

Assessing Progress toward Sustainable Competitiveness

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One of the key developments in the policy space over the past decade has been the advancement of concepts related to environmental sustainability and more recently inclusive growth. Such conceptual schemes comprise social, economic, and environmental components of sustainability, and they provide an intellectual basis for societies around the world to coalesce around the principles of sustained and universal levels of prosperity.

The emergence and widespread acceptance of the principle of social inclusion in the public domain has both a cultural origin and an economic one. Its cultural origin can be traced back as far as the 17th-century idea of egalitarianism, an idea that became embedded in cultural norms and then evolved into a widely held value system in international politics that provided a common rhetoric about human development. In the aftermath of World War II, this concept was translated into the universal declaration of human rights.¹ Its economic origin is rooted in the unprecedented economic development of Western economies since the mid-20th century. During this period, high standards of living were achieved by large swaths of the populations of these economies, with the expectation that these standards would remain high and expand globally over time.

In a similar fashion, the concept of environmental sustainability has evolved from two ideas: ecologism—the idea that the non-human world is worthy of moral consideration²—and environmentalism, a broad-based movement concerned with protecting the environment, and in particular with the effects of environmental damage on the health and well-being of both humans and the environment.

Over the past decades, these ideas have become prominent in the global discourse and have helped to create a public expectation of growing prosperity that goes hand in hand with social justice and environmental protection. Yet the possibility of achieving this vision within the boundaries of the prevalent growth model has been called into question as increasing pressures on the environment have become evident, and as concerns voiced over the distribution of the benefits of economic development have grown more forceful. The mounting social and environmental pressures observed in rapidly growing developing and emerging economies suggest that these dimensions are strongly intertwined and therefore should be addressed as part of the economic development process. And because environmental and social sustainability are simultaneously inputs and outcomes of the growth process, they should not be considered in isolation, but rather as integral parts of the economic growth process.

Despite increased awareness about the urgency of social and environmental issues, progress toward a more sustainable future is slow. On the environmental sustainability side, although concrete improvements have been achieved in many countries on specific issues such

Box 1: The Advisory Board on Sustainable Competitiveness

The Advisory Board on Sustainable Competitiveness has been assisting the World Economic Forum to integrate the concept of sustainability more fully into its competitiveness work since the beginning of the Sustainable Competitiveness project. Members are drawn from the network of Global Agenda Councils, the World Economic Forum's knowledge backbone. They represent voices from key business sectors, government, and civil society. The members of the Advisory Board are:

James Cameron, Chairman, Climate Change Capital, United Kingdom

Dan Esty, Professor, Yale University, USA

Clément Gignac, Chief Economist and Senior Vice-President, Industrial Alliance Insurance and Financial Services, Canada

Jeni Klugman, Director for Gender, The World Bank, USA

Marc A. Levy, Deputy Director, Center for International Earth Science Information Network, Columbia University, USA

John W. McArthur, Senior Fellow, UN Foundation & Nonresident Senior Fellow, Brookings Institution

Kevin X. Murphy, President and Chief Executive Officer, J.E. Austin Associates Inc., USA

Mari Elka Pangestu, Minister of Tourism and Creative Economy, Indonesia

Lindene Patton, Chief Climate Product Officer, Zurich Financial Services, Switzerland

Anthony O'Sullivan, Head Private Sector Development, Organisation for Economic Co-operation and Development (OECD), France

Xavier Sala-i-Martin, Professor, Economics Department, Columbia University, USA

Mark Spelman, Global Managing Director, Accenture, United Kingdom

Simon Zadek, Co-Director of the UNEP Inquiry on Options for a Sustainable Finance System, United Nations Environment Programme, Switzerland

as the regulation of hazardous substances,³ progress on broader issues has been patchy. Pollution and biodiversity loss are of growing concern, while climate change and its unpredictable consequences remain substantially unaddressed. The world is also facing an increasing scarcity of water, energy, and mineral resources, for which demand continues to climb. These developments signal that—despite growing awareness about the risks related to unsustainable resource and environmental management—the world is not moving toward a more sustainable path and concrete results are yet to be achieved.

On the social sustainability side, there appears to be a trend toward more polarized societies. Although part of this trend can be traced back to the slowdown following the financial crisis, research also finds a structural decline in the share of GDP accruing to labor, mainly driven by skill-biased technological change related to globalization.⁴ There is a concern that this trend may result in a high concentration of wealth similar to that experienced by Western economies in the earlier stages of industrialization. According to Thomas Piketty's recent analysis,⁵ the widespread gains in prosperity to which Western societies have become accustomed and that emerging economies aim to achieve were realized only in the first decades following World War II.⁶

The recent interest in social inclusion and socioeconomic inequality is linked, in large part, to its potentially socially destabilizing effect. Research shows that more polarized societies may undermine trust in

democratic and market institutions, leading to greater political instability.⁷

Taken together, the limited progress in addressing environmental and social concerns could undermine the prospects for worldwide shared prosperity. In the absence of economic growth, any effort toward a more equal distribution of income would do little good for the millions of people in developing countries who remain at low levels of income and human development. Therefore, while enhancing competitiveness remains a fundamental prerequisite to raising prosperity, it should be accompanied by transformations that adapt to the new technological, geopolitical, and ecological reality to ensure that progress translates into higher human development for all. At the same time, sustainable competitiveness should be at the heart of the thinking about sustainability because competitive economies tend to be more innovative, more resilient, and better able to respond to external shocks and thus maintain high levels of prosperity going forward.

Attaining higher levels of sustainability requires that governments, businesses, and civil society work together to address the emerging challenges. Progress on these challenges requires high levels of multi-stakeholder collaboration—for example, on environmental regulation, where a balance with productivity needs to be ensured, and on social inclusion, which can be achieved only if businesses contribute to human capital development. Such collaboration is needed to achieve more pragmatic

progress and allow countries to transition to more sustainable models of growth.

Even though the number of studies on sustainability has grown significantly over the past decades, the detailed linkages between sustainability and competitiveness remain to a large extent uncertain.

To fill this gap, the World Economic Forum has engaged in a series of activities to expand its knowledge of sustainability and of the relationship between sustainability and competitiveness, and has been at the forefront of the discussion on environmental sustainability. This work aims to shape the agenda by catalyzing public-private platforms that help governments draw on their joint expertise to identify and implement solutions to the most pressing issues facing the global community. Issues of economic, social, and environmental sustainability have been showcased and discussed at many of the Forum's regional and annual meetings. Since 2010, the World Economic Forum—in collaboration with a multi-stakeholder Advisory Board of international experts (Box 1)—has embarked on an effort to integrate the concept of sustainability into its competitiveness work. The Forum continues its efforts to build a more robust narrative of the concept of sustainable competitiveness.

DEFINING SUSTAINABLE COMPETITIVENESS

With the 1987 publication of the report *Our Common Future*, sustainable development was defined as the “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”⁸ The breadth of the definition was meant to capture the several dimensions of development that go beyond the usual boundaries of economic growth in order to include both the tangible and intangible necessities of life.

The concept of sustainable competitiveness places more emphasis than the concept of sustainable development does on the importance of productivity as a driver of prosperity and long-term growth. We define *sustainable competitiveness* as *the set of institutions, policies, and factors that make a nation productive over the longer term while ensuring social and environmental sustainability. Social sustainability*, in turn, is defined as *the institutions, policies, and factors that enable all members of society to experience the best possible health, participation, and security; and that maximize their potential to contribute to and benefit from the economic prosperity of the country in which they live. And we define environmental sustainability as the institutions, policies, and factors that ensure an efficient management of resources to enable prosperity for present and future generations.*

Fundamental to the concept of sustainable competitiveness is the notion that, although competitiveness can be equated with productivity,

sustainable competitiveness can be linked to a broader concept that focuses on aspects that go beyond mere economic outcomes to include other important elements that render societies sustainably prosperous by ensuring high-quality growth.

Another way of looking at the concept of sustainable competitiveness is that it aims to gauge not only whether a country has the potential to grow over the medium and long term, but whether the national development process is producing the kind of society in which we want to live.

Competitiveness and environmental sustainability

The concepts of competitiveness and environmental sustainability are linked at both the country and the firm level. At the country level, because Earth's natural resources are either limited or are renewed at a specific physical rate, finding an appropriate combination of technology and the planet's carrying capacity could prevent the limitations of resources from becoming a drag on growth. Developing sustainable practices could also, to a certain extent, fuel productivity. For example, biodiversity can be an important source of innovation.

At the firm level, the impact of environmental regulations on productivity is still controversial, especially if externalities are not taken into account. However, many companies have started to become more aware that environmental challenges such as pollution, climate change, and resource scarcity could affect them (see Box 2). First, these challenges could affect a firm's bottom line at some point in time, for example through frequent supply chain disruptions resulting from unforeseen meteorological catastrophes (which are thought to be affected by climate change). Second, stricter environmental regulations could also impact business operations, for example when businesses must face higher prices for commodities used as inputs of production. And third, as consumers become more aware of environmental sustainability issues, companies become more concerned about reputational risks.⁹ Consequently, the business sector has started to take a keener interest in environmental issues than it did a couple of decades ago. This is evidenced in the increasing number of companies voluntarily reporting on their emissions,¹⁰ and in the number of financial management firms signing on to the United Nation's Principles for Responsible Investment.¹¹ Companies are also taking action on issues that may impact the sector in which they do business. For example, food-processing companies have put forward and supported initiatives relating to water scarcity because this scarcity may have—in some cases is already having—an impact on crops and therefore on the supply of raw materials and cost of commodities. Another example is the information technology (IT) sector, where “sustainability is fast becoming an important corporate-performance

Box 2: Progress toward stronger environmental regulations

In the run-up to the 21st Conference of the Parties (COP) of the United Nations Framework Convention on Climate Change to be held in 2015 in Paris, when a new climate accord is due, countries are getting more serious about their environmental policies.

On climate change, for example, as a recent report by the Global Legislators Organisations (GLOBE International) and the Grantham Research Institute at the London School of Economics points out, climate legislation in 66 countries now covers nearly 88 percent of current greenhouse gas emissions.¹ To be sure, although some major industrialized countries have experienced serious resistance to climate legislation—for example, Australia’s government repealed a key element of the country’s Clean Energy Act (the carbon tax) three times in 2014;² and Japan announced, in the COP 19 session of the Convention on Climate Change in Warsaw, that its greenhouse gas emissions will be slashed by only 3.8 percent by 2020 compared with 2005 levels to accommodate a much reduced reliance on low carbon nuclear energy after the accident at Fukushima³—almost 500 climate laws were passed in the 66 countries studied.⁴

According to the GLOBE report, developing countries and emerging markets have passed climate change laws and regulations at a faster pace than developed countries. For example:

Sub Saharan Africa saw major developments in 2013, with progress made in almost all of the study countries, notably the approval of national plans and strategies on climate change

- Kenya adopted 2013-2017 Climate Change Action Plan;
- Mozambique adopted 2013-2025 National Strategy for Climate Change;
- Tanzania passed its National Strategy on REDD+;
- Nigeria’s Legislative Council approved the adoption of a National Climate Change Policy and Response Strategy

The Americas are also taking concrete legislations

- Bolivia passed its Framework Law on Mother Earth and Integral Development to Live Well;
- El Salvador adopted its National Climate Change Strategy;
- In Ecuador, Decree 1815 established the Intersectoral National Strategy for Climate Change;
- In Costa Rica a draft General Law on Climate Change has been introduced and is expected to pass in 2014.⁵

Another breakthrough in the climate change regulatory landscape this year is the United States’ announcement to tackle carbon dioxide emissions. President Barack Obama,

who promised to “respond to the threat of climate change” in his inaugural speech after his re-election, has exercised executive authority through the Environmental Protection Agency to reduce emissions nationwide by an average of 25 percent by 2020 and 30 percent by 2030.⁶

Confirming this trend, Figure 1 shows that, overall, countries are getting more serious about their environmental regulation. Findings from the Executive Opinion Survey (the Survey) show that the stringency of regulations has increased by more than 0.1 points in the last 10 years, and regulatory enforcement has increased by nearly 0.1 points in the same period of time.

Whether motivated by improved climate change science, the cost of doing nothing,⁷ or the heightened perception of environmental risk (since 2010, the respondents of the World Economic Forum’s Global Risks Perceptions Survey consider environmental risks both to be more likely to happen and to have greater impact),⁸ the increase in the number and efficacy of environmental regulations is welcome and timely. The drivers for this increase differ across the world. In Asia, for example, stronger policies are motivated as much by energy security as they are by local pollution and public health challenges, and in forested nations international attention on deforestation probably plays a key role in encouraging more stringent regulation to preserve forests. A growing realization that environmental degradation could derail growth is also contributing to this trend. The World Bank estimates the cost of pollution to China at around 9 percent of its gross national income,⁹ while China’s Ministry of Environmental Protection put it at around 3.5 percent of GDP (based on 2010 figures). According to the Global Burden of Disease 2010 study published in the *Lancet* in December 2012–January 2013, air pollution contributed to 1.2 million premature deaths in China in 2010.¹⁰

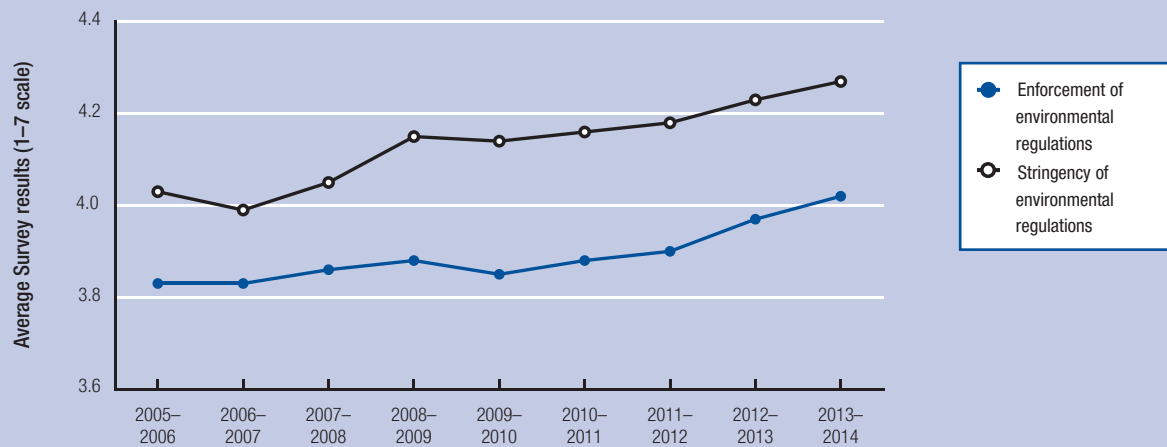
However, the GLOBE International report concludes that, despite the positive trends toward a greater number of environmental regulations, the cumulative ambition of these laws is still not enough to limit global average temperature rise to 2°C above pre-industrial levels—the agreed goal of the international community. In general, the expanded efforts of regulators to deliver more sustainable development mechanism have not yet produced tangible effects on a large scale.

