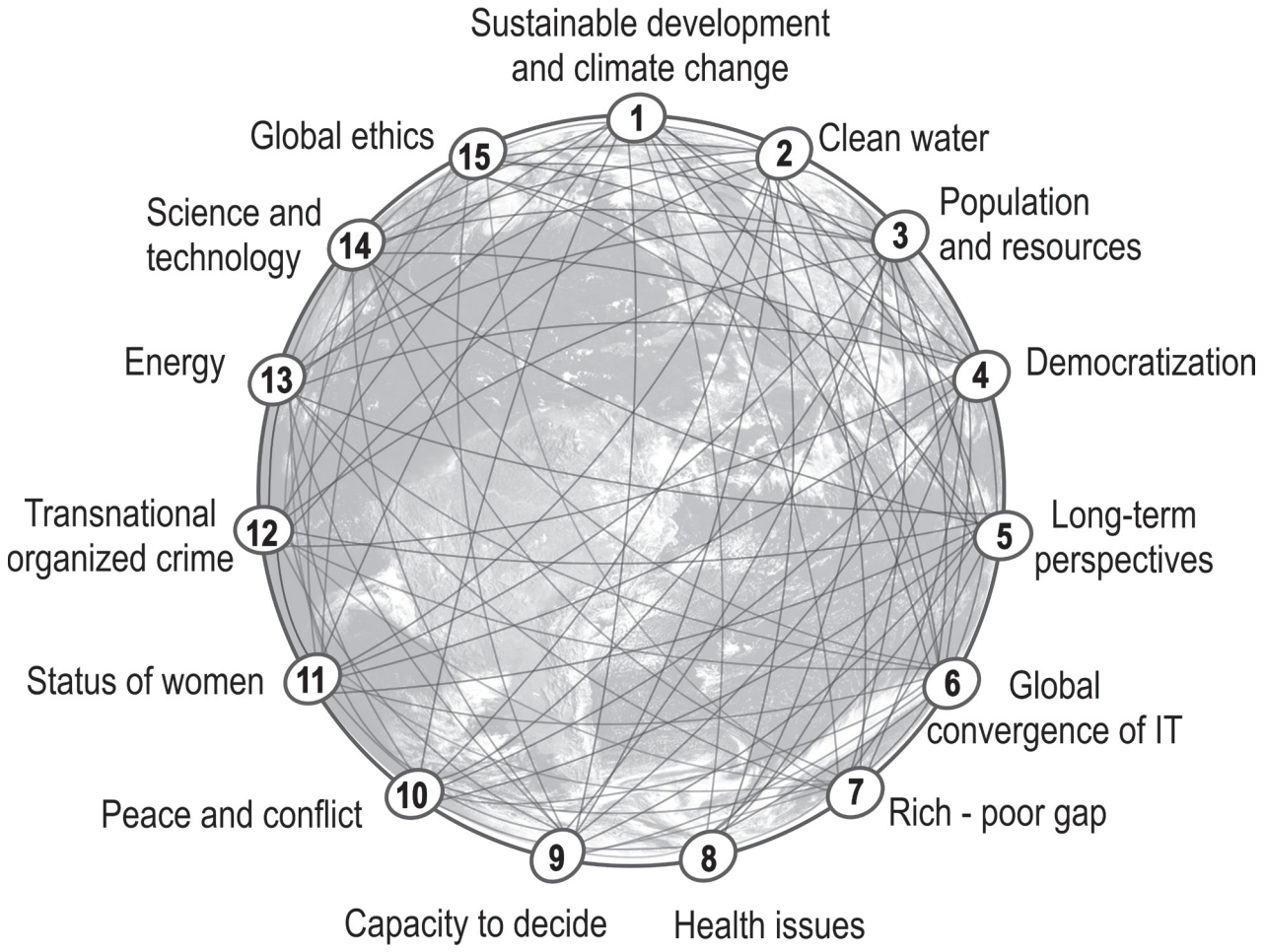
15 Global Challenges

The 15 Global Challenges provide a framework to assess the global and local prospects for humanity. The Challenges are interdependent: an improvement in one makes it easier to address others; deterioration in one makes it harder to address others. Arguing whether one is more important than another is like arguing that the human nervous system is more important than the respiratory system.



Readers are invited to contribute their insights to improve the overview of these 15 global challenges for next year's edition. Please use the online forms at www.StateoftheFuture.org (select "15 Global Challenges").

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Global Challenges

This chapter presents two-page descriptions of 15 Global Challenges that have been identified and updated through an ongoing Delphi process and environmental scanning since 1996. The scanning process includes feedback from Millennium Project global assessments on the future of specific topics like media, energy, education, etc.; staff and interns scanning the Internet; expert reviews from the previous year's text; on-line feedback; regional input from The Millennium Project Node Chairs; feedback from The Millennium Project's email lists; monitoring conferences, seminars, and publications; and discussions around the world as staff and Node Chairs give talks on these challenges. All of this is distilled for patterns, and data are updated and cross-referenced.

These Challenges are transnational in nature and transinstitutional in solution. They cannot be addressed by any government or institution acting alone. They require collaborative action among governments, international organizations, corporations, universities, NGOs, and creative individuals. Although listed in sequence, Challenge 1 on sustainable development and climate change is no more or less important than Challenge 15 on global ethics. There is greater consensus about the global situation as expressed in these Challenges and the actions to address them than is evident in the news media.

More detailed treatments of the Global Challenges are available in the CD's Chapter 1, totaling over 1,400 pages. For each Challenge, there is a more comprehensive overview, alternative views or additional comments from participants on the overview, regional perspectives and relevant information from recent literature, a set of actions with a range of views from interviews with decisionmakers to address the challenge, additional actions and views on those actions, and suggested indicators to measure progress or lack thereof.

Both print and CD versions are the cumulative and distilled range of views from over 4,000 participants. See the Appendix for the demographics of the participants and see the CD's Appendix A for the full list of participants. Full details of the questionnaires and interview protocols that have been used from 1996 to 2009 to generate both the short and more detailed treatments of these Challenges are available at www.millennium-project.org (select "Lookout Studies").

The graphs at the end of this chapter illustrate trends for several variables and developments that assess changes relevant to the Global Challenges presented. They were created using the State of the Future Index methodology with trend impact analysis outlined in Chapter 2 and detailed in the CD Chapter 2.

1. How can sustainable development be achieved for all while addressing global climate change?

Atmospheric CO_2 is 394.35 ppm as of May 2011, the highest in at least 2 million years. Each decade since 1970 has been warmer than the preceding one; 2010 tied 2005 as the warmest year on record. The world is warming faster than the latest IPCC projections. Even the most recent estimates may understate reality since they do not take into account permafrost melting. Humans add about 45 gigatons of CO_2 equivalent of GHGs per year; half is processed by nature and half accumulates in the atmosphere. By 2050 another 2.3 billion people could be added to the planet and income per capita could more than double, dramatically increasing greenhouse gases. Climate change threatens the well-being of all humans, especially the poor, who have contributed the least to the problem. They are the most vulnerable to climate change's impacts because they depend on agriculture and fisheries, and they lack financial and technological resources to cope. The amount of global wealth exposed to natural disasters risk has nearly tripled from $525.7 billion 40 years ago to $1.58 trillion. Large reinsurance companies estimate the annual economic loss due to climate change could reach $300 billion per year within a decade.

Climate change could be accelerated by dangerous feedbacks: melting ice/snow on tundras reflect less light and absorb more heat, releasing more methane, which in turn increases global warming and melts more tundra; warming ocean water releases methane hydrates from the seabed to the air, warming the atmosphere and melting more ice, which further warms the water to release more methane hydrates; the use of methane hydrates or otherwise disturbing deeper sea beds releases more methane to the atmosphere and accelerates global warming; Antarctic melting reflects less light, absorbs more heat, and increases melting; and the Greenland ice sheet (with 20% of the world's ice) could eventually slide into the ocean.

The synergy between economic growth and technological innovation has been the most significant engine of change for the last 200 years, but unless we improve our economic, environmental, and social behaviors, the next 100 years could be disastrous. According to UNEP's *Towards a Green Economy* report, investing 2% of global GDP ($1.3 trillion per year) into 10 key sectors can kick-start a transition toward a low-carbon, resource-efficient green economy that would increase income per capita and reduce the ecological footprint by nearly 50% by 2050 compared with business as usual. Meanwhile, the world spends 1–2% of global GDP on subsidies that often lead to unsustainable resource use. The World Bank established a $100 million fund to support developing countries to set up their own carbon-trading scheme.

Glaciers are melting, polar ice caps are thinning, and coral reefs are dying. Some 30% of fish stocks have already collapsed, and 21% of mammal species and 70% of plants are under threat. Oceans absorb 30 million tons of CO_2 each day, increasing their acidity. The number of dead zones—areas with too little oxygen to support life—has doubled every decade since the 1960s. Over the long term, increased CO_2 in the atmosphere leads to proliferation of microbes that emit hydrogen sulfide—a very poisonous gas.

International negotiations on the post-Kyoto framework have shown insufficient progress since the voluntary national reduction targets of the Copenhagen Accord. UNEP estimates that these pledges would lead to a 20% overshoot in emissions in 2020 compared with the levels required to limit global warming to 2°C and stabilize at 450 ppm CO_2. There is also a growing fear that the target itself is inadequate—that the world needs to lower CO_2 to 350 ppm or else the momentum of climate change could grow beyond humanity's ability to reverse it. Emissions from increased production of internationally traded products have more than offset the emissions reductions achieved under the Kyoto Protocol.

Although the Montreal Protocol is expected to restore the ozone layer by 2050, depletion of that layer this spring reached an unprecedented level over the Arctic due to the continuing presence of ozone-depleting substances in the atmosphere and a very cold winter in the stratosphere.

Humanity's material extraction increased by eight times during the twentieth century. Today our consumption of renewable natural resources is 50% larger than nature's capacity to regenerate. Global ecosystem services are valued at $16–64 trillion, which far exceeds the sums spent to protect them.

It is time for a U.S.–China Apollo-like 10-year goal and global R&D strategy to address climate change, focusing on new technologies like electric cars, saltwater agriculture, carbon capture and reuse, solar power satellites (a Japanese national goal), pure meat without growing animals, maglev trains, urban systems ecology, and a global climate change collective intelligence to support better decisions and keep track of it all. These technologies would have to supplement other key policy measures, including carbon taxes, cap and trade schemes, reduced deforestation, industrial efficiencies, cogeneration, conservation, recycling, and a switch of government subsidies from fossil fuels to renewable energy.

Scientists are studying how to create sunshades in space, build towers to suck CO_2 from the air, sequester CO_2 underground, and reuse carbon at power plants to produce cement and grow algae for biofuels. Other suggestions include retrofitting coal plants to burn leaner and to capture and reuse carbon emissions, raising fuel efficiency standards, and increasing vegetarianism (the livestock sector emits more GHGs than transportation does). Others have suggested new taxes, such as on carbon, international financial transactions, urban congestion, international travel, and environmental footprints. Such taxes could support international public/private funding mechanisms for high-impact technologies. Massive public educational efforts via popular film, television, music, games, and contests should stress what we can do.

Given the difficulty of reaching a unanimous agreement, some argue that alternative forums such as G-20, the Montreal Protocol, or the Major Economies Forum may be a more realistic platform to manage climate change. Without a global strategy to address climate change, the environmental movement may turn on the fossil fuel industries. The legal foundations are being laid to sue for damages caused by GHGs.

Climate change adaptation and mitigation policies should be integrated into an overall sustainable development strategy. Without sustainable growth, billions more people will be condemned to poverty, and much of civilization could collapse, which is unnecessary since we know enough already to tackle climate change while increasing economic growth. Challenge 1 will be addressed seriously when green GDP increases while poverty and global greenhouse gas emissions decrease for five years in a row.

Regional Considerations

Africa: The regional focus will be on adaptation to climate change rather than mitigation, as Africa does not contribute much CO_2. Southern Africa could lose more than 30% of its maize crop by 2030 due to climate change. Re-afforestation, saltwater agriculture along the coasts, and solar energy in the Sahara could be massive sources of sustainable growth.

Asia and Oceania: China is the world's largest CO_2 emitter, but it plans to cut the amount of energy and CO_2 per unit of economic growth by 16–17% from 2011 to 2016. Japan pledged to cut GHG emissions by 25% from 1990 levels by 2020, but its emissions are still well above the 1990 levels, and the government has failed to establish a domestic carbon trading market. More-stringent producer responsibility policies in South Korea triggered a 14% increase in recycling rates and an economic benefit of $1.6 billion. China and India lose as much as 12% and 10% respectively of their GDP due to environmental damage. As part of a $1 billion deal with Norway, Indonesia introduced a two-year moratorium on new permits to clear primary forest.

Europe: Europe's emission trading scheme in 2010 accounted for 75% of the world's carbon emissions trading. GHG emissions covered under EU ETS increased 3% due to the economic recovery, but the EU is on track to meet the Kyoto target of 8% reduction. However, if carbon contents of imported goods are counted, EU's reduction drops to 1%.

Russia's GHG emissions fell 3.3% in 2009, reversing a 10-year steady increase, and Russia aims to reduce GHG emissions by 22–25% by 2020 compared with 1990 (which is still an increase in absolute terms, since Russia's emissions plunged sharply after the collapse of the Soviet Union). Nitrogen pollution from farms, vehicles, industry, and waste treatment costs the EU up to 320 billion euros per year. Germany tops the first Green Economy Index as a country with strongest green leadership.

Latin America: South America has 40% of the planet's biodiversity and 25% of its forests. Brazil announced in December 2010 that deforestation in the Brazilian Amazon had fallen to its lowest rate for 22 years, but the latest data show a 27% jump in deforestation from August 2010 to April 2011, mostly in soybean areas. National pressures for hydro and biofuel energy and international pressures for food may be too strong to preserve ecosystems in Brazil. Concentration of land tenure, breakup of farms into smaller parcels, and conversion of rural areas into new urban settlements are generating irreversible ecological damage in most countries. Recycling in Brazil generates $2 billion a year, while avoiding 10 million tons of GHG emissions. Bolivia introduced a new law that grants nature equal rights to humans and has proposed an international treaty with similar concepts.

North America: Without a successful green tech transition, U.S. GHG emissions may increase by 6% between 2005 and 2035. Air pollution and exposure to toxic chemicals cost U.S. children $76.6 billion in health expenses. Two-thirds of Latinos in the U.S. live in areas that do not comply with federal standards for air quality, and Hispanics are three times more likely than whites to die from asthma. Permafrost temperature in northern Alaska increased about 4–7°C during the last century, almost half of it during the last 20 years. On average, every American wastes 253 pounds of food every year. U.S. Congress refused to end oil subsidies.

2. How can everyone have sufficient clean water without conflict?

Water should be central to development and climate change strategies. Over half the world could live in water-stressed areas by 2050 due to population growth, climate change, and increasing demand for water per capita. According to IFPRI this would put at risk approximately $63 trillion of the global economy just 39 years from today. By 2030 global water demand could be 40% more than the current supply. This could change with new agricultural practices, policy changes, and intelligently applied new technologies. Otherwise conflicts over trade-offs among agricultural, urban, and ecological uses of water are likely to increase, along with the potential for mass migrations and wars. Although water-related conflicts are already taking place, water-sharing agreements have been reached even among people in conflict and have led to cooperation in other areas.

Today, some 2.4 billion people live in water-scarce regions. Falling water tables worldwide and increasing depletion of sustainably managed water lead some to introduce the concept of "peak water," similar to peak oil. Nevertheless, the world is on track to meet the MDG target on drinking water, but it is likely to miss the MDG sanitation target by almost 1 billion people. Since 1990, an additional 1.3 billion people gained access to improved drinking water and 500 million got better sanitation. Yet 884 million people still lack access to clean water today (down from 900 million last year), and 2.6 billion people still lack access to safe sanitation. Nature also needs sufficient water to be viable to support all life.

About 80% of diseases in the developing world are water-related; most are due to poor management of human excreta. At least 1.8 million children under five die every year due to unsafe water, inadequate sanitation, and the lack of hygiene. Diarrheal disease in children under 15 has a greater impact than HIV, malaria, and tuberculosis combined. WHO estimates that every dollar invested in improved sanitation and water produces economic benefits that range from $3 to $34, depending on the region and types of technologies applied.

Agriculture accounts for 70% of human usage of fresh water; the majority of that is used for livestock production. Such water demands will increase to feed growing populations with increasing incomes. Global demand for meat may increase by 50% by 2025 and double by 2050, further accelerating the demand for water per capita. The UN estimates that $50–60 billion annually between now and 2030 is needed to avoid future water shortages. Some 30% of global cereal production could be lost in current production regions due to water scarcity, yet new areas in Russia and Canada could open due to climate change. Cooling systems for energy production require large amounts of water. Energy demand may increase 40% in 20 years; coupled with increased food demands, dramatic changes in water management will be required.

Breakthroughs in desalination, such as pressurization of seawater to produce vapor jets, filtration via carbon nanotubes, and reverse osmosis, are needed along with less costly pollution treatment and better water catchments. Future demand for fresh water could be reduced by saltwater agriculture on coastlines, producing pure meat without growing animals, increasing vegetarianism, fixing leaking pipes, and the reuse of treated water.

Development planning should integrate the lessons learned from producing more food with less water via drip irrigation and precision agriculture, rainwater collection and irrigation, watershed management, selective introduction of water pricing, and successful community-scale projects around the world. Plans should also help convert degraded or abandoned farmlands to forest or grasslands; invest in household sanitation, reforestation, water storage, and treatment of industrial effluents in multipurpose water schemes; and construct eco-friendly dams, pipelines, and aqueducts to move water from areas of abundance to scarcity. Just as it has become popular to calculate someone's carbon footprint, people are beginning to calculate their "water footprint." The UN General Assembly declared access to clean water and sanitation to be a human right.

Challenge 2 will have been addressed seriously when the number of people without clean water and those suffering from water-borne diseases diminishes by half from their peaks and when the percentage of water used in agriculture drops for five years in a row.

Regional Considerations

Africa: Africa's rapid urbanization has outpaced its capacity to provide sufficient water; the population without such access has nearly doubled since 1990 to over 55 million today. The ZAMCOM agreement to consolidate regional water management needs ratification by one more of the eight countries sharing the Zambezi river basin to come into effect. In the meantime, Mozambique, Zambia, and Zimbabwe moved ahead and signed a memorandum of understanding to improve power generation along the river. Foreign aid covers up to 90% of some sub-Saharan African countries' water and sanitation expenditures. Without policy changes, this region will not meet the MDG target on water until 2040 and the one on sanitation until 2076. Uganda launched a €212 Kampala Lake

Victoria Water and Sanitation project to upgrade and rehabilitate water supply and sanitation in urban and peri-urban Kampala. The "Safe Water for Africa" partnership plans to raise over $20 million to provide safe water to at least 2 million Africans by 2012. Since the majority of Africa depends on rain-fed agriculture, upgrading rain-fed systems and improving agricultural productivity will immediately improve millions of lives. Putting sanitation facilities in some village schools could bring girls back to school.

ASIA AND OCEANIA: Asia has 60% of the world's population but only 28% of its fresh water. Inadequate sanitation costs the economies of four Southeast Asian countries the equivalent of about 2% of their GDP. Agriculture accounts for between 65% and 90% of national water consumption across the Middle East, and underground aquifers are rapidly depleting. Yemen may have the first capital city to run out of water; it has the world's second-fastest growing population; its water tables are falling by 6.5 feet per year, and increasing water prices could spark social unrest. A massive infrastructure project plans to take water from the Yangtze River Basin and supply Beijing by 2014. In the meantime, the Beijing government will set aside $3.5 million to buy water from other provinces in 2011. More than 70% of China's waterways and 90% of its groundwater are contaminated; 33% of China's river and lake water is unfit for even industrial use; deep-groundwater tables have dropped by up to 90 meters in the Hai river basin. The water situation in China is expected to continue to get worse for the next six to nine years under the best-case scenarios. With only 8% of the world's fresh water, China has to meet the needs of 22% of the world's population. Forced migration due to water shortages has begun in China, and India should be next. The Yangtze, Mekong, Salween, Ganges, and Indus are among the 10 most polluted rivers in the world. India feeds 17% of the world's people on less than 5% of the world's water and 3% of its farmland. Mobile and nearly waterless public toilets that need to be cleaned only once a week will be piloted in Delhi, India. Saltwater intrusion into Bangladeshi coastal rivers reaches 100 miles inland and will increase with climate change. By 2050, an additional 1.5 billion m^3 of water will be needed in the Middle East, of which about a third will be allocated to the Palestinian Authority and Jordan. Chapter 10 of the Middle East Geneva Accords explains how to resolve Israeli-Palestinian water issues.

EUROPE: In 2009–10, water scarcity occurred in much of Southern Europe: the Czech Republic, Cyprus, and Malta reported continuous water scarcity; France, Hungary, the UK, Portugal, and Spain reported droughts or rainfall levels lower than the long-term average. The EU is to conduct a Policy Review for water scarcity and droughts in 2012. EU took Portugal to court for failing to submit river basin plans, an obligation under the EU Water Framework Directive. Water utilities in Germany pay farmers to switch to organic operations because it costs less than removing farm chemicals from water supplies. Spain is the first country to use the water footprint analysis in policymaking. The European Commission launched a €40-million fund to improve access to water in Africa, the Caribbean, and the Pacific. The world's largest reserves of fresh water are in Russia, which could export water to China and Middle Asia.

LATIN AMERICA: The region has 31% of the world's fresh water, yet 50 million people there have no access to safe drinking water, 125 million lack sanitation services, and 40% live in areas that hold only 10% of the region's water resources. The region's water demand could increase 300% by 2050. Mexico launched "2030 Water Agenda" for universal water access and wastewater treatment. Costa Rica needs to invest $2.4 billion to improve water and sanitation conditions by 2030. El Salvador will be hit hardest by water shortages in the region. Glaciers are shrinking, risking the region's water, agriculture, and energy security; 68% of the region's electricity is from hydroelectric sources. Water crises might occur in megacities within a generation unless new water supplies are generated, lessons from both successful and unsuccessful approaches to privatization are applied, and legislation is updated for more reliable, transparent, and consistent integrated water resources management.

NORTH AMERICA: The U.S. may have passed its "peak water" level in the 1970s. More than 30 states are in litigation with their neighbors over water. Some 13% of Native American households have no access to safe water and/or wastewater disposal, compared with 0.6% in non-native households. Each kilowatt-hour of electricity in the U.S. requires about 25 gallons of water for cooling, making power plants the second largest water consumer in the country (39% of all water withdrawals) after agriculture. Western Canada's tar sands consume an estimated 20–45 cubic meters of water per megawatt-hour, nearly 10 times that for conventional oil extraction. Canada is mapping its underground water supplies to help policymakers prevent water shortages. Government agricultural water subsidies should be changed to encourage conservation.

3. How can population growth and resources be brought into balance?

There were 1 billion humans in 1804; 2 billion in 1927; 6 billion in 1999; and 7 billion today. The UN's forecasts for 2050 range from 8.1 billion to 10.6 billion, with 9.3 billion as the mid-projection. Nearly all the population increases will be in urban areas in developing countries, where the slum population expanded from 767 million in 2000 to 828 million in 2010 and is expected to reach 889 million by 2020. Without sufficient nutrition, shelter, water, and sanitation produced by more intelligent human-nature symbioses, increased migrations, conflicts, and disease seem inevitable. ICT continues to improve the match between needs and resources worldwide in real time, and nanotech will help reduce material use per unit of output while increasing quality. However, food prices may continue to rise due to increasing affluence (especially in India and China), soil erosion and the loss of cropland, increasing fertilizer costs (high oil prices), market speculation, aquifer depletion, falling water tables and water pollution, diversion of crops to biofuels, increasing meat consumption, falling food reserves, diversion of water from rural to urban, and a variety of climate change impacts. The World Bank estimates that rising food prices pushed an additional 44 million people into poverty between June 2010 and January 2011.

Population dynamics are changing from high mortality and high fertility to low mortality and low fertility. If fertility rates continue to fall, world population could actually shrink to 6.2 billion by 2100, creating an elderly world difficult to support; if not, however, the UN projects 15.8 billion by 2100. Today life expectancy at birth is 68 years, which is projected to grow to 81 by 2100; with advances in longevity research, this projection will increase. About 20% of the world will be over 60 by 2050, and 20% of the older population will be aged 80 or more. Some 20% of Europeans are 60 or older, compared with 10% in Asia and Latin America and 5% in Africa. Over 20 countries have falling populations, which could increase to 44 countries by 2050, with the vast majority of them in Europe. Countering this "retirement problem" is the potential for future scientific and medical breakthroughs that could give people longer and more productive lives than most would believe possible today. People will work longer and create many forms of tele-work, part-time work, and job rotation to reduce the economic burden on younger generations and to keep up living standards.

Meanwhile, 925 million people were undernourished in 2010 (reduced from over 1 billion in 2009), while 30–40% of food production from farm to mouth is lost in many countries. The WFP provides food assistance to more than 90 million people in 73 countries, yet in some of these countries, agricultural lands (mostly in sub-Saharan Africa) are being sold or leased to foreign investors to feed their own countries. OECD estimates that the private sector's investment in farmland and agricultural infrastructure is as much as $25 billion and could double or triple over the next three to five years. Responsible Agricultural Investment, backed by the World Bank and UN agencies, aims to promote investment that respects local rights and livelihoods, but it is heavily criticized by NGOs as a move to legitimize land grabbing.

To keep up with population and economic growth, food production should increase by 70% by 2050. Meat consumption is predicted to increase from 37kg/ person/year in 2000 to over 52kg/person/year by 2050; if so, then 50% of cereal production would go to animal feed.

Monocultures undermine biodiversity, which is critical for agricultural viability. Conventional farming relying on expensive inputs is not resilient to climatic change. Agricultural productivity could decline 9–21% in developing countries by 2050 as a result of global warming. Massive wheat damage by the Ug99 fungus in 2009 was less in 2010; its genome is now sequenced, leading to countermeasures, but it remains a threat according to FAO. Small-scale farmers can double food production within 10 years by using ecological methods. Agroecological farming projects have shown an average crop yield increase of 80% in 57 countries, with an average increase of 116% for all African projects. Aquaculture produces about half of human-consumed fish.

New agricultural approaches are needed, such as producing pure meat without growing animals, better rain-fed agriculture and irrigation management, genetic engineering for higher-yielding and drought-tolerant crops, precision agriculture and aquaculture, and saltwater agriculture on coastlines to produce food for human and animals, biofuels, and pulp for the paper industry as well as to absorb CO_2, reduce the drain on freshwater agriculture and land, and increase employment. An animal rights group has offered $1 million to the first producers of commercially viable in-vitro chicken by mid-2012.

Challenge 3 will be addressed seriously when the annual growth in world population drops to fewer than 30 million, the number of hungry people decreases by half, the infant mortality rate decreases

by two-thirds between 2000 and 2015, and new approaches to aging become economically viable.

REGIONAL CONSIDERATIONS

AFRICA: FAO estimates that 20 million hectares of farmland have been acquired by foreign interests in Africa during the last three years, many with 50-year leases or more. About 40% of children under five are chronically malnourished. Very rapid growth of the young population and low prospects for employment in most nations in sub-Saharan Africa and some nations in the Muslim world could lead to prolonged instability until at least the 2030s. Africa's population doubled in the past 27 years to reach 1 billion and could reach 3.6 billion by 2100. Niger's population growth exceeds economic growth; if its birth rate is halved by 2050, the population will grow from 14 million today to 53 million by 2050, while if the birth rate continues at current levels the population will grow to 80 million. Much of the urban management class is being seriously reduced by AIDS, which is also lowering life expectancy. Only 28% of married women of childbearing age are using contraceptives, compared with the global average of 62%. Africa's ecological footprint could exceed its biocapacity within the next 20 years. Conflicts continue to prevent development investments, ruin fertile farmland, create refugees, compound food emergencies, and prevent better management of natural resources.

ASIA AND OCEANIA: Asia's urban population may grow to 3.1 billion by 2050. China has 88 cities with populations over 1 million. It plans to merge nine cities in the South to create a "mega-city" the size of Switzerland. China has to feed 22% of the world's population with less than 7% of the world's arable land. There were six Chinese children for every one elder in 1975; by 2035 there will be two elders for every one child. China is growing old before it has grown rich. The fertility rate in China has fallen from 5.8 children in 1970 to 1.5 today. By 2050, those 65 years or older will be 38% of Japan's population and 35% of South Korea's. Approximately a third of the population in the Middle East is below 15; another third is 15–29; youth unemployment there is over 25%. New concepts of employment may be needed to prevent political instability.

EUROPE: After 2012, the European working-age population will start to shrink, while the number of individuals aged 60 and over will continue to increase by about 2 million per year. Europe's low fertility rate and its aging and shrinking population will force changes in pension and social security systems, incentives for more children, and increases in immigrant labor, affecting international relations, culture, and the social fabric. The EU27 population at-risk-of-poverty has fluctuated around 16.5% since 2005. Tensions among the EU member states over the influx of thousands of illegal immigrants in the wake of "the Arab Spring" intensify as Mediterranean countries, led by Italy, ask for greater burden sharing and may lead to changes in the Schengen treaty. Rural populations are expected to shrink, freeing additional land for agriculture.

LATIN AMERICA: About 85% of the region will be urban by 2030, requiring massive urban and agricultural infrastructural investments. Over 53 million people are malnourished. Brazil, Ecuador, Venezuela, Guatemala, Honduras, and Nicaragua have approved food security laws to ensure local agricultural products are primarily used to feed their own populations and not for export; nine more countries are planning the same. Latin America's elderly population is likely to triple from 6.3% in 2005 to 18.5% in 2050—to 188 million. By 2050, half of Mexico's population will be older than 43, an 18-year increase in median age. As fertility rates fall in Brazil and longevity increases by 50% over the next 20 years, the ability to meet financial requirements for the elderly will diminish; hence, the concept of retirement will have to change and social inclusion will have to improve to avoid future intergenerational conflicts.

NORTH AMERICA: The number of those 65 or older in the U.S. is expected to grow from about 40 million in 2009 to 72 million in 2030. About 15% of American girls now begin puberty by age 7, potentially increasing girls' odds of depression and behavioral problems. Less than 2% of the U.S. population provides the largest share of world food exports, while 37 million people in the U.S. receive food from Feed America. Two-thirds of people in the U.S. are overweight or obese. Reducing "throw-away" consumption could change the population-resource balance. Biotech and nanotech are just beginning to have an impact on medicine; hence dramatic breakthroughs in longevity seem inevitable in 25–50 years. Vancouver, Toronto, and Calgary are among the five most livable cities of the world. Global warming should increase Canadian grain exports.

4. How can genuine democracy emerge from authoritarian regimes?

Peaceful protests with unrelenting public courage to demand democratic transitions from authoritarian regimes made history across the Arab world. Unparalleled forms of social power are shaping the future of democracy. Tensions between an expanding global consciousness and old structures that limit freedom are giving birth to new experiments in governance. Although the perception and implementation of democracy differ globally, it is generally accepted that democracy is a relationship between a responsible citizenry and a responsive government that encourages participation in the political process and guarantees basic rights.

Social revolutions in 2011 are not yet reflected in Freedom House's 2010 ratings, which showed political and civil liberties declined for the fifth consecutive year, the longest decline since 1972, when the annual analysis began. Freedom declined in 25 countries and improved in 11. Those living in 87 "free" countries constituted 43% of world population, while 20% live in 60 "partly free" countries, and 35% (over 2.5 billion people) live in 47 countries listed as "not free." There were 115 electoral democracies in 2010, compared with 123 in 2005. Press freedoms have declined for nine consecutive years; 15% of the world lives in the 68 countries with a "free" press, 42% in 65 countries with a "partly free" press, and 43% live in 63 countries without free media.

Predominantly young and increasingly educated populations are using the Internet to organize around common ideals, independent of conventional institutional controls and regardless of nationality or languages. These new forms of Internet-augmented democracy are beginning to wield unparalleled social power, often bypassing conventional news media, as happened in the Arab Spring Awakening, where 60% of the population is below the age of 30. And next? The transition to stable democracies will be difficult (see Chapter 3). New democracies must address previous abuses of power to earn citizens' loyalties without increasing social discord and slowing the reconciliation process.

Some global trends nurturing the emergence of democracy include increasing literacy, interdependence, Internet access, e-government systems, international standards and treaties, multipolarity and multilateralism in decisionmaking, developments that force global cooperation, improved quality of governance assessment systems, transparent judicial systems, and the growing number and power of NGOs. It is critical to establish legitimate tamper-proof election systems with internationally accepted standards for election observers. Some 20 countries offer legally binding Internet voting. Direct voting on issues via the Internet could be next to augment representative democracy.

Since an educated and informed public is critical to democracy, it is important to learn how to counter and prevent disinformation, cyberwarfare, politically motivated government censorship, reporters' self-censorship, and interest-group control over the Internet and other media. Organized crime, corruption, concentration of media ownership, corporate monopolies, increased lobbying, and impunity threaten democracy. Old ideological, political, ethnic, and nationalistic legacies also have to be addressed to maintain the long-range trend toward democracy. Fortunately, injustices in different parts of the world become the concern of others around the world, who then pressure governing systems to address the issue. Despite restrictions and intimidations, independent journalists, intellectuals, and concerned citizens are increasing global transparency via digital media.

Although making development assistance dependent on good governance has helped in some countries, genuine democracy will be achieved when local people—not external actors—demand government accountability. Since democracies tend not to fight each other and since humanitarian crises are far more likely under authoritarian than democratic regimes, expanding democracy should help build a peaceful and just future for all. Meanwhile, international procedures are needed to assist failed states or regions within states, and intervention strategies need to be designed for when a state constitutes a significant threat to its citizens or others.

Challenge 4 will be addressed seriously when strategies to address threats to democracy are in place, when less than 10% of the world lives in nondemocratic countries, when Internet and media freedom protection is internationally enforced, and when voter participation exceeds 60% in most democratic elections.

Regional Considerations

Africa: North African revolutions are not reflected in Freedom House's 2010 ratings. Ratings for sub-Saharan African democracy continued to decline; Ethiopia and Djibouti changed status to

"not free," while only Guinea improved to "partly free." Freedom House rated 9 countries in the region as "free," 22 as "partly free", and 17 "not free." Democratic elections are still difficult due to intimidation and fraud. The Charter on Democracy, Elections and Governance adopted by the African Union in 2007 was signed by 37 AU Members; as of mid-May 2011 eight countries have ratified and another eight deposited the instruments of ratification, increasing the likelihood of increasing democratic values in the region. Priorities for building democracy in Africa include improving education, citizenry, and Internet access, while reducing corruption, sectarianism, violence, and patronage.

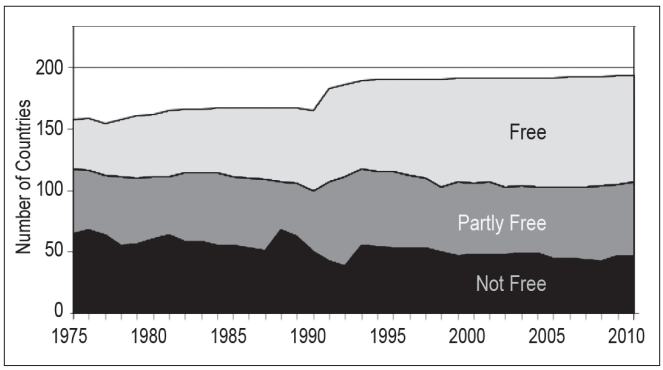
ASIA AND OCEANIA: Over the past few years, South Asia experienced more gains than setbacks, notes Freedom House. It rated 16 countries as "free" in the Asia-Pacific region, 15 as "partially free," and 8 as "not free." Notably successful elections took place in the Philippines and Tonga, while Sri Lanka suffered the most prominent decline in the region, due to its elections. Violent reprisal and censorship continue in several other countries. President Hu of China announced plans to improve its social management system by the end of the decade and turn China into a *xiaokang* (moderately prosperous and happy) society. Since the country is home to over half of the world population presently living in countries rated "not free," a modification of its status would change the world map of democracy. Among Central Asian countries, Kyrgyzstan's status improved from "not free" to "partly free," while Afghanistan continued to decline. In the Middle East and North Africa, Israel remains the only country ranked "free" and qualifying as an electoral democracy, while 3 countries are "partly free" and 14 "not free." However, the uprisings of 2011 open new possibilities for a more democratic society, despite the violent response of some countries' authoritarian regimes.

EUROPE: All 27 EU countries are rated "free," the EU Parliament is the largest transnational democratic electorate in the world, and the European Citizens' Initiative became law, enabling direct participation of citizens to propose regulations in areas under the Commission's authority. Yet, an increasing number of immigrants from Africa and Asia and their poor integration challenge the region's tradition of tolerance and civil liberties. Several member states call for a revision of the Schengen treaty on open borders. While the EU has the world's greatest press freedom, Hungarians protested against new media control legislation that some felt could return state censorship. In most Central and East European (non-EU) countries, autocracy and lack of progressive institutions continues to hinder the democratization process. However, gains were noted in Georgia and Moldova, while Russia continues aggressive efforts to curb corruption.

LATIN AMERICA: The democratization of governments in the region is interrelated with the actions of the U.S. The big challenge for Latin America is the institutional weakness for addressing organized crime that is threatening its democracies. The interlinking of organized crime and government corruption caused Mexico's status to change in 2010 from "free" to "partly free." Freedom House rated 22 countries in the region "free," 10 "partly free," and 1"not free." The system of primary elections in some countries favors those who are already in power and limits the freedom of choice for large majorities. However, a sense of solidarity of the people and increased influence of civil society organizations, as well as examples of democratic governance set by Chile and Brazil, are helping to strengthen democratic processes.

NORTH AMERICA: Concerns persist in Canada and the U.S. about the electoral processes, the concentration of media ownership, and powerful lobbies. Greater corporate and union spending on election advertising increases worries over political corruption. The U.S. State Department has budgeted $67 million to support democratic development in lower-income countries, while at home the future for 10–13 million illegal aliens challenges human rights and jurisprudence. Canada had four national elections in the past seven years. The Web site pairvote.ca is facilitating pairing voters from different voting districts to vote for each other's party, thus keeping the balance of popular vote unchanged while improving proportionate representation.

Figure 5. Global trends in freedom



Source: Freedom in the World 2011, Freedom House

5. How can policymaking be made more sensitive to global long-term perspectives?

The earthquakes, tsunamis, and nuclear disasters in Japan exposed the need for global, national, and local systems for resilience—the capacity to anticipate, respond, and recover from disasters while identifying future technological and social innovations and opportunities. The Ministry of Foreign Affairs in Denmark notes that for every $1 invested in resilience and prevention, $4–7 are saved in response. Related to resilience is the concept of collective intelligence—emergent properties from synergies among brains, software, and information (see the CD Chapter 6), which will be increasingly required to cope with accelerating knowledge explosions, complexities, and interdependencies. Implementing and integrating resilience and collective intelligence systems is one way to make policymaking more sensitive to global long-term perspectives.

Heads of government could benefit from establishing an Office of the Future connected to related units in government agencies whose functions would continue from one administration to the next. These can be augmented by advisory councils of futurists and be connected to resilience and collective intelligence systems that scan for change around the world and can identify and assess expert judgments in real-time (the Real-Time Delphi is an example). The staff for such systems should synthesize futures research from others, calculate State of the Future Indexes for relevant subjects or countries (see Chapter 2), and produce annual state of the future reports. Existent government future strategy units (see the CD Chapter 4.1) are being networked by Singapore's Future Strategy Unit to share best practices, just as the UN Strategic Planning Network connects 12 UN agency strategy units. These two networks could also be connected with the Office of the UN Secretary-General to help coordinate strategies and goals. Leaders should make these new systems as transparent and participatory as possible to include and increase the public's intelligence and resilience. As a result, more future-oriented and global-minded voters might elect leaders who are sensitive to global long-term perspectives.

National legislatures could establish standing "Committees for the Future," as Finland has done. National foresight studies should be continually updated, improved, and conducted interactively with issue networks of policymakers and futurists and with other national long-range efforts. Futurists should create more useful communications to policymakers. Alternative scenarios should be shared with parliamentarians and the public for feedback. They should show cause-and-effect relations and expose decision points leading to different consequences from different strategies and policies. Decisionmakers and their advisors should be trained in futures research for optimal use of these systems (see www.millennium-project.org/millennium/FRM-V3.html). Government budgets should consider 5–10 year allocations attached to rolling 5–10 year SOFIs, scenarios, and strategies. Governments with short-term election cycles should consider longer, more-stable terms and funds for the staff of parliamentarians. A checklist of ways to better connect futures research to decisionmaking is available in Chapter 12 of the CD.

It could be that humanity needs and is ready to create a global, multifaceted, general long-range view to help it make better long-range decisions to the benefit of the species. Communications and advertising companies could create memes to help the public become sensitive to global long-term perspectives so that more future-oriented educated publics could support more future-oriented, global-minded politicians. Prizes could be given to recognize the best examples of global long-term decisionmaking. Participatory policymaking processes augmented by e-government services can be created that are informed by futures research. Universities should fund the convergence of disciplines, teach futures research and synthesis as well as analysis, and produce generalists in addition to specialists. Efforts to increase the number and quality of courses on futures concepts and methods should be supported, as well as augmenting standard curricula with futures methodologies converted to teaching techniques that help future-orient instruction.

Although there is increasing recognition that accelerating change requires global longer-term perspectives, decisionmakers feel little pressure to consider them. Nevertheless, attaining long-range goals like landing on the moon or eradicating smallpox that were considered impossible inspired many people to go beyond selfish, short-term interests to great achievements. (An international assessment of such future goals is found in Chapter 4.2 on the CD.) To some degree, the G20 was initiated to improve global long-range policymaking, and one day the G2 (U.S. and China) may lead global climate change and other long-range policies. Governments could add foresight as a performance evaluation criterion, add foresight to their training institutions, and require a "future considerations" section be added to policy reporting requirements. Promote the meme: from reaction to anticipation.

Each of the 15 Global Challenges in this chapter and the eight UN Millennium Development Goals could be the basis for transinstitutional coalitions composed of self-selected governments, corporations, NGOs, universities, and international organizations that are willing to commit the resources and talent to address a specific challenge or goal. Challenge 5 will be addressed seriously when foresight functions are a routine part of most organizations and governments, when national SOFIs are used in at least 50 countries, when the consequences of high-risk projects are routinely considered before they are initiated, and when standing Committees for the Future exist in at least 50 national legislatures.

REGIONAL CONSIDERATIONS

AFRICA: Foresightfordevelopment.org makes research documents, projects, scenarios, people, and blogs available to support African futures research. South Africa produces the regional Risk and Vulnerability Atlas to aid long-range planning. China has become a force in African long-range planning. Daily management of many African countries makes future global perspectives difficult; hence, more-regional bodies like the African Union and the African Development Bank are more likely to further futures work in Africa and should build on 10 years of work of UNDP/African Futures. Civil society is also becoming a bigger stakeholder and lobby in foresight.

ASIA AND OCEANIA: China's Five Year Plan promotes long-term thinking, and since it tends to make decisions in a longer time frame than others, its increasing power and eventually that of India should lead to more global, long-term decisionmaking as these nations interact with the rest of the world. Japan includes private-sector companies in its long-term strategic planning unit. The Prime Minister's Office of Singapore has begun an international network of government future strategy units.

EUROPE: EPTA, the European Parliamentary Technology Assessment, is a network and database of 18 European parliaments to integrate futures into decisionmaking. Forecasts of migrations from Asia and Africa are forcing Europe to reassess its future, as are the EU2020 strategy, Lisbon Strategy, sovereign debt crisis, emergence of China, and forecasts of public finances for social and health services for an aging population. The 7th Framework Programme of the EU expands foresight support; the Institute for Prospective Technological Studies provides futures studies for EU decisionmaking; the European Foresight Platform connects futurists; an annual European Futurists Conference is held in Switzerland; iKnow Project scans for weak signals and wild cards, and the European Regional Foresight College improves futures instruction. The Netherlands constitution requires a 50-year horizon for land use planning. Russian Ministries use Delphi and scenarios for foresight, while corporations tend to use technology roadmaps.

LATIN AMERICA: Research from ECLAC and UNIDO's technological foresight training could be improved to stimulate long-range decisionmaking; participation in such international organizations will improve the region's long-range global dialogs. Mexico initiated and signed an agreement to create the Pacific Latinamerican Alliance with the governments of Peru, Chile, and Colombia to promote free trade in a larger zone than Mercosur. Alternative long-term development strategies are being created by the Bolivian Alliance for the Americas, the Union of South American Nations, and the Community of Latin America and Caribbean States. The shift toward more socialist politics in some countries is motivating alternative futures thinking. Yet futures approaches are ignored by the academic and mass media, which focus on urgent and confrontational issues over ideologies, unmet basic needs, inequality, and large economic groups that monopolize services. Venezuela has the Sembrar el Futuro prize for students' futures thinking, and Mexico initiated the Global Millennium Prize for students' ideas for addressing global long-range challenges. Since the average age in Latin America is only 24, it is fundamental to incorporate the visions of the next generation via social networks and apps.

NORTH AMERICA: Create a map of individuals and organizations with foresight and use it to create a virtual organization at the White House for regular input to the policy process; the same for Langevin Block in Canada. "Future considerations" should be added to standard reporting requirements. Examples of successful global long-range activates should be promoted (see CD Chapter 12) along with cases where the lack of futures thinking proved costly. Global perspectives in decisionmaking are emerging due to perpetual collaboration among different institutions and nations that has become the norm to address the increasing complexity and speed of global change. Global long-term perspectives continue to be evident in the climate change policies of many local governments.

6. How can the global convergence of information and communications technologies work for everyone?

Over 2 billion Internet users, 5 billion mobile phones, and uncountable billions of hardware devices are intercommunicating in a vast real-time multi-network, supporting every facet of human activity. New forms of civilization will emerge from this convergence of minds, information, and technology worldwide. The eG8 was created in 2011 to explore government-business roles in managing this evolution. It is reasonable to assume that the majority of the world will experience ubiquitous computing and eventually spend most of its time in some form of technologically augmented reality. Today mobile devices have become personal electronic companions, combining computer, GPS, telephone, camera, projector, music player, TV, and intelligent guides to local and global resources.

As Moore's Law continues, costs fall, and ease of use increases, even remote and less developed areas will participate in this emerging globalization. The race is on to complete the global nervous system of civilization. Collaborative systems, social networks, and collective intelligences are self-organizing into new forms of transnational democracies that address issues and opportunities. This is giving birth to unprecedented international conscience and action, augmenting conventional management. Such open systems seem natural responses to increasing complexity that has grown beyond hierarchical control. Open source software's non-ownership model may become a significant element in the next economic system. Businesses are building offices and holding meetings in cyberworlds that compete with conventional reality.

One of the next "big things" could be the emergence of collective intelligences for issues, businesses, and countries, forming new kinds of organizations able to address problems and opportunities without conventional management. Collective intelligence can be thought of as a continually emerging property that we create (hands on) from synergies among people, software, and information that continually learns from feedback to produce just-in-time knowledge for better decisions than any one of these elements acting alone. Real-time streamed communications shorten the time it takes from situational awareness to decisions. Search engines and Wikipedia give instant access to "all" the world's stored knowledge. The Web is evolving from the present user-generated and participatory system (Web 2.0) into Web 3.0, a more intelligent partner that has knowledge about the meaning of the information it stores and has the ability to reason with that knowledge. Most mobile phones being sold today have computer capabilities, with thousands of apps and access to cloud computing.

However, this explosive growth of Internet traffic, mainly from video streaming, has created a stress on the Net's capacities, requiring new approaches to keep up with bandwidth demand, while the ubiquity of the Internet in society makes its reliability critically vital. People and businesses are trusting their data and software to "cloud computing" on distant Net-connected servers rather than their own computers, raising privacy and reliability questions. The Amazon cloud data center's outage and Sony PlayStation's release of personal data for millions of users are examples. Even though Wikipedia has become the world's encyclopedia, it struggles to counter disinformation campaigns fought through its pages. Governments are wrestling with how to control harmful content. A vigorous debate continues on net neutrality, the doctrine that technical and economic factors for Net users should not be affected by considerations of equipment, type of user, or communications content.

Humanity, the built environment, and ubiquitous computing are becoming a continuum of consciousness and technology reflecting the full range of human behavior, from individual philanthropy to organized crime. Low-cost computers are replacing high-cost weapons as an instrument of power in asymmetrical warfare. Cyberspace is also a new medium for disinformation among competing commercial interests, ideological adversaries, governments, and extremists, and is a battleground between cybercriminals and law enforcement. The full range of cybercrimes worldwide is estimated at $1 trillion annually. Fundamental rethinking will be required to ensure that people will be able to have reasonable faith in information. We have to learn how to counter future forms of information warfare that otherwise could lead to the distrust of all forms of information in cyberspace.

It is hard to imagine how the world can work for all without reliable tele-education, tele-medicine, and tele-everything. Internet bases with wireless transmission are being constructed in remote villages; cell phones with Internet access are being designed for educational and business access by the lowest-income groups; and innovative programs are being created to connect

the poorest 2 billion people to the evolving nervous system of civilization. Two million children now have OLPC (One Laptop Per Child) XOs. Social networking spurs the growth of political consciousness and popular power, as in the "Arab Spring." E-government systems allow citizens to receive valuable information from their leaders, provide feedback to them, and carry out needed transactions without time-consuming and possibly corrupt human intermediaries. Telemedicine capabilities are uniting doctors and patients across continents. E-government systems exist to some degree for the majority of the world; the UN conducts comparative assessments of the e-government status of its member states.

Developing countries and foreign aid should have broadband access as national priorities, to make it easier to use the Internet to connect developing-country professionals overseas with the development processes back home, improve educational and business usage, and make e-government and other forms of development more available. Challenge 6 will have been addressed seriously when Internet access and basic tele-education are free and available universally and when basic tele-medicine is commonplace everywhere.

Regional Considerations

Africa: According to worldinternetstats.com, Internet penetration in Africa is 10.9%, up 25% since last year. There are 506 million mobiles, for 50% penetration. The new Main One and West Africa fiber-optic cables are cutting cost and increasing speed. Kenya's Digital Villages Project integrates Internet access, business training, and microcredit. FAO's Africa Crop Calendar Web site provides information for 130 crops. Tele-education, tele-medicine, and e-government will become more important as African professionals die of AIDS in increasing numbers.

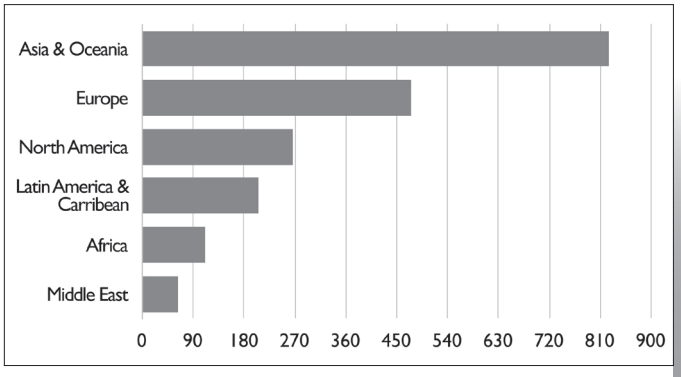
Asia and Oceania: Asia has the largest share of the world's Internet users (42%) but only 20% penetration. China has about 420 million Internet users with nearly 280 million Internet-connected mobile phones. Controversies over control of Internet access continue in China. Vietnam, India, Turkey, and Iran have tightened controls on Internet access and content. Phones are being smuggled into North Korea to post reports on conditions. The UN continues to rate South Korea the top e-ready country, but that nation is struggling with video game addiction. Some 300,000 people in Bangladesh are learning English from the BBC. India is establishing e-government stations in rural villages.

Europe: About 70% of EU-27 households had access to the Internet in 2010. Finland has made 1 MB/s broadband a legal right for all Finns. The EU's Safer Internet Programme is working in 26 European countries to counter child pornography, pedophilia, and digital bullying. The EU policy is that Internet access is a right, but it can be cut off for misuse. Estonians (inside and outside their country) cast their votes for the Estonian parliament by mobile phones in March 2011. Macedonia is providing computers to all in grades 1–3.

Latin America: About 34% of the region has Internet access. The region's children with Internet access will rise from 1.5 million today to 30 million by 2015. Uruguay is the first country to provide all primary students with their own Internet-connected laptop, followed by Costa Rica. Fulfilling the promise of these tools will require more serious attention to training. The Internet was of great assistance in dealing with the Haiti earthquake. Fiber optic cable has been laid between Cuba and Venezuela.

North America: Free to all on the Internet, Google and Wikipedia are making the phrase "I don't know" obsolete. Wikipedia is educating the world with 3.7 million articles in English and lesser amount in nine other languages. Silicon Valley continues as a world leader in innovative software due to company policies like Google's that gives its employees 20% free time to create anything they want. This "20-pecent Time" is credited with half of Google's new products. The United States is in ninth place in the world in access to high broadband connections. Broadband development in rural and underserved areas was undermined by the financial crisis, but it is still a U.S. national priority. The U.S. Computer Emergency Readiness Team reported an estimated 39% increase in cyber-attacks against government computer networks in 2010.

Figure 6: Internet users in the World by Geographic Region, 2011 (millions)



7. How can ethical market economies be encouraged to help reduce the gap between rich and poor?

Nearly half a billion people grew out of extreme poverty ($1.25 a day) between 2005 and 2010. The number and percent in extreme poverty is falling. Currently it is about 900 million or 13% of the world. The World Bank forecasts this to fall to 883 million by 2015 (down from 1.37 billion in 2005), while those living on less than $2 a day to fall to 2.04 billion from 2.56 billion. UNDP's new Multidimensional Poverty Index finds 1.75 billion people in poverty. The number of countries classified as low-income has fallen from 66 to 40. However, the gap between rich and poor within and among countries continues to widen due to globalization, some argue, and the number of unstable states grew from 28 to 37 between 2006 and 2011. Nevertheless, global economic recovery from the recession of 2009 (–0.5% world GDP) is expected to continue. The world's economy grew 5% in 2010, and the IMF expects growth at 4.5% for 2011 and 2012. Although better measures of human progress are being developed (see Chapter 2), GDP is still recognized as an indicator of economic change.

World GDP passed $74 trillion (PPP) in 2010 and is expected to pass $78 trillion in 2011, while per capita income grew from $10,800 (2009) to $11,100 (2010). The IMF forecasts economic growth to average 4.6% from 2011 to 2015, led mostly by emerging and developing economies. These are expected to average 6.6% growth compared with advanced economies averaging 2.5% growth over that same period. The contribution of BRIC to world GDP in 2010 was over 17.5%. And with the addition of South Africa to that group, this ratio is expected to increase to 33% by 2015. World trade shrank 12% in 2009 but grew 14.5% in 2010, and WTO expects it to grow another 6.5% in 2011. Developing economies' exports grew 16.5%. Remittances increased to $440 billion in 2010. The net ODA from DAC countries reached a record $128.7 billion in 2010, a 6.5% increase over 2009, but FDI inflows remained stagnant in 2010 at $1.1 trillion, and the ILO estimates that some 210 million people (about 32 million more than in 2007) are looking for jobs, bringing global unemployment to 6.2%. Industrial economies' unemployment accounted for 55% of the increase in worldwide unemployment between 2007 and 2010. UNFPA notes that in the 48 poorest countries, where population is expected to double by 2050, some 60% of the people are under age 25.

The world needs a long-term strategic plan for a global partnership between rich and poor. Forbes counts 1,210 billionaires, with 108 of the 214 added over the past year from the BRIC nations. Such a plan should use the strength of free markets and rules based on global ethics. Conventional approaches to poverty reduction (technical assistance and credit) that work in low- and middle-income stable countries do not work in fragile countries, which need stability first.

Ethical market economies require improved fair trade, increased economic freedom, a "level playing field" guaranteed by an honest judicial system with adherence to the rule of law and by governments that provide political stability, a chance to participate in local development decisions, reduced corruption, insured property rights, business incentives to comply with social and environmental goals, a healthy investment climate, and access to land, capital, and information. Direction from central government with relatively free markets is competing with the decentralized, individualized private enterprise for lifting people out of poverty.

New indicators for measuring progress and economic development are being developed to help managers move from short-term profit-based strategies to long-term viability. Technical assistance to leapfrog into new activities via tele-education and tele-work should be coupled with microcredit mechanisms for people to seek markets rather than non-existent jobs. An alternative to trying to beat the brain drain is to connect people overseas to the development process back home by a variety of Internet systems. If the WTO eliminated agricultural export subsidies, developing countries would gain $72 billion per year, according to UNDP. Structural imbalances in world trade have to be corrected to assure fair competition, respect of human rights, and labor and environmental standards, as well as efficient management of the global commons and prevention of monopolies. China's monetary policy adjustments could help other countries' economic development and access to world markets.

The low-carbon green economy has attracted over $2 trillion in private investment since 2007 and is a driving force for FDI. Climate Investment Funds of $6.4 billion help implement pilot projects in 45 developing countries through MDBs. Financing to the private sector by the MDBs increased from less than $4 billion in 1990 to $40 billion per year in 2010, while the IFC committed a record $18 billion in investments in private companies in 129 countries. Since 1976, microfinance institutions provided loans to over 113 million clients worldwide.

Challenge 7 will be addressed seriously when market economy abuses and corruption by companies and governments are intensively prosecuted and when the inequality gap—by all definitions—declines in 8 out of 10 years.

REGIONAL CONSIDERATIONS

AFRICA: Net bilateral ODA to Africa increased by 3.6% in 2010 to $29.3 billion, of which $26.5 billion went to sub-Saharan Africa. Despite a continued sustained economic growth since 2005 at an average of 4.7%, about half of sub-Saharan Africa continues to live in extreme poverty. Increasing commodity prices worldwide helped African oil exporters while having adverse effects on oil-importing countries. The East African Community is working toward economic integration. The rapidly evolving Chinese-African alliance is a new geopolitical reality that could help reduce income gaps for both sides; China-Africa trade is expected to triple between 2011 and 2015. The region's development continues to be impeded by high birth rates, increasing food prices, gender inequality, income and location biases, weak infrastructure, high indirect costs, corruption, armed conflicts, poor governance, environmental degradation and climate change, poor health conditions, and lack of education. Although the world will meet the MDG of halving poverty from 1990 to 2015 due to China's and India's growth, 17 African countries will not.

ASIA AND OCEANIA: Asia's economy grew 8.3% in 2010, according to the IMF, while WTO lists developing Asia's growth at 8.8%, and it is expected to grow over 8.4% per year over the next five years, led by China's average of 10% per year. India's poverty ($1.25/day), which was 51.3% in 1990, is expected to fall to 22.4% in 2015. China's poverty was 60% in 1990 and it is likely to plummet to 4.8% by 2015. China became the world's largest exporter (28% growth in 2010) and the second largest economy, with over 13% share of world economic output in 2010. China is now challenged to keep its growth from generating dangerous inflation. Japan's reconstruction after its environmental disasters will force it to reduce its development funding for the region. Increasing pollution, water and energy problems, and the rich-poor gap threaten the future economic growth of developing Asia. Corruption, organized crime, and conflict continue to impede Central Asia's development. Natural disasters and the effects of climate change are threatening the development and the very existence of entire Pacific communities.

EUROPE: EU-15 dynamic FDI to the other member states is fostering integration and helps economies across the EU. Despite signs of economic recovery, unemployment is expected to remain at around 10% for 2011–12; by March 2011, average youth unemployment in the Euro zone was 19.8% (but 44.6% in Spain). Cutbacks in social expenditures were protested across much of Europe and are likely to increase economic disparities. The European Financial Stabilization Mechanism to stabilize the euro and assist debt-stricken EU countries, along with the Europe 2020 Strategy, is intended to stimulate the regional economy; however, financial difficulties persist, causing friction during implementation. The combination of aging populations, falling fertility rates, a shrinking middle class in some countries, and expensive public services is not sustainable without increasing the number of immigrants and more tele-entrepreneurs among retired Europeans. In emerging Europe and Central Asia, 36% of the population lives on less than $5 per day. The Stabilization Fund helped Russia recover from the global financial crisis better than expected. It has one of the lowest foreign debts among major economies and its foreign reserves are the world's third largest, mainly due to revenues from oil and gas exports. Germany suggested lowering the EU's agricultural subsidies to improve foreign assistance.

LATIN AMERICA: The region's economy grew 6% in 2010, helped by rising commodity prices, 40% growth in 2010 capital flows (largest in history to the region), and stimulating policies. Regional GDP is expected to grow about 4% annually over 2011–15. FDI for Brazil increased by a record 87% in 2010. Yet the region's rich-poor gap continues as the world's largest. The wealthiest 20% manage 57% of resources, while the poorest 20% only get 3.5% of the income. Brazil, Mexico, and Argentina experience the highest inequalities. The region needs to attract high technology investments, create better access to the means of production, change land tenure, encourage international companies to increase salaries, create long-range visions for education and labor demand, and expand microcredit with business training.

NORTH AMERICA: The unemployment rate was 9% in the U.S. in April 2011 and 7.6% in Canada. The U.S. national debt is above the $14.3 trillion cap, and in 2010 over 43.9 million people (one in seven Americans) were enrolled in the food stamps program. Meanwhile, the top 0.1% of Americans control 10% of the nation's wealth, the U.S. has the most billionaires, and CEO pay rose 24%. The six largest U.S. banks control 63% of U.S. GDP, but new financial regulations give government more control over the banking system and financial markets and increase protection of the poor.

8. How can the threat of new and reemerging diseases and immune microorganisms be reduced?

World health is improving, the incidence of diseases is falling, and people are living longer, yet many old challenges remain and future threats are serious. Over 30% fewer children under five died in 2010 than in 1990, and total mortality from infectious disease fell from 25% in 1998 to less than 16% in 2010. Funding for global health continues to increase to an estimated $26.8 billion in 2010, which has also increased the need for better coherence among the many new actors in world health.

Non-communicable diseases and emerging and drug-resistant infectious diseases are increasing. Because the world is aging and increasingly sedentary, cardiovascular disease is now the leading cause of death in the developing as well as the industrial world. However, infectious diseases are the second largest killer and cause about 67% of all preventable deaths of children under five (pneumonia, diarrhea, malaria, and measles). Poverty, urbanization, travel, immigration, trade, increased encroachment on animal territories, and concentrated livestock production move infectious organisms to more people in less time than ever before and could trigger new pandemics. Over the past 40 years, 39 new infectious diseases have been discovered, 20 diseases are now drug-resistant, and old diseases have reappeared, such as cholera, yellow fever, plague, dengue fever, meningitis, hemorrhagic fever, and diphtheria. In the last five years, more than 1,100 epidemics have been verified. About 75% of emerging pathogens are zoonotic (they jump species).

During 2011 there were six potential epidemics. The most dangerous may be the NDM-1 enzyme that can make a variety of bacteria resistant to most drugs. Previously only found in hospitals, it was found this year in New Delhi's drinking water and sewers, making it easier to spread. Other notable developments this year include the European E. coli/ Hemolytic Uremic Syndrome foodborne outbreak; the progression of arteminisin-resistent malaria near the Cambodian border; the cholera epidemic in Haiti; the continued global threat from MDR and XDR TB in the AIDS population; and the potential for epidemics and nuclear contamination in post-earthquake, post-nuclear-meltdown Japan.

The H1N1 (swine flu) that infected millions around the world ended in August 2010 due to the ability of WHO and the global network to detect, isolate, genetically evaluate, vaccinate, and persuade the public to act. Mexico (where the virus was first identified) responded with praiseworthy professionalism in handling the A/H1N1 flu outbreak. The H5N1 (avian flu) of 2007–08 killed half of the people infected, spread slowly, has mutated three times in 15 years, and could mutate again. The best ways to address epidemic disease remain early detection, accurate reporting, prompt isolation, and transparent information and communications infrastructure, with increased investment in clean drinking water, sanitation, and handwashing. WHO's eHealth systems, international health regulations, immunization programs, and the Global Outbreak Alert and Response Network are other essentials of the needed infrastructure.

New HIV infections declined 19% over the past decade; AIDS-related deaths dropped by 19% between 2004 and 2009; the median cost of antiretroviral medicine per person in low-income countries has dropped to $137 per year; and 45% of the estimated 9.7 million people in need of antiretroviral therapy received it by the end of 2010. Yet two new HIV infections occur for every person starting treatment; 2.6 million were newly infected and 2 million died during 2009; and 33 million people are living with HIV/AIDS today. Some experts recommend a combination of annual voluntary universal testing in high-prevalence populations coupled with the immediate initiation of ART for those who test positive. Because ART reduces the viral load to the point where it cannot be detected it also prevents transmission. Others say this "test and treat" approach is too expensive and a human rights violation. WHO has adopted a new 2011–15 strategy instead that seeks to optimize HIV prevention, diagnosis, treatment, and care outcomes; to leverage broader health outcomes through HIV responses; to build strong and sustainable health systems; and to address inequalities and advance human rights.

Neglected tropical diseases are a group of parasitic and bacterial infections that are the most common afflictions of the world's poorest people. They blind, disable, disfigure, and stigmatize their victims, trapping them in a cycle of poverty and disease. Many low-cost interventions are available, yet the majority of affected people do not have access to them. Some of the largest health impacts remain: schistosomiasis (200 million cases), dengue fever (50 million new cases a year), measles (30 million cases a year), onchocerciasis (18 million cases in Africa), typhoid and leishmaniasis (approximately

12 million each globally), rotavirus (600,000 child deaths per year), and shigella childhood diarrhea (600,000 deaths per year). About half of the world's population is at risk of several endemic diseases. Hepatitis B infects up to 2 billion people. There is more TB in the world now than ever before, even though TB treatment success with DOTS exceeded 85%. Between 1995 and 2008, over 43 million people have been treated and 36 million people cured. There is progress with malaria: 38 countries (9 in Africa) documented reductions of more than 50% in the number of malaria cases between 2000 and 2008, and more than 100 million long-lasting insecticide-treated bed nets have been distributed in the fight against malaria.

To counter bioterrorism, R&D has increased for improved bio-sensors and general vaccines able to boost the immune system to contain any deadly infection. Such vaccines could be placed around the world like fire extinguishers. Some small viruses have been found to attack large viruses, offering the possibility of a new route to disease cures. New problems may come from unregulated synthetic biology laboratories of the future. People are living longer, health care costs are increasing, and the shortage of health workers is growing, making tele-medicine and self-diagnosis via biochip sensors and online expert systems increasingly necessary. Better trade security will be necessary to prevent increased food- or animal-borne disease. Viral incidence in animals is being mapped in Africa, China, and South Asia to divert epidemics before they reach humans. Future uses of genetic data, software, and nanotechnology will help detect and treat disease at the genetic or molecular level.

Regional Considerations

Africa: With 11% of the world's population, Africa has 25% of the world's disease burden, 3% of its health workers, and 1% of its health expenditures. Sub-Saharan Africa accounted for 68% of all people living with HIV in 2010; it has one of the world's worst tuberculosis epidemics, compounded by rising drug resistance and HIV co-infection. Patients on ART increased from 1–2% in 2003 to 48% by the end of 2009. PEPFAR (a U.S. program) is funding 105 medical schools in the sub-Saharan region to encourage graduates to stay in Africa and is funding laboratories across the continent. Some 16% of children in Zimbabwe and 12% in Botswana are AIDS orphans; 34 sub-Saharan African countries stabilized or decreased HIV infections by more than 25% between 2001 and 2009.

Asia and Oceania: The emergent research on NDM-1 gene and drug resistance found in the New Delhi water system has alerted WHO investigators to a "potential nightmare" situation. Asia is an epicenter of emerging epidemics. If Asian poultry farmers received incentives to replace their live-market businesses—the source of many viruses—with frozen-products markets, the annual loss of life and economic impacts could be reduced. HIV continues to increase in central Asia. At least 5 million people have HIV/AIDS in India and China. Japan's life expectancy at birth in 2010 was 83 years; in China it was 74.

Europe: The Ukraine has the highest prevalence of HIV in Europe, focused on sex workers and drug users, with 161,119 cases (31,241 AIDS and 17,791 deaths), but it has decreased the incidence from 18% to 6% from 2006 to 2009 due to extensive HIV programs. The aging population of Europe continues to pressure government medical services, while infant mortality under five has been cut in half since 1990 and maternal mortality has dropped by one-fourth. TB deaths continue to increase in Europe after a 40-year decline. President Medvedev initiated obligatory drug tests in Russian schools and universities.

Latin America: The region has the highest life expectancy among developing regions. While Haiti's HIV rate has fallen from 6% to 2.2% over the last 10 years, the earthquake killed 300,000 people and has devastated medical systems and brought on a cholera outbreak, with more than 1,200 deaths and the possibility of spread to the Americas. The HIV/AIDS epidemic remains stable, with 2 million people and 0.6% prevalence, and antiretroviral therapy is at almost 60%. Brazil has shown that free antiretroviral therapy since 1996 dramatically cut AIDS mortality, extended survival time, saved $2 billion in hospital costs, and keep prevalence to 0.6%. Neglected tropical diseases affect 200 million people in Latin America (intestinal worms, Chagas, schistosomiasis, trachoma, dengue fever, leishmaniasis, lymphatic filariasis, and onchocerciasis).

North America: A California Biobank 20-year study will evaluate genetic markers for risk of disease in 250,000 patients by linking DNA samples to electronic medical records. The U.S. has 1.2 million people with HIV; Canada has 73,000. About 33% of children in the U.S. are overweight or obese, and one survey found that children aged 8–18 spent on average 7.5 hours a day with entertainment media.

9. How can the capacity to decide be improved as the nature of work and institutions change?

The increasing complexity of everything for much of the world is forcing humans to rely more and more on computers. In 1997 IBM's Deep Blue beat the world chess champion. In 2011 IBM's Watson beat top TV quiz show knowledge champions.What's next? Just as the autonomic nervous system runs most biological decisionmaking, so too computer systems are increasingly making the day-to-day decisions of civilization. We have far more data, evidence, and computer models to make decisions today, but that also means we have far more information overload and excessive choice proliferation. The number and complexity of choices seem to be growing beyond our abilities to analyze, synthesize, and make decisions. The acceleration of change reduces the time from recognition of the need to make a decision to completion of all the steps to make the right decision.

Many of the world's decisionmaking processes are inefficient, slow, and ill informed. Today's challenges cannot be addressed by governments, corporations, NGOs, universities, and intergovernmental bodies acting alone; hence, transinstitutional decisionmaking has to be developed, and common platforms have to be created for transinstitutional strategic decisionmaking and implementation. Previous economic models continue to mistakenly assume that human beings are well-informed, rational decisionmakers in spite of research to the contrary. And relying on computer models for decisions proved unreliable in the financial crisis. However, some progress has been made.

Adaptive learning models such as cellular automata, genetic algorithms, and neural networks are growing in capability and accuracy, and databases describing individual behavior are becoming even more massive. In social sciences it has been difficult to develop "laws" to forecast social behavior and, hence, make good decisions based on forecasted consequences. With the advent of massive digital databases and new software, we can let the computer make more empirically based forecasts of the plausible range of how people will react to various decisions. At the same time, increasing democratization and interactive media are involving more people in decisionmaking, which further increases complexity. This can reinforce the principle of subsidiarity—decisions made by the smallest number of people possible at the level closest to the impact of a decision. Fortunately, the world is moving toward ubiquitous computing with institutional and individual collective intelligence (emergent properties from synergies among brains, software, and information) for "just-in-time" knowledge to inform decisions. Ubiquitous computing will increase the number of decisions per day, constantly changing schedules and priorities. Decisionmaking will be increasingly augmented by the integration of sensors imbedded in products, in buildings, and in living bodies with a more intelligent Web and with institutional and personal collective intelligence software that helps us receive and respond to feedback for improving decisions.

Cloud computing, knowledge visualization, and a variety of decision support software are increasingly available at falling prices. DSS improves decisions by filtering out bias and providing a more objective assessment of facts and potential options. Some software lets groups select criteria and rate options, some averages people's bets on future events, while others show how issues have alternative positions and how each is supported or refuted by research.

The MIT Collective Intelligence Center sees its mission as answering "How can people and computers be connected so that collectively they act more intelligently than any individuals, groups, or computers have ever done before?" They are trying to develop measures of collective intelligence (like IQ tests for individuals). Rapid collection and assessment of many judgments via on-line software can support timelier decisionmaking. (See the attached CD Appendix L for an explanation of the Real-Time Delphi.) Google invited "citizen cartographers" to refine the U.S. map. This sort of activity is fundamentally different than the "wisdom of crowds" in which the average judgment is taken to be an answer to unresolved issues. The "wisdom of crowds" approach is essentially a vote, while collective intelligence is a continually emergent property from synergies among data-information-knowledge, software-hardware, and individual and groups of brains that continually learn from feedback. Self-organization of volunteers around the world via Web sites is increasing transparency and creating new forms of decisionmaking. Blogs are increasingly used to support decisions. Issues-based information software in e-government allows decisionmaking to be more transparent and accountable. Although cognitive neuroscience promises to improve decisionmaking, little has been applied for the public.

Political and business decisions include competitive intelligence and analysis to guide decisionmaking; as the world continues to globalize,

increasing interdependencies, synergetic intelligence and analysis should also be considered. What synergies are possible among competing businesses, groups, and nations? Synergetic analysis aims to increase "win-win" decisions that assist a larger number of enterprises while reducing the wasted efforts of "win-lose" decisions.

Often decisions are delayed because people don't know something—a condition Google is beginning to eliminate. Training programs for decisionmakers should bring together research on why irrational decisions are made, lessons of history, futures research methods, forecasting, cognitive science, data reliability, utilization of statistics, conventional decision support methods (e.g., PERT, cost/benefit, etc.), collective intelligence, ethical considerations, goal seeking, risk, the role of leadership, transparency, accountability, participatory decisionmaking with new decision support software, e-government, ways to identify and better an organization's improvement system, prioritization processes, and collaborative decisionmaking with different institutions.

Challenge 9 will be addressed seriously when the State of the Future Index or similar systems are used regularly in decisionmaking, when national corporate law is modified to recognize transinstitutional organizations, and when at least 50 countries require elected officials to be trained in decisionmaking.

Regional Considerations

Africa: North African revolutions promise to open the decisionmaking processes, increasing freedom of the press to better inform the public. For tribally oriented Africa, the question remains, how can the cultural advantages of extended families be kept while making political and economic decisions more objective and less corrupt? Development of African civil society may need external pressure for freedom of the press, accountability, and transparency of government. Microsoft is collaborating to help e-government systems improve transparency and decisionmaking. If the brain drain cannot be reversed, expatriates should be connected to the development processes back home through Internet systems.

Asia and Oceania: In general, decisions tend to focus more on the good of the family than on the good of the individual in Asian societies; will individualistic Internet change this philosophy? Synergies of Asian spirituality and collectivist culture with more linear, continuous, and individualistic western decisionmaking systems could produce new decisionmaking philosophies. Kuwait is introducing a collective intelligence system and a national SOFI for the Early Warning System in the Prime Minister's Office. ASEAN could be the key institution to help improve decisionmaking systems in the region.

Europe: Bureaucratic complexity, lack of transparency, and proliferation of decision heads threatens clear decisionmaking in the EU. Europe is experiencing "reporting fatigue" due to so many treaties and bureaucratic rules. Tensions between the EU and its member governments and among ethnic groups are making decisionmaking difficult. Russia is improving policy decisionmaking efficiency by coordination among stakeholders in nanotechnology research among several Councils, Commissions at the Russian Parliament, government, and the Russian Academy of Science. It was a response to the cross-sectoral and multidisciplinary nature of nanotech.

Latin America: Chile is pioneering e-government systems that can be models for other countries in the region. For e-government to increase transparency, reduce corruption, and improve decisions, Internet access beyond the wealthiest 20% is necessary. The remaining 80% receive inefficient service, difficult access locations, restricted operating hours, and non-transparent processes. Government institutional design, management, and data for decisionmaking are weak in the region. Latin America has to improve citizen participation and public education for political awareness.

North America: Blogs and self-organizing groups on the Internet are becoming de facto decisionmakers in North America, with decisions made at the lowest level appropriate to the problem. Approximately 20% of U.S. corporations use decision support systems to select criteria, rate options, or show how issues have alternative business positions and how each is supported or refuted by research. Intellipedia provides open source intelligence to improve decisionmaking. The region's dependence on computer-augmented decisionmaking—from e-government to tele-business—creates new vulnerabilities to manipulation by organized crime, corruption, and cyber-terrorism, as discussed in Challenges 6 and 12.

10. How can shared values and new security strategies reduce ethnic conflicts, terrorism, and the use of weapons of mass destruction?

Although the vast majority of the world is living in peace, half the world continues to be vulnerable to social instability and violence due to growing global and local inequalities, outdated social structures, inadequate legal systems and increasing costs of food, water, and energy. In areas of worsening political, environmental, and economic conditions, increasing migrations can be expected. Add in the future effects of climate change, and there could be as many as 400 million migrants by 2050. While inter-state conflicts decreased, internal unrest is increasing. The UN estimates that 40% of the internal conflicts over the past 60 years were natural resource–related. As growing populations and economies increase the drain on natural resources, social tensions are expected to increase, triggering complex interactions of old ethnic and religious conflicts, civil unrest, terrorism, and crime. Substantial technological and social changes will be needed to prevent this; countries will need to include non-traditional security strategies for addressing the root causes of unrest. Since many countries affected by conflict return to war within five years of a cease-fire, more serious efforts are required to dismantle the structures of violence and establish structures of peace.

Conflicts have decreased over the past two decades, cross-cultural dialogues are flourishing, and intra-state conflicts are increasingly being settled by international interventions. Today, there are 10 conflicts (down from 14 last year) with at least 1,000 deaths per year: Afghanistan, Iraq, Somalia, Yemen, NW Pakistan, Naxalites in India, Mexican cartels, Sudan, Libya, and one classified as international extremism. Yet the 27.5 million internally displaced persons is the highest total since the 1990s. The probