	65	43.6	97	45.4	71	53.0	59	62.6
Bulgaria	47	53.7	60	46.2	24	61.1	35	67.8	32	69.0
Cambodia	115	36.2	119	26.6	96	45.8	112	39.7	111	33.3
Cameroon	100	40.1	111	28.7	72	51.4	111	40.0	109	35.2
Canada	14	74.3	11	88.1	26	60.5	11	79.1	12	77.5
Chad	125	30.1	127	16.5	100	45.1	129	20.8	131	14.4
Chile	19	70.2	25	71.0	14	69.5	63	56.5	47	67.0
China, People's Republic of	64	49.1	77	40.5	37	57.7	87	50.3	89	50.6
Colombia	93	41.4	78	40.1	105	42.8	76	51.9	60	61.9
Congo, Republic of	116	35.2	121	24.5	93	47.2	110	40.1	106	37.5
Costa Rica	44	56.7	40	59.7	55	53.7	52	60.4	72	58.3
Côte d'Ivoire	126	29.0	126	18.7	120	39.3	118	35.7	114	31.1
Croatia, Republic of	50	52.1	52	52.6	70	51.6	32	68.2	36	68.6
Cyprus	28	64.0	24	71.2	41	56.9	43	62.7	48	66.6
Czech Republic	43	56.8	37	61.5	66	52.1	25	71.9	28	71.1
Denmark	4	83.7	1	93.6	5	73.7	5	83.3	9	79.6
Dominican Republic	99	40.3	78	40.1	115	40.5	64	56.0	74	57.3
Ecuador	108	37.6	117	27.6	91	47.6	73	52.7	88	50.7
Egypt, Arab Republic of	106	37.9	88	36.1	118	39.7	75	52.3	68	58.7
El Salvador	74	45.8	63	44.2	92	47.4	78	51.8	62	60.9
Estonia, Republic of	16	70.6	22	71.7	14	69.5	18	75.7	3	83.6
Ethiopia	119	34.7	105	29.6	118	39.7	109	40.3	122	26.2
Finland	6	81.6	5	92.6	11	70.7	3	83.9	7	80.1
France	25	65.4	21	75.7	52	55.2	20	75.3	29	70.5
Georgia	50	52.1	68	42.7	21	62.5	50	60.5	37	68.5
Germany	17	70.5	14	84.7	48	56.4	14	77.0	38	68.4
Ghana	61	49.8	55	50.3	82	49.4	99	43.8	100	41.6
Greece	60	49.9	46	57.5	107	42.4	15	76.6	2	84.2
Guatemala	89	42.3	91	35.6	86	49.0	97	45.1	108	36.3
Guinea	130	23.9	125	19.0	130	28.8	122	31.6	127	21.1
Haiti	124	31.0	124	20.9	109	42.1	122	31.6	93	47.5
Honduras	76	45.5	89	35.8	52	55.2	81	51.5	84	53.3
Hong Kong SAR	3	84.4	16	83.0	1	85.7	46	61.4	55	64.0
Hungary	58	51.0	38	61.1	112	41.0	30	69.5	31	70.0
Iceland	1	85.6	6	92.3	3	78.9	2	86.7	1	90.6
India	72	46.3	64	43.8	89	48.8	94	45.9	99	41.9
Indonesia	81	44.5	100	33.3	50	55.8	85	50.9	81	55.1
Iran, Islamic Republic of	101	39.8	114	28.2	63	52.7	86	50.4	78	56.5
Iraq	129	24.9	131	13.7	120	39.3	113	39.4	96	45.1
Ireland	13	75.5	15	84.1	18	66.7	12	78.0	27	72.3
Israel	37	58.3	35	63.0	57	53.6	36	67.3	52	65.1
Italy	69	47.0	47	56.3	124	37.8	19	75.5	16	76.5
Jamaica	110	37.5	61	44.6	129	29.6	72	52.9	86	51.5
Japan	35	59.2	20	77.6	114	40.7	29	70.6	22	73.8
Jordan	48	53.6	50	54.2	61	52.9	50	60.5	61	61.2
Kazakhstan, Republic of	66	47.8	98	34.0	22	61.6	40	64.5	42	67.8
Kenya	98	40.8	103	31.5	78	50.1	98	44.9	97	44.2
Korea, Republic of	31	62.9	30	65.7	29	60.1	33	68.1	5	81.4
Kuwait	53	51.6	53	51.7	71	51.5	62	56.6	82	54.5
Lao PDR	120	34.1	118	27.2	110	41.9	100	43.1	111	33.3
Latvia, Republic of	35	59.2	42	59.4	34	58.9	28	70.8	24	73.0
Lebanon	123	32.7	101	33.2	128	32.1	55	60.0	39	68.0

Table 7. Innovation Capacity Index 2009–2010: Pillar rankings* (cont'd.)

	Pillar 1: Institutional environment						Pillar 2: Human capital, training, and social inclusion			
	Pillar		Good governance		Country policy assessment		Pillar		Education	
COUNTRY	RANKING	SCORE	RANKING	SCORE	RANKING	SCORE	RANKING	SCORE	RANKING	SCORE
Lithuania, Republic of	37	58.3	43	58.8	36	57.8	24	72.9	12	77.5
Luxembourg	2	84.5	9	88.3	2	80.7	21	74.8	17	75.8
Macedonia, FYR	73	46.1	70	42.5	78	50.1	44	62.0	73	58.1
Madagascar	57	51.1	67	42.9	33	59.3	108	40.5	102	40.2
Malawi	111	37.0	84	37.5	126	36.5	117	36.9	116	30.0
Malaysia	37	58.3	45	58.0	35	58.7	68	54.7	76	56.9
Mali	85	43.2	74	41.8	101	44.7	126	30.1	126	21.7
Malta	23	66.0	23	71.4	26	60.5	49	60.6	39	68.0
Mauritania	103	38.8	95	34.8	105	42.8	119	35.4	123	25.4
Mauritius	46	56.1	33	64.2	90	47.9	69	53.4	77	56.6
Mexico	75	45.6	71	42.3	87	48.9	61	57.0	70	58.5
Morocco	92	41.5	72	42.2	113	40.9	105	41.5	104	39.3
Mozambique, Republic of	80	44.6	86	37.1	66	52.1	127	29.8	128	20.5
Namibia	49	52.9	48	55.8	80	50.0	92	47.2	90	50.5
Nepal	113	36.8	106	29.5	102	44.2	102	41.7	115	30.1
Netherlands	12	77.2	7	89.3	20	65.1	6	82.0	19	75.2
New Zealand	5	82.1	4	92.7	10	71.4	10	79.2	9	79.6
Nicaragua	90	42.2	95	34.8	82	49.4	84	51.0	93	47.5
Niger	84	43.6	94	34.9	64	52.4	130	20.3	130	15.0
Nigeria	87	42.8	109	28.9	46	56.6	107	40.8	101	40.6
Norway	9	80.6	12	87.6	6	73.5	1	88.9	4	82.4
Oman	34	59.9	44	58.6	23	61.3	66	55.4	43	67.5
Pakistan	108	37.6	120	26.1	84	49.1	106	40.9	113	32.4
Panama	53	51.6	57	46.9	49	56.3	70	53.1	68	58.7
Papua New Guinea	93	41.4	104	30.9	68	51.9	114	38.1	118	29.9
Paraguay	114	36.7	108	29.4	104	44.0	89	49.1	49	66.4
Peru	77	45.4	80	39.0	69	51.8	57	59.9	41	67.9
Philippines	102	39.5	99	33.9	99	45.2	48	60.9	56	63.7
Poland	53	51.6	51	54.0	84	49.1	39	66.1	46	67.2
Portugal	33	60.2	27	69.2	75	51.2	27	70.9	35	68.8
Qatar	21	69.6	32	64.4	4	74.8	90	49.0	71	58.4
Romania	64	49.1	59	46.8	73	51.3	55	60.0	58	63.2
Russian Federation	79	45.2	106	29.5	25	60.8	37	66.7	43	67.5
Rwanda	96	40.9	84	37.5	102	44.2	124	31.5	124	22.6
Saudi Arabia	42	57.6	72	42.2	8	72.9	67	55.0	15	77.0
Senegal	67	47.3	75	41.7	62	52.8	120	34.5	125	22.1
Singapore	8	80.8	9	88.3	7	73.4	33	68.1	33	68.9
Slovak Republic	44	56.7	39	59.8	55	53.7	31	68.8	50	65.6
Slovenia, Republic of	30	63.6	26	69.9	39	57.2	26	71.0	26	72.9
South Africa	37	58.3	40	59.7	41	56.9	78	51.8	63	60.5
Spain	28	64.0	29	68.2	31	59.8	13	77.1	22	73.8
Sri Lanka	107	37.8	87	36.6	122	39.1	73	52.7	65	59.9
Sudan	128	25.3	128	16.1	127	34.4	116	37.0	103	40.0
Suriname	71	46.4	62	44.3	87	48.9	76	51.9	80	56.1
Sweden	6	81.6	2	93.4	13	69.7	4	83.4	21	74.3
Switzerland	9	80.6	3	93.3	17	67.8	7	81.9	14	77.3
Syrian Arab Republic	118	34.8	110	28.8	111	41.5	96	45.3	87	51.3
Taiwan	32	60.7	31	64.8	47	56.5	23	73.9	6	81.0
Tanzania	63	49.2	76	40.9	38	57.4	95	45.5	116	30.0
Thailand	62	49.7	69	42.6	43	56.8	59	58.5	54	64.6
Togo	122	34.0	115	27.8	117	40.2	125	31.4	119	29.1
Trinidad and Tobago	52	51.9	57	46.9	43	56.8	45	61.8	83	53.7
Tunisia	56	51.3	54	51.2	73	51.3	65	55.9	84	53.3
Turkey	59	50.7	56	47.6	54	53.9	82	51.4	75	57.0
Uganda	88	42.7	97	34.2	76	51.1	101	42.7	120	27.6
Ukraine	83	44.4	89	35.8	60	53.0	38	66.5	20	75.1
United Arab Emirates	24	65.5	36	61.8	16	69.2	53	60.3	64	60.4
United Kingdom	17	70.5	17	81.3	32	59.7	15	76.6	24	73.0
United States	22	66.6	19	77.8	51	55.5	17	76.5	8	80.0
Uruguay	41	57.9	28	68.7	94	47.1	54	60.2	53	65.0
Venezuela	120	34.1	123	22.7	97	45.4	60	57.2	57	63.5
Vietnam	91	42.1	93	35.1	81	49.8	80	51.7	95	45.4
Yemen, Republic of	117	35.0	113	28.4	107	42.4	121	33.6	105	38.2
Zambia	78	45.3	82	38.3	64	52.4	115	37.6	110	33.9
Zimbabwe	131	14.2	129	16.0	131	12.2	102	41.7	98	42.3

Table 7. Innovation Capacity Index 2009–2010: Pillar rankings* (cont'd.)

	Pillar 2: Human capital, training, and social inclusion		Pillar 3: Regulatory and legal framework			
	Social inclusion and equity policies		Pillar		Doing business	
COUNTRY	RANKING	SCORE	RANKING	SCORE	RANKING	SCORE
Afghanistan, Islamic Republic of	131	2.4	114	50.6	114	50.6
Algeria	91	46.1	99	57.6	99	57.6
Angola	127	28.6	124	44.0	124	44.0
Argentina	49	59.0	88	61.3	88	61.3
Australia	11	80.3	10	81.4	10	81.4
Austria	17	77.3	49	69.3	49	69.3
Azerbaijan, Republic of	51	58.8	76	63.4	76	63.4
Bahrain, Kingdom of	52	58.4	13	80.3	13	80.3
Bangladesh	100	44.8	94	59.1	94	59.1
Belgium	6	85.6	26	74.4	26	74.4
Belize	87	47.4	71	64.5	71	64.5
Bolivia	115	39.2	119	46.6	119	46.6
Bosnia and Herzegovina	38	65.7	109	54.4	109	54.4
Botswana	95	45.5	60	66.8	60	66.8
Brazil	88	46.6	114	50.6	114	50.6
Bulgaria	36	66.9	38	71.4	38	71.4
Cambodia	101	44.1	103	57.1	103	57.1
Cameroon	102	43.2	118	49.1	118	49.1
Canada	12	80.1	3	88.8	3	88.8
Chad	128	26.0	125	41.8	125	41.8
Chile	77	49.6	23	75.4	23	75.4
China, People's Republic of	75	50.1	58	67.3	58	67.3
Colombia	98	45.2	56	67.6	56	67.6
Congo, Republic of	105	42.2	129	39.3	129	39.3
Costa Rica	42	61.8	93	59.3	93	59.3
Côte d'Ivoire	116	38.8	117	49.9	117	49.9
Croatia, Republic of	33	68.0	82	62.2	82	62.2
Cyprus	46	59.6	ND	ND	ND	ND
Czech Republic	21	72.5	54	68.0	54	68.0
Denmark	5	85.7	9	81.7	9	81.7
Dominican Republic	61	55.1	80	62.9	80	62.9
Ecuador	64	54.0	96	58.2	96	58.2
Egypt, Arab Republic of	83	48.0	68	65.8	68	65.8
El Salvador	93	45.7	69	65.6	69	65.6
Estonia, Republic of	25	70.4	18	77.3	18	77.3
Ethiopia	76	49.7	84	62.1	84	62.1
Finland	4	86.4	19	77.2	19	77.2
France	16	78.4	64	66.3	64	66.3
Georgia	60	55.3	12	80.5	12	80.5
Germany	9	82.8	44	70.4	44	70.4
Ghana	96	45.3	42	70.5	42	70.5
Greece	23	71.5	110	54.1	110	54.1
Guatemala	72	50.9	66	66.1	66	66.1
Guinea	117	38.6	120	46.2	120	46.2
Haiti	130	21.0	128	40.9	128	40.9
Honduras	74	50.4	100	57.5	100	57.5
Hong Kong SAR	47	59.3	4	88.4	4	88.4
Hungary	29	69.2	57	67.4	57	67.4
Iceland	8	84.3	16	78.7	16	78.7
India	81	48.6	79	63.1	79	63.1
Indonesia	82	48.1	96	58.2	96	58.2
Iran, Islamic Republic of	90	46.4	95	58.9	95	58.9
Iraq	125	30.9	87	61.6	87	61.6
Ireland	10	81.8	7	83.8	7	83.8
Israel	31	68.7	21	76.7	21	76.7
Italy	18	74.8	40	70.6	40	70.6
Jamaica	65	53.7	45	70.3	45	70.3
Japan	32	68.5	17	77.7	17	77.7
Jordan	44	60.1	80	62.9	80	62.9
Kazakhstan, Republic of	41	62.2	31	73.8	31	73.8
Kenya	96	45.3	77	63.3	77	63.3
Korea, Republic of	48	59.2	53	68.3	53	68.3
Kuwait	53	58.3	30	73.9	30	73.9
Lao PDR	77	49.6	111	51.3	111	51.3
Latvia, Republic of	28	69.4	32	73.6	32	73.6
Lebanon	66	53.6	67	66.0	67	66.0

Table 7. Innovation Capacity Index 2009–2010: Pillar rankings* (cont'd.)

	Pillar 2: Human capital, training, and social inclusion		Pillar 3: Regulatory and legal framework			
	Social inclusion and equity policies		Pillar		Doing business	
COUNTRY	RANKING	SCORE	RANKING	SCORE	RANKING	SCORE
Lithuania, Republic of	26	69.8	29	74.1	29	74.1
Luxembourg	19	74.3	71	64.5	71	64.5
Macedonia, FYR	40	64.6	61	66.6	61	66.6
Madagascar	111	40.8	73	64.4	73	64.4
Malawi	107	41.5	92	60.4	92	60.4
Malaysia	68	53.2	14	80.1	14	80.1
Mali	121	35.7	113	51.0	113	51.0
Malta	68	53.2	ND	ND	ND	ND
Mauritania	106	42.1	102	57.2	102	57.2
Mauritius	73	50.8	25	75.0	25	75.0
Mexico	57	55.9	47	69.9	47	69.9
Morocco	103	42.9	89	61.1	89	61.1
Mozambique, Republic of	123	34.5	65	66.2	65	66.2
Namibia	99	45.0	78	63.2	78	63.2
Nepal	79	49.4	52	68.4	52	68.4
Netherlands	3	86.6	28	74.2	28	74.2
New Zealand	14	78.9	1	96.2	1	96.2
Nicaragua	67	53.3	91	60.5	91	60.5
Niger	129	23.9	111	51.3	111	51.3
Nigeria	109	40.9	105	56.2	105	56.2
Norway	1	93.2	8	81.9	8	81.9
Oman	93	45.7	24	75.3	24	75.3
Pakistan	88	46.6	50	69.1	50	69.1
Panama	79	49.4	74	64.2	74	64.2
Papua New Guinea	109	40.9	35	72.8	35	72.8
Paraguay	118	37.6	63	66.4	63	66.4
Peru	62	54.5	46	70.1	46	70.1
Philippines	50	58.9	96	58.2	96	58.2
Poland	39	65.3	59	66.9	59	66.9
Portugal	22	72.3	34	73.1	34	73.1
Qatar	114	39.6	27	74.3	27	74.3
Romania	54	57.8	69	65.6	69	65.6
Russian Federation	37	66.1	48	69.8	48	69.8
Rwanda	119	37.5	121	46.1	121	46.1
Saudi Arabia	120	37.4	15	79.4	15	79.4
Senegal	104	42.8	123	45.1	123	45.1
Singapore	34	67.4	2	89.9	2	89.9
Slovak Republic	24	70.9	36	72.5	36	72.5
Slovenia, Republic of	27	69.7	85	62.0	85	62.0
South Africa	92	46.0	21	76.7	21	76.7
Spain	13	79.2	61	66.6	61	66.6
Sri Lanka	84	47.8	55	67.8	55	67.8
Sudan	122	34.6	75	63.5	75	63.5
Suriname	84	47.8	126	41.2	126	41.2
Sweden	2	89.5	11	80.8	11	80.8
Switzerland	7	85.0	37	72.2	37	72.2
Syrian Arab Republic	112	40.5	106	56.1	106	56.1
Taiwan	29	69.2	39	71.1	39	71.1
Tanzania	59	55.8	101	57.3	101	57.3
Thailand	63	54.4	20	77.1	20	77.1
Togo	124	33.3	126	41.2	126	41.2
Trinidad and Tobago	35	67.3	40	70.6	40	70.6
Tunisia	55	57.7	82	62.2	82	62.2
Turkey	86	47.6	33	73.3	33	73.3
Uganda	71	52.8	114	50.6	114	50.6
Ukraine	43	60.8	108	55.4	108	55.4
United Arab Emirates	44	60.1	42	70.5	42	70.5
United Kingdom	14	78.9	5	87.3	5	87.3
United States	20	74.2	5	87.3	5	87.3
Uruguay	56	57.1	85	62.0	85	62.0
Venezuela	70	53.1	122	45.2	122	45.2
Vietnam	57	55.9	89	61.1	89	61.1
Yemen, Republic of	126	30.5	107	55.9	107	55.9
Zambia	113	40.0	51	68.5	51	68.5
Zimbabwe	108	41.4	104	56.3	104	56.3

Table 7. Innovation Capacity Index 2009–2010: Pillar rankings* (cont'd.)

	Pillar 4: Research and development						Pillar 5: Adoption and use of information and communication technologies			
	Pillar		R&D infrastructure		Patents and trademarks		Pillar		Telephone communications	
COUNTRY	RANKING	SCORE	RANKING	SCORE	RANKING	SCORE	RANKING	SCORE	RANKING	SCORE
Afghanistan, Islamic Republic of	129	0.0	127	0.0	119	0.0	124	20.8	123	44.9
Algeria	79	10.8	84	18.0	88	0.7	76	47.6	77	77.8
Angola	62	15.2	73	22.5	95	0.4	101	33.1	81	76.3
Argentina	46	20.0	70	23.7	30	16.3	49	56.5	45	86.4
Australia	15	51.2	15	58.4	17	41.0	18	78.9	16	94.1
Austria	19	48.6	13	59.1	22	33.9	17	79.0	24	92.4
Azerbaijan, Republic of	113	2.0	113	3.8	85	0.9	83	44.3	87	74.6
Bahrain, Kingdom of	80	10.6	68	24.6	53	5.0	40	65.2	35	89.2
Bangladesh	65	13.8	46	30.9	106	0.2	112	30.2	115	54.5
Belgium	17	50.0	20	53.2	15	45.6	23	75.3	20	93.3
Belize	103	4.9	97	11.5	66	2.2	89	41.9	79	77.2
Bolivia	95	7.1	91	13.2	85	0.9	97	36.3	109	63.1
Bosnia and Herzegovina	117	1.0	121	0.3	78	1.2	73	49.3	74	78.2
Botswana	87	8.3	94	12.9	92	0.6	86	43.3	66	79.7
Brazil	53	17.8	62	27.2	54	4.7	60	53.4	64	81.0
Bulgaria	35	24.4	37	35.1	39	9.4	44	62.5	54	84.6
Cambodia	96	6.5	100	10.0	92	0.6	117	26.8	116	53.3
Cameroon	64	14.4	39	33.6	119	0.0	111	30.5	113	57.4
Canada	12	54.7	14	58.8	11	48.9	8	84.4	3	98.2
Chad	129	0.0	127	0.0	119	0.0	126	19.8	122	48.3
Chile	33	25.4	45	31.3	28	17.1	47	58.7	50	85.6
China, People's Republic of	55	16.9	54	29.5	56	4.4	79	45.5	114	55.1
Colombia	68	13.0	77	21.1	72	1.8	68	51.4	58	84.5
Congo, Republic of	102	5.7	112	4.1	119	0.0	125	20.0	128	31.5
Costa Rica	61	15.5	76	21.2	40	8.6	59	53.8	36	88.9
Côte d'Ivoire	125	0.2	121	0.3	112	0.1	113	29.8	111	59.5
Croatia, Republic of	39	22.8	40	33.4	43	7.9	35	66.9	28	91.1
Cyprus	37	23.8	53	29.6	29	16.9	33	67.5	30	90.6
Czech Republic	26	36.1	21	52.6	36	13.0	30	68.9	40	87.4
Denmark	23	45.9	11	65.6	26	18.4	3	88.2	12	95.2
Dominican Republic	116	1.1	126	0.1	77	1.3	75	47.7	72	78.5
Ecuador	91	8.0	96	11.9	58	4.2	77	47.3	65	79.8
Egypt, Arab Republic of	72	12.7	72	23.0	95	0.4	74	47.9	71	79.0
El Salvador	92	7.7	95	12.7	64	2.8	69	51.2	46	86.3
Estonia, Republic of	32	27.8	31	41.0	38	11.9	25	73.2	34	89.9
Ethiopia	104	4.8	103	8.8	119	0.0	127	19.4	120	49.7
Finland	3	74.3	3	81.2	7	64.7	20	78.4	30	90.6
France	21	46.6	17	55.3	21	36.2	16	80.3	7	96.2
Georgia	89	8.2	86	17.0	78	1.2	85	44.0	93	70.8
Germany	14	52.0	12	59.8	16	42.6	13	81.4	2	98.4
Ghana	84	8.4	74	22.2	112	0.1	98	35.3	94	70.7
Greece	34	25.3	33	37.4	41	8.3	43	63.7	9	96.0
Guatemala	99	6.1	101	9.9	66	2.2	81	44.8	90	74.1
Guinea	80	10.6	59	28.3	119	0.0	123	21.0	117	52.6
Haiti	125	0.2	127	0.0	106	0.2	129	17.3	127	31.8
Honduras	55	16.9	43	32.0	72	1.8	96	36.6	102	67.3
Hong Kong SAR	24	40.0	30	42.1	20	37.1	11	82.4	10	95.7
Hungary	30	29.9	32	39.0	27	17.2	38	66.3	38	87.8
Iceland	15	51.2	5	70.3	24	28.2	14	81.1	4	98.1
India	69	12.9	71	23.1	88	0.7	93	40.5	73	78.4
Indonesia	107	4.5	105	7.8	83	1.1	88	42.0	84	76.0
Iran, Islamic Republic of	59	16.5	58	28.4	66	2.2	67	51.9	63	81.7
Iraq	120	0.4	121	0.3	95	0.4	118	25.9	131	6.0
Ireland	18	49.0	24	49.7	12	47.9	18	78.9	15	94.2
Israel	6	66.5	1	83.5	14	46.1	29	69.7	24	92.4
Italy	28	31.8	28	44.1	33	14.6	21	77.3	22	92.9
Jamaica	84	8.4	92	13.0	63	2.9	53	55.5	105	63.8
Japan	4	69.0	9	66.7	4	72.2	22	76.4	32	90.3
Jordan	54	17.5	55	29.1	78	1.2	61	53.0	80	77.1
Kazakhstan, Republic of	109	3.6	110	5.7	69	2.0	56	54.7	69	79.4
Kenya	57	16.8	27	44.4	102	0.3	107	32.2	108	63.3
Korea, Republic of	10	61.1	7	68.9	10	50.1	10	83.1	14	94.5
Kuwait	98	6.3	98	11.1	95	0.4	46	62.2	43	86.5
Lao PDR	111	3.0	106	7.5	112	0.1	110	31.1	92	71.3
Latvia, Republic of	40	21.1	41	32.5	44	7.4	34	67.3	52	84.9
Lebanon	73	12.2	59	28.3	106	0.2	70	50.2	99	68.0

Table 7. Innovation Capacity Index 2009–2010: Pillar rankings* (cont'd.)

	Pillar 4: Research and development						Pillar 5: Adoption and use of information and communication technologies			
	Pillar		R&D infrastructure		Patents and trademarks		Pillar		Telephone communications	
COUNTRY	RANKING	SCORE	RANKING	SCORE	RANKING	SCORE	RANKING	SCORE	RANKING	SCORE
Lithuania, Republic of	42	20.3	42	32.4	50	5.8	36	66.8	47	86.2
Luxembourg	8	62.1	26	45.1	2	83.3	7	86.2	8	96.1
Macedonia, FYR	51	18.1	47	30.7	62	3.0	52	55.6	76	77.9
Madagascar	96	6.5	90	14.4	102	0.3	121	23.2	118	51.1
Malawi	122	0.3	118	0.7	106	0.2	108	31.8	91	71.4
Malaysia	40	21.1	49	30.3	41	8.3	39	65.8	54	84.6
Mali	129	0.0	127	0.0	119	0.0	130	15.9	125	34.4
Malta	31	28.9	61	28.2	23	29.9	31	68.7	17	93.4
Mauritania	112	2.5	106	7.5	119	0.0	109	31.3	96	68.9
Mauritius	75	11.5	85	17.8	59	3.9	48	58.2	39	87.5
Mexico	47	19.5	50	30.2	54	4.7	62	52.6	60	83.0
Morocco	57	16.8	44	31.8	72	1.8	80	45.2	98	68.2
Mozambique, Republic of	82	10.5	87	16.5	95	0.4	119	24.7	124	43.2
Namibia	101	5.8	89	14.5	88	0.7	87	42.1	69	79.4
Nepal	119	0.5	116	0.8	95	0.4	114	29.7	104	64.1
Netherlands	11	60.2	19	53.9	5	71.1	1	92.6	17	93.4
New Zealand	22	46.1	22	52.0	18	37.9	15	80.8	27	91.8
Nicaragua	115	1.4	115	0.9	70	1.9	105	32.5	121	49.6
Niger	127	0.1	125	0.2	119	0.0	131	11.1	129	24.3
Nigeria	106	4.6	99	10.4	106	0.2	100	34.0	99	68.0
Norway	20	47.1	18	54.1	19	37.4	6	86.9	21	93.1
Oman	87	8.3	64	26.9	85	0.9	65	52.0	54	84.6
Pakistan	74	12.1	75	21.8	94	0.5	91	41.2	81	76.3
Panama	59	16.5	80	19.5	37	12.9	72	49.4	59	83.2
Papua New Guinea	120	0.4	116	0.8	112	0.1	116	28.2	86	74.7
Paraguay	84	8.4	114	1.4	34	14.0	81	44.8	85	75.5
Peru	100	6.0	104	8.0	61	3.7	84	44.1	88	74.4
Philippines	76	11.3	82	18.4	78	1.2	92	41.1	112	58.4
Poland	36	24.0	34	36.2	46	6.9	45	62.3	43	86.5
Portugal	29	30.7	29	43.1	35	13.3	32	67.7	33	90.1
Qatar	77	11.1	79	20.5	72	1.8	41	65.0	37	88.7
Romania	47	19.5	56	29.0	48	6.2	41	65.0	42	86.6
Russian Federation	52	18.0	52	29.7	60	3.8	55	54.8	78	77.7
Rwanda	127	0.1	121	0.3	119	0.0	120	23.9	119	51.0
Saudi Arabia	77	11.1	57	28.9	95	0.4	50	56.4	51	85.3
Senegal	70	12.8	67	25.6	112	0.1	104	32.6	103	65.9
Singapore	9	62.0	8	67.6	9	55.2	12	81.7	17	93.4
Slovak Republic	38	23.6	36	35.5	47	6.8	37	66.4	47	86.2
Slovenia, Republic of	27	35.7	23	50.2	31	15.5	24	73.4	26	92.0
South Africa	43	20.2	47	30.7	52	5.4	71	49.6	68	79.5
Spain	25	36.7	25	49.2	25	19.1	26	73.0	23	92.5
Sri Lanka	94	7.4	92	13.0	72	1.8	93	40.5	110	62.0
Sudan	114	1.6	111	4.2	119	0.0	99	34.3	83	76.1
Suriname	89	8.2	69	24.1	70	1.9	95	40.2	75	78.0
Sweden	2	75.6	2	82.4	6	66.1	2	89.6	6	97.2
Switzerland	7	66.2	6	69.1	8	61.2	5	88.0	1	99.4
Syrian Arab Republic	122	0.3	120	0.4	102	0.3	90	41.4	97	68.3
Taiwan	1	82.7	4	76.9	1	100.0	27	71.3	5	97.6
Tanzania	83	8.6	51	30.1	119	0.0	115	29.1	107	63.6
Thailand	70	12.8	83	18.2	48	6.2	57	54.2	66	79.7
Togo	108	4.4	108	7.2	112	0.1	128	18.2	130	20.5
Trinidad and Tobago	63	14.8	62	27.2	65	2.3	54	55.3	52	84.9
Tunisia	43	20.2	38	33.8	83	1.1	65	52.0	54	84.6
Turkey	50	18.4	66	26.4	45	7.1	64	52.2	49	86.1
Uganda	110	3.5	109	7.0	119	0.0	122	22.6	126	34.1
Ukraine	43	20.2	34	36.2	57	4.3	51	55.8	89	74.3
United Arab Emirates	67	13.6	64	26.9	102	0.3	28	70.9	29	90.9
United Kingdom	13	53.2	16	57.3	13	47.4	3	88.2	13	94.8
United States	5	68.8	10	66.3	3	72.4	9	83.4	11	95.3
Uruguay	49	18.5	78	21.0	31	15.5	58	54.0	41	86.7
Venezuela	93	7.5	102	9.5	51	5.6	63	52.5	62	82.1
Vietnam	66	13.7	81	19.0	78	1.2	78	46.9	61	82.8
Yemen, Republic of	118	0.6	127	0.0	88	0.7	103	32.8	95	70.0
Zambia	122	0.3	119	0.6	106	0.2	106	32.3	101	67.8
Zimbabwe	105	4.7	88	16.3	112	0.1	102	32.9	105	63.8

Table 7. Innovation Capacity Index 2009–2010: Pillar rankings* (cont'd.)

	Pillar 5: Adoption and use of information and communication technologies							
	Mobile cellular ommunications		Internet, computers, and TV		Government ICT usage		Quality of the infrastructure	
COUNTRY	RANKING	SCORE	RANKING	SCORE	RANKING	SCORE	RANKING	SCORE
Afghanistan, Islamic Republic of	125	26.8	117	1.7	122	20.5	117	23.7
Algeria	56	76.8	92	6.8	91	35.2	45	82.8
Angola	119	36.5	112	2.2	96	33.3	111	34.4
Argentina	39	84.7	57	20.0	39	58.4	66	67.2
Australia	44	83.2	17	66.7	8	81.1	55	77.1
Austria	32	86.0	21	62.0	16	74.3	6	98.3
Azerbaijan, Republic of	80	63.4	84	9.9	77	46.1	65	67.4
Bahrain, Kingdom of	1	99.9	47	27.6	42	57.2	26	91.3
Bangladesh	106	46.9	111	2.3	104	29.4	102	43.7
Belgium	41	84.4	24	56.5	24	67.8	24	91.4
Belize	91	56.4	67	16.5	84	41.0	121	17.0
Bolivia	100	49.8	102	4.1	66	48.7	93	48.7
Bosnia and Herzegovina	68	73.4	62	17.9	80	45.1	74	62.1
Botswana	58	76.6	99	4.3	89	36.5	92	49.8
Brazil	69	73.0	54	23.5	45	56.8	79	58.8
Bulgaria	15	90.6	44	30.5	42	57.2	23	91.6
Cambodia	99	50.7	129	0.4	103	29.9	125	13.1
Cameroon	107	46.6	113	1.9	110	27.3	101	44.1
Canada	78	64.6	3	87.2	7	81.7	55	77.1
Chad	121	32.3	129	0.4	129	10.5	130	0.8
Chile	45	82.3	49	25.9	40	58.2	61	72.3
China, People's Republic of	89	58.0	66	16.9	61	50.2	29	91.0
Colombia	66	74.9	67	16.5	50	53.2	85	56.5
Congo, Republic of	103	47.9	118	1.4	109	27.4	128	8.3
Costa Rica	94	53.1	48	26.2	55	51.4	63	69.9
Côte d'Ivoire	105	47.0	116	1.8	125	18.5	103	43.0
Croatia, Republic of	11	91.6	35	40.3	46	56.5	49	80.8
Cyprus	17	90.2	32	41.5	35	60.2	50	80.6
Czech Republic	12	91.4	33	41.1	25	67.0	11	96.8
Denmark	70	72.6	4	84.1	2	91.3	2	99.0
Dominican Republic	74	69.5	83	11.0	64	49.4	67	65.8
Ecuador	54	77.6	74	13.2	68	48.4	104	42.8
Egypt, Arab Republic of	83	60.6	85	9.3	71	47.7	42	84.8
El Salvador	27	87.8	87	8.9	63	49.7	75	60.2
Estonia, Republic of	24	88.1	22	58.8	13	76.0	90	53.7
Ethiopia	131	2.9	128	0.5	124	18.6	107	38.0
Finland	59	76.4	14	69.3	15	74.9	35	87.4
France	59	76.4	19	65.3	9	80.4	7	98.2
Georgia	65	75.0	79	12.0	78	46.0	83	57.6
Germany	29	86.4	19	65.3	22	71.4	4	98.7
Ghana	97	51.7	113	1.9	101	30.0	94	48.3
Greece	25	87.9	53	23.8	42	57.2	19	93.1
Guatemala	71	71.6	93	6.4	81	42.8	64	67.9
Guinea	123	27.7	126	0.6	127	14.0	127	9.8
Haiti	130	8.0	97	4.8	120	21.0	113	31.0
Honduras	96	52.5	100	4.2	86	40.5	98	47.2
Hong Kong SAR	19	89.8	15	68.5	ND	ND	30	90.6
Hungary	21	89.1	30	42.8	30	64.9	70	64.1
Iceland	30	86.2	10	71.8	21	71.8	54	77.4
India	110	45.6	85	9.3	87	38.1	89	53.8
Indonesia	88	58.1	96	5.0	83	41.1	70	64.1
Iran, Islamic Republic of	90	57.9	50	24.3	85	40.7	52	78.2
Iraq	93	53.9	119	1.3	112	26.9	33	88.9
Ireland	8	95.0	23	57.6	19	73.0	13	96.6
Israel	48	81.9	38	37.9	17	73.9	2	99.0
Italy	1	99.9	26	53.7	26	66.8	8	97.3
Jamaica	16	90.4	45	28.9	75	46.8	48	81.5
Japan	77	67.2	18	66.0	11	77.0	24	91.4
Jordan	56	76.8	74	13.2	48	54.8	19	93.1
Kazakhstan, Republic of	79	63.8	64	17.4	72	47.4	41	85.1
Kenya	109	46.0	100	4.2	92	34.7	112	33.3
Korea, Republic of	12	91.4	13	69.7	6	83.2	22	91.8
Kuwait	18	89.9	46	27.9	54	52.0	31	89.8
Lao PDR	108	46.2	113	1.9	115	23.8	123	14.4
Latvia, Republic of	25	87.9	29	44.7	36	59.4	37	86.5
Lebanon	85	59.9	55	22.4	68	48.4	36	86.8

Table 7. Innovation Capacity Index 2009–2010: Pillar rankings* (cont'd.)

	Pillar 5: Adoption and use of information and communication technologies							
	Mobile cellular communications		Internet, computers, and TV		Government ICT usage		Quality of the infrastructure	
COUNTRY	RANKING	SCORE	RANKING	SCORE	RANKING	SCORE	RANKING	SCORE
Lithuania, Republic of	4	97.7	39	36.5	28	66.2	44	83.7
Luxembourg	9	94.1	9	75.2	14	75.1	1	99.8
Macedonia, FYR	52	79.1	43	30.9	66	48.7	73	62.8
Madagascar	122	31.1	122	0.9	99	30.7	124	13.3
Malawi	104	47.6	125	0.7	108	28.8	115	26.0
Malaysia	47	82.2	37	38.7	34	60.6	21	92.2
Mali	128	12.4	124	0.8	126	15.9	100	44.6
Malta	23	88.2	34	40.7	29	65.8	39	85.6
Mauritania	95	52.9	110	2.6	123	20.3	126	11.3
Mauritius	55	77.0	50	24.3	59	50.9	10	97.0
Mexico	61	76.2	59	19.0	37	58.9	86	55.8
Morocco	64	75.3	77	12.5	104	29.4	60	72.8
Mozambique, Republic of	118	41.4	121	1.1	113	25.6	110	35.6
Namibia	86	59.7	76	13.0	95	34.5	106	39.1
Nepal	124	27.4	122	0.9	110	27.3	91	52.7
Netherlands	30	86.2	1	95.9	5	86.3	17	95.6
New Zealand	28	86.6	11	71.6	17	73.9	39	85.6
Nicaragua	92	55.8	103	4.0	88	36.7	95	48.2
Niger	127	13.2	131	0.3	128	11.4	119	20.6
Nigeria	102	48.2	103	4.0	100	30.6	105	40.3
Norway	49	81.6	5	83.4	3	89.2	32	89.7
Oman	40	84.5	71	14.9	74	46.9	75	60.2
Pakistan	81	62.3	94	5.6	97	31.6	78	59.3
Panama	67	74.4	81	11.3	73	47.2	68	64.9
Papua New Guinea	126	24.6	106	3.6	121	20.8	129	3.5
Paraguay	84	60.4	90	7.6	76	46.5	53	77.8
Peru	116	41.6	63	17.7	53	52.5	81	58.0
Philippines	72	69.8	89	8.2	62	50.0	82	57.8
Poland	22	88.9	42	31.0	33	61.3	51	78.6
Portugal	5	97.3	40	32.6	31	64.8	26	91.3
Qatar	6	96.7	40	32.6	51	53.1	43	84.3
Romania	34	85.3	28	46.8	49	53.8	80	58.4
Russian Federation	12	91.4	58	19.9	56	51.2	57	75.1
Rwanda	120	32.5	126	0.6	104	29.4	120	19.0
Saudi Arabia	20	89.2	56	20.3	64	49.4	62	70.7
Senegal	101	49.2	105	3.9	114	25.3	108	36.8
Singapore	33	85.6	12	70.4	23	70.1	5	98.6
Slovak Republic	37	84.9	31	42.0	37	58.9	28	91.2
Slovenia, Republic of	51	79.4	25	55.2	26	66.8	12	96.7
South Africa	45	82.3	82	11.1	56	51.2	75	60.2
Spain	35	85.1	27	47.2	20	72.3	15	95.8
Sri Lanka	82	62.2	98	4.6	82	42.4	58	74.5
Sudan	129	11.9	73	13.9	117	21.9	97	47.3
Suriname	76	68.5	87	8.9	92	34.7	114	26.3
Sweden	36	85.0	2	91.0	1	91.6	59	74.2
Switzerland	43	83.4	6	83.3	12	76.3	9	97.2
Syrian Arab Republic	87	59.4	78	12.1	90	36.1	84	56.8
Taiwan	63	75.6	16	67.7	ND	ND	ND	ND
Tanzania	113	43.2	120	1.2	107	29.3	116	24.7
Thailand	53	78.3	72	14.1	60	50.3	15	95.8
Togo	116	41.6	106	3.6	117	21.9	118	22.3
Trinidad and Tobago	62	75.7	60	18.5	51	53.1	47	81.6
Tunisia	42	83.7	79	12.0	94	34.6	46	82.3
Turkey	50	81.2	65	17.1	70	48.3	87	55.6
Uganda	111	45.4	108	3.3	98	31.3	122	16.0
Ukraine	7	95.4	61	18.1	41	57.3	34	88.7
United Arab Emirates	3	98.6	36	40.2	32	63.0	18	94.5
United Kingdom	10	93.0	7	81.9	10	78.7	13	96.6
United States	73	69.6	8	79.8	4	86.4	38	86.3
Uruguay	74	69.5	52	24.0	46	56.5	88	55.4
Venezuela	37	84.9	70	15.4	58	51.0	72	63.2
Vietnam	98	51.1	69	15.6	79	45.6	69	64.5
Yemen, Republic of	112	44.8	94	5.6	119	21.4	109	35.7
Zambia	115	42.8	109	2.7	116	22.7	99	45.8
Zimbabwe	114	42.9	91	7.2	101	30.0	95	48.2

Table 8. Innovation Capacity Index 2009–2010: Country clusters: Index scores and rankings*

High-income: GNI per capita > US$11,456							
Full democracies	Within group rank	Overall ICI rank	ICI score	Czech Republic	24	32	58.0
				Portugal	25	35	57.2
Sweden	1	1	82.2	Malta	26	52	52.4
Finland	2	2	77.8	Greece	27	62	50.2
United States	3	3	77.5	**Flawed democracies**	Within group rank	Overall ICI rank	ICI score
Switzerland	4	4	77.0				
Netherlands	5	5	76.6	Taiwan	1	13	72.9
Canada	6	7	74.8	Israel	2	21	68.2
United Kingdom	7	8	74.6	Estonia	3	25	62.7
Norway	8	9	73.5	Slovak Republic	4	39	55.8
New Zealand	9	10	73.4	Hungary	5	41	55.6
Luxembourg	10	11	73.3	Cyprus	6	53	52.3
Denmark	10	11	73.3	Trinidad and Tobago	7	69	48.7
Iceland	12	14	72.6	Hybrid regimes	Within group rank	Overall ICI rank	ICI score
Japan	13	15	72.1				
Australia	14	17	71.2	Singapore	1	6	76.5
Ireland	15	18	70.5	Hong Kong SAR	2	16	71.3
Korea, Republic of	16	19	70.0	Authoritarian regimes	Within group rank	Overall ICI rank	ICI score
Germany	17	20	68.8				
Belgium	18	22	67.6	Bahrain, Kingdom of	1	36	56.6
Austria	19	23	66.7	United Arab Emirates	2	37	56.2
France	20	24	65.4	Qatar	3	45	53.8
Spain	21	28	60.3	Saudi Arabia	4	55	51.9
Italy	22	30	59.1	Oman	5	62	50.2
Slovenia, Republic of	23	31	58.6	Kuwait	6	64	50.1

Upper-middle-income: GNI per capita: US$3,706–US$11,455							
Full democracies	Within group rank	Overall ICI rank	ICI score	**Flawed democracies**	Within group rank	Overall ICI rank	ICI score
Uruguay	1	49	52.8	Lithuania, Republic of	1	26	60.7
Mauritius	2	49	52.8	Latvia, Republic of	2	27	60.5
Costa Rica	3	58	51.5	Chile	3	29	59.4
Hybrid regimes	Within group rank	Overall ICI rank	ICI score	Bulgaria	4	33	57.7
				Malaysia	5	34	57.3
Russian Federation	1	49	52.8	Croatia, Republic of	6	38	56.0
Turkey	2	59	50.8	Poland	7	40	55.7
Lebanon	3	83	45.8	South Africa	8	46	53.3
Venezuela	4	102	40.9	Romania	9	47	53.1
Authoritarian regimes	Within group rank	Overall ICI rank	ICI score	Mexico	10	61	50.5
				Argentina	11	66	49.2
Kazakhstan, Republic of	NA	57	51.6	Botswana	12	67	49.1
				Panama	13	68	48.9
				Jamaica	14	81	46.2
				Brazil	15	87	45.2
				Belize	16	98	42.1
				Suriname	17	105	40.1

*All rankings and scores are after rounding.

Table 8. Innovation Capacity Index 2009–2010: Country clusters: Index scores and rankings* (cont'd.)

Lower-middle-income: GNI per capita: US$936–US$3,705							
Flawed democracies	Within group rank	Overall ICI rank	ICI score	**Hybrid regimes**	Within group rank	Overall ICI rank	ICI score
Thailand	1	43	54.6	Georgia	1	42	55.1
Macedonia, FYR	2	47	53.1	Bosnia and Herzegovina	2	70	48.3
Ukraine	3	54	52.0				
Peru	4	60	50.6	Ecuador	3	91	44.2
El Salvador	5	70	48.3	Iraq	4	119	34.2
Colombia	6	72	48.0	**Authoritarian regimes**	Within group rank	Overall ICI rank	ICI score
Namibia	7	73	47.5	Jordan	1	44	53.9
Philippines	8	75	47.0	Tunisia	2	56	51.8
Dominican Republic	9	79	46.3	China, People's Republic of	3	65	49.5
Honduras	10	82	46.0				
India	11	85	45.6	Azerbaijan	4	74	47.3
Sri Lanka	12	86	45.5	Algeria	5	76	46.7
Indonesia	13	88	44.9	Egypt, Arab Republic of	6	79	46.3
Guatemala	14	89	44.5	Iran, Islamic Republic of	7	84	45.7
Paraguay	15	90	44.3	Morocco	8	95	43.3
Nicaragua	16	93	43.4	Syrian Arab Republic	9	107	39.4
Bolivia	17	100	41.5	Cameroon	10	109	38.3
				Sudan	11	118	35.0
				Angola	12	121	33.4
				Congo, Republic of	13	123	33.0

Low-income: GNI per capita < US$935							
Flawed democracies	Within group rank	Overall ICI rank	ICI score	**Hybrid regimes**	Within group rank	Overall ICI rank	ICI score
Papua New Guinea	NA	101	41.3	Ghana	1	77	46.6
Authoritarian regimes	Within group rank	Overall ICI rank	ICI score	Tanzania	2	92	43.7
				Madagascar	3	93	43.4
Vietnam	1	78	46.4	Kenya	4	95	43.3
Nigeria	2	104	40.2	Pakistan	5	97	42.7
Mauritania	3	115	37.1	Zambia	6	99	41.8
Lao PDR	4	116	36.8	Nepal	7	103	40.3
Yemen, Republic of	5	117	35.1	Bangladesh	8	106	39.8
Rwanda	6	122	33.3	Mozambique, Republic of	9	108	39.1
Côte d'Ivoire	7	124	32.4	Uganda	10	109	38.3
Zimbabwe	8	125	31.8	Senegal	11	111	38.1
Niger	9	126	30.6	Cambodia	12	112	37.5
Togo	10	127	30.1	Malawi	12	112	37.5
Guinea	11	128	29.1	Ethiopia	14	114	37.3
Chad	12	130	25.6	Mali	15	120	33.8
Afghanistan, Islamic Republic of	13	131	24.0	Haiti	16	129	28.7

*All rankings and scores are after rounding.

Sweden: Why is its innovation outlook so bright?

An impressive performance

Sweden is the top ranked country in the 2009 edition of the Innovation Capacity Index because it does exceptionally well in all the areas captured by the Index. Figure 3 shows Sweden's relative performance with respect to other high-income countries in 10 of the indicators used in the estimation of the Index. As can be seen, Sweden is an exceptionally good performer, very often placing in the top ranks in those areas identified as being particularly important to assessing innovation capacity. Indeed, Sweden has a rank of number one among 131 countries in transparency and judicial independence, corruption perceptions, gender equity, e-government readiness, personal computer penetration rates, receipts of royalties and license fees, as well as the "doing business" indicators for the time and number of procedures required to register property. It has a rank of 2 in scientific and technical journal articles per capita, environmental sustainability, and research and development expenditure in relation to GDP, where it is second only to Israel. There are 12 other indicators in which Sweden has a top 8 rank, including the quality of its public administration, the effectiveness of its government, rule of law, the more egalitarian distribution of national income, Internet penetration rates, as well as other indicators of good governance. Table 9 shows Sweden's pillar ranks in the ICI.

Sweden's rank is richly deserved. It is a country that has had an extremely virtuous fiscal policy for the past decade, running budget surpluses with the aim of saving resources to deal with the long-term effects of population aging, but also generating, in the short-term, substantial resources to invest heavily in knowledge and training, to earn a top position in terms of labor productivity growth among high income countries. On a per capita basis, Sweden has the largest university system in the world. According to the OECD, "Swedish research is, in relation to the size of its population, leading in the world in terms of scientific output, measured by the number of publications in internationally acknowledged scientific journals."[71] Sweden is also a leader in terms of patent registration.

Openness and transparency

Sweden has in impressive record of openness and transparency in government. It has put in place comprehensive safety nets which provide security to vulnerable groups in the population. It has thus been able, during periods of economic stress—such as in the context of the 2008–09 world financial crisis—to shelter its population from the effects of the global economic slowdown. Since it also has levels of public debt that are well below those prevailing among competitor countries, Sweden has greater flexibility when it is time to provide fiscal stimulus.

Women in Sweden have access to a wider spectrum of educational, political, and work opportunities and enjoy a higher standard of living than women in other parts of the world. They also have achieved the highest echelons of political power and have an important presence in the business world. Sweden is also an egalitarian society with a more even income distribution than most countries in the OECD, and, thus, a strong sense of solidarity and stable labor relations. The country has also achieved an enviable record in terms of caring for the environment; it ranks second in the world in the Environmental Sustainability Index.

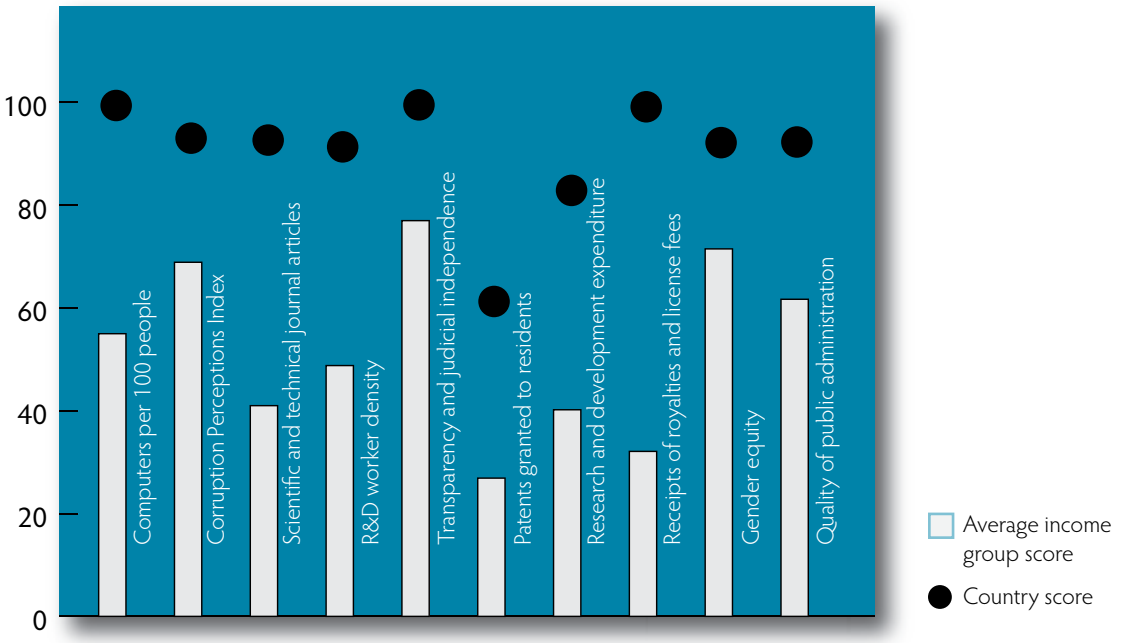
Sweden's public sector is highly qualified and enjoys unusually high degrees of credibility with the business community and civil society. Although the country has high tax rates, there is no evidence that this has discouraged entrepreneurship and innovation. More likely than not, this reflects the fact that the relatively high levels of revenue collection are then reinvested in the economy at large in education, infrastructure development and modernization, public health, and other components of the safety net, as well as training and other productivity-enhancing initiatives, all of which are directly beneficial to the private sector. Having an honest public administration—as demonstrated by Sweden's privileged and consistently high rankings in Transparency International's *Corruption Perceptions Index*—suggest that what matters is not whether tax rates are high or not, but rather whether the government uses the taxes collected in ways that will be productive and that will boost its credibility with economic agents.

A leader in ICT

The government has also played an important catalytic role in encouraging the use of the entire spectrum of information and communication technologies, as made clear by the very high penetration rates of mobile phones, computers, broadband, and the Internet. Not only does the government spend gener-

[71] OECD and European Communities, 2005, p. 189.

Figure 3. **Sweden: Significant indicators above income group average**



ously in research and development (particularly through institutions of higher education), but the Swedish business sector has also been a driving force in R&D spending, particularly in the telecommunications and pharmaceutical sectors. Sweden has benefited from an economy that, according to the OECD, is dominated by public-private partnerships between manufacturing groups that allocate considerable resources to R&D on the one hand, and public agencies and companies, on the other. This has led, in turn, to the emergence of a manufacturing sector that spans "all of the high-technology and medium high-technology industries" (OECD, 2005, p. 190).

A virtuous cycle of development

Sweden is likely to retain a privileged position in future editions of the Innovation Capacity Index. A combination of solid institutions, good policies and a public administration strongly committed to the idea of building upon past achievements has pushed the country into what one might call a *virtuous cycle of development*. Successive governments have implemented policies whose primary motivation has been the public good. This in turn has transformed the business community and civil society into active, well informed participants in the shaping of public policies. Just as citizens and corporations pay their taxes because the benefits of doing so are tangible and transparent, governments have been empowered to focus their energies and talents in devising innovative ways to improve the quality of governance. Sweden and its Nordic neighbors provide a useful template for other countries to examine, and, where feasible, to emulate. There is much in their approach to development—combining key elements of modern capitalism without some of its excesses, with a strong commitment to social policies that are fundamentally egalitarian in nature—that is worthy of close examination and study.

Table 9. **Sweden: ICI pillar rankings**

	Rank	Score
Overall position	1	82.2
1. Institutional environment	6	81.6
2. Human capital, training, and social inclusion	4	83.4
3. Regulatory and legal framework	11	80.8
4. Research and development	2	75.6
5. Usage of information and communication technologies	2	89.6

Chile: Catching up with the top performers

The best innovation capacity in Latin America

With a rank of 29 among the 131 countries included in the ICI, Chile is by far the best performing country in Latin America. Indeed, it has a rank a full 20 places ahead of Uruguay (49), the next best performer (Table 10). As may be seen in Table 6, Chile is firmly positioned among 12 members of the European Union, with some slightly ahead (e.g., Belgium, Austria, France, and Spain), and others slightly behind (Italy, Slovenia, the Czech Republic, and Portugal). Chile has the highest rank among countries with a broadly similar level of income per capita, with only Malaysia (34) exhibiting a similar performance. As shown in Table 10, Chile has a rank of 1 in Latin America in several important indicators including government effectiveness, rule of law, absence of corruption, the fiscal balance (as a proxy indicator for the strength of macroeconomic policies), the number of schools connected to the Internet, the ease of paying taxes, broadband penetration rates, reliability of electricity generation, and a top 5 rank in a much larger set of indicators.

Chile's strong performance in the Innovation Capacity Index is the result of a combination of several factors, two of which have played a central role and are, therefore, desirable to highlight: first, the gradual build-up of an institutional environment that has been broadly supportive of private sector development; and second, the introduction of a range of policies that have explicitly sought to enhance the role of high technologies in promoting gains in factor productivity. It will be useful to present here a brief overview of both.

Chile ranks 23rd among 180 countries in Transparency International's *Corruption Perceptions Index 2008*, tied with France (23) and ahead of Spain (28), Portugal (32), and far ahead of Korea (40), Italy (55), Mexico (72), Brazil (80), and Argentina (109). In fact, the 22 countries with a better score than Chile are all high-income countries, as defined by the World Bank. In the ICI's own Good Governance subindex—which also includes measures of voice and accountability, political stability, government effectiveness, rule of law, the property rights framework, and transparency and judicial independence—and in the Country Policy Assessment subindex, which captures various measures of the quality of public sector policies, Chile ranks 25 and 14 respectively, out of 131 countries in 2009 (see Table 7).

Legitimizing market reforms

Market reforms in Chile have been legitimized in the eyes of the public because they have benefited the population in tangible ways, for instance, by increases in per capita income or, as noted earlier, sustained reductions in poverty levels. This contrasts sharply with other countries in the region, where the motivations for public policy have more often been a mixture of dubious ideology or some confusion about public ends and private benefits among the ruling elites. In addition, on those occasions when flaws in the public administration in Chile have emerged, the authorities' response has been swift and effective. For example, Chile today has a demanding campaign contributions law that is tougher than those found in the statutes of many high-income democracies. Furthermore, the authorities have generally been very good about generating a broad consensus for their policies, which ensures sustainability in the policy environment. Successive governments over the past 19 years, following the country's return to democracy, have been fairly successful in setting in motion processes of consultation, to elicit the views of various sectors in society, such as opposition political parties, trade unions, and various organizations of civil society. This has resulted in greater understanding on the part of the population, and elicited their commitment to the often painful measures that accompany the implementation of various economic adjustment measures. This approach has also led to a more equitable distribution of the costs of adjustment and contributed to political stability.

A solid macro environment

Together with the Nordics, Chile is part of a small group of countries in which the political process has resulted in broad-based support for fiscal discipline, where safeguards have been introduced, which effectively insulate the budget from the short-term horizon of politicians, and from the diverse demands placed upon it by economic agents in a pluralistic democracy. The net effect has been a virtuous fiscal policy, which has contributed to a sustained reduction in the levels of public debt, from close to 90 percent of GDP in the mid-1980s, to less than 7 percent of GDP in 2008. We find no example, either among industrialized countries or in the developing world, with as sustained a downward adjustment in debt levels as in Chile. In fact, quite the opposite is the case: the vast majority of OECD members have higher levels of public debt today than 10 years

ago. Indeed, according to the IMF, against the background of the global financial crisis and the fiscal stimulus measures that have been taken to address the effects of the crisis, public debt in the advanced economies will rise from 75 percent of GDP in 2008 to 110 percent of GDP in 2014.

Chile's policies have, in contrast, greatly reduced the debt-servicing burden of the public debt in Chile, contributed to sharply lower interest rates, and to the highest credit ratings in Latin America. Indeed, in 2009 Chile was the only country to have actually seen a rise in its credit ratings, at a time of massive ratings downgrades worldwide, affecting corporations and sovereign debt issuers alike. A lower debt burden has, of course, allowed spending to rise in other areas, including education and public health, and is very much behind the progress made in reducing the incidence of poverty, which fell from 38.6 percent in 1990 to 13 percent in 2006.[72]

Moreover, as noted above, not only has Chile done much to establish a clear, transparent framework for public policies, also involving a solid legal and regulatory framework—it has a ranking of 23 in the third pillar of the ICI, which captures several indicators measuring various obstacles to private sector activity—but the government has also played a leading role in promoting other innovation-friendly policies which have nicely complemented those aimed at improving the institutional climate.

Good innovation policies

The government has shown remarkable commitment to e-government, to increasing efficiency in public management, to diminishing the transaction and coordination costs between public entities, to facilitating innovation and creativity in management, to increasing the public value of services, improving government transparency and, more generally, to enhancing the quality of the services provided by the government to civil society.[73] Three areas in which this has been done in a particularly effective way, providing best practice, are those reforms introduced at the Internal Revenue Service and through the electronic platforms ChileCompra and Trámite Fácil. At the IRS, e-government has boosted direct interactions with tax payers and greatly facilitated tax compliance. Close to 100 percent of Chilean tax-payers now pay income taxes through the Internet, and the Chilean IRS is acknowledged to be one of the most modern, efficient, high-quality taxation administrations in the world, setting high international standards for tax compliance.

ChileCompra was launched in 2000 and is a public electronic system for purchasing and hiring, based on an Internet platform. It has earned a worldwide reputation for excellence, transparency and efficiency. It serves companies, public organizations, and citizens, and is by far the largest business-to-business site in Chile, involving over 1000 purchasing organizations which invoiced well in excess of US$2 billion in transactions by 2005. It has also been a catalyst for the use of the Internet throughout the country. Trámite Fácil is a government site coordinating the work of over 240 government agencies and bodies, and taking care of a broad range of processes online, including birth certificates, identity documents, pension fund payments, trademarks/patents, housing subsidies, university credits, and so on. The government's efforts to integrate the Chilean school system with the Internet have been no less successful, and have involved heavy infrastructure investments, the training of over 90,000 teachers in the basics of ICTs, digital literacy campaigns, encouraging the study of English and several novel public/private partnerships aimed at bringing to the classroom the latest technologies and know-how.

Some challenges ahead to boost innovation capacity

The authorities in Chile have shown remarkable leadership, as well, in identifying the key challenges ahead to strengthening the role of ICTs in improving productivity and in boosting the innovation capacities of the public and private sectors and civil society. In this respect, they feel that it is necessary to expand and intensify the integration of digital technologies in the educational curriculum and to improve the education and training of highly qualified workers (see Table 11 showing the OECD's Program for International Student Assessment (PISA) results for Chile and other countries). It is also necessary, in their view, to enhance connectivity, especially among the lowest four-fifths of the income distribution, by overcoming unequal income distribution, restrictions facing micro- and small companies, and connectivity problems in rural and remote regions. They would also like to encourage the development by the private sector of computer packages for low-income households and micro-companies so that they can access the Internet more cheaply and effectively, and

[72] For a discussion of the institutional framework in place for the implementation of fiscal policy in Chile, including the targeting of a surplus in the government balance since 2000, as well as other progress made in the implementation of a sound institutional framework, see López-Claros (2004).

[73] For a comprehensive discussion of these issues see Alvarez Voullième et al., 2006.

Table 10. The Innovation Capacity Index: Chile and Latin America

	Selected variables								
	Innovation Capacity Index			Government effectiveness			Rule of law		
	Score	Rank* (131)	Region Rank	Score	Rank* (131)	Region Rank	Score	Rank* (131)	Region Rank
Chile	59.4	29	1	70.8	25	1	79.2	23	1
Uruguay	52.8	49	2	55.0	41	2	62.1	45	2
Costa Rica	51.5	58	3	50.7	47	3	60.8	47	3
Peru	50.6	60	4	30.3	87	13	32.2	98	14
Mexico	50.5	61	5	44.1	59	6	35.5	86	11
Argentina	49.2	66	6	37.7	72	11	37.0	79	8
Panama	48.9	68	7	47.1	53	5	44.8	66	4
Trinidad and Tobago	48.7	69	8	50.1	50	4	44.3	67	5
El Salvador	48.3	70	9	35.5	75	12	33.0	94	13
Colombia	48.0	72	10	41.9	63	8	35.7	85	10
Dominican Republic	46.3	79	11	29.8	90	14	36.2	83	9
Jamaica	46.2	81	12	43.9	60	7	34.2	89	12
Honduras	46.0	82	13	27.0	93	15	28.6	106	16
Brazil	45.2	87	14	38.0	70	10	38.9	73	7
Guatemala	44.5	89	15	26.7	95	16	22.3	119	20
Paraguay	44.3	90	16	20.2	112	18	25.6	114	18
Ecuador	44.2	91	17	15.5	120	21	23.9	116	19
Nicaragua	43.4	93	18	18.8	117	20	28.9	103	15
Bolivia	41.5	100	19	20.8	111	17	26.0	111	17
Venezuela	40.9	102	20	19.6	115	19	13.1	127	22
Suriname	40.1	105	21	40.4	66	9	43.8	68	6
Haiti	28.7	129	22	8.5	124	22	14.4	124	21
Memorandum items:									
Finland	77.8	2	-	88.6	8	-	96.4	8	-
New Zealand	73.4	10	-	87.6	10	-	97.6	5	-
Ireland	70.5	18	-	81.8	17	-	94.0	14	-
Spain	60.3	28	-	65.5	31	-	77.9	24	-
Portugal	57.2	35	-	62.6	33	-	73.6	27	-

* Ranks after rounding to one decimal point.

to continue government subsidies for rural and remote areas and low-income communities and microcompanies. Priority is also being given to increasing R&D in the use of ICTs to stimulate competitiveness of the main export sectors, to rectify limitations in the legal system, to provide an appropriate institutional framework to stimulate/encourage e-trade, e-government, and use of ICTs, and to assure public trust in electronic operations and platforms. Finally, priority is also being given to facilitating the takeoff of the ICT industry by improving virtuous cycles of cooperation between institutions of higher education and the business community. This is seen as essential for narrowing the skills gap that exists today between Chile and the average in the OECD, made evident by the results of the PISA tests (Table 11).

India: Priority areas for boosting innovation capacity

Viewed in a long-term perspective, India's recent economic

Table 10. The Innovation Capacity Index: Chile and Latin America (cont'd.)

	Selected variables								
	Corruption Perceptions Index			Fiscal balance			Paying taxes		
	Score	Rank* (131)	Region Rank	Score	Rank* (131)	Region Rank	Score	Rank* (131)	Region Rank
Chile	69.0	21	1	62.3	9	1	84.2	17	1
Uruguay	69.0	21	1	30.3	65	15	63.1	91	10
Costa Rica	51.0	40	3	38.1	37	5	59.3	99	12
Peru	36.0	61	6	30.7	62	14	76.6	39	3
Mexico	36.0	61	6	29.4	71	17	63.4	89	9
Argentina	29.0	87	16	32.0	57	12	45.4	120	18
Panama	34.0	72	11	37.1	39	7	53.1	112	15
Trinidad and Tobago	36.0	61	6	56.3	16	2	75.2	43	4
El Salvador	39.0	56	4	21.8	105	21	62.5	92	11
Colombia	38.0	59	5	19.4	113	22	43.5	122	19
Dominican Republic	30.0	82	14	29.3	72	18	55.8	109	14
Jamaica	31.0	79	12	35.0	45	8	49.6	118	17
Honduras	26.0	98	17	29.7	68	16	58.8	102	13
Brazil	35.0	68	10	30.8	61	13	42.8	123	20
Guatemala	31.0	79	12	26.5	85	19	68.6	74	7
Paraguay	24.0	106	19	38.3	35	4	71.2	69	6
Ecuador	20.0	116	20	34.1	49	10	74.9	45	5
Nicaragua	25.0	103	18	34.0	51	11	52.7	115	16
Bolivia	30.0	82	14	37.5	38	6	36.1	127	22
Venezuela	19.0	120	21	41.8	25	3	38.8	124	21
Suriname	36.0	61	6	23.4	99	20	83.7	19	2
Haiti	14.0	130	22	34.5	47	9	66.8	82	8
Memorandum items:									
Finland	90.0	5	-	48.2	20	-	74.0	52	-
New Zealand	93.0	1	-	51.4	18	-	87.7	12	-
Ireland	77.0	16	-	43.8	24	-	89.3	9	-
Spain	65.0	26	-	40.9	26	-	72.9	61	-
Portugal	61.0	29	-	19.2	116	-	78.2	36	-

* Ranks after rounding to one decimal point.

performance has been quite impressive. According to the OECD, GDP per capita has accelerated from 1.2 percent in the 30-year period to 1980 to 7.5 percent currently, a growth rate, which, if sustained, would double income per capita in a decade. This is clearly an important achievement that has brought with it a substantial reduction in the incidence of poverty, from 36 percent in 1994 to some 27 percent by 2005.[74]

Inevitably, the global financial crisis has contributed to a deceleration of India's economic growth in 2008 and 2009, and the emergence of other problems, such as a substantial widening of the budget deficit (see below). However, assuming this to be a temporary phenomenon, the key question for Indian economic policy for the foreseeable future will be what policies will allow it to sustain or, indeed, accelerate its growth performance over the next decade. Just as China has benefited from a massive process of urbanization in the past two decades which has contributed in an important way to its high economic growth rates, India has a similar structural fea-

[74] This progress notwithstanding, China has grown more quickly than India over the same period and, consequently, has seen much faster reduction in poverty levels, regardless of the poverty line chosen. China has much lower infant mortality, higher life expectancy, and lower illiteracy rates than India.

Table 10. The Innovation Capacity Index: Chile and Latin America (cont'd.)

	Selected variables								
	Environmental sustainability			Total fixed broadband subscribers per 100 inhabitants			E-government readiness index		
	Score	Rank* (131)	Region Rank	Score	Rank* (131)	Region Rank*	Score	Rank* (131)	Region Rank
Chile	83.4	28	4	19.8	42	1	58.2	40	3
Uruguay	82.3	35	8	13.6	51	3	56.5	46	5
Costa Rica	90.5	5	1	8.1	56	8	51.4	55	9
Peru	78.1	55	13	5.6	64	11	52.5	53	8
Mexico	79.8	43	11	11.8	52	4	58.9	37	1
Argentina	81.8	37	9	18.1	43	2	58.4	39	2
Panama	83.1	29	5	2.8	77	15	47.2	73	15
Trinidad and Tobago	70.4	81	19	3.2	73	14	53.1	51	7
El Salvador	77.2	60	15	3.6	72	13	49.7	63	11
Colombia	88.3	9	2	7.2	57	9	53.2	50	6
Dominican Republic	83.0	32	6	4.3	68	12	49.4	64	12
Jamaica	79.1	51	12	8.2	55	7	46.8	75	16
Honduras	75.4	68	17	0.0	108	21	40.5	86	19
Brazil	82.7	33	7	11.6	53	5	56.8	45	4
Guatemala	76.7	64	16	0.6	91	20	42.8	81	18
Paraguay	77.7	59	14	2.2	81	16	46.5	76	17
Ecuador	84.4	22	3	6.6	60	10	48.4	68	14
Nicaragua	73.4	72	18	0.9	87	19	36.7	88	20
Bolivia	64.7	96	20	1.0	86	18	48.7	66	13
Venezuela	80.0	42	10	8.5	54	6	51.0	58	10
Suriname	-	-	-	1.6	84	17	34.7	92	21
Haiti	60.7	104	21	0.0	108	21	21.0	120	22
Memorandum items:									
Finland	91.4	4	-	91.7	4	-	74.9	15	-
New Zealand	88.9	7	-	44.4	28	-	73.9	17	-
Ireland	82.7	33	-	45.1	27	-	73.0	19	-
Spain	83.1	29	-	49.4	25	-	72.3	20	-
Portugal	85.8	18	-	41.6	30	-	64.8	31	-

* Ranks after rounding to one decimal point.

ture: favorable demographics, which is likely to fuel growth. For the next 20 years, the share of the working age population will rise, and India will have to find ways to bring its masses of young people into the mainstream by spending on education and improving the quality of its educational institutions, in order to boost the productivity of its young, particularly the poor.

There has also been a significant improvement in recent years in the quality of India's policy environment and the degree of sophistication of its private sector. In those areas in which the government has decided to open up participation to the private sector—telecommunications, civil aviation—the response has been impressive. According to the OECD, India's telecommunications sector has become the third largest in the world. In contrast, in electricity generation, where public enterprises are still dominant, shortages are common, and there is a serious problem of non-payment due to "poor management of distribution enterprises and a failure to eradicate theft" (OECD,

Table 11. The Innovation Capacity Index and PISA scores: Latin America

	PISA (Program for International Student Assessment)*								
	Innovation Capacity Index			Science		Reading		Mathematics	
	Score	Rank** (131)	Region Rank	Score	Upper and Lower Ranks*** (57)	Score	Upper and Lower Ranks*** (57)	Score	Upper and Lower Ranks*** (57)
Chile	59.4	29	1	438	40-42	442	37-40	411	44-48
Uruguay	52.8	49	2	428	42-45	413	41-44	427	42-43
Costa Rica	51.5	58	3	-	-	-	-	-	-
Peru	50.6	60	4	-	-	-	-	-	-
Mexico	50.5	61	5	410	48-49	410	41-44	406	46-48
Argentina	49.2	66	6	391	50-55	374	51-53	381	50-53
Panama	48.9	68	7	-	-	-	-	-	-
Trinidad and Tobago	48.7	69	8	-	-	-	-	-	-
El Salvador	48.3	70	9	-	-	-	-	-	-
Colombia	48.0	72	10	388	50-55	385	48-53	370	52-55
Dominican Republic	46.3	79	11	-	-	-	-	-	-
Jamaica	46.2	81	12	-	-	-	-	-	-
Honduras	46.0	82	13	-	-	-	-	-	-
Brazil	45.2	87	14	390	50-54	393	46-51	370	53-55
Guatemala	44.5	89	15	-	-	-	-	-	-
Paraguay	44.3	90	16	-	-	-	-	-	-
Ecuador	44.2	91	17	-	-	-	-	-	-
Nicaragua	43.4	93	18	-	-	-	-	-	-
Bolivia	41.5	100	19	-	-	-	-	-	-
Venezuela	40.9	102	20	-	-	-	-	-	-
Suriname	40.1	105	21	-	-	-	-	-	-
Haiti	28.7	129	22	-	-	-	-	-	-
Memorandum items:									
Finland	77.8	2	-	563	1-1	547	2-2	548	1-4
New Zealand	73.4	10	-	530	3-9	521	4-6	522	8-13
Ireland	70.5	18	-	508	15-22	517	5-8	501	17-23
Spain	60.3	28	-	488	26-34	461	34-36	480	31-34
Portugal	57.2	35	-	474	35-38	472	29-34	466	35-38

* *PISA 2006: Science Competencies for Tomorrow's World*. Executive Summary. OECD, 2007.

** Ranks after rounding to one decimal point.

*** Rankings for all participating countries. On the basis of the samples of students assessed by PISA, it is not always possible to say with confidence which of two countries with similar performance has a higher mean score for the whole population. However, it is possible to give a range of possible rankings within which each country falls.

2007). There would thus appear to be wide scope for gains in efficiency in resource allocation in India, with corresponding gains in productivity and economic growth.

India does not do well in the Innovation Capacity Index, with an overall ranking of 85 among 131 countries (Table 6). Looking at the various pillars of the ICI, India's worst ranking (94) corresponds to human capital, training, and social inclusion, followed by adoption and use of information and communication technologies (93) (see Table 7). To boost its capacity for innovation, policymakers in India will have to address a number of important weaknesses, of which the most important are discussed below. Figure 4 presents the ICI's top priorities for policy reform for India.

Education and labor market

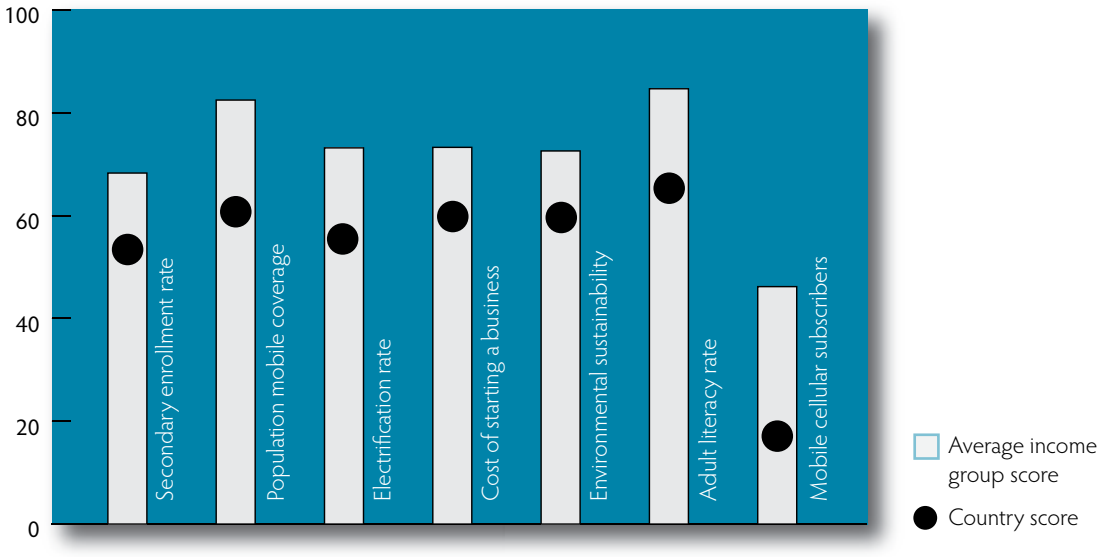
India continues to have high illiteracy rates—its rank in the ICI on this particular indicator is 110—suggesting that illiteracy still afflicts several hundred million people, not surprisingly a serious blight on innovation capacity. School enrolment rates remain low by international standards, with its rank for secondary school level an unimpressive 94. The scope for improvement in girls' education is especially intense—the ICI attaches to India a rank of 89 on the gender equity index. Given the wide range of positive payoffs associated with improvements in girls' education and, more generally, gender equity, much more will have to be done over the longer term to integrate women into the economy, the educational system, and India's political establishment. India will also have to educate and train its young poor, to enable them to join the labor force with usable skills, particularly in those sectors with potential comparative advantage. There is every expectation that world demand for outsourcing will rise in coming years, reflecting the continued shift of backroom operations associated with further reductions in the cost of communications. For India to be able to take full advantage of these opportunities, it will have to improve the level of skills and training of its workforce. In this respect, it is particularly worrying to see that India suffers from huge inefficiencies in its labor market, with laws governing regular employment contracts much stricter than in many emerging markets, and in virtually all members of the OECD. As noted by the OECD, one major reason for this is "the requirement to obtain government permission to lay off just one worker from manufacturing plants with more than 100 workers." Not surprisingly, a rigid labor market will prevent India from deriving the full benefit of its comparative advantage in labor-intensive industries.

A serious fiscal deficit problem

For many years now India has had a serious problem with its public finances. Essentially, it has been running deficits of some 6-10 percent of GDP for the past decade, among the highest in the world. This problem has many dimensions and it is worthwhile to highlight several here. First, India's public debt level, at 83 percent of GDP in 2009, is already very high by international standards; indeed, it is larger than that of Brazil and Argentina, twice that of Turkey, four times that of China, and well over ten times larger than that of Russia, as well as of most OECD countries. Second, with total revenue collection in the neighborhood of 18 percent of GDP (again, extremely low by international standards) due to its very narrow revenue base—the central government collects no more than about 11 percentage points of GDP in taxes—the revenue-to-debt ratio is among the lowest in the world.

In an attempt to bring about some measure of medium-term fiscal adjustment, the government brought into force in 2003 a Fiscal Responsibility Budget Management Act (FRBMA) which established a path of deficit reduction through 2009. The high economic growth rates during the period 2004–07 boosted government revenue and some progress was made in reducing the deficit, but the 2008 financial crisis and the need

Figure 4. **India: Top priorities for policy reform**



to respond to the weakening of economic activity through fiscal stimulus means that the deficit in 2009 will be back to some 10 percent of GDP. In any case, the law has generally applied to the central government only, whereas, in fact, a large share of the deficit problem is with the states. Moreover, it does not contain a medium-term debt target that might act as a binding constraint on the public finances. The law also does not establish any penalties or sanctions for departures from the path of fiscal adjustment laid down in the FRBMA. According to the IMF, "despite the apparent consolidation, off-budget activities increased, deadlines to comply with fiscal targets were extended and the fiscal adjustment was not underpinned by expenditure reform."[75] India's fiscal situation is, without doubt, a severely limiting constraint on the country's ability to boost its innovation capacity.

A large public debt constrains the ability of the government to allocate greater resources to education and public health, and to improve the country's dilapidated infrastructure, all areas where India, as noted earlier, is lagging behind. The inability of the government to introduce expenditure reform is, likewise, a major constraint on policies that might seek to direct greater resources to more productivity-enhancing areas. This year, India is spending close to 4 percent of GDP on regressive subsidies on petroleum, diesel, and various other products, a sum roughly equivalent to what it spends on education and health combined. This is a shocking statistic that highlights the significant need to improve the macroeconomic environment.[76] Without doubt, the deficit is a drag on the economy. A much lower deficit would have been associated with higher growth rates and higher levels of revenue, which would have boosted the ability of the government to respond to pressing social needs.

Not doing business

It takes 13 procedures, a total of 30 days at a cost of 70 percent of income per capita to open up a business in India. In the World Bank's *Doing Business Report 2009*, India ranked 121 (among 181 countries) in this indicator, representing a *drop* of seven places with respect to 2008. Among the 131 countries ranked in the ICI, India has a rank of 100 for the cost of registering property, a rank of 116 for the ease of paying taxes, and a rank of 180 for enforcing contracts. The fact is that bureaucratic red tape and excessive regulation remain serious problems in India, a country afflicted with a pervasive culture of government intervention and control, which adds to business costs, discourages the development of small and medium-sized enterprises, and, given the important role played by entrepreneurship in most forms of innovation, is thus a heavy burden on India's innovative capacity.

Russia's unfulfilled potential

Russia is in many ways a unique case, with a relatively mediocre ranking of 49, well below the rank of countries such as Chile (29), Malaysia (34), and Poland (40), which share broadly similar levels of income per capita (see Tables 6 and 8). Russia has a solid human capital endowment, reflecting decades of investment in education in science and technology. If, as noted earlier, Latin America has a grand total of three Nobel Laureates in science, there are at least ten Russian Nobel Laureates in physics alone. And had Alfred Nobel created a category for mathematics, there is little doubt that Russian mathematicians would have been awarded many prizes, perhaps more than any other nation. At the same time, however, it is a country where there is a huge gap between the stock of resources spent in past decades to foster contributions to knowledge, on the one hand, and, on the other, the kind of output that we would normally recognize today as reflecting achievements in scientific innovation, such as, for instance, patent registration or the presence of identifiable Russian brands in manufactured exports. Soviet technology was able to send the first man into space; it made significant advances in nuclear energy technology; but the context of the Cold War and the inefficiencies of central planning misdirected vast resources to the military-industrial complex, at huge cost in terms of living standards. By the time the Soviet Union collapsed in 1991, it was producing large nuclear submarines, MIG aircraft, and other weapons (sold on credit to its allies in the developing world), but not many consumer goods, and few, if any, manufactured goods with even minimal presence in the global economy. The 1990s witnessed a disorderly transition to a sort of market economy which involved redeployment of labor from the military-industrial complex and other heavy and inefficient industries to the private non-defense sector, particularly light manufacturing, services, and other industries long neglected under the state planning system.

[75] International Monetary Fund, 2009b, p. 34.

[76] There is yet another dimension to the fiscal deficit problem which will not be addressed here, having to do with the impact of debt financing on the financial system; it is much easier for the banks to lend to the government than to lend to small and medium-sized enterprises, which are so much at the center of the innovation chain in other countries.

A difficult business environment

There are several factors that help explain the persistence of this gap between its relatively solid educational base and Russia's notable absence among international innovators. First and foremost, 18 years into its transition, Russia has still not established a particularly nurturing business environment. In fact, a case can be made that in some areas, such as levels of corruption, the property rights climate, the lack of independence of the courts, the general level of transparency in the public sector, and in the relations between the government and the business community—what the OECD calls "framework conditions" but which fundamentally refer to the stability and efficiency of the institutions that underpin the market economy—Russia is worse off today than it was five years ago.

This is certainly made unambiguously clear from the good governance indicators compiled by the World Bank and used in the institutional environment pillar of the ICI, as well as by Russia's embarrassingly low rankings in Transparency International's *Corruptions Perceptions Index*—147 among 180 countries in 2008, a drop of *61 positions* since 2003.[77] Russia's deteriorating property rights climate, including for intellectual property, is particularly noteworthy—piracy is rampant in Russia—and perhaps more than any other indicator suggests the severe obstacles which at present exist for the creation of an institutional framework that will encourage innovation.

The high incidence of crime and corruption (ranging from "visits" from tax and fire inspectors to politically motivated expropriations by the state) remains a heavy burden on businesses, imposing heavy costs on them, and, therefore, undermining the ability of Russian companies to compete abroad.[78] Accounting and auditing standards are weak, raising yet another set of concerns about the investment climate. Increasing restraints on freedom of the press highlight the risks for the abuse of power, and the difficulties for civil society to emerge as a constructive counterweight to the growing power of the state. The World Bank's *Doing Business Report* (which provides the indicators that go into the regulatory and legal framework pillar of the ICI) paints a rather uncharitable picture of bureaucracy and red tape in Russia: from rigid labor-market laws and mind-numbing obstacles to the obtaining of licenses—it takes 54 procedures and an average of 704 days to obtain one, at a cost of close to 3,800 percent of income per capita—to difficulties in the payment of taxes and to impediments to international trade. Trading across borders is so laden with red tape in Russia that the country ranks 155th among 181 countries in this particular indicator of the *Doing Business Report*. This is a particularly perturbing indicator, given the need to encourage exports other than resource-based commodities, on which the Russian economy is totally dependent. According to the OECD, the share of high-value added goods in manufacturing exports from Russia to OECD countries is less than 1 percent and is even lower (0.2 percent) in the case of ICT goods. (In Taiwan, in contrast, close to 50 percent of manufactured exports are high-tech exports). Figure 5 presents the ICI's top priorities for policy reform in Russia.

Innovation policies

These extremely unfavorable business environment conditions have had a number of undesirable repercussions. The country is a major exporter of talent. Not surprisingly, capable Russian researchers with a modicum of ambition emigrate at the first available opportunity. There is no significant engagement between the scientific community and the business world. The sort of collaboration and interaction between institutions of higher education and the enterprise sector which have been so instrumental in the development of a vibrant ICT industry in Israel and Taiwan is largely absent in Russia. State funding for research and development to institutions of higher education accounts for less than 5 percent of total state funding to such institutions. This, in turn, means that state funding to science does not play the catalytic role that it has played in other countries to spur innovation. Instead, as noted by the OECD, the emphasis on "institution-based financing tends to protect incumbents and creates few incentives to increase efficiency, productivity or innovation. On the contrary, since much funding is 'cost-based' and allocated with reference to employment levels

[77] In fact, between 2003 and 2008, Russia has been one of the world's worst performing countries in the *Corruption Perceptions Index*, sharing (undistinguished) company with the likes of Belarus, the Islamic Republic of Iran, Sudan, Uzbekistan, Syria, and Gambia. China's rank fell from 66 to 72; India's rank moved from 83 to 85, and Brazil's from 54 to 80, with Russia having, by far, the worst performance among the largest emerging markets.

[78] According to Richard Pipes (2009), "One of the major obstacles to conducting business in Russia is the all-pervasive corruption. Because the government plays such an immense role in the country's economy, controlling some of its most important sectors, little can be done without bribing officials. A recent survey by Russia's Ministry of the Interior revealed, without any apparent embarrassment, that the average amount of a bribe this year has nearly tripled compared to the previous year, amounting to more than 27,000 rubles or nearly US$1,000. To make matters worse, business cannot rely on courts to settle their claims and disputes, and in extreme cases resort to arbitration."

and fixed assets, greater efficiency could lead to loss of funding" (Gianella and Tompson, 2009, p. 20).

The government has attempted to steer policies in the direction of better support for R&D, with the aim of encouraging the emergence of a culture of innovation. It is aware that while levels of overall R&D spending are not low by emerging market standards, such spending remains unduly concentrated on a few sectors, and consists overwhelmingly of state funding, in sharp contrast with other countries, where much of R&D spending comes from the private sector. One way in which a better balance could be achieved in this area would be to phase out fiscal disincentives to enterprise R&D spending through accelerated write-offs. A law passed in June of 2005 on Special Economic Zones was intended to contribute to diversification of Russia's industrial structure and to stimulate innovation. Unfortunately, Russia does not have a good history with such special zones, although they have been a staple of Russian structural reforms since the 1990s. In the specific case of the 2005 law, we are skeptical that it will have the desirable effects—particularly in terms of attracting foreign investment, as Taiwan and Israel have been brilliantly successful in doing—given that "disputes concerning the creation and operation of SEZs are to be settled in Russian courts under Russian law" (Gianella and Tompson, p. 27). In the absence of mechanisms of international arbitration, it is unlikely that foreign investors may want to expose themselves to the lack of independence and arbitrariness of Russian judges and courts and, more generally, to the primitive, opaque nature of the Russian legal system.

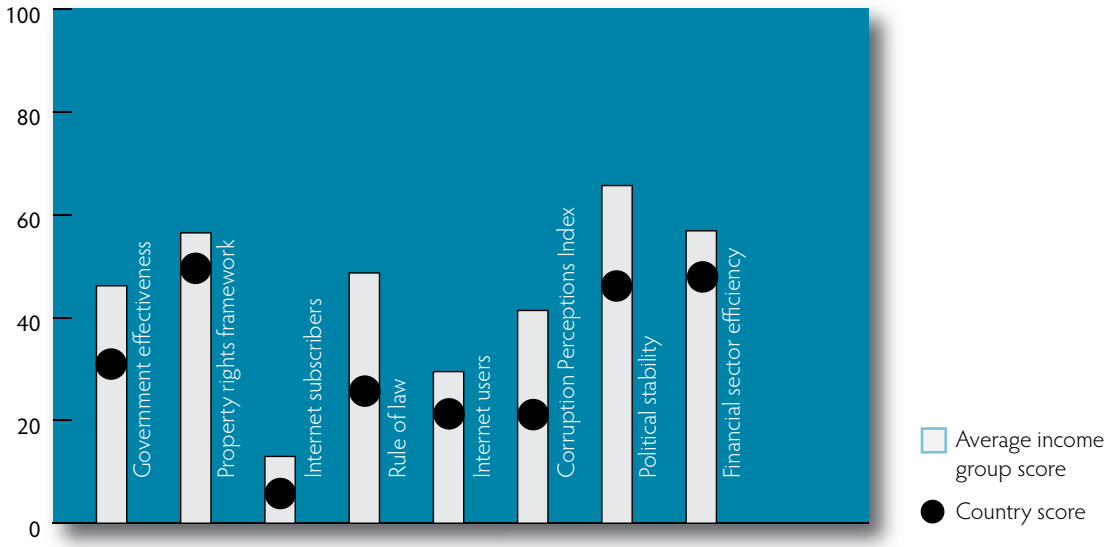
Low ICT penetration

Finally, Russia does not do as well as might be expected in the ICI because, with the exception of mobile telephony, it does not have particularly impressive penetration rates for the latest technologies. Even in the area of personal computers—where notable progress has been made in recent years in terms of expanding their use in businesses and households—PC use per 100 inhabitants is about 13.3, putting Russia in 56th place in the world, slightly worse than its rank of 52 in 2006, and broadly in the middle among the 131 economies covered in the ICI. Similar results hold for Internet use: improvements with respect to the recent past, but absolute levels that are not high enough to put Russia above its 64th place in the world.

Other weaknesses undermining innovation potential

Other factors are likely to complicate the authorities' attempts at boosting innovation capacity over the medium term: first is the weakening of a culture of meritocracy in the public sector, with many senior positions in government now going to people with links to the security establishment, who increasingly—and presumably without the required qualifications—find themselves running large state enterprises in the energy and other sectors; second, the return to old authoritarian traditions which sit uncomfortably with the openness and willingness to "challenge the system" that are so common in successful cases of innovation; third is the country's long-term demographic trends, which foresee a rapidly aging and declining population, limit-

Figure 5. Russia: Top priorities for policy reform



ing the role of the labor force as an engine of economic growth in coming years; finally, an ambivalent attitude toward foreign direct investment, which is welcomed one day, but quickly followed by "renegotiations" of previously agreed contracts with foreign partners, all of this accompanied by the return of old-fashioned ideas about "strategic sectors" which should remain under state control. This has led to a marked increase in the presence of the state in the energy and raw materials sectors. Furthermore, the 2008–2009 financial crisis is projected to result in something close to a 10 percent drop in GDP growth in 2009, and a massive widening of the budget deficit, creating a likely setback for the government's efforts to do more in this critically important area. The sum total of the above suggests that Russia is a classic case of unfulfilled potential—a giant still playing in the little leagues.

Taiwan: Green Silicon Island

A recent and insightful contribution to the debate on the policies that contribute to economic growth is the 2008 study published by the Commission on Growth and Development,[79] which examined the experiences of 13 countries which, beginning in 1960, grew at an annual average rate of at least 7 percent over a period of 25 years or more, and identified those factors which contributed to such remarkable economic performance. The 13 economies examined include Taiwan. And since Taiwan's real growth rate over the 30-year period beginning in 1960 was 9.2 percent, one can assume that it must have been very near the top in this high-growth league. Indeed, between 1952 and 2007, income per capita rose from US$197 to US$16,800, arguably the most remarkable case of catching up seen in the post-World War II period.

Sound policies

A closer look at the Taiwan experience suggests that a combination of sound policies, the strong engagement of the private sector, effective governance, imaginative institutional arrangements, and good macroeconomic management has lifted its population from poverty and helped it join the ranks of the most prosperous and innovative economies in the world.[80] Major investments have been made in both human resources and infrastructure by both government and the business community, and the benefits of economic growth have been widely shared by all segments of society. Targeted and well thought out government intervention, aimed at facilitating the emergence of a strong private sector role in ICT has worked in Taiwan, because the government has kept active consultative mechanisms in place to attract the input and technical expertise of the private sector, to agree on common approaches, and to bring into its institutions the best technical experts to support both government and business.

A global leader in ICT

Taiwan ranks among the world's top producers of notebook personal computers, flat panel displays, modems, motherboards, and other electronic components and products. In 2007, it ranked fourth globally in the production value of its semiconductor industry (US$44.4 billion) and was first in the world in the production of image display hardware (US$54.5 billion). Taiwan has an impressive capacity for innovation, firm-level technology absorption, collaboration between institutions of higher education and the business community in research, and a pre-eminent position in the use of the latest technologies, from mobile telephones to personal computers and the Internet. Its rank of 13 in the Innovation Capacity Index (Table 6) reflects exceptionally high performance in a number of indicators including patent registration (per capita), in which Taiwan is number 1, schools connected to the Internet (1), R&D worker density (4), tertiary enrolment rate (4), fixed telephone lines (4), students enrolled in science and engineering (5), among others. In fact, Taiwan is ranked 1 in the world in the ICI's Research and Development pillar (Table 7). In research productivity, Taiwan ranked 7th in papers indexed in the 2007 *Science Citation Index*, 7th in papers indexed in *Engineering Index*,[81] and 4th among all countries in US patents granted in 2008. Figure 6 shows some of Taiwan's key strengths.

Human capital development

Although seemingly a disadvantage at the time, the brain drain of the 1960s and 1970s—when some 50,000 of the brightest young Taiwanese went overseas (principally to the United States) for

[79] See The Growth Commission, 2008, available at: www.growthcommission.org The Growth Report was funded by the World Bank, several industrial country aid agencies (Australia, Canada, the United Kingdom), and some private foundations. The Commission was chaired by Nobel Laureate in Economics Michael Spence.

[80] For further details see Dahl and López-Claros, 2006. This section on Taiwan also draws from a visit to Taipei made by López-Claros in February, 2009.

[81] National Science Council, 2008, available at: http//www.nsc.gov.tw/tech/

university and advanced studies—allowed Taiwan to build a large pool of qualified and experienced people before its economy was ready to absorb them. From 1985 onwards, incentives drew them back to Taiwan as entrepreneurs, to create start-ups in the science parks, or to take up research, academic, and management positions, bringing not only their knowledge and experience, but also their networks of contacts and working relationships with leading international companies, and enabling today's Taiwanese universities to educate its own manpower for continuing expansion at home. These informal networks, supplemented by overseas offices of various institutes and research centers, facilitate technology transfer, innovation, and strong entrepreneurial relationships.

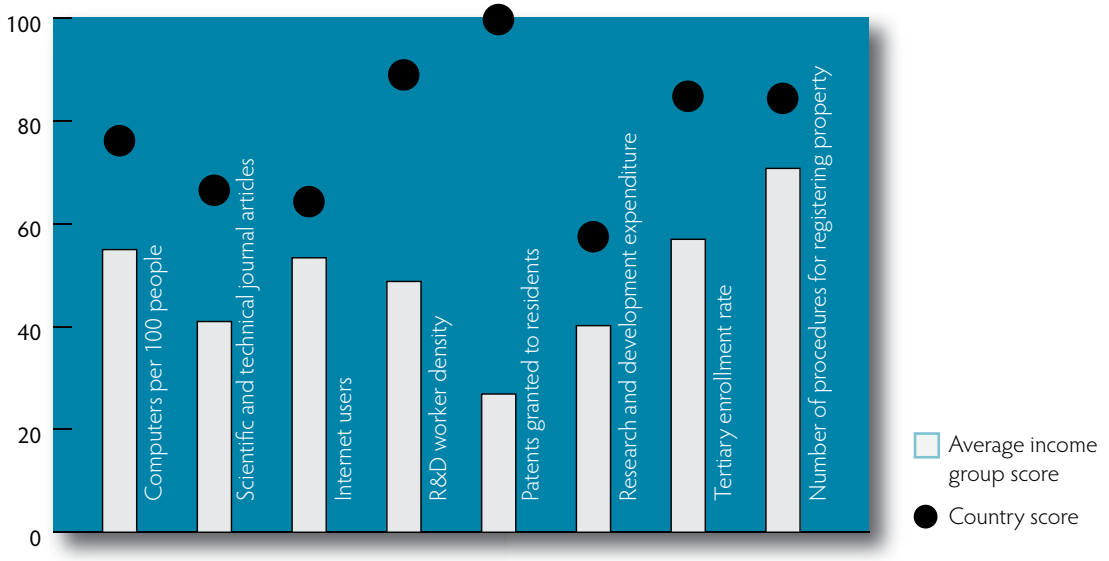
Launched in 2000, the government's Department of Industrial Technology has vigorously promoted e-business, following four strategic elements: policy, environment, applications, and promotion, with the goal of establishing a global logistics operation system based on a highly efficient e-supply chain framework, linking leading international IT companies (IBM, HP, and Compaq) with 42 Taiwan contract manufacturers, and 15 domestic e-supply chains among domestic IT manufacturers.

Deploying the information society

At the heart of Taiwan's ICT revolution is the Institute for Information Industry (III), a joint government-private sector think tank and management consultancy, promoting the development of the ICT industry and deploying the information society. The III provides a neutral source of expertise independent of both partisan politics and individual corporate agendas, helping Taiwan to increase productivity, raise efficiency, and develop international collaborative projects with key industrial and academic partners and global offices in various important ICT centers. The government contracts a wide range of functions to the III, making use of its human resources in a flexible manner, from proposing policy, providing market analyses, incubating start-ups, developing such concepts as the integrated service model and the digital home, to generating consumer, communications, and computer technologies, and generating over 100 patent applications annually. The III provides professional IT training in both the public and private sectors, develops programs to address the digital divide, creates digital opportunity centers in remote areas and internationally for developing countries, and provides services to small and medium enterprises, as well as disadvantaged and handicapped groups. Over the years, III has provided training to some 400,000 professionals. It also designs and manages projects to strengthen ICT infrastructure, including the planning of e-Taiwan, to extend broadband access to all households, and M-Taiwan, to provide mobile access through a combination of cellular telephone and WLAN networks. As manufacturing moves offshore, it moves the industry forward from tangible to intangible products, and aims to establish best practices in Taiwan as a model for the rest of the world.

With a million or more Taiwanese working in mainland China, trade with that country involves well over US$100 billion in investment—the logical place for Taiwanese businesses to locate

Figure 6. **Taiwan: Significant indicators above income group average**



production and take advantage of low land prices and cheap labor. Competition with the mainland is now forcing Taiwan to search for new areas of comparative advantage as a center for research and for corporate headquarters, maintain its engineering and management talent, and invest more in research and collaboration between industry, the research institutes, and universities.

In addition to manufacturing them, Taiwan is quickly adopting ICTs. The III estimated that already in 2007, there were over 10 million Internet users in Taiwan, with a penetration rate of 44 percent, and showing signs of reaching saturation. There were also about 12.5 million mobile Internet subscribers and 4.7 million broadband subscribers.

Taiwan's network of 10 science parks helps incubate startups and offers an environment in which companies can take several years to grow before they decide to build their own building on leased government land, shielding them from high property costs. They screen applicants in relation to national priorities and for synergies with park activities. Each science park focuses on a different area, such as semiconductors, integrated circuits, computers and peripherals, telecommunications, precision machinery, biotechnology, and recycling technology, among others. They account for some 40 percent of total exports and imports, or close to US$190 billion and a significant share of government revenue.

In Taiwan, ICTs are not only a matter for business, but play a role in promoting its own social and economic development. The interaction of the two sheds important light on Taiwan's success in this area. However, despite the high value placed on education in Chinese culture, and the efforts made by the government to build human resources, there is still a gap between academia and industry, because the traditional Chinese educational approach at the primary and secondary level does not encourage the kind of innovative thinking necessary for success in scientific research and development, making the student transition to university more difficult. With a work force mostly under 30, the challenge will be to retrain maturing workers as technologies, production processes, and whole industries evolve, to emphasize lifelong learning, using ICTs as well as ongoing programs in the science centers and elsewhere, to sustain momentum and make the educational system as flexible and entrepreneurial as industry.

With the ICT industry having reached a stage of maturity, it will have to support new ventures that leverage Taiwan's comparative advantages, all of which are typical of Porter's innovation-driven stage of development. This may involve venturing into such areas as using ICT to boost alternative energy sources, helping to create digital homes and deliver new services in such burgeoning fields as long-distance patient care and other forms of biomedical research, services aimed at enhancing the quality of life for the elderly, and keeping abreast of developments in the world's leading technology centers to maintain a competitive edge. In this respect, it will be essential to improve the regulatory framework for services, which at times suffer from excessive regulation. This observation is borne out by Taiwan's relatively poor ranking in pillar 3 of the ICI which captures various dimensions of the regulatory environment and where Taiwan's rank of 39 out of 131 countries shows much scope for improvement.

Conclusions

Richard Cooper (2004a, p. 151) makes a compelling case that at the outset of the 21st century technical change and innovation have become "the dominant characteristic" of our time. "New technological ideas," he adds, "combined with social order and the trained human beings who generate and apply them, are the basis for modern economic prosperity." The traditional sources of power and influence—territory, resources, raw manpower, and military might—for centuries the chief determinants of nations' prosperity, are far less important today than they used to be and have given way to a new world in which successful development is increasingly linked to sound policies, to good governance, to effective management of scarce financial resources, and, most important, to the extent to which societies are able to harness the latent capacities of their populations. Successful countries today are not necessarily large geographically or richly endowed with natural resources, nor able to project military power beyond their borders. Increasingly, they are countries that have managed to expand opportunities for their populations through the full exploitation of the opportunities afforded by the world economy through international trade, foreign investment, the adoption of new technologies, macroeconomic stability, and high rates of saving.

The Innovation Capacity Index featured in this chapter correlates a wide-ranging set of relevant factors, policies, and institutional characteristics which are seen as playing a central role in boosting a nation's capacity for innovation. How can

countries transform knowledge into value in ways that will result in new products and services, processes and systems? What are the priority policy areas that merit particular attention if countries are to be able to participate successfully in an increasingly complex global economy, requiring growing levels of sophistication? How do these priorities, in turn, depend on a nation's particular stage of development—the quality of its institutions, the human capital endowment of its labor force—and the nature of the political regime against which policies are framed? In building the ICI's theoretical framework, we have established a firm linkage between the stage of development of a given country and the relative importance attached to the many factors boosting innovation capacity. But we have also taken the view, firmly anchored in empirical observation, that democracies tend to be better than authoritarian regimes at encouraging the creation of friendly environments for innovation.

The Innovation Capacity Index is intended to be a policy tool to better examine the broad range of policies and institutions which underpin the creation of an environment conducive to innovation. The methodologies developed allow the identification of country-specific factors which demand priority attention. The reader's attention is directed to the innovation profiles in part 3 of the *Report* which identify, for each country, the top priorities for policy reform. Although this is the first edition of the ICI, the Index will be estimated annually and it is expected that, over time, it will also provide a historical perspective on individual country performance. Above all, by identifying individual country strengths and weaknesses, the Index is intended to stimulate policy dialogue. And the rich body of data used for the calculation of the Index rankings should also provide ample opportunities for the sort of high-minded international comparisons of best-practices which are an essential component of better policy formulation.

To highlight the uses to which the ICI can be deployed, in this chapter we have examined in some depth the innovation capacity of five countries: Sweden, Chile, India, Russia, and Taiwan. Sweden is the ICI's top performing country in 2009, serving as an impressive benchmark for other countries. Yes, Sweden is a rich industrial country with an important presence in the global economy, but there is much in the Swedish approach to innovation that is of particular relevance not only to other industrialized countries, but to many middle-income countries with aspirations to join the league of top innovators. We are particularly impressed by Sweden's ability to combine open and transparent government, universal social protections, and high levels of competitiveness and productivity to create one of the most innovative economies in the world. Equally impressive is the extent to which an excellent policy framework has turned the private sector into the main engine of innovation.

Chile is an interesting case because it proves that sound policies and good institutions are not the *result* of wealth and prosperity but rather engines for its creation. Chile's performance is far ahead of any other country in Latin America and in many critical areas it is already ahead of the European Union average. A mix of sound macroeconomic management—including arguably one of the most virtuous fiscal policies in the world—institutional reforms, and opening up of the economy to the benefits of free trade, foreign investment, and international competition have combined to create a reliable engine of high growth and poverty reduction. But the authorities have also sought to implement micro policies aimed at enhancing the efficiency of public services through various electronic platforms and at facilitating the use of ICTs more generally. Chile is well poised to catch up with the richer members of the EU, even if some poor performers in the region may occasionally complicate the context for policy implementation.

India is one of the world's most rapidly growing economies and has aspirations to be a global player in the field of technological innovation. Its economic performance over the past two decades has been impressive and has turned India into the world's fourth largest economy. India has favorable demographics, with a growing working age population which, if properly educated, could spur rising productivity and growth. In coming years, however, much more will have to be done to deal with India's disadvantages, including high illiteracy rates, a poorly developed infrastructure, a festering fiscal deficit problem which has pushed the public finances to unhealthy levels of indebtedness, and a regulatory framework characterized by mind-boggling bureaucracy and red tape, which go far to discouraging entrepreneurship and innovation. Still, beyond the benefits of good demographics, India has many features in its favor, including a long political tradition of democracy and rule of law. While its ranking in the ICI (85) is not high, there is enormous scope for the implementation of better policies, including institutional reforms, which might

allow India to scale up in the rankings.

Russia's innovation performance lags far behind its true potential. It is a country with a well-established tradition of solid contributions to basic science. In previous decades it was a leader in space exploration, nuclear technology, and aviation. Its transition from the inefficiencies of central planning to the challenges of a market economy has not been easy. During the past five years, the country has lost some steam as a result of the commodity boom which has increased its economic dependence on energy and other raw materials exports. Furthermore, the country does not have a friendly business environment capable of spurring entrepreneurship and allowing the incubation of new ideas and approaches to new products or process creation. Corruption has become an endemic problem of a magnitude most often seen in low-income countries with broken institutions. Its judges and courts lack the independence that might encourage more non-energy investments and its gradual return to authoritarian forms of governance does not bode well for the creation of an environment conducive to various forms of innovation. And yet, there is no intrinsic reason why a country with such a rich complement of human and natural resources and a long and distinguished history of scientific innovation should not catch up with the Swedens of this world.

Taiwan is arguably the most impressive example during the post-World War II period of both the consequences of high growth and the policies that underpin it. That a country should be able to increase its income per capita from under US$200 in 1952 to close to US$17,000 in 2007 is nothing short of astounding. Taiwan's success is attributable to two factors: first, it succeeded in accomplishing many of the good things that have been critical for high growth elsewhere in the world—while taking full advantage of the benefits of international trade and investment and the acquisition of new technologies—and it avoided making the errors that have been such a drag on development in so many other countries. In less than half a century Taiwan transformed itself from a simple agrarian society in the earliest stage of development into a remarkable global technology powerhouse, a world leader in the production of ICT equipment with a supporting infrastructure of science parks, public-private research institutions, and think tanks that have turned Taiwan into one of the world's most prolific innovators. Taiwan's challenge in coming years will be to find creative ways to cooperate with China—an emerging technology power in her own right, with a much lower cost structure—and to move closer to the best performers in the ICI.

Future editions of the *Innovation for Development Report* will provide in-depth analysis of innovation capacity in a growing number of countries. The Innovation Capacity Index will be estimated annually and the results published and analyzed in successive Reports. For obvious reasons, this chapter has covered methodological issues in some detail, as it was thought appropriate to lay out in reasonably explicit form the basic building blocks of the ICI and its underlying assumptions. It is expected, however, that in coming years, the emphasis will shift to analysis of innovation issues as they emerge among the countries covered by the *Report*. Country coverage is also expected to gradually rise over time. Readers are invited to visit a dedicated website at:

www.innovationfordevelopmentreport.org

to find innovation profiles for 63 countries not included in this year's published edition, as well as abstracts and short biographical sketches by the authors who contributed the other papers to this year's *Report*. It is hoped that the framework provided by the *Report* for examining factors, policies, and institutions which contribute to creating an environment that boosts nations' capacity for innovation will prove useful for analysis and policy dialogue in coming years. We expect that these questions will move to center stage in the debate over how best to safeguard human prosperity.

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Appendix. Innovation Capacity Index: Variable definitions

Variable	Source	Definition (as described by source) [1]
Pillar 1: Institutional environment		
Good governance		
Voice and accountability	World Governance Institute (WGI)—World Bank	Aggregate indicator. Measures the extent to which country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.
Political stability	WGI	Aggregate indicator. Measures the perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including domestic violence and terrorism.
Government effectiveness	WGI	Aggregate indicator. Measures the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.
Rule of law	WGI	Aggregate indicator. Measures the extent to which agents have confidence in and abide by the rules of society, in particular the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence.
Property rights framework	Aggregate indicator	It is the average of the following aggregate indicators: "Property rights" and "Enforcing contracts."
Property rights	World Bank and WEF	The value of this indicator is given preferentially by the World Bank "Country Policy and Institutional Assessment (CPIA) property rights and rule-based governance" ratings. This criterion assesses the extent to which private economic activity is facilitated by an effective legal system and rule-based governance structure in which property and contract rights are reliably respected and enforced. Each of three dimensions is rated separately: (a) legal basis for secure property and contract rights; (b) predictability, transparency, and impartiality of laws and regulations affecting economic activity, and their enforcement by the legal and judicial system; and (c) crime and violence as an impediment to economic activity. For those countries without this rating, an estimate was made using the World Economic Forum's (WEF) Executive Opinion Survey (EOS) data on property rights and intellectual property protection.
Enforcing contracts	DBR	Average of the three scores corresponding to the World Bank's *Doing Business Report* (DBR) enforcing contracts variables: "number of procedures," "time," and "cost." Indicators on enforcing contracts measure the efficiency of the judicial system in resolving a commercial dispute. The data are collected by studying the codes of civil procedure and other court regulations as well as surveys completed by local litigation lawyers (and, in a quarter of the countries, by judges as well). A procedure is defined as any interaction between the parties, or between them and the judge or court officer. This includes steps to file the case, steps for trial and judgment and steps necessary to enforce the judgment. Time is recorded in calendar days, counted from the moment the plaintiff files the lawsuit in court until payment. This includes both the days when actions take place and the waiting periods between. The respondents make separate estimates of the average duration of different stages of dispute resolution: the completion of service of process (time to file the case), the issuance of judgment (time for the trial and obtaining the judgment) and the moment of payment (time for enforcement). Cost is recorded as a percentage of the claim, assumed to be equivalent to 200 percent of income per capita. Only official costs required by law are recorded, including court and enforcement costs and average attorney fees where the use of attorneys is mandatory or common.
Transparency and judicial independence	World Bank and WEF	The value of this indicator is given preferentially by the World Bank CPIA "transparency, accountability, and corruption in the public sector" ratings. This criterion assesses the extent to which the executive can be held accountable for its use of funds and the results of its actions by the electorate and by the legislature and judiciary, and the extent to which public employees within the executive are required to account for the use of resources, administrative decisions, and results obtained. Each of these three dimensions was rated separately with equal weighting: (a) the accountability of the executive to oversight institutions and of public employees for their performance; (b) access of civil society to information on public affairs; and (c) state capture by narrow vested interests. For those countries without this rating, an estimate was made using the WEF's EOS ratings on "transparency of government policy making," "judicial independence," and "diversion of public funds."

[1] The variable definitions provided here reflect, for the most part, those provided by the compiling organizations themselves.

Variable	Source	Definition (as described by source) [1]
Pillar 1: Institutional environment		
Corruption Perceptions Index	Transparency International (TI)	A country or territory's corruptions perception index score indicates the degree of public sector corruption as perceived by business people and country analysts, and ranges between 10 (highly clean) and 0 (highly corrupt).
Country policy assessment		
Public sector management		
Quality of budgetary and financial management	World Bank, WEF and *Institutional Investor* magazine Country Credit Survey	This indicator is the average of two components: a quality of budgetary and financial management score, as described below, and a credit rating score. The value of the first part of this indicator is given preferentially by the World Bank CPIA "quality of budgetary and financial management" ratings. This criterion assesses the extent to which there is: (a) a comprehensive and credible budget, linked to policy priorities; (b) effective financial management systems to ensure that the budget is implemented as intended in a controlled and predictable way; and (c) timely and accurate accounting and fiscal reporting, including timely and audited public accounts and effective arrangements for follow up. Each of these three dimensions was rated separately. For those countries without this rating, an estimate was made using the WEF's EOS "wastefulness of government spending" ratings. For the credit rating score the country-by-country credit ratings developed by the *Institutional Investor* magazine were used. These are based on information provided by senior economists and sovereign-risk analysts at leading global banks and money management and securities firms. They have graded each country on a scale of 0 to 100, with 100 representing those countries that have the least chance of default. Participants are not permitted to rate their home countries. The individual credit responses are weighted using an institutional investor formula that gives more importance to responses from institutions with greater worldwide exposure and more-sophisticated country analysis systems.
Quality of public administration	World Bank and WEF	The value of this indicator is given preferentially by the World Bank CPIA "quality of public administration" ratings. This criterion assesses the extent to which civilian central government staffs (including teachers, health workers, and police) are structured to design and implement government policy and deliver services effectively. Civilian central government staffs include the central executive together with all other ministries and administrative departments, including autonomous agencies. It excludes the armed forces, state-owned enterprises, and sub-national government. The key dimensions for assessment are: policy coordination and responsiveness; service delivery and operational efficiency; merit and ethics; pay adequacy and management of the wage bill. For those countries without this rating, an estimate was made using the "favoritism in decisions of government officials" and "public trust of politicians" ratings of the WEF's EOS.
Structural policies		
Financial sector efficiency	World Bank and WEF	The value of this indicator is given preferentially by the World Bank CPIA "financial sector" ratings. This criterion assesses the structure of the financial sector and the policies and regulations that affect it. Three dimensions are covered: (a) financial stability; (b) the sector's efficiency, depth, and resource mobilization strength; and (c) access to financial services. These are areas that are fundamental to support successful and sustainable reforms and development. The first dimension assesses the sector's vulnerability to shocks, the banking system's soundness, and the adequacy of relevant institutional elements, such as the degree of adherence to the base core principles and the quality of risk management and supervision. The second dimension assesses efficiency, the degree of competition, and the ownership structure of the financial system, as well as its depth and resource mobilization strength. The third dimension covers institutional factors (such as the adequacy of payment and credit reporting systems), the regulatory framework affecting financial transactions (including collateral and bankruptcy laws and their enforcement), and the extent to which consumers and firms have access to financial services. For those countries without this rating, an estimate was made using the "financial market sophistication," "venture capital availability" and "ease of access to loans" ratings from the WEF's EOS.

Variable	Source	Definition (as described by source) [1]
Pillar 1: Institutional environment		
Trade openness	World Bank World Trade Indicators (WTI)	TTRI, *Trade Tariff Restrictiveness Index*, (MFN applied tariff) – all goods. This Index summarizes the impact of each country's non-discriminatory trade policies on its aggregate imports. It is the uniform equivalent tariff that would maintain the country's aggregate import volume at its current level (given heterogeneous tariffs). It captures the trade distortions that each country's MFN (most favored nation) tariffs impose on its import bundle using estimated elasticities to calculate the impact of a tariff schedule on a country's imports. These measures are based on actual or current trade patterns and thus do not capture restrictions facing new or potential trade. They also do not take into account domestic subsidies or export taxes. Expressed as a tariff rate.
Foreign direct investment gross inflows	UN Conference on Trade and Development (UNCTAD)	Definitions of foreign direct investment (FDI) used by the UNCTAD WIR are contained in the *Balance of Payments Manual: Fifth Edition* (BPM5) (Washington, D.C., International Monetary Fund, 1993) and the *Detailed Benchmark Definition of Foreign Direct Investment: Third Edition* (BD3) (Paris, Organisation for Economic Co-operation and Development, 1996). According to the BPM5, FDI refers to an investment made to acquire lasting interest in enterprises operating outside of the economy of the investor. Further, in cases of FDI, the investor's purpose is to gain an effective voice in the management of the enterprise. Expressed as percent of GDP.
Macroeconomy		
Debt levels	IMF World Economic Outlook (WEO), IMF Country Reports, CIA and World Bank World Development Indicators (WDI)	Gross debt comprises the stock (at year-end) of all government gross liabilities (both to residents and non-residents), in percent of GDP. To avoid double counting, the data are based on a consolidated account (eliminating liabilities and assets between components of the government, such as budgetary units and social security funds). General government reflects a consolidated account of central government plus state, provincial, or local governments.
Fiscal balance	World Bank WDI, IMF Country Reports	Cash deficit/surplus, defined as revenue (including grants) minus expenditures, minus net acquisition of non-financial assets, in percent of GDP.
Macrostability	International Financial Statistics (IFS), IMF WEO and Country Reports	This value is the weighted average of these three scores: "inflation," "interest rate spread," and "national savings rate." The average interest rate spread measures the difference between market short-term lending and deposit rates as published in the IMF's International Financial Statistics. The national savings rate is the share of GDP saved by households within the year. Consumer prices are annual percentage changes in the CPI; we use averages for the year, not end-of-period data.

Variable	Source	Definition (as described by source) [1]
Pillar 2: Human capital, training and social inclusion		
Good governance		
Education		
Adult literacy rate	World Bank WDI	The proportion of the adult population aged 15 years and older which is literate, expressed as a percentage of the corresponding population in a given country, territory, or geographic area, at a specific point in time, usually mid-year.
Secondary gross enrolment ratio	World Bank WDI	Number of pupils enrolled in a given level of education, regardless of age, expressed as a percentage of the population in the theoretical age group for the same level of education.
Tertiary gross enrolment ratio	World Bank WDI	Number of pupils enrolled in a given level of education, regardless of age, expressed as a percentage of the population in the theoretical age group for the same level of education. For the tertiary level, the population used is the five-year age group following on from the secondary school-leaving age.

Variable	Source	Definition (as described by source) [1]
Pillar 2: Human capital, training and social inclusion		
Expenditure in education	World Bank WDI	Public spending in education includes both capital expenditures (spending on construction, renovation, major repairs and purchases of heavy equipment or vehicles) and current expenditures (spending on goods and services that are consumed within the current year and which must be renewed the following year, including such expenditures as staff salaries and benefits, contracted or purchased services, books and teaching materials, welfare services, furniture and equipment, minor repairs, fuel, insurance, rents, telecommunications, and travel). Expressed in percent of GDP.
Social inclusion and equity policies		
Gender equity	UN HDR	The value of this indicator is given preferentially by the United Nations (UN) Human Development Report (HDR) "Gender Empowerment Measure" (GEM), a composite index measuring gender inequality in three basic dimensions of empowerment: economic participation and decision-making, political participation, and decision making and power over economic resources. For those countries without this value, an estimate was made using the UNHDR "Gender-Related Development Index" (GDI), measuring average achievement in the three basic dimensions captured in the human development index: a long and healthy life, knowledge, and a decent standard of living, adjusted to account for inequalities between men and women.
Environmental sustainability	2008 Environmental Perfomance Index	The *2008 Environmental Performance Index* (EPI) ranks 149 countries on 25 indicators tracked across six established policy categories: environmental health, air pollution, water resources, biodiversity and habitat, productive natural resources, and climate change. The EPI identifies broadly accepted targets for environmental performance and measures how close each country comes to these goals. As a quantitative gauge of pollution control and natural resource management results, the *Index* provides a powerful tool for improving policymaking and shifting environmental decision making onto firmer analytic foundations.
Health worker density	World Bank WDI	It is calculated as a weighted average of the number of physicians, nurses, and midwives per 1000 people. Physicians are defined as graduates of any facility or school of medicine who are working in the country in any medical field (practice, teaching, research), including generalists and specialists. Nurses include professional, auxiliary, and enrolled nurses and others, such as those in dental and primary care. Midwives include professional, auxiliary, and enrolled midwives.
Inequality measure	UN HDR, World Bank WDI	The ratio of the income or expenditure share of the richest 20 percent group to that of the poorest 20 percent.

Variable	Source	Definition (as described by source) [1]
Pillar 3: Regulatory and legal framework		
Doing business		
Starting a business		
Number of procedures	DBR (*Doing Business Report*)	A procedure is defined as any interaction of the company founder with external parties (for example, government agencies, lawyers, auditors, or notaries). Includes procedures to legally start and operate a company, preregistration (name verification, notarization), registration in the economy's most populous city, and post-registration (social security registration, company seal).
Time	DBR	Time in days required to complete each procedure. It does not include time spent gathering information. Each procedure starts on a separate day. It is considered completed once final document is received. No prior contact with officials is needed. If a procedure can be accelerated for an additional cost, the fastest procedure is chosen.

Variable	Source	Definition (as described by source) [1]
Pillar 3: Regulatory and legal framework		
Cost	DBR	Cost as percent of income per capita required to complete each procedure: official costs only, no bribes, and no professional fees, unless these services are required by law.
Ease of employing workers		
Ease of employing workers	DBR	This value is the average of these three DBR employing worker scores: "difficulty of hiring index," "rigidity of hours index," and "difficulty of firing index." The difficulty of hiring index measures whether fixed-term contracts are prohibited for permanent tasks, the maximum cumulative duration of fixed-term contracts, and the ratio of the minimum wage for a trainee or first-time employee to the average value added per worker. The rigidity of hours index has five components: whether night or weekend work is unrestricted, whether the workweek can consist of 5.5 days; whether the workweek can extend to 50 hours or more (including overtime) for two months a year to respond to a seasonal increase in production; and whether paid annual vacation is 21 working days or fewer. The difficulty of firing index has eight components: whether redundancy is disallowed as a basis for terminating workers, whether the employer needs to notify a third party (such as a government agency) to terminate 1 redundant worker, whether the employer needs to notify a third party to terminate a group of 25 redundant workers, whether the employer needs approval from a third party to terminate 1 redundant worker, whether the employer needs approval from a third party to terminate a group of 25 redundant workers, whether the law requires the employer to consider reassignment or retraining options before redundancy termination, whether priority rules apply for redundancies, and whether priority rules apply for reemployment.
Paying taxes		
Paying taxes	Aggregate indicator	This value is the average of these three DBR paying taxes scores: "number of payments per year," "hours per year," and "total tax rate." The tax payments indicator reflects the total number of taxes and contributions paid per year, the method of payment, the frequency of payment, and the number of agencies involved for this standardized case during the second year of operation. Time is recorded in hours per year. The indicator measures the time to prepare, file, and pay (or withhold) three major types of taxes and contributions: the corporate income tax, value added or sales tax and labor taxes, including payroll taxes and social contributions. Includes collecting information to compute tax payable, completing tax forms, filing with proper agencies, arranging payment or withholding, and preparing separate tax accounting books. The total tax rate measures the amount of taxes and mandatory contributions payable by the business in the second year of operation, expressed as a share of commercial profits. Includes: profit or corporate income tax, social contributions and labor taxes paid by the employer, property and property transfer taxes, dividend, capital gains, and financial transactions taxes, waste collection, vehicle, road, and other taxes.
Protecting investors		
Strength of investor protection	DBR	Strength of investor protection index: The average of the extent of the "disclosure," "extent of director liability," and "ease of shareholder suits" indexes.
Registering property		
Number of procedures	DBR	Procedures to legally transfer title on real property, including: preregistration (checking for liens, notarizing sales agreement), registration in the economy's most populous city, and post-registration (paying taxes, filing title with municipality).
Time	DBR	Time in days required to complete each procedure for registering property. Does not include time spent gathering information. Each procedure starts on a separate day. A procedure is considered completed once final document is received. No prior contact with officials is needed.
Cost	DBR	Cost is recorded as a percentage of the property value, assumed to be equivalent to 50 times income per capita. Only official costs required by law are recorded, including fees, transfer taxes, stamp duties, and any other payment to the property registry, notaries, public agencies, or lawyers.

Variable	Source	Definition (as described by source) [1]
Pillar 4: Research and development		
R&D infrastructure		
Research and development expenditure	World Bank WDI	Current and capital expenditures (including overhead) on creative, systematic activity intended to increase the stock of knowledge. Included are fundamental and applied research and experimental development work leading to new devices, products, or processes. Expressed as percent of GDP.
Information and communication technology expenditure	World Bank WDI	Includes external spending on information technology ("tangible" spending on information technology products purchased by businesses, households, governments, and education institutions from vendors or organizations outside the purchasing entity), internal spending on information technology ("intangible" spending on internally customized software, capital depreciation, and the like), and spending on telecommunications and other office equipment. Expressed as percent of GDP.
R&D worker density	World Bank WDI	It is calculated as a weighted average of the number of researchers and technicians in R&D per million people. Researchers are people trained to work in any field of science who are engaged in professional research and development activity, usually requiring the completion of tertiary education. Technicians in R&D are people engaged in professional R&D activity, who have received vocational or technical training (usually three years beyond the first stage of secondary education) in any branch of knowledge or technology of a specified standard.
Students in science and engineering	UN HDR	Students in science, engineering, manufacturing, and construction: The share (percent) of tertiary students enrolled in natural sciences; engineering, mathematics, and computer sciences; architecture and town planning; transport and communications; trade, craft, and industrial programmes; and agriculture, forestry, and fisheries.
Scientific and technical journal articles	World Bank WDI	Scientific and engineering technical journal articles per million people published in the following fields: physics, biology, chemistry, mathematics, clinical medicine, biomedical research, engineering and technology, and earth and space sciences.
Schools connected to the Internet	World Bank WDI	Schools connected to the Internet are the share (percent) of primary and secondary schools in the country that have access to the Internet.
Patents and trademarks		
Patents granted to residents	*Trilateral Cooperation Statistical Report* (TCSR)	Patents are documents issued by a government office that grant a set of exclusive rights for exploitation (made, used, sold, and imported) of an invention to an inventor or his assignee for a fixed period of time, in exchange for the disclosure and description of the invention. The data correspond to patents granted by the US Patent and Trademark Office (USPTO), European Patent Office (EPO), or Japan Patent Office (JPO). Data for each country represent the highest number of patents granted from either office, according to the 2007 TCSR. Data are per million people.
Trademark applications filed by residents	World Bank WDI	A trademark is any distinctive word, sign, indicator, or a combination of these used by an individual, business organization, or other legal entity to identify that the products and/or services with this trademark have the same origin, and to distinguish them from others in the marketplace or trade. An application for registration of a trademark must be filed with the appropriate national or regional trademark office. Data are per million people.
Receipts of royalty and license fees	World Bank WDI	Receipts between residents and non-residents for the authorized use of intangible, non-produced, non-financial assets and proprietary rights (such as patents, trademarks, copyrights, franchises, and industrial processes) and for the use, through licensing agreements, of produced originals of prototypes (such as films and manuscripts). Data are based on the balance of payments and are on a current US$ per person basis.
Payment of royalty and license fees	World Bank WDI	Payments between residents and non-residents for the authorized use of intangible, non-produced, non-financial assets and proprietary rights (such as patents, copyrights, trademarks, industrial processes, and franchises) and for the use, through licensing agreements, of produced originals of prototypes (such as manuscripts and films). Data are in current US$ per person and are derived from the balance of payments.

Variable	Source	Definition (as described by source) [1]
Pillar 5: Adoption and use of information and communication technologies		
Telephone Communications		
Main (fixed) telephone lines	*International Telecommunication Union (ITU)*	A main line is a (fixed) telephone line connecting the subscriber's terminal equipment to the public switched network, and having a dedicated port in the telephone exchange equipment. This term is synonymous with the terms main station or Direct Exchange Line (DEL) commonly used in telecommunication documents. It may not be the same as an access line or a subscriber. The number of ISDN channels and fixed wireless subscribers should be included. Data are expressed per 100 inhabitants.
Waiting list for main (fixed) lines	ITU	Un-met applications for connection to the Public Switched Telephone Network (PSTN) due to a lack of technical facilities (equipment, lines, etc.). The waiting list should reflect the total number reported by all PSTN service providers in the country. Data are expressed per 1000 inhabitants.
Business connection charge	ITU	Installation (or connection) refers to the one-off charge involved in applying for business basic telephone service. Where there are different charges for different exchange areas, the charge for the largest urban area should be used and specified in a note. Data are expressed as percent of GDP/capita.
Business monthly subscription	ITU	Monthly subscription refers to the recurring fixed charge for a business subscription to the PSTN. The charge should cover the rental of the line but not the rental of the terminal (e.g., telephone set) where the terminal equipment market is liberalized. Separate charges for first and subsequent lines should be stated where appropriate. If the rental charge includes any allowance for free or reduced rate call units, this should be indicated. If there are different charges for different exchange areas, the largest urban area should be used and specified in a note. Data are expressed as percent of GDP/capita.
Residential connection charge	ITU	Installation (or connection) refers to the one-off charge involved in applying for residential basic telephone service. Where there are different charges for different exchange areas, the charge for the largest urban area should be used and specified in a note. Data are expressed as percent of GDP/capita.
Residential monthly subscription	ITU	Monthly subscription refers to the recurring fixed charge for a residential subscription to the PSTN. The charge should cover the rental of the line, but not the rental of the terminal (e.g., telephone set) where the terminal equipment market is liberalized. Separate charges for first and subsequent lines should be stated where appropriate. If the rental charge includes any allowance for free or reduced rate call units, this should be indicated. If there are different charges for different exchange areas, the largest urban area should be used and specified in a note. Data are expressed as percent of GDP/capita.
Mobile cellular communications		
Subscribers	ITU	Refers to the use of portable telephones subscribing to a public mobile telephone service and provides access to Public Switched Telephone Network (PSTN) using cellular technology. This can include analog and digital cellular systems. This should also include subscribers to IMT-2000 (Third Generation, 3G). Subscribers to public mobile data services or radio paging services should not be included. Data are per 100 inhabitants.
Prepaid subscribers	ITU	Number of mobile cellular subscribers using prepaid cards. These are subscribers who, rather than paying a fixed monthly subscription fee, choose to purchase blocks of usage time. Only active prepaid subscribers who have used the system within a reasonable period of time should be included. This period (e.g., 3 months) should be indicated in a note. Data are per 100 inhabitants.
Population coverage	ITU	Mobile cellular coverage of population in percent. This indicator measures the percentage of inhabitants who are within range of a mobile cellular signal, irrespective of whether or not they are subscribers. This is calculated by dividing the number of inhabitants within range of a mobile cellular signal by the total population. Note that this is not the same as the mobile subscription density or penetration.
Connection charge	ITU	The initial, one-time charge for a new subscription. Refundable deposits should not be counted. Although some operators waive the connection charge, this does not include the cost of the Subscriber Identity Module (SIM) card. The price of the SIM card should be included in the connection charge. A note should indicate whether taxes are included (preferred) or not. It should also be noted if free minutes are included in the plan. Data are expressed as percent of GDP/capita.

Variable	Source	Definition (as described by source) [1]
Pillar 5: Adoption and use of information and communication technologies		
Internet, computers, and TV		
Total fixed internet subscribers	*ITU*	The number of total Internet subscribers with fixed access, including dial-up, total fixed broadband, cable modem, DSL Internet, other broadband, and leased line Internet subscribers. Only active subscribers who have used the system within a reasonable period of time should be included. This period (e.g., 3 months) should be indicated in a note. Data are per 100 inhabitants.
Total fixed broadband subscribers	ITU	Total Internet subscribers excluding dial-up Internet: cable-modem (cable tv), DSL, leased line, and others (satellite, fibre, LAN, wireless, wimax...). Total broadband Internet subscribers refers to a subscriber who pays for high-speed access to the public Internet (a TCP/IP connection), at speeds equal to, or greater than, 256 kbit/s, in one or both directions. If countries use a different definition of broadband, this should be indicated in a note. This total is measured irrespective of the method of payment. It excludes subscribers with access to data communications (including the Internet) via mobile cellular networks. Data are per 100 inhabitants.
Internet users	ITU	The estimated number of Internet users per 100 inhabitants. A growing number of countries are measuring this through regular surveys. Surveys usually indicate a percentage of the population for a certain age group (e.g., 15–74 years old). The number of Internet users in this age group should be supplied and not the percentage of Internet users in this age group multiplied by the entire population. In situations where surveys are not available, an estimate can be derived based on the number of subscribers. The methodology used should be supplied, including reference to the frequency of use (e.g., in the last month).
Personal computers	ITU	The number of Personal Computers (PC) measures the number of computers installed in a country per 100 inhabitants. The statistic includes PCs, laptops, notebooks etc., but excludes terminals connected to mainframe and mini-computers that are primarily intended for shared use, and devices such as smart-phones that have only some, but not all, of the functions of a PC (e.g., they may lack a full-sized keyboard, a large screen, an Internet connection, drives, etc).
Television receivers	ITU	The total number of television sets per 100 inhabitants. A television set is a device capable of receiving broadcast television signals, using popular access means such as over-the-air, cable, and satellite. A television set may be a stand-alone device, or it may be integrated into another device, such as a computer or a mobile phone. It may be useful to distinguish between digital and analog signal delivery and between TV sets receiving only a limited number of signals (usually over-the-air) and those that have multiple channels available (e.g., by satellite or cable).
Government ICT usage		
E-government readiness index	UN Global E-*Government Readiness Report*	E-government readiness is a composite index comprising the Web measure index, the telecommunication infrastructure index and the human capital index. E-government is defined as the use of ICT and its application by the government for the provision of information and public services to the people. The aim of e-government therefore is to provide efficient government management of information to the citizen, better service delivery to citizens, and empowerment of the people through access to information and participation in public policy decision making.
Quality of the infrastructure		
Electrification rate	UN HDR	The number of people with electricity access as a percentage of the total population.
Electric power transmission and distribution losses	World Bank WDI	Electric power transmission and distribution losses include losses in transmission between sources of supply and points of distribution and in the distribution to consumers, including pilferage. It is expressed as percent of output.
Roads paved	World Bank WDI	Paved roads are those surfaced with crushed stone (macadam) and hydrocarbon binder or bituminized agents, with concrete, or with cobblestones, as a percentage of all the country's roads, measured in length.