Against this backdrop, it is clear that private sector–led initiatives and public-private partnerships are needed to help mobilize new constituencies and deliver the needed targets. Already some key private-sector groups are forming to act voluntarily on climate and realize opportunities associated with climate-smart business. For example, the Consumer Goods Forum (CGF) is a group focused on sustainability composed of 400 retailers, manufacturers, service providers, and other stakeholders across 70 countries, with combined sales of nearly US\$2.5 trillion.¹¹ More specifically, the CGF has four key focus areas: addressing climate change, achieving zero net deforestation, shifting to natural refrigerants, and removing waste from supply chains. In another example, the Banking and Environment Initiative (BEI) comprises 10 of the world’s largest banks, including Barclays, China Construction Bank, and Deutsche Bank. Its mission is to lead the banking

(Cont’d.)

Box 2: Progress toward stronger environmental regulations (cont'd.)

Figure 1: Evolution of Survey results for environmental regulation indicators, 2005–14



Source: World Economic Forum, Executive Opinion Survey, multiple years.

Note: Full Survey questions are provided here:

Stringency of environmental regulations: How would you assess the stringency of your country's environmental regulations? [1 = very lax; 7 = among the world's most stringent];

Enforcement of environmental regulations: How would you assess the enforcement of environmental regulations in your country? [1 = very lax; 7 = among the world's most rigorous]

industry in collectively directing capital toward environmentally and socially sustainable economic development.

These groups are not only working on a sectoral basis but also coming together across industries to drive more significant impacts. For example, the BEI is supporting the CGF by providing models to finance sustainable commodity supply chains. Initiatives that encourage collaboration and communication cross stakeholders are just a first step toward finding a pragmatic solution to complex environmental problems, yet they represent a key step because they set the foundation for crafting regulations that are more simple and effective when applied to the reality of business operations.

Notes

1 Nachmany et al. 2014.

2 For more information, see the website of the Australian Government's Department of the Environment at <http://www.environment.gov.au/climate-change/repealing-carbon-tax>.

3 Kuramochi 2014.

4 See the *GLOBE Climate Legislation Study* by Nachmany et al. 2014.

5 Nachmany et al. 2014; this checklist is from pages 4 and 5 of a summary of that report on the organization's website, <http://www.globeinternational.org/studies/legislation/climate>.

6 Harder 2014.

7 The Economist 2014.

8 World Economic Forum 2014.

9 World Bank and the Development Research Center of the State Council, P. R. China 2013, p. 249.

10 The Lancet 2013.

11 For information about the Consumer Goods Forum, see <http://www.theconsumergoodsforum.com/>.

metric.”¹² Information technology companies—concerned with energy costs, reputational risks, and difficulties they confront in continuing to expand their capacity—are beginning to reduce their footprint by adopting “greener data centers” that significantly reduce energy demand.

The relationship between environmental sustainability and competitiveness is multifaceted and affects an economy in different ways. Multiple channels support a positive relationship between environmentally

sustainable practices and productivity gains; here we identify and describe the main ones:

- **Efficient use of natural resources.** The efficient use of natural resources includes both managing exhaustible raw materials and using renewable resources within their regenerative capacity in order to minimize production costs, ensure their availability for future generations, and reduce pollution.

As described by the literature on public goods, welfare increases once the negative externalities generated by pollution are corrected.¹³ It follows that environmental sustainability can bring about a better economic outcome if it is associated with formal or informal institutions that define property rights and result in the adoption of sustainable processes over the use of scarce resources.

- **Carbon reduction.** Climate change is a global issue, but its impact on individual countries and companies is significant. Some sectors are more exposed than others: agriculture is the most exposed to the effects of climate change such as rise of temperature, water scarcity, and extreme weather. Although solutions for global emission reductions require international coordination, carbon-reducing business practices can have a positive effect on long-term competitiveness. In the context of rising energy demand, improving energy efficiency through management changes, investing in technology improvement, and using low-carbon energy infrastructure can produce significant savings relatively quickly.¹⁴ In addition, investments in capital expenditures for emission reduction can generate business opportunities for new sectors

Climate change is already perceived as one of the environmental challenges with the most far-reaching and most severe negative impact on human well-being, but the debate on how to address it most efficiently is still ongoing. Some studies support the position that increasing energy efficiency and introducing emissions standards are more costly to the economy as a whole than the use of carbon pricing,¹⁵ while others see carbon taxes as having more negative impact on the economy in the short run. For example, according to a study by the Congressional Budget Office of the United States,¹⁶ the impact of a carbon tax could be detrimental to output in the short run by raising the cost of energy and transport; however, this cost could be partially offset by cuts in marginal income taxation. In the longer run, a higher pricing of carbon-intensive goods would reduce emissions and thus reduce the taxation level and the initial economic drag associated with it.

One more element to take into account is the impact of externalities linked to climate change. Choosing a less carbon-intensive development path generates returns by reducing losses that result from climate change. For example, the negative impact of climate change on crops is already documented.¹⁷

There is also agreement that climate change gives rise to extreme weather, which in turn can destroy tangible assets such as infrastructure,

public facilities, and industrial stocks. These weather events interrupt the regular flow of goods and services both within and between countries. According to an estimate of the 2007–2008 UN *Human Development Report*, to reach the Millennium Development Goals by 2015, the cost associated with coping with a more hostile climate since 2007 is approximately US\$85 billion per year more than would be required to achieve these same goals if climate change did not have to be considered. To take one example, the recent floods in the Balkans are, according to scientists, probably linked to climate change.¹⁸ According to the World Health Organization,¹⁹ this event has caused the death of almost 60 people and displaced over 60,000 more. Looking at its economic impact alone, the European Bank for Reconstruction and Development reports physical damages estimated at €1.5–€2 billion in Serbia and about €1.3 billion in Bosnia and Herzegovina, particularly affecting agriculture, power generation, mining, and transport infrastructure.

- **Improved health.** A high-quality natural environment improves the productivity of the workforce by reducing health damage caused by pollution or environmental degradation. Since health affects productivity and pollution affects health, efforts to reduce pollution may be interpreted as an investment in human capital. Recent empirical evidence has indicated that, in the United States, ozone levels below federal air quality standards have a positive impact on productivity (a 10 parts per billion decrease in ozone concentrations raises worker productivity by 4.2 percent).²⁰ Finally, environment-driven health problems lead to resource misallocation, forcing governments to fund additional, and otherwise unnecessary, health programs and diverting resources that would otherwise go into productivity-enhancing investments in, for example, education or innovation.
- **Biodiversity for innovation.** Ultimately, environmental degradation can impact the way ecosystems work and reduce biodiversity. Biodiversity supports the productivity of the workforce by providing food, fiber, shelter, and natural medicines, and it regulates the water supply and air quality. According to the Convention on Biodiversity,²¹ more than 1.3 billion people in the world depend on biodiversity and on basic ecosystem goods for their livelihoods. Biodiversity losses caused by deforestation or significant land use changes—which today are estimated to be 100 to 1,000 times greater than is thought to occur naturally—increase the vulnerability of terrestrial and aquatic ecosystems and induce changes in

climate and ocean acidity.²² Biodiversity is also a key driver of economic growth, especially in developing countries, because it provides the basis for many innovations in areas such as pharmaceutical or cosmetic products. At the same time, interfering with ecosystems may make living conditions for humans more difficult and perhaps engender additional costs. Last but not least, biodiversity restoration and protection can create profitable business opportunities, incentivizing the development of new technologies and products for their utilization in still-unexplored markets. Furthermore, investing in the greening of tourism can reduce the cost of energy, water, and waste and thus enhance the value of biodiversity, ecosystems, and cultural heritage.²³

Competitiveness and social sustainability

Interest among economists and social scientists in the relationship between income distribution and economic performance has been growing over the last 20 years. Although the findings are not yet conclusive, the diverging patterns in income of different population clusters in developing and developed economies alike are certainly tangible and explain the broad interest around this topic.

However, the concept of social sustainability goes beyond just inequality. Although there is no unique consensus around the concept of social sustainability, it is possible to identify recurring themes in the different definitions that have been proposed so far. Human rights, equity, and social justice are among the most relevant.

Since the recommendations of the Stiglitz-Sen-Fitoussi Commission in 2009,²⁴ many attempts have been made to identify the relationship between social sustainability and development. However, empirical evidence to support the theory that the two are interdependent remains somewhat inconclusive.

More recently the concept of *inclusive growth* has entered international discourse. Although not yet universally defined, inclusive growth looks at how countries can achieve growth and balanced social outcomes simultaneously. Box 3 describes a related initiative on inclusive growth launched at the World Economic Forum, which attempts to respond to this challenge.

Recent events in different parts of the world have generated concerns that an unbalanced social model can undermine the stability of the growth process for both current and future generations. If economic benefits are perceived to be unevenly distributed within a society, and this inequality leads to significant social discontent, the capacity of individuals to contribute to and benefit from higher rates of economic growth can be affected.

Based on our definition of sustainable competitiveness, specified above, we analyze here those dimensions of social sustainability that are likely to fuel productivity and long-term prosperity while at the same time preserving social stability. Our aim is to unbundle the most relevant elements, even if they are often interrelated and not always clearly distinct:

- **Inclusion.** An inclusive society ensures that all citizens contribute to and benefit from the economic prosperity of their country. Inclusion is a prerequisite for social cohesion because, if some members of the community are marginalized, the society will lack the necessary coherence of goals to accomplish common purposes. Typical examples of social exclusion that have a considerable negative impact on the competitiveness of a nation are the lack of access to basic necessities, discrimination according to gender, youth marginalization, and extreme polarization of income. Any type of social exclusion that prevents people from fully participating in the labor market reduces the availability of talent to a country's firms and organizations, thereby reducing competitiveness. Lack of access to sanitation, drinkable water, or healthcare can dramatically impair labor productivity, reducing the ability of the economy to compete globally. At the same time, when young people are marginalized by the labor market and have access only to short-term and highly volatile jobs, they remain vulnerable, especially during downturns. These workers usually receive less on-the-job training than their counterparts in stable positions, thus reducing the overall level of human capital. Finally, the participation and empowerment of women is key to ensuring a large talent pool and tends to bring about other positive effects, such as reducing infant mortality, reducing poverty, improving the management of scarce resources, reducing conflict, and guaranteeing food security.
- **Equity and cohesion.** An equitable society guarantees the same opportunities for all its members, rewarding them according to their talents and fairly redistributing the benefits of growing wealth,²⁵ creating a cohesive society with no excessive income disparities across different groups. Inequality is a multidimensional concept. For the purposes of this *Report*, we are mainly interested in income inequality, which certainly represents one of the biggest challenges for policymakers globally and which is highly correlated with access to other opportunities.

Although some earlier literature found a positive relationship between growth and inequality, more recent research tends to find the opposite, via the following channels: first, high levels of inequality

Box 3: The World Economic Forum's Global Project on Inclusive Growth

In many countries, the gap between rich and poor is widening, youth unemployment is rising, and access to basic services remains a challenge. Even in several fast-growing developing countries, it appears that growth has not made a notable dent in income inequality or poverty, and the vulnerabilities associated with these problems remain entrenched.¹ The global community is calling for change—for solutions that foster economic growth in a more inclusive manner.

The question of how to unlock new sources of productive employment and strengthen the contribution of economic growth to improvements in broad living standards is becoming an increasingly important concern for political and business leaders in developed and developing countries alike. However, although international consensus on the need to develop new approaches in this respect is widespread, very little in the way of concrete policy guidance has emerged from the G-20 or from international institutions. There is a growing need for analytical frameworks and evidence-based solutions suited to this purpose.

The economic fundamentals that have accompanied high and sustained economic growth are well known and form the basis of the World Economic Forum's 12-pillar model of competitiveness. Nevertheless, the economic debate on inclusive growth is still taking shape, and the Forum is playing an active role in disentangling the complex relationship between growth and equity, building on its existing benchmarking and sustainability work. The mechanisms through which growth-enhancing policies impact poverty and inequality are difficult to unravel, however. Several policy areas have been identified as “win-win” or “super pro-poor” in that they have both a positive effect on growth and a negative effect on inequality, while others remain inconclusive.²

For example, policies and structural reforms should provide equality of opportunity so that all segments of society can participate in its growth by expanding and improving labor, technology, and capital in order to raise living standards. Increasing affordability and access to high-quality education and training, and providing access to credit and other incentives for small business development, are among the most effective instruments available to governments for achieving progressive growth. These should be complemented by policies that redress some of the inequalities in outcomes, particularly those experienced by poor and vulnerable segments of the populations, through attention to areas such as provisioning public services, establishing a progressive tax code, and providing basic social and labor protections.³

The international community has made significant progress in defining inclusive growth. However, agreeing on a comprehensive and more actionable framework remains an ongoing challenge. One widely accepted definition of inclusive

growth involves output growth that is sustained over decades, is broad-based across economic sectors, creates productive employment opportunities for the majority of the country's population, and reduces poverty.⁴ Reductions in excessive income inequality have also emerged as a prerequisite for inclusive growth, supported by mounting evidence that inequality undermines growth.⁵ In summary, inclusive growth is about both the pace and pattern of economic growth.⁶

The World Economic Forum's Global Project on Inclusive Growth aims to mobilize a better response to this challenge by drawing on its multiple, relevant capabilities in partnership with key international organizations to build on this initial framework and push the policy agenda further. Specifically, it will seek to assemble a comparative analysis of the extent to which countries make use of the wide spectrum of policy incentives and institutional mechanisms that influence the pattern and pace of broad-based progress in living standards.

An initial framework includes areas such as creating an enabling environment for human capital formation, reinforcing the wage and productivity growth link, fostering entrepreneurship and investment, reinforcing business and political ethics, promoting gender parity, reviewing fiscal policy (tax code and social protection), and providing improved public services and infrastructure. Once completed, this framework will be used as a point of departure for a series of policy dialogues among policymakers, business leaders, and other opinion shapers. The goal is to establish a more concretely actionable foundation for policy by giving countries a clearer relative sense of the extent to which they are exploiting the policy space and the best practices available to them on the basis of the recent experience of their peers or the historical experience of other relevant countries. By doing so, the Global Project on Inclusive Growth aims to shed light on the full spectrum of policy levers available to promote social participation in the process and benefits of economic growth without dampening incentives to work, save, and invest.

Notes

- 1 While extreme poverty (at a \$1.25 per day threshold) has declined notably, taking such narrowly defined poverty headcount ratios underestimates the large numbers of low-income people who fall just above fixed international poverty thresholds (e.g., \$2 or \$2.75 per day). See AfDB 2013; Ali and Zhuang 2007.
- 2 Lopez 2004; Killick 2002.
- 3 Furman 2014; IMF 2013.
- 4 Commission on Growth and Development 2008; Ianchovichina and Lundstrom 2009.
- 5 Berg and Ostry 2011; Ostry et al. 2014.
- 6 Ianchovichina and Lundstrom Gable 2012.

can potentially distort the political process;²⁶ second, inequality can lead to reduction in human capital investments;²⁷ third, it may require more redistributive efforts, thus potentially introducing more market distortions; fourth, in presence of weak institutions, it can lead to economically harmful social tensions; and finally, in countries defined as “wage-led,” a more equal distribution of income tends to deliver higher output.²⁸ Persistent inequalities tend to limit upward social mobility, preventing gifted and hard-working individuals from being rewarded according to their talents. However, it can be argued that some degree of disparity—provided it is not driven by rent positions—is actually beneficial for growth because it incentivizes people to invest in education, work harder, and be more innovative and productive.

- **Resilience.** A social system is resilient when it can absorb temporary or permanent shocks and adapt to quickly changing conditions without compromising its stability. Formal or informal institutions usually perform the role of shock absorber, reducing the vulnerability of the society as a whole. In advanced economies, welfare states promote the economic and social well-being of the society by protecting their members from excessive loss of income during old age and during periods of unemployment or illness. Although welfare systems represent a source of stability for an economy, they can turn into a hurdle for its competitiveness since overly generous social security programs increase labor costs; can undermine the stability of public finances and limit macro-stabilization policies; and can hamper the incentives to work, innovate, and excel. In order to be sustainable, a social protection system needs to be well balanced and affordable.

The resilience of a social system also depends on the features of its labor market and on the extent of the black economy. When workers have access only to short-term contracts or vulnerable employment, they are exposed to negative shocks and to all the costs associated with unemployment. Moreover, a widespread black economy may affect the resilience of a social system, since informal workers are more vulnerable to concerns related to job loss, old age, maternity, disability, or illness.

Relationship between environmental and social sustainability

The third and final relationship we would like to explore is the one between environmental and social sustainability. The quality of the environment and the structure of a society are clearly correlated. On the one hand, well-managed natural resources increase the quality of life, reduce tensions within and between generations,

provide better opportunities for the whole community, and improve the resilience of the society. Moreover, the management of natural resources might translate into “in-kind” income distribution, as resource scarcity may leave the poorest of the population unable to access basic necessities. On the other hand, widespread prosperity, which facilitates a high quality of life, requires a functioning economy that, by definition, uses natural resources. For this reason, although the academic literature tends to focus on these two dimensions individually, the World Economic Forum is interested in exploring the way environmental and social sustainability interact with one another. In this chapter, selected channels that have been extensively highlighted by the literature are presented:

- **Health and environmental degradation.** As discussed in the previous section, a degraded environment negatively affects the health, and thus the productivity, of the workforce. It also reduces the overall quality of life of members of the society. Each year, air pollution, unsafe drinking water, and exposure to chemical products contribute to a number of often-lethal diseases both in the developed and developing world. According to the Organisation for Economic Co-operation and Development (OECD),²⁹ unsafe water supplies, lack of sanitation, and poor hygiene are responsible for 3 percent of all deaths worldwide, of which 90 percent are children's. An unhealthy environment dampens economic opportunities, prevents people from participating in the life of the community, diverts resources from productive uses, and contributes to urban decline.
- **Demography, poverty, and the environment.** The relationship between demography and environmental/social sustainability is extremely intricate. Rapidly growing populations can be a source of environmental stress, leading to greenhouse gas emissions, high rates of soil erosion, and the extinction of species. If rapid population growth is not accompanied by environmental management, it can give rise to tensions between groups for the control of scarce resources and can therefore be a source of further social instability, creating a vicious circle. Persistent poverty may also affect the environment and may lead to massive unplanned urbanization, such as slums, where large segments of the population are without access to basic services. Such settlements can have significant repercussions for the environment, including deforestation and the pollution of water resources, which results from the lack of waste management.

- **Energy and social stability.** Increases in energy prices disproportionately affect the real purchasing power of the lowest earners in the society, because the elasticity of energy demand (fuel and electricity) is relatively rigid in the short run. Rising energy prices can therefore exacerbate income polarization. In societies where the purchasing power of significant segments of the population is low, high energy prices can endanger the affordability of basic services unless the loss of purchasing power is offset by fiscal policies.

An additional link between energy, environment, and social sustainability is the use of particular alternative energy sources such as ethanol and biodiesel. Although these types of energy sources help to reduce CO₂ emissions, they also use wide land areas and contribute to increased food prices. Moreover, these alternatives also have significant environmental impact in the form of additional pressure on water resources. Hence, the assessment of energy policies needs to be based on a holistic view that takes into consideration a broad spectrum of environmental and social consequences.

- **Climate change, food security, and conflict.**³⁰

In the future, rising sea levels and more extreme weather conditions may force millions of people to migrate, adding pressure to natural resources—especially water—in the destination areas. Rising competition over these resources could eventually result in military conflict. Adverse changes in temperature and precipitation have started to affect the capacity of many areas to produce food, thus increasing the vulnerability of the population. According to some studies, at present 1.7 billion people live in water-stressed countries. Industrialization and demographic forces are likely to further aggravate the situation, and climate change may exacerbate the situation even more by decreasing stream-flow and groundwater recharge.

Pressure on water resources and land, combined with a growing world population and rising poverty in some regions, may also aggravate migration and food security concerns, which already represent major problems today.³¹ At present, the Food and Agriculture Organization of the United Nations estimates that approximately 850 million people globally (or 12 percent of the world's population) are without sufficient access to food or are malnourished; these people are concentrated mostly in the developing world.³² In less-developed countries, decreasing crop yields may lead to further exploiting degraded land, while globally, changing environmental conditions are reducing crop productivity. This constellation of pressures

may increase food insecurity in the long term, even in areas where food availability is relatively secure today, which in turn may lead to exacerbate poverty and migration phenomena.

- **Climate change and women's empowerment.**³³

According to a growing body of research, climate change is not gender neutral. In many rural and traditional societies in Africa, women are responsible for securing water, food, and energy for cooking and heating. But the effects of climate change such as droughts, heat waves, infections encouraged by rising temperatures, deforestation, and uncertain rainfall make it harder for these women to secure the resources they need. This, in turn, further weakens their position in society and reduces opportunities to better their lives and that of their families.

THE MEASUREMENT OF SUSTAINABLE COMPETITIVENESS

In order to assess where we stand today and to provide meaningful insights about how best to address the complex and highly interdependent challenges related to sustainable competitiveness, it is helpful to structure the analysis through a conceptual framework and to be able to measure the concept.

Efforts to measure sustainability

The following sections lay out the key existing approaches to measuring sustainability and describe the methodology of the sustainability-adjusted Global Competitiveness Index, which is the World Economic Forum's ongoing contribution to these efforts.

At the country level, the main references in this domain remain, as highlighted in previous editions of this *Report*, the recommendations of the Stiglitz-Sen-Fitoussi Commission; the European Commission's sustainability objectives presented in the Europe 2020 growth strategy; the OECD's Better Life Index; and the United Nations Development Programme's (UNDP) Human Development Index (HDI), which has included the environmental sustainability and equity adjustments.³⁴ The United Nations, subsequent to the first Millennium Development Goals, is discussing a wider set of indicators to track progress in sustainability with the new Sustainable Development Goals (see Box 4).

Other efforts to measure specific aspects of social sustainability include the World Bank's *Worldwide Governance Indicators Framework* and the International Labour Organization's Decent Work initiative.³⁵ For the metrics of environmental sustainability, the main contributions remain the Environmental Performance Index (EPI) developed by researchers at Yale and Columbia universities;³⁶ the Ecological Footprint, developed by the Global Footprint Network;³⁷ and the Global Adaptation Index.³⁸

Box 4: The Sustainable Development Goals: A sound basis for sustainable growth

Because the Millennium Development Goals (MDGs) have evolved into the Sustainable Development Goals (SDGs)—a development that is expected to be adopted in by the United Nations in 2015—sustainable development is once again a top priority on policymakers' agendas. The vision emerging from the discussion of the SDGs 2015 is a more encompassing one of sustainable development that is at the center of the political process, putting poverty eradication at the core of the SDGs but also recognizing that “changing unsustainable and promoting sustainable patterns of consumption and production and protecting and managing the natural resource base of economic and social development are the overarching objectives of and essential requirements for sustainable development.”¹

boundaries and the importance of just, equitable, and inclusive growth for long-term development. This approach is very much in line with the World Economic Forum's work on sustainable competitiveness that, since *The Global Competitiveness Report 2011–2012*, attempts to show a direct link between environmental and social sustainability and economic performance.

Moving from the MDGs to the SDGs is also important from a financing point of view. The cost of achieving the SDGs promises to be significantly higher than the cost of achieving the MDGs. The Organisation for Economic Co-operation and Development (OECD) estimated that the “finance gap” (the amount of investment necessary to achieve the MDGs by 2015) was approximately US\$120 billion a year,² while a

Table 1: Sustainable Development Goals and Global Competitiveness Index equivalents

Goals proposed by the UN's Open Working Group on SDGs	Equivalent in the GCI
Goal 3: Attain healthy lives for all	4th pillar (health subpillar)
Goal 4: Provide quality education and life-long learning opportunities for all	4th pillar (primary education subpillar) and 5th pillar (higher education and training)
Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	7th pillar (labor market efficiency)
Goal 9: Promote sustainable infrastructure and industrialization and foster innovation	2nd pillar (infrastructure) and 12th pillar (innovation)
Goal 16: Achieve peaceful and inclusive societies, access to justice for all, and effective and capable institutions	1st pillar (institutions)

Source: United Nations Open Working Group on Sustainable Development Goals, July 2014.

The SDGs now appear to be linked more closely to competitiveness than they used to be because most are prerequisites for job creation and long-term sustainable growth. This link is one of the reasons that policymakers find them attractive. In the proposed list of 17 SDGs to be achieved by 2030, five are directly captured by pillars and subpillars of the Global Competitiveness Index (GCI) (Table 1), while three—Goals 6 (Ensure available and sustainable use of water and sanitation for all), 10 (Reduce inequality within and among countries), and 15 (Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss)—are captured by the sustainable competitiveness framework.

In addition, by dedicating nearly half of the goals directly to environmental and social sustainability, the United Nations' Open Working Group acknowledges both our planet's

recent report by the United Nations Conference on Trade and Development (UNCTAD) estimated the gap of reaching the SDGs to be nearly US\$2.5 trillion per year.³

Aid will not be enough to achieve these goals. However, by focusing on factors that incorporate some of the drivers of higher standards of living, the SDGs can create a virtuous cycle that could enable countries to generate significant wealth to lift their own people out of poverty, enhancing sustainable competitiveness.

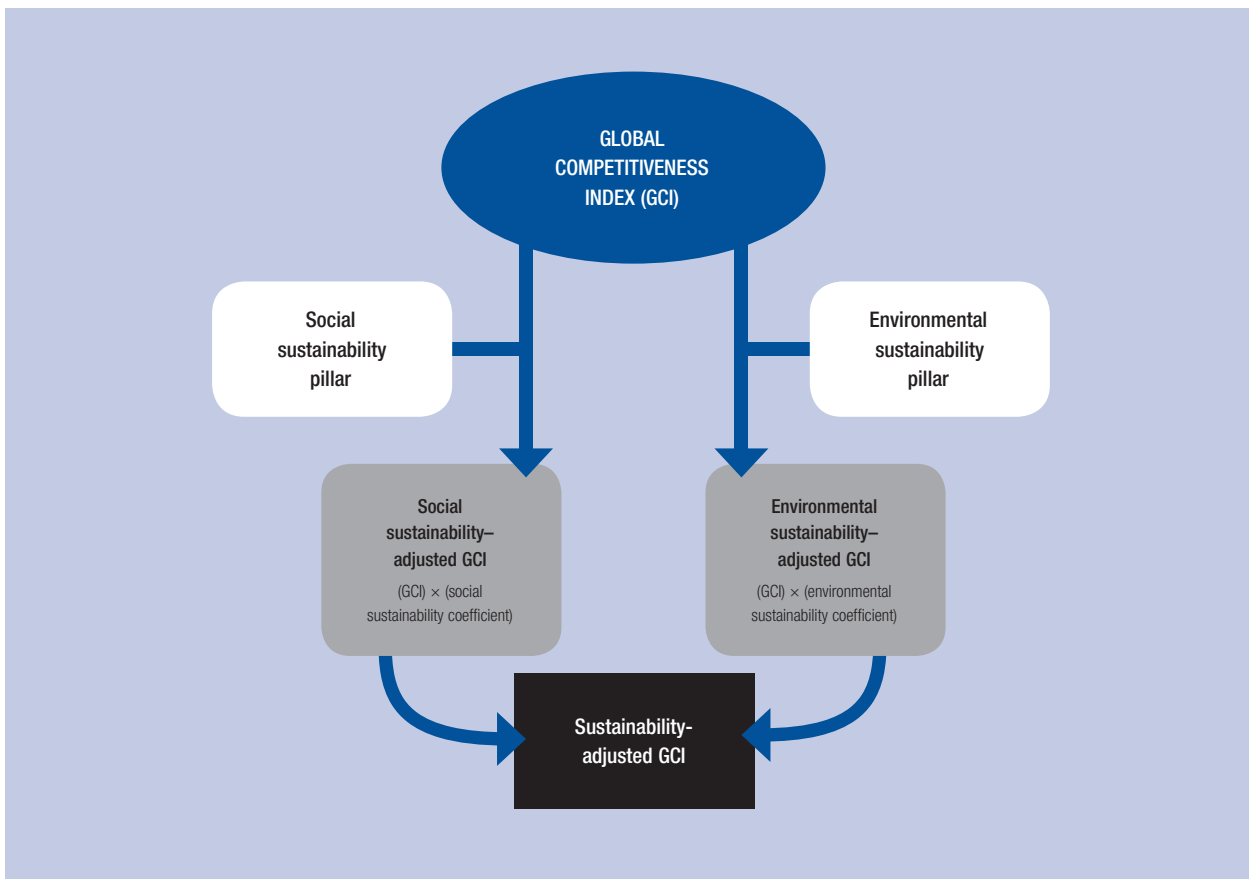
Notes

- 1 United Nations Open Working Group on Sustainable Development Goals 2014; further information about the SDGs is available at <http://sustainabledevelopment.un.org/owg.html>.
- 2 Stijns et al. 2012.
- 3 UNCTAD 2014.

Another source of sustainability measures comes from companies' reporting standards such as the *triple bottom line accounting*, as a growing body of firms and public institutions systematically reveal information about their environmental and social performance beyond the traditional financial statement.

Despite this progress, a generalized lack of high-quality, internationally comparable data that would allow countries to fully understand how they fare in these critical areas and benchmark themselves against peers persists. Without an improvement in the quality and availability of key data on social and environmental sustainability, countries will continue to face challenges

Figure 1: The structure of the sustainability-adjusted GCI



Note: Refer to appendix A for a detail explanation of the methodology.

when assessing and monitoring key dimensions of their situation. The lack of data also renders far-reaching quantitative analysis of the topic impossible and makes it difficult to identify channels of influence and assign relative importance to the different aspects of sustainable competitiveness. Better data would enable countries to make better decisions in their attempt to identify and implement appropriate policies and measures to ensure that their development model leads to the desired outcomes. The lack of data is a challenge that is shared by all the frameworks described above as well as by our sustainable competitiveness assessment, detailed in the next section.

Sustainable competitiveness: The analytical framework

Based on our definition of sustainable competitiveness, we have developed a framework that aims to create a common ground to develop policies that balance economic prosperity with social inclusion and environmental stewardship. This conceptual model is represented in Figure 1, which presents a framework where the Forum's index for measuring competitiveness, the Global Competitiveness Index (GCI), is adjusted by factors that encompass social and environmental sustainability. This framework highlights the central

position of competitiveness as the key driver of prosperity in society, recognizing that high levels of competitiveness are crucial to sustained prosperity.

The GCI measures the level of competitiveness of an economy, as discussed in Chapter 1.1, which is defined as *the set of institutions, policies, and factors that determine the level of productivity of an economy*. The GCI is a comprehensive index that takes into account 12 pillars or drivers: institutions, infrastructure, macroeconomic environment, health and primary education, higher education and training, goods market efficiency, labor market efficiency, financial market development, technological readiness, market size, business sophistication, and innovation. The variables that are analyzed in each of these 12 pillars are well known and benefit from more than 30 years of ongoing work on competitiveness at the World Economic Forum as well as a rich literature on growth and development.

However, the framework presented in Figure 1 indicates that competitiveness on its own may not lead to sustainable levels of prosperity. Although the attainment of a certain level of economic prosperity is essential for achieving high standards of living, within this exercise, countries are assessed also for their ability to generate this long-lasting prosperity for their citizens in a sustainable way. In other words, competitiveness is

Figure 2: Summary of indicators for social sustainability

Access to basic necessities	Vulnerability to economic exclusion	Social cohesion
<ul style="list-style-type: none"> • Access to sanitation • Access to improved drinking water • Access to healthcare 	<ul style="list-style-type: none"> • Vulnerable employment • Extent of informal economy • Social safety net protection 	<ul style="list-style-type: none"> • Income Gini index • Social mobility • Youth unemployment

a necessary but not sufficient condition for continued prosperity—hence the need for the additional social sustainability-adjusted and environmental sustainability-adjusted measures of competitiveness.

As described in the first half of this chapter, defining the functional relationship between competitiveness and sustainability and identifying and measuring the pillars and variables that are driving environmental and social sustainability are complex tasks from both a conceptual and a measurement point of view. Sufficient evidence does not yet exist that would allow us to identify a solid functional relationship among them; we therefore opt for the simple approach of defining a linear relationship among the three dimensions. As a result, the final overall sustainability-adjusted Global Competitiveness Index is an average of the two sustainability-adjusted indexes: the social sustainability-adjusted GCI and the environmental sustainability-adjusted GCI.³⁹

Social sustainability pillar

For social sustainability, the Forum identifies three conceptual elements (Figure 2). The first category aims to assess a *population's access to basic necessities*.⁴⁰ It includes three indicators: *Access to sanitation*, *Access to improved drinking water*, and *Access to healthcare services*. This category is thus a measure of inclusion as well as a measure of the fulfillment of basic physical needs. Other indicators that we would have liked to incorporate but could not because of the lack of data include access to decent housing and food security. A population with poor access to water, food, shelter, healthcare, and sanitation cannot develop to its full capacity.

The second category is linked to the concept of perceived economic security. Hence it aims to evaluate a *population's vulnerability to economic exclusion*. Three indicators have been chosen for this evaluation: *Vulnerable employment* as a percentage of total employment, the *Extent of the informal economy*, and *Social safety net protection*. The vulnerable employment indicator measures the percentage of people who are self-employed in a small business or are in a small family business that may provide income levels insufficient to meet the living standards of the country of residence and can prove unstable in times of economic difficulties.

The extent of the informal economy provides a sense of how well integrated the workforce is into official structures. A workforce that is less integrated leaves workers more vulnerable to concerns related to job loss, old age, maternity, disability, or illness. The social safety net is a complementary measure of protection: in times of financial and economic instability, the safety net helps households to maintain their access to basic necessities and to weather crises without falling into poverty traps. Providing protection also leads to a sense of financial security that enables individuals to undertake investments and entrepreneurial risk, which can in turn translate into the creation of new jobs and innovative ideas, thus benefitting the economy.

A third category can be thought of as an assessment of *social cohesion* and includes the following indicators: the *Income Gini index*, *Social mobility*, and *Youth unemployment*. The income Gini index is a measure of income inequality, but keep in mind that—from a normative approach—excessive inequality may hide relative poverty that would prevent lower-income families from accessing the same opportunities as those with incomes at the high end of the range in the society.

Linked to this idea, we include an indicator on social mobility. In the context of sustainable competitiveness, it is crucial that subsequent generations can improve their condition regardless of the socioeconomic status of their parents. From a purely economic perspective, the absence of such social mobility can be detrimental to human capital development because talented individuals, in a society that does not allow them to access education or to move ahead, will not be leveraged for economic advancement and they may leave their home country to pursue opportunities abroad. Additionally, low expectations for the future in a context of high unemployment and persistent inequality can spark political instability. On a broader conceptual level, social mobility is also a direct measure of the freedom to pursue human development.

Finally, high youth unemployment can reduce social cohesion and incur significant economic and social costs. It depresses lifetime earnings for unemployed workers, taking a toll on their health and reducing the potential of the next generation to succeed. From an economic standpoint, high youth unemployment

Figure 3: Summary of indicators for environmental sustainability

Environmental policy	Use of renewable resources	Degradation of the environment
<ul style="list-style-type: none"> • Environmental regulations (stringency and enforcement) • Number of ratified international environmental treaties • Terrestrial biome protection 	<ul style="list-style-type: none"> • Baseline water stress • Wastewater treatment • Forest cover change • Fish stocks' overexploitation 	<ul style="list-style-type: none"> • Level of particulate matter concentration • CO₂ intensity • Quality of the natural environment

reflects a failure to mobilize existing resources and build productive skills.

Environmental sustainability pillar

To develop the environmental sustainability pillar, the Forum has continued to work closely with experts at Yale's Center for Environmental Law and Policy (YCELP), with the Center for International Earth Science Information Network (CIESIN) at Columbia University's Earth Institute, and with the World Resource Institute (WRI) to define the best existing indicators in this area and to understand the strengths and limitations of these data.

More generally, the measures captured here and presented in the environmental sustainability pillar are meant to complement the analysis carried out through the Environmental Performance Index (EPI), which provides a much more comprehensive indication of national performance on a variety of environmental indicators. In this pillar, indicators have been selected according to three categories (see Figure 3) aimed at covering the most relevant aspects of environmental sustainability.

The first area measured in the environmental sustainability pillar is *environmental policy*, which is composed of a gauge of the stringency and enforcement of *Environmental regulations* along with the extent to which land areas are protected (biome protection), providing an assessment of a country's commitment to protecting natural capital. We also include a measure of the number of key *International environmental treaties*, out of a total of 25, in which the country is a participant. This indicator demonstrates the country's level of engagement with environmental issues and thus its willingness to become involved in international efforts toward addressing global environmental challenges. Together these variables capture to some extent the political will of countries to respond to environmental issues in a structured and consistent way and indicate their importance in the government agenda.

The second area relates to the *use of renewable resources*. These indicators comprise measures of Baseline water stress in an economy, which models the relation between water supply availability and demand in each country; *Wastewater treatment*, which gauges

what percentage of (mainly urban) wastewater is treated before it is released into the ecosystem; *Forest cover change*, which takes into account reported information about the percentage of total land area that is deforested (or afforested) over time; and the overexploitation of *Fish stocks*. A diminishing regeneration capacity is one of the major environmental issues for which a simple solution is not easily identified. Although the data in this area are among the most difficult to collect and interpret, it is crucial for a country to manage these resources in order to ensure that they remain available for future generations.

The third area takes into consideration the *degradation of the environment*, which can cause serious damage to human health while destroying the ecosystem. The specific indicators used to measure this concept are the *Level of particulate matter concentration*, *CO₂ intensity*, and the *Quality of the natural environment*. Particulate matter concentration is a proxy for air pollution, which has proven negative effects on human health and is monitored by local authorities in many countries. The quality of the natural environment is a perception-based assessment of the local status of the environment that measures the observation of local business leaders on the ground. CO₂ intensity is a measure of the efficiency of energy use in relation to the emissions it produces.

It is important to note that, although CO₂ intensity also provides a sense of national contributions to climate change, the decision was taken again this year not to include climate change as a specific factor in this pillar. This is because there is currently no agreement on how to attribute emission responsibilities to particular countries. For example, in a world of globalized markets, should emissions be allocated to the country producing the goods that created the emissions or to the consuming country? Also it is not yet clear what impact countries' contributions to climate change would have on national competitiveness, particularly in the absence of an international agreement that would impose costs on large emitters.

While the variables described in this and the previous sections capture a number of important aspects of social and environmental sustainability, additional variables are needed to obtain a more

complete measure of the concept. These indicators include measurements of social participation and respect for core human rights, as well as discrimination and the treatment of minority populations and additional environmental indicators. However, because of the lack of quality indicators in these areas, we are unable to include them for the time being.

Updates to the environmental sustainability pillar

As a result of collaboration with our partners and our research, we were able to improve the methodology this year by updating a number of indicators because data became available or because improved measurement methodologies were provided. The indicator *Baseline water stress* replaces *Agricultural water intensity*. The methodology for the calculation of the indicators *Forest cover change*, *Particulate matter (2.5) concentration*, and *Fish stocks overexploited* has been updated to bring these indicators in line with the results of the Environmental Performance Index. Finally, the new indicator *Wastewater treatment* was added to the framework.

Calculation of the sustainability-adjusted GCI

The two areas of sustainability—social and environmental—are treated as independent adjustments to each country's performance in the GCI.

The details behind the aggregation are described in Appendix A; Appendix B provides detailed notes and sources for each indicator. The aggregation leads to three outcomes: an environmental sustainability-adjusted GCI, a social sustainability-adjusted GCI, and an overall sustainability-adjusted GCI that combines the two effects. Lacking clear theoretical guidelines in assigning weights to the individual elements, each indicator has been given an equal weight within each pillar.

As described in detail in Appendix A, each pillar is converted into an "adjustment coefficient" with a range of 0.8 to 1.2; this coefficient is then used to adjust the GCI score upward or downward. Consequently, the sustainability-adjusted GCI score ranges between a maximum of 20 percent lower or 20 percent higher than the underlying GCI score.

The single indicators are aggregated using a simple average. Although this aggregation method is transparent and simple to replicate, its limitation is that it allows for compensation across the different sustainability dimensions. For example, a country may achieve a strong performance in terms of carbon intensity but a poor performance on deforestation. In this case, the two scores will be averaged out and the overall score may mask an uneven performance across different dimensions. This needs to be kept in mind when interpreting the results. Notwithstanding extensive research efforts, again this year we were not able to

identify new metrics of appropriate quality to be included in the index.

In the Sustainable Competitiveness exercise, country coverage is again driven by data availability: we are able to cover 113 economies this year, a subset of the 144 economies covered in the 2014–2015 GCI.

Results of the sustainability-adjusted GCI analysis

This section presents the results of the sustainability-adjusted GCI. Table 1 shows how the GCI score is adjusted once sustainability indicators are taken into account. An upward arrow shows that sustainability results drive a better score than the GCI itself; a downward arrow points to a situation of vulnerability in terms of social and/or environmental sustainability that lowers the GCI score. A horizontal arrow indicates that GCI results do not change substantially when considering sustainability aspects. The results indicate that there is no clear trade-off between being competitive and being sustainable.

As noted in previous editions, the findings show that, irrespective of their level of competitiveness, on the two elements of sustainability countries can attain results that are above or below their competitiveness score. However, we observe that countries in the top half of the competitiveness rankings tend to perform better on sustainability as well. This is particularly true for the social sustainability dimension, which is, not surprisingly, highly correlated with level of development. Developed economies tend to have more mature institutions that ensure that citizens have access to basic infrastructure, healthcare, and welfare. At the same time, countries that face challenges related to their competitiveness fare even more poorly in terms of social sustainability.

In terms of environmental sustainability, the picture is more complex. Countries toward the lower end of the competitiveness scale tend to fare better than advanced economies in terms of emissions such as CO₂, as well as in manufacturing-related pollution such as waste and by-products of industrial processes.⁴¹ However, these economies are currently facing problems that advanced economies have already experienced in their own earlier stages of development, such as biodiversity loss caused by deforestation, urbanization, and the expansion of agricultural land as well as air pollution (proxied here by particulate matter, or PM_{2.5}, emissions) triggered by the use of older combustion technologies, especially in the transport sector.

RESULTS FOR SELECTED ECONOMIES

Because many of the aspects relating to sustainability require many years for significant change to occur, we observe only small movements in the performance of economies from one year to the next. Nonetheless, constant monitoring and benchmarking of selected indicators helps to identify possible areas of risk and the

Table 1: Adjustment to the GCI scores by sustainability indicators

Country/Economy	GCI 2014–2015		Social sustainability-adjusted GCI [†]		Environmental sustainability-adjusted GCI [‡]		Sustainability-adjusted GCI ^{††}	
	Rank*	Value	Value	Direction	Value	Direction	Value	Direction
Switzerland	1	5.7	6.75	↑	6.84	↑	6.8	↑
United States	3	5.54	5.97	↗	5.24	↘	5.61	⇒
Finland	4	5.5	6.38	↑	5.98	↗	6.18	↗
Germany	5	5.49	6.36	↑	6	↗	6.18	↗
Japan	6	5.47	6.29	↗	5.83	↗	6.06	↗
Netherlands	8	5.45	6.39	↑	5.88	↗	6.13	↗
United Kingdom	9	5.41	5.95	↗	5.75	↗	5.85	↗
Sweden	10	5.41	6.05	↗	5.95	↗	6	↗
Norway	11	5.35	6.43	↑	6.14	↗	6.28	↑
United Arab Emirates	12	5.33	6.1	↗	5.16	⇒	5.63	↗
Denmark	13	5.29	6.14	↑	5.69	↗	5.91	↗
Canada	15	5.24	5.95	↗	5.51	↗	5.73	↗
New Zealand	17	5.2	5.94	↗	6.04	↑	5.99	↑
Belgium	18	5.18	5.89	↗	5.48	↗	5.68	↗
Luxembourg	19	5.17	5.96	↑	5.73	↗	5.85	↗
Malaysia	20	5.16	5.59	↗	4.86	↘	5.22	⇒
Austria	21	5.16	6	↑	5.85	↗	5.92	↑
Australia	22	5.08	5.8	↗	5.54	↗	5.67	↗
France	23	5.08	5.56	↗	5.52	↗	5.54	↗
Saudi Arabia	24	5.06	5.2	⇒	4.74	↘	4.97	⇒
Ireland	25	4.98	5.38	↗	5.14	⇒	5.26	↗
Korea, Rep.	26	4.96	5.25	↗	4.85	⇒	5.05	⇒
China	28	4.89	4.96	⇒	4.28	↘	4.62	↘
Estonia	29	4.71	5.13	↗	4.71	⇒	4.92	⇒
Iceland	30	4.71	5.41	↗	5.39	↗	5.4	↑
Thailand	31	4.66	4.63	⇒	4.38	↘	4.51	⇒
Chile	33	4.6	4.68	⇒	4.78	⇒	4.73	⇒
Indonesia	34	4.57	4.31	↘	4.26	↘	4.28	↘
Spain	35	4.55	4.65	⇒	4.73	⇒	4.69	⇒
Portugal	36	4.54	4.61	⇒	4.56	⇒	4.58	⇒
Czech Republic	37	4.53	4.97	↗	4.9	↗	4.93	↗
Azerbaijan	38	4.53	4.33	⇒	4.09	↘	4.21	↘
Mauritius	39	4.52	4.7	⇒	4.25	↘	4.47	⇒
Lithuania	41	4.51	4.66	⇒	4.85	↗	4.75	↗
Latvia	42	4.5	4.64	⇒	4.89	↗	4.77	↗
Poland	43	4.48	4.48	⇒	4.62	⇒	4.55	⇒
Turkey	45	4.46	4.49	⇒	4.05	↘	4.27	⇒
Panama	48	4.43	4.42	⇒	4.53	⇒	4.47	⇒
Italy	49	4.42	4.36	⇒	4.44	⇒	4.4	⇒
Kazakhstan	50	4.42	4.69	↗	3.91	↘	4.3	⇒
Costa Rica	51	4.42	4.51	⇒	4.63	⇒	4.57	⇒
Philippines	52	4.4	4.26	⇒	4.25	⇒	4.25	⇒
Russian Federation	53	4.37	4.46	⇒	4.19	⇒	4.33	⇒
Bulgaria	54	4.37	4.31	⇒	4.48	⇒	4.4	⇒
South Africa	56	4.35	4.11	↘	4.18	⇒	4.14	⇒
Brazil	57	4.34	4.29	⇒	4.54	⇒	4.42	⇒
Cyprus	58	4.31	4.48	⇒	4.07	↘	4.27	⇒
Romania	59	4.3	4.13	⇒	4.21	⇒	4.17	⇒
Hungary	60	4.28	4.35	⇒	4.54	↗	4.44	⇒
Mexico	61	4.27	4.2	⇒	3.98	↘	4.09	⇒
Macedonia, FYR	63	4.26	4.13	⇒	3.66	↘	3.9	↘
Peru	65	4.24	3.99	↘	4.02	↘	4	↘
Colombia	66	4.23	3.8	↘	4.17	⇒	3.98	↘
Montenegro	67	4.23	4.08	⇒	4.38	⇒	4.23	⇒
Vietnam	68	4.23	4.11	⇒	3.67	↘	3.89	↘
Georgia	69	4.22	3.88	↘	4.1	⇒	3.99	⇒
Slovenia	70	4.22	4.52	↗	4.78	↗	4.65	↗

(Cont'd.)

Table 1: Adjustment to the GCI scores by sustainability indicators (cont'd.)

Country/Economy	GCI 2014–2015		Social sustainability-adjusted GCI†		Environmental sustainability-adjusted GCI‡		Sustainability-adjusted GCI‡‡	
	Rank*	Value	Value	Direction	Value	Direction	Value	Direction
India	71	4.21	3.98	↘	3.72	↘	3.85	↘
Morocco	72	4.21	3.88	↘	3.89	↘	3.88	↘
Sri Lanka	73	4.19	4.1	⇒	4.47	↗	4.28	⇒
Slovak Republic	75	4.15	4.23	⇒	4.41	↗	4.32	⇒
Ukraine	76	4.14	4.19	⇒	3.7	↘	3.95	⇒
Croatia	77	4.13	4.06	⇒	4.21	⇒	4.14	⇒
Guatemala	78	4.1	4	⇒	4.05	⇒	4.03	⇒
Algeria	79	4.08	3.89	⇒	3.58	↘	3.73	↘
Uruguay	80	4.04	4.19	⇒	4.21	⇒	4.2	⇒
Greece	81	4.04	3.85	⇒	4.09	⇒	3.97	⇒
Moldova	82	4.03	3.98	⇒	3.97	⇒	3.98	⇒
Iran, Islamic rep.	83	4.03	3.73	↘	3.64	↘	3.68	↘
El Salvador	84	4.01	3.78	↘	3.63	↘	3.71	↘
Armenia	85	4.01	3.79	↘	3.92	⇒	3.85	⇒
Jamaica	86	3.98	3.58	↘	3.71	↘	3.65	↘
Tunisia	87	3.96	3.74	↘	3.58	↘	3.66	↘
Namibia	88	3.96	3.48	↘	4.11	⇒	3.79	⇒
Trinidad and Tobago	89	3.95	4.03	⇒	3.62	↘	3.83	⇒
Kenya	90	3.93	3.53	↘	4.05	⇒	3.79	⇒
Serbia	94	3.9	3.68	↘	3.86	⇒	3.77	⇒
Cambodia	95	3.89	3.58	↘	3.85	⇒	3.71	⇒
Zambia	96	3.86	3.48	↘	4.08	↗	3.78	⇒
Albania	97	3.84	3.63	↘	3.56	↘	3.59	↘
Mongolia	98	3.83	3.6	↘	3.3	↘	3.45	↘
Nicaragua	99	3.82	3.55	↘	3.79	⇒	3.67	⇒
Honduras	100	3.82	3.52	↘	3.78	⇒	3.65	⇒
Dominican Republic	101	3.82	3.38	↘	3.44	↘	3.41	↘
Nepal	102	3.81	3.74	⇒	3.66	⇒	3.7	⇒
Argentina	104	3.79	3.75	⇒	3.36	↘	3.55	↘
Bolivia	105	3.77	3.44	↘	3.76	⇒	3.6	⇒
Gabon	106	3.74	3.27	↘	3.98	↗	3.63	⇒
Kyrgyz Republic	108	3.73	3.66	⇒	3.29	↘	3.47	↘
Bangladesh	109	3.72	3.65	⇒	3.35	↘	3.5	↘
Ghana	111	3.71	3.4	↘	3.79	⇒	3.6	⇒
Senegal	112	3.7	3.43	↘	3.82	⇒	3.62	⇒
Lebanon	113	3.68	3.49	↘	2.95	↓	3.22	↘
Côte d'Ivoire	115	3.67	3.37	↘	3.66	⇒	3.52	⇒
Cameroon	116	3.66	3.37	↘	3.85	↗	3.61	⇒
Guyana	117	3.65	3.56	⇒	3.33	↘	3.45	↘
Ethiopia	118	3.6	3.24	↘	3.75	⇒	3.5	⇒
Egypt	119	3.6	3.33	↘	3.26	↘	3.3	↘
Paraguay	120	3.59	3.31	↘	3.42	⇒	3.37	↘
Tanzania	121	3.57	3.38	↘	3.59	⇒	3.48	⇒
Swaziland	123	3.55	3.27	↘	3.4	⇒	3.34	↘
Zimbabwe	124	3.54	3.24	↘	3.81	↗	3.53	⇒
Libya	126	3.48	2.93	↓	2.79	↓	2.86	↓
Nigeria	127	3.44	2.97	↘	3.57	⇒	3.27	⇒
Pakistan	129	3.42	3.16	↘	2.99	↘	3.08	↘
Venezuela	131	3.32	3.15	↘	3.13	↘	3.14	⇒
Mozambique	133	3.24	2.7	↓	3.2	⇒	2.95	↘
Timor-Leste	136	3.17	2.89	↘	2.68	↓	2.78	↘
Haiti	137	3.14	2.51	↓	2.72	↘	2.62	↓
Sierra Leone	138	3.1	2.85	↘	2.96	⇒	2.91	↘
Angola	140	3.04	2.59	↘	2.75	↘	2.67	↘
Yemen	142	2.96	2.56	↘	2.37	↓	2.46	↓
Guinea	144	2.79	2.61	↘	2.6	↘	2.61	↘

* This is the GCI rank, as presented in Chapter 1.1. Only the 113 economies covered by this exercise are included in the table.

† This is the score obtained by multiplying the GCI score by the social sustainability coefficient.

‡ This is the score obtained by multiplying the GCI score by the environmental sustainability coefficient.

‡‡ This is the average of social sustainability-adjusted GCI and environmental sustainability-adjusted GCI scores.

Please refer to the technical appendix of this chapter for a description of how the coefficients are calculated. All the underlying indicators are available at <http://www.weforum.org/content/pages/sustainable-competitiveness>.

Key

- ↑ GCI score changes by > +15% to +20%
- ↗ GCI score changes by > +5% to +15%
- ⇒ GCI score remains stable between +5% and -5%
- ↘ GCI score changes by < -5% to -15%
- ↓ GCI score changes by < -15% to -20%

direction of progress on particular dimensions in each country. The following description of results (presented in the order of this year's GCI ranking) provides an overall picture of the performance and highlights the main strengths and areas of challenge for selected economies.

Switzerland confirms its strong sustainability performance. Its 1st place in the GCI rankings is reinforced when that Index is adjusted by social and environmental sustainability indicators. Youth unemployment is slightly increasing but remains at a fairly low level (8.4 percent), while social protection and mobility remain in line with past rankings, painting a positive picture of the Swiss social system. In terms of environmental sustainability, Switzerland, by achieving relatively positive results across all the measured dimensions, again demonstrates that trade-offs between being sustainable and being competitive are not necessary. For example, the country's strong results on environmental stewardship are achieved by enforcing effective environmental regulations, providing water treatment, and protecting its biodiversity. However, improvements could be made in some areas: air pollutant emissions are still above an optimal level, and the country has also seen a slight decrease in forest cover since the year 2000. Therefore, although Switzerland's leadership manages its social and environmental capital rather well, stakeholders should not be complacent and should continue to monitor and improve the management of Swiss resources.

The sustainability performance of the **United States** is mixed. When adjusted by the social sustainability dimension, US competitiveness improves slightly but less than that of other advanced economies because of its still-high levels of income inequality and youth unemployment (15 percent on a decreasing trend). In terms of environmental sustainability, the adjusted score reveals a somewhat lower performance, spanning air pollutant emission, depleting fish stocks, and a low commitment to joining international treaties. Recent reports of a greater policy focus on social and environmental problems—as exemplified by the adoption of the Clean Water Act and Clean Power Act—puts the country in the right direction for attaining more sustainable path.

Nordic countries also continue to perform well overall and display specific areas of improvement. **Finland**, despite an inclusive social system and a track record of managing resources responsibly, has to address a rather high level of youth unemployment (approximately 19 percent), depleting fish stocks, diminishing forest cover, and limited protected areas.

Germany is similar in many respects to the Nordic economies. On the social sustainability pillar, it is characterized by relatively low youth unemployment, widespread access to healthcare, and the presence of

a social safety net. However, emerging social difficulties, such as rising poverty in Germany, are reported by local studies, demonstrating that such difficulties have started to concern a significant portion of the population even in some of the most prosperous countries in the world.⁴² Like social sustainability, environmental sustainability is also assessed relatively positively. Stringent and well-enforced regulations and the existence of a large area of protected land indicate Germany's particular attention to environmental issues. However, CO₂ intensity is still relatively high and does not seem to be on a decreasing trend, fish stocks are overexploited, and particulate matter emission is beyond the optimal level.

Japan delivers a relatively positive performance on the social sustainability component as a result of its low youth unemployment, its small informal economy, and its resilient social safety net. The country attains an overall positive performance on the environmental dimension as well, but with a number of areas still in need of improvement. Japan is tightening some of its environmental policies, yet it continues to be penalized by a high level of CO₂ emissions and shows some signs of water stress.

Sweden has the highest youth unemployment rate within the Nordic group, which results in its relatively weaker position within the Nordics on the social sustainability pillar. Nonetheless, Sweden remains a country with notable social protection and is one of the least unequal societies in the world. In terms of environmental sustainability, it adopts effective regulations and manages to control air pollution, but it is depleting its fish stocks and its forests have diminished over the last decade, two areas that may require policy attention.

Norway attains the strongest social sustainability performance of all the countries in the sample this year, balancing low inequality and social protection with high mobility and low level of unemployment. On the environment side, similar to other economies in the region, Norway is making efforts to reduce its footprint on its natural capital but should manage fish stocks and forests in a more sustainable way because both are declining.

In the **United Arab Emirates**, low youth unemployment and wide access to basic necessities positively influence social sustainability, which therefore does not compromise its general competitiveness level. In terms of environmental sustainability, severe water stress (which is partly a consequence of the country's particular geographical positioning), pressure on fish stocks, and a high concentration of particulate matter and CO₂ emissions impact its sustainability-adjusted competitiveness. In addition, the country is signatory to fewer international environmental treaties than most other economies.

China's competitiveness continues to suffer from limitations resulting from low sustainability, especially as it pertains to the environment. In terms of social sustainability, China is slowly expanding access to drinking water and sanitation for the entire population, but inequality is still high and the welfare system is available only to some full-time urban workers. The country does not report data related to youth unemployment or vulnerable employment; these indicators cannot therefore be assessed. On the environmental sustainability side, China encounters some severe difficulties especially concerning water and air pollution. CO₂ emissions have stopped increasing but they remain high, while the concentration of PM_{2.5} particles signals potential health concerns related to air pollution, especially in urban areas. The country's management of water resources is relatively unsustainable: increasing water stress and the heavy pollution of streams results in severely damaged water resources, and only a low proportion of the water withdrawn is treated before it is returned to the ecosystem. The introduction of pollution taxes has not yet delivered a significant reduction of emissions, and, despite intentions to improve the situation, policy has yet to be implemented in an effective way.

Indonesia's competitiveness performance declines when adjusted by sustainability. In terms of social sustainability, the most critical area remains the significant share of the population in vulnerable employment, despite a slight improvement. Additionally, access to healthcare and sanitation remains low (40 percent of the population still does not have regular access to sanitation facilities). In terms of environmental sustainability, deforestation, fish stock depletion, and lack of water management continue to damage Indonesia's highly diverse ecosystem. Environmental regulations and their enforcement remain insufficient, putting the invaluable natural capital of the country at risk.

As it faces difficulties related to sustainability, especially in the environmental area, the **Russian Federation** attains an intermediate performance on both pillars again this year. In terms of social sustainability, the Russian Federation is still characterized by a relatively weak social safety net, high and increasing inequality, and limited social mobility. All these indicators have remained constant since the last assessment. In terms of environmental sustainability, regulations are still only weakly enforced and only 21 percent of the water withdrawn is treated. This low treatment rate could be a source of water stress in the future, although today Russia is endowed with one of the largest water reserves in the world. Emissions, especially CO₂ intensity, are also higher than international standards, and fish stocks are depleting. The country should better manage its natural capital to ensure prosperity in the long run.

South Africa's main social problems remain its extremely high income inequality and youth unemployment, but inadequate access to healthcare and a poor social safety net are also contributing to a below par result on the social sustainability dimension. In addition, the country has not yet achieved universal access to sanitation. From an environmental point of view, South Africa is not protecting its rich biodiversity enough: it protects only a few areas, has little wastewater treatment, and is depleting its fish stocks. In addition, CO₂ emissions are at the level of more industrialized economies. On a positive note, it seems that the country has made progress in forest stewardship.

Brazil's results on sustainable competitiveness remain substantially in line with its GCI score. In terms of social sustainability, inequality is still very high and, despite some positive developments, the country is still characterized by its population's limited access to the healthcare system and the social safety net. However, these factors are partially compensated by its low youth unemployment and almost universal access to improved drinking water. From the environmental point of view, deforestation—despite efforts from the government such as the creation of the Real Time Deforestation Detection System—and a lack of water treatment remain significant issues. On a positive note, despite the negative effect of deforestation on greenhouse gas emissions, the overall carbon intensity level and particulate matter concentration are lower than in countries at a similar stage of development. In addition, an abundance of water puts little stress on water availability. But the adoption of tighter environmental regulations is needed to make sure that Brazil's rich natural capital is managed responsibly and will remain an asset for future generations.

Mexico's competitiveness is also not entirely sustainable, especially from the environmental point of view, where there are several penalizing factors: the enforcement of its regulations is rather lax, and perhaps partially explains the country's low performance on most of the dimensions: management of water resources, fish stocks, forestry, and carbon intensity. Only 37 percent of the wastewater is treated, adding pressure to the country's water supply. Looking at Mexico's social sustainability performance, its low youth unemployment and widespread access to water and sanitation offset its relatively high level of inequality, its widespread informal economy, and the limited coverage of its social safety net.

Colombia's competitiveness is reduced again this year once sustainability is taken into account. Although overall poverty has been declining for decades, the country's social sustainability is still weak: access to healthcare services is limited and Colombia does not yet have an integrated social safety net, which exposes a large fraction of the population in vulnerable

employment to poverty risk. The existence of some social programs and the Family Welfare Institute has not so far been able to provide a structure that sufficiently supports disadvantaged individuals. The difficult economic situation of many households hinders social mobility, which reinforces persistent income inequality. In terms of environmental sustainability, Colombia should better defend its vast and biologically diverse natural capital endowment. The country has managed to institute several protected areas and can count on remarkable water reserves. However, its enforcement of environmental regulations remains weak and its treatment of the water used is limited. Deforestation also continues to represent a problematic issue. Forest is cleared mainly because of illegal logging, agriculture, mining operations, and the construction of infrastructure and housing. Balancing economic development and sustainability is particularly challenging for a country whose surface area is 50 percent covered by forests, yet preserving its natural heritage and managing its forests sustainably would bring benefits for Colombia's competitiveness in the long run.

Vietnam's GCI performance is again weakened once sustainability measures are considered. In terms of social sustainability, the country's main challenges are the insufficient coverage of its social safety nets in the context of large segments of its population living with vulnerable employment and low social mobility. In the environmental domain, difficulties are even more worrisome in some areas. Regulations are still assessed as lax and not well enforced, and the country's level of commitment to international treaties remains low. Vietnam's recent industrialization combined with its limited environmental norms is having a strong negative impact on the environment, including air and water pollution, where only a negligible fraction of the water used is treated.

India's competitiveness is also reduced when sustainability is taken into account. Social sustainability is hindered mainly by the population's very uneven access to sanitation (still only 36 percent of Indians have access to these basic services) and high rates of vulnerable employment. To a lesser extent, its large informal economy and its lack of a universal social safety net show that India remains largely a poor country that is developing with large disparities within its society. India's environmental performance is also below par because the country's natural assets are depleting, despite some efforts in tightening environmental regulations since the adoption of the Air (Prevention and Control of Pollution) Act 1981.⁴³ Air quality has slightly improved this year, but concentrations of particulate matter and carbon intensity are still very high: this is the case especially in the main urban centers, which are ranked among the 50 most polluted cities worldwide. In addition, the limited treatment of wastewater is increasing pressure

on India's water tables, and limited protected areas are wearing down the assessment of the quality of the natural environment. Although on some issues the authorities are working to improve the situation, little action has been taken on specific but significant areas of environmental management. For example, in 2011, the Indian Supreme Court refused to ban asbestos, which is internationally recognized as toxic and banned in almost all developed countries. Also, enforcement of its regulations is often ineffective, especially when it comes to improving water quality—a lack that is still having an effect on child mortality.⁴⁴

Kenya's sustainable competitiveness is weakened primarily by the social dimension of sustainability, while environmental sustainability is not presently affecting the country's overall sustainability-adjusted score. Kenya has made only slight progress in expanding access to improved drinking water, healthcare services, and sanitation facilities. Youth unemployment has increased and inequality remains relatively high. In terms of environmental sustainability, however, Kenya has been sensitive to the loss of biodiversity that accompanies its socioeconomic development and the government has adopted measures to protect the environment with a relatively strict regulatory framework, a strong commitment to international treaties, the creation of protected land areas, and the adoption of a national environment policy. Yet protection of forests and habitats remains an issue, with logging related to timber production and agriculture reducing the stock of forests faster than their natural regenerative capacity. Furthermore, water treatment practices are rare and fish stocks are depleting.

Although **Ghana** is one of the most developed countries in the region, the social sustainability pillar assessment unveils persistent gaps in access to improved sanitation, and large portions of the population work in vulnerable jobs or in the informal economy and do not have access to social security. In terms of environmental sustainability, Ghana's performance is somewhat more balanced but some concerns remain. Deforestation is continuing to deplete the country's natural resources at a rapid rate: on average, almost 5 percent of the forest cover is lost each year. In addition to logging, commercial agriculture is clearing land by burning and cutting wooded areas, damaging the country's forest cover. Water withdrawn is almost never treated, resulting in further polluting streams and aquifers. In addition, environmental regulations are not very stringent and tend to be somewhat poorly enforced. More efficient resource management would enable Ghana to preserve its natural wealth and improve the living conditions of its citizens.

Senegal's main areas of vulnerability are related to social sustainability. Although slightly improving this year, access to improved sanitation is limited (this is

available to only 52 percent of the population). Access to improved drinking water is more widely available, albeit still insufficient (74 percent). In addition, large portions of the population do not have access to healthcare services and are not protected by a social safety net. The social structure of Senegal remains somewhat less unequal than other African economies, however. Its income Gini index is 40.3—better than that of Ghana or Kenya. The environmental sustainability pillar, despite an overall performance that is in line with the GCI, also presents some areas of concern. Overexploited fish stocks, along with air and water pollution, are again the priorities that need to be addressed to ensure sustainability. Because of its level of development, it is hardly surprising that infrastructure for water treatment is also lacking. The creation of several protected land areas and commitments to most of the international environment treaties are important steps that the country has recently taken toward protecting the environment. By expanding the protection of its resources, Senegal could achieve a more sustainable development path.

Africa's most populated country, **Nigeria**, is encountering sustainability challenges especially in the social domain. Access to basic services remains very low for millions of Nigerians: only 28 percent of the population has access to basic hygiene, and less than 65 percent enjoys improved water. Similarly, safety nets and healthcare services are available only to a minority of people. These issues, typical of a developing economy, may jeopardize the future competitiveness of the country as they limit the country's human capital. On the environmental side, Nigeria's low stage of development results in a low level of carbon intensity, and the country is currently not putting excessive stress on its water resources. However, water treatment is virtually nonexistent and could be a source of concern for future water availability that could have significant social consequences, as over 35 percent of the population uses un-improved water. Environmental regulations are also limited and not appropriately enforced, which could result in further environmental damages affecting the population.

CONCLUSIONS AND NEXT STEPS

This chapter assesses sustainable competitiveness in 113 economies and fosters the understanding of conceptual links between productivity on the one hand and social and environmental sustainability on the other. By combining social and environmental indicators with the GCI's results, the Forum has been able to continue its assessment of sustainable competitiveness at the national level and to contribute to creating a policy space for both dimensions of sustainability in relation to competitiveness. This analysis continues to support the important finding that there is no necessary trade-off between being competitive and being sustainable.

In fact, competitiveness and sustainability can work in complementary ways and holistic policies can have a positive effect on both in the long term.

As environmental and social tipping points become more palpable, economies that have been investing and planning for the long run, balancing economic progress with social inclusion and good and effective environmental stewardship, will be in a better position to maintain high prosperity for their citizens, even in presence of external shocks. Given the complexity of the issue at hand and important gaps in data, it must be remembered that this is a work in progress and that conclusions regarding countries' performance in terms of sustainable competitiveness can only be indicative.

We find that progress varies across different areas of sustainability. Five consecutive years of low growth in advanced economies and the more recent slowdown in emerging markets create a climate of lack of opportunities, which is reflected in growing concerns about the social dimension. This makes the inclusiveness of the growth process an increasingly topical and timely issue.

Public interest in environmental issues—with the exception of climate change—is higher than it was decades ago, although it seems less strong than it had been before the crisis. At the same time, firms are now more actively transitioning toward more sustainable practices. Overall, it is increasingly urgent that more tangible results on enhancing environmental sustainability are achieved.

The World Economic Forum will continue to serve the international community by providing a neutral multi-stakeholder platform to advance the understanding and analysis of this important concept. The Forum will also continue to work at the frontier of sustainability measurement to fully assess progress in national policies. Recognizing that multi-stakeholder collaboration is vital for creating the confidence necessary to undertake the investments to build more sustainable economies, we hope that this assessment will provide the basis for public-private dialogue on how to make economies environmentally and socially more sustainable for the benefit of present and future generations.

NOTES

- 1 Beitz 2009.
- 2 Brian Baxter wrote an introduction to ecogism in a book by that name in 2000. See Baxter 2000.
- 3 For example, asbestos has been banned in many countries following the 1992 Stockholm Convention on persistent organic pollutants. The European Union banned leaded gasoline in 2000, and restricted the use of certain hazardous substances in electrical and electronic equipment in 2003.
- 4 See, for example, Singh and Dhumale 2000; for the change in labor shares, see Neiman and Karabarbounis 2013.

- 5 *Capital in the Twenty-First Century*. The central idea of the analysis by Piketty is that only when the growth rate is higher than the return to capital will the benefits of growth lead to widespread prosperity. When the relationship flips, inequality would surge. See Piketty 2014.
- 6 In addition, the slow growth experienced recently in advanced economies has revived concerns about “secular stagnation,” with Lawrence Summers envisaging that even before the financial crisis a trend of low aggregate demand had begun in the United States.
- 7 For examples, see Acemoglu and Robinson 2006 and Aven 2014.
- 8 This definition is from the World Commission on Environment and Development’s (the Brundtland Commission’s) report *Our Common Future*. This report is commonly known as “the Brundtland Report.”
- 9 For an example of a company’s awareness of sustainability and reputational risk, see <http://www.scjohnson.com/en/commitment/focus-on/greengauge.aspx>.
- 10 As reported by nongovernmental organizations, such as the Carbon Disclosure Project; see <https://www.cdp.net/en-US/Pages/HomePage.aspx>.
- 11 For information about the Principles for Responsible Investment, see <http://www.unpri.org/>.
- 12 Bughin et al. 2010.
- 13 Luenberger 1995.
- 14 CDP and WWF-US 2013.
- 15 Parry et al. 2014.
- 16 CBO 2013.
- 17 The Economist 2014.
- 18 See, for example, UNEP 1997 for an analysis of the link between climate change and exceptional natural events.
- 19 WHO 2014.
- 20 Zivin and Neidell 2011.
- 21 Information on the Convention on Biological Diversity is available at <https://www.cbd.int/development/>.
- 22 See Rockström 2009.
- 23 UNEP 2011.
- 24 Stiglitz et al. 2009.
- 25 For an overview on the income inequality problem, see OECD 2011; Mankiw 2013; and Stiglitz 2012.
- 26 See for example Alesina and Rodrik 1994; Persson and Tabellini 1994.
- 27 See for example Deininger and Squire 1996.
- 28 Carvalho and Rezai 2013.
- 29 OECD 2012.
- 30 See Raleigh and Urdal 2009 for further discussion of this topic.
- 31 UNCTAD 2011b.
- 32 See <http://www.fao.org/economic/ess/ess-fs/ess-fadata/en/#.U9jppPmSxfE> for the United Nations Food and Agriculture Organization statistics.
- 33 See Bätthge 2010 for further discussion of climate change and women’s empowerment.
- 34 See Stiglitz et al. 2009; the European Commission’s Europe 2020 growth strategy, available at http://ec.europa.eu/europe2020/index_en.htm; the OECD’s Better Life Index, available at <http://www.oecdbetterlifeindex.org/>; and UNDP 2011.
- 35 The World Bank’s *Worldwide Governance Indicators Framework* is available at <http://info.worldbank.org/governance/wgi/index.aspx>; Information about the Decent Work initiative is available at <http://www.ilo.org/integration/themes/mdw/lang--en/index.htm>.
- 36 For more information on the EPI, see <http://www.epi.yale.edu/>.
- 37 See <http://www.footprintnetwork.org/en/index.php/GFN/page/methodology/> for information about information about the Global Footprint Network.
- 38 Information about the Global Adaptation Index is available at <http://index.gain.org/>.
- 39 The lack of some additional indicators, especially in the social sustainability dimension, constrains the model and does not allow for a comprehensive measurement of sustainability. For example, Germany performs well on the social sustainability pillar despite an existing trend of decreasing wages in Germany where, according to the Federal Employment Agency, over the past four years the number of individuals who require state support to get by despite full- or part-time jobs has increased steadily. Similarly, in Italy, the Italian National Institute of Statistics (Istat) disseminates the relative and absolute poverty estimations for households in the country, based on 2012 Households Budget Survey data. In 2012 the relative poverty incidence was equal to 12.7 percent, whereas the absolute poverty rate was 6.8 percent. These dimensions, although measured at country level in advanced economies, are not measured worldwide. Additionally, because poverty thresholds change from country to country, it is difficult to establish a cross-country comparison. The Gini index variable does not yet capture similar phenomena in the assessed countries.
- 40 The lack of access to basic necessities indicates a state of poverty.
- 41 Industry-related pollution is not measured by indicators used by the Sustainable Competitiveness framework.
- 42 See <http://www.der-paritaetische.de/ab2013/trends/>.
- 43 See India’s National Biodiversity Authority, available at <http://nbaindia.org/uploaded/Biodiversityindia/Legal/23.%20Air%20%28Prevention%20and%20control%20of%20Pollution%29%20Act%201981.pdf>.
- 44 Greenstone and Hanna 2011.

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Appendix A: Calculation of the sustainability-adjusted GCI

As described in the text, the two areas of sustainability—social and environmental—are treated as independent adjustments to each country’s performance in the Global Competitiveness Index (GCI). The adjustment is calculated according to the following steps.

AGGREGATION

In the first step, the individual indicators in each area are normalized on a 1-to-7 scale and aggregated by averaging the normalized scores, such that a social sustainability score and an environmental sustainability score are calculated for each country.

In the second step, these scores are normalized again on a 0.8-to-1.2 scale,^a which is based on the distribution of each of the two sustainability components. The purpose of this methodology is to reward the countries attaining a relatively good performance on the two sustainability components while penalizing those that register a poor performance. Applying this methodology corresponds to transforming actual averages into coefficients ranging from 0.8 to 1.2. For example, the worst performer on the social sustainability pillar obtains a score of 0.8 and the best performer a 1.2. The same calculation is conducted for the environmental sustainability pillar.

Normalizing on a 0.8-to-1.2 scale and using the actual sample maximum and minimum are corroborated by the statistical distribution of the data, so as to ensure that the final data are not skewed. In the absence of empirical evidence, the selection of the impact limits (0.8–1.2) relies on the best judgment of the authors and is based on the assumption that countries can experience either an opportunity if they manage their resources well or a weakness if they do not.

The selection of this methodology is not intended to be scientific, but it represents a normative approach aimed at stimulating discussions on policy priorities and possibly stimulating scientific research in this field.

In the third step, the GCI score of each country is multiplied twice: once by its social sustainability coefficient and once by its environmental sustainability coefficient, to obtain two separate sustainability-adjusted GCI scores. Finally, an average of the two scores provides an overall measure of the sustainability adjustment.

STRUCTURE OF THE SUSTAINABILITY PILLARS

The computation of the sustainability components is based on an arithmetic mean aggregation of scores from the indicator level.^b

Variables that are not derived from the Executive Opinion Survey (the Survey) are identified by an asterisk (*) in the following pages. To make the aggregation possible, these variables are transformed into a 1-to-7 scale in order to align them with the Survey results. We apply a min-max transformation, which preserves the order of, and the relative distance between, country scores.^c

Indicators marked with a “(log)” subscript are transformed applying the logarithm (base 10) to the raw score.

Social sustainability pillar

- S01 Income Gini index*
- S02 Youth unemployment*
- S03 Access to sanitation*_(log)
- S04 Access to improved drinking water*^d
- S05 Access to healthcare services^d
- S06 Social safety net protection
- S07 Extent of informal economy
- S08 Social mobility
- S09 Vulnerable employment*

Environmental sustainability pillar

- S10 Stringency of environmental regulations^e
- S11 Enforcement of environmental regulations^e
- S12 Terrestrial biome protection*
- S13 No. of ratified international environmental treaties*
- S14 Baseline water stress*
- S15 Wastewater treatment*
- S16 CO₂ intensity*_(log)
- S17 Fish stocks overexploited*_(log)
- S18 Forest cover change*
- S19 Particulate matter (2.5) concentration*_(log)
- S20 Quality of the natural environment

NOTES

a. Formally we have

$$0.4 \times \left(\frac{\text{country score} - \text{sample minimum}}{\text{sample maximum} - \text{sample minimum}} \right) + 0.8$$

The *sample minimum* and *sample maximum* are, respectively, the lowest and highest country scores in the sample of economies covered by the sustainability-adjusted GCI in each pillar.

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

$$category_i = \frac{\sum_{k=1}^K indicator_k}{K}$$

c Formally, we have:

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

The *sample minimum* and *sample maximum* are, respectively, the lowest and highest country scores in the sample of economies covered by the sustainability-adjusted GCI. In some instances, adjustments were made to account for extreme outliers. For those indicators for which a higher value indicates a worse outcome (e.g., CO₂ emission, income Gini index), the transformation formula takes the following form, thus ensuring that 1 and 7 still corresponds to the worst and best possible outcomes, best possible outcomes, respectively:

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

d Variables S03, S04, and S05 are combined to form one single variable.

e Variables S10 and S11 are combined to form one single variable.

Appendix B:

Technical notes and sources for sustainability indicators

The data in this *Report* represent the best available estimates from various national authorities, international agencies, and private sources at the time the *Report* was prepared. It is possible that some data will have been revised or updated by the sources after publication. Throughout the *Report*, *n/a* denotes that the value is not available or that the available data are unreasonably outdated or do not come from a reliable source.

For each indicator, the title appears on the first line, preceded by its number to allow for quick reference. The numbering is the same as the one used in Appendix A. Below is a description of each indicator or, in the case of Executive Opinion Survey data, the full question and associated answers. If necessary, additional information is provided underneath.

S01 Income Gini index

Measure of income inequality [0 = perfect equality; 100 = perfect inequality] | 2010 or most recent

This indicator measures the extent to which the distribution of income among individuals or households within an economy deviates from a perfectly equal distribution. A Lorenz curve plots the cumulative percentages of total income received against the cumulative number of recipients, starting with the poorest individual. The Gini index measures the area between the Lorenz curve and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line. Thus a Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality.

Sources: World Bank, *World Development Indicators Online* (retrieved June 20, 2014); African Economic Outlook online statistics (retrieved March 21, 2014); Organisation for Economic Co-operation and Development (OECD), *Society at a Glance 2014*; US Central Intelligence Agency (CIA), *The World Factbook* (retrieved March 21, 2014); Eurostat, online statistics (retrieved March 21, 2014); national sources

S02 Youth unemployment

Percent of total unemployed youth to total labor force aged 15–24 | 2012 or most recent

Youth unemployment refers to the share of the labor force aged 15–24 without work but available for and seeking employment.

Sources: International Labor Organization, ILOstat database available at http://www.ilo.org/ilostat/faces/home/statisticaldata/bulk-download?_adf.ctrl-state=t48e83vhx_4&clean=true&_afLoop=76512585054249 (retrieved March 27, 2014); World Bank, *World Development Indicators Online* (retrieved June 20, 2014); national sources

S03 Access to sanitation

Percent of total population using improved sanitation facilities | 2012 or most recent

Share of the population with at least adequate access to excreta disposal facilities that can effectively prevent human, animal, and insect contact with excreta. Improved facilities range from simple but protected pit latrines to flush toilets with a sewerage connection. To be effective, facilities must be correctly constructed and properly maintained.

Source: World Health Organization, *World Health Statistics 2014* available at <http://apps.who.int/gho/data/node.main.606?lang=en> (retrieved June 27, 2014)

S04 Access to improved drinking water

Percentage of population with access to improved drinking water | 2012 or most recent

Share of the population with reasonable access to an adequate amount of water from an improved source, such as a household connection, public standpipe, borehole, protected well or spring, or rainwater collection. Unimproved sources include vendors, tanker trucks, and unprotected wells and springs. *Reasonable access* is defined as the availability of at least 20 liters per person per day from a source within 1 kilometer of the dwelling.

Source: World Health Organization, *World Health Statistics 2014*, available at <http://apps.who.int/gho/data/node.main.606?lang=en> (retrieved June 27, 2014)

S05 Access to healthcare services

How accessible is healthcare in your country? [1 = limited—only the privileged have access; 7 = universal—all citizens have access to healthcare] | 2013–2014 weighted average

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Chapter 1.3 of this *Report*.

S06 Social safety net protection

In your country, to what extent does a formal social safety net provide protection for the general population from economic insecurity in the event of job loss or disability? [1 = not at all; 7 = provides full protection] | 2013–2014 weighted average

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Chapter 1.3 of this *Report*.

S07 Extent of informal economy

In your country, how much economic activity would you estimate to be undeclared or unregistered? [1 = most economic activity is undeclared or unregistered; 7 = most economic activity is declared or registered] | 2013–2014 weighted average

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Chapter 1.3 of this *Report*.

S08 Social mobility

In your country, to what extent do individuals have the opportunity to improve their economic situation through their personal efforts regardless of the socioeconomic status of their parents? [1 = little opportunity exists to improve one's economic situation; 7 = significant opportunity exists to improve one's economic situation] | 2013–2014 weighted average

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Chapter 1.3 of this Report.

S09 Vulnerable employment

Proportion of own-account and contributing family workers in total employment | 2012 or most recent

Vulnerable employment refers to unpaid family workers and own-account workers as a percentage of total employment—that is, the share of own-account and contributing family workers in total employment. A contributing family worker is a person who is self-employed in a market-oriented establishment operated by a related person living in the same household, and who cannot be regarded as a partner because the degree of his or her commitment to the operation of the establishment, in terms of the working time or other factors to be determined by national circumstances, is not at a level comparable with that of the head of the establishment.

Source: World Bank, *World Development Indicators Online* (retrieved June 20, 2014)

S10 Stringency of environmental regulations

How would you assess the stringency of your country's environmental regulations? [1 = very lax, among the worst in the world; 7 = among the world's most stringent] | 2013–2014 weighted average

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Chapter 1.3 of this Report.

S11 Enforcement of environmental regulations

In your country, how would you assess the enforcement of environmental regulations? [1 = very lax, among the worst in the world; 7 = among the world's most rigorous] | 2013–2014 weighted average

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Chapter 1.3 of this Report.

S12 Terrestrial biome protection

Weighted average of the percentage of land area protected in each biome (weights are derived from the proportion of the national territory falling in each biome) | 2012 or most recent

This indicator is calculated by CIESIN (Columbia University's Center for International Earth Science Information Network) by overlaying the protected area mask on terrestrial biome data from Olson et al. (2001) for each country. A *biome* is defined as a major regional or global biotic community, such as a grassland or desert, characterized chiefly by the dominant forms of plant life and the prevailing climate. Scores are capped at 17 percent per biome such that higher levels of protection of some biomes cannot be used to offset lower levels of protection of other biomes, hence the maximum level of protection a country can achieve is 17 percent. CIESIN uses time series of the World Database on Protected Areas (WDPA) developed by the United Nations Environment Programme (UNEP) World Conservation Monitoring Centre (WCMC) in 2011, which provides a spatial time series of protected area coverage from 1990 to 2012. The WCMC considers all nationally designated protected areas whose location and extent is known. Boundaries were defined by polygons where available, and where they were not available protected area centroids were buffered to create a circle in accordance with the protected area size. The WCMC removed all overlaps between different protected areas by dissolving the boundaries to create a protected areas mask.

Source: Yale Center for Environmental Law & Policy (YCELP) and the Center for International Earth Science Information Network (CIESIN) at Columbia University, Environmental Performance Index 2014, available at <http://epi.yale.edu/epi/issue-rankings>

S13 No. of ratified international environmental treaties

Total number of ratified environmental treaties | 2012 or most recent

This indicator measures the total number of international treaties from a set of 25 for which a state is a participant. A state is acknowledged as a "participant" whenever its status for each treaty appears as "Ratified," "Accession," or "In Force." The treaties included are: the International Convention for the Regulation of Whaling, 1948 Washington; the International Convention for the Prevention of Pollution of the Sea by Oil, 1954, as amended in 1962 and 1969, 1954 London; the Convention on Wetlands of International Importance especially as Waterfowl Habitat, 1971 Ramsar; the Convention Concerning the Protection of the World Cultural and Natural Heritage, 1972 Paris; the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 London, Mexico City, Moscow, Washington; the Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973 Washington; the International Convention for the Prevention of Pollution from Ships (MARPOL) as modified by the Protocol of 1978, 1978 London; the Convention on the Conservation of Migratory Species of Wild Animals, 1979 Bonn; the United Nations Convention on the Law of the Sea, 1982 Montego Bay; the Convention on the Protection of the Ozone Layer, 1985 Vienna; the Protocol on Substances that Deplete the Ozone Layer, 1987 Montreal; the Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989 Basel; the International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990 London; the United Nations Framework Convention on Climate Change, 1992 New York; the Convention on Biological Diversity, 1992 Rio de Janeiro; the International Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, particularly Africa, 1994 Paris; the Agreement relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982, 1994 New York; the Agreement relating to the Provisions of the United Nations Convention on the Law of the Sea relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, 1995 New York; the Kyoto Protocol to the United Nations Framework Convention on the Climate Change, Kyoto 1997; the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, 1998 Rotterdam; the Cartagena Protocol of Biosafety to the Convention on Biological Diversity, 2000 Montreal; the Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances, 2000 London; the Stockholm Convention on Persistent Organic Pollutants, 2001 Stockholm; the International Treaty on Plant Genetic Resources for Food and Agriculture, 2001 Rome; the International Tropical Timber Agreement, 2006 Geneva.

Source: The International Union for Conservation of Nature (IUCN), Environmental Law Centre ELIS Treaty Database

S14 Baseline water stress**Normalized (0–5) ratio of total annual water withdrawals to total available annual renewable supply | 2010 or most recent**

This indicator measures total annual water withdrawals (municipal, industrial, and agricultural) expressed as a percentage of the total annual available flow. It is calculated as the ratio of water withdrawal to the mean available blue water (1950–2008). In turn, water withdrawals and available blue water are estimated separately. Water withdrawal is calculated in two steps: (1) national-level withdrawals are estimated using multiple regression time series models of withdrawals as a function of GDP, population, irrigated area, and electrical power production. Regressions are performed separately for each sector (domestic, industrial, and agricultural) and used to predict withdrawals for the current year. (2) These withdrawal estimates are then spatially disaggregated by sector based on regressions with spatial datasets. Available blue water is the sum of water flowing into the catchment from upstream catchments plus any imports of water to the catchment; upstream consumptive use plus runoff (precipitation minus evaporation and change in soil moisture storage) are then subtracted. For further details about the calculation of each component, please refer to the working paper “Aqueduct Metadata Document, Aqueduct Global Maps 2.0,” available at http://www.wri.org/sites/default/files/pdf/aqueduct_metadata_global.pdf.

Source: World Resources Institute, *Aqueduct Country and River Basin Rankings*, December 2013 edition, available at <http://www.wri.org/resources/data-sets/aqueduct-country-and-river-basin-rankings>

S15 Wastewater treatment**Percentage of wastewater that receives treatment weighted by connection to wastewater treatment rate | 2012 or most recent**

This indicator measures the percentage of wastewater that is treated before it is released back into ecosystems. The percentage of wastewater treated represents a measure of largely urban waste collection and treatment, since few rural areas are connected to sewage systems. The variable is calculated by weighting the average of the wastewater treatment rate values for the years 2000 through 2012 by the sewerage connection percentages. The original values are collated using a hierarchy of sources, selected in the following order: (1) country-level statistical data and reports; (2) values derived from the Organisation of Economic Co-operation and Development (OECD)’s variable “Connected to wastewater treatment plan without treatment” by taking the inverse of this percentage; (3) the United Nations Statistics Division’s “Population connected to wastewater treatment” variable; (4) secondary treatment levels from the *Pinsent Masons Water Yearbook*, 14th edition, available at <http://wateryearbook.pinsentmasons.com/>; and (5) FAO-AQUASTAT values (Total volume of wastewater treated/Total volume of wastewater collected) $\times 100$ for a given year in a given country.

Source: Yale Center for Environmental Law & Policy (YCELP) and the Center for International Earth Science Information Network (CIESIN) at Columbia University, Environmental Performance Index 2014, available at <http://epi.yale.edu/epi/issue-rankings>

S16 CO₂ intensity**CO₂ intensity (kg of CO₂ per kg of oil equivalent energy use) | 2010 or most recent**

Carbon dioxide (CO₂) emissions are those stemming from the burning of fossil fuels and the manufacture of cement. They include CO₂ produced during consumption of solid, liquid, and gas fuels and gas flaring. *Energy use* refers to use of primary energy before transformation to other end-use fuels, which is equal to indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircraft engaged in international transport. A logarithm transformation is applied to the ratio of these statistics in order to spread the data distribution.

Source: World Bank, *World Development Indicators database*, <http://data.worldbank.org> (retrieved June 20, 2014)

S17 Fish stocks overexploited**Fraction of the country’s exclusive economic zone with overexploited and collapsed stocks | 2011 or most recent**

The Sea Around Us (SAU) project’s Stock Status Plots (SSPs) are created in four steps (Kleisner and Pauly, 2011). In the first step, SAU defines a *stock* as a taxon (at the species, genus, or family level of taxonomic assignment) that occurs in the catch records for at least 5 consecutive years, over a minimum span of 10 years, and that has a total catch in an area of at least 1,000 tonnes over the time span. In the second step, SAU assesses the status of the stock for every year relative to the peak catch. SAU defines five states of stock status for a catch time series. This definition is assigned to every taxon that meets the definition of a stock for a particular spatial area (e.g., exclusive economic zones, or EEZs). These states are: (1) Developing—before the year of peak catch and less than 50 percent of the peak catch; (2) Exploited—before or after the year of peak catch and more than 50 percent of the peak catch; (3) Overexploited—after the year of peak catch and less than 50 percent but more than 10 percent of the peak catch; (4) Collapsed—after the year of peak catch and less than 10 percent of the peak catch; and (5) Rebuilding—after the year of peak catch and after the stock has collapsed, when catch has recovered to between 10 percent and 50 percent of the peak. In the third step, SAU graphs the number of stocks by status in a given year by tallying the number of stocks in a particular state and presenting these as percentages. In the final step, the cumulative catch of stock by status in a given year is summed over all stocks and presented as a percentage in the catch by stock status graph. The combination of these two figures represents the complete Stock Status Plot. The numbers for this indicator are taken from the overexploited and collapsed numbers of stocks over total numbers of stocks per EEZ. A logarithm transformation is applied to these statistics in order to spread the data distribution.

Source: Yale Center for Environmental Law & Policy (YCELP) and the Center for International Earth Science Information Network (CIESIN) at Columbia University, Environmental Performance Index 2014, available at <http://epi.yale.edu/epi/issue-rankings>

S18 Forest cover change**Forest cover change, as compared to 2000 levels | 2012 or most recent**

This indicator measures the percent change in forest cover between 2000 and 2012 in areas with greater than 50 percent tree cover. It factors in areas of deforestation (forest loss), reforestation (forest restoration or replanting), and afforestation (conversion of bare or cultivated land into forest). Hansen et al. (2013) used 650,000 Landsat 7 satellite images with a resolution of 30 meters to quantify the area of forest loss. As defined in Hansen et al. (2013), *trees* were defined as all vegetation taller than 5 meters. *Forest loss* was defined as a stand replacement disturbance or the complete removal of tree cover canopy at the Landsat pixel scale. Results were disaggregated by reference percent tree cover stratum (e.g., greater than 50 percent crown cover to approximately 0 percent crown cover) and by year.

Source: Yale Center for Environmental Law & Policy (YCELP) and the Center for International Earth Science Information Network (CIESIN) at Columbia University, Environmental Performance Index 2014, available at <http://epi.yale.edu/epi/issue-rankings>

S19 Particulate matter (2.5) concentration

Population-weighted exposure to $PM_{2.5}$ (micro-grams per cubic meter) | 2012 or most recent

$PM_{2.5}$, also known as *fine particulate matter*, refers to particles or droplets in the air that are 2.5 micrometers or less in width. Although invisible to the naked human eye as individual particles, $PM_{2.5}$ can reduce visibility and cause the air to appear hazy when its levels are elevated. This indicator is based on a model that was parameterized by data on aerosol optical depth (AOD) from NASA's MODIS, SeaWiFS, MISR satellite instruments, and the GEOS-Chem chemical transport model. The parameterized model covered all areas south of 70 degree north latitude and north of 70 degree south latitude. Van Donkelaar et al. estimated annual global surface $PM_{2.5}$ concentrations at a 10 x 10 km spatial resolution, and then created three-year moving averages from 2000 to 2012. Population-weighted average exposure values were calculated using population data from the Global Rural Urban Mapping Project (2011) database. For additional details, see Aaron van Donkelaar, January 2015 (embargoed), and http://epi.yale.edu/files/2014_epi_metadata.pdf.

Source: Yale Center for Environmental Law & Policy (YCELP) and the Center for International Earth Science Information Network (CIESIN) at Columbia University, Environmental Performance Index 2014, available at <http://epi.yale.edu/epi/issue-rankings>

S20 Quality of the natural environment

In your country, how would you assess the quality of the natural environment? [1 = extremely poor, among the worst in the world; 7 = among the world's most pristine] | 2013–2014 weighted average

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Chapter 1.3 of this Report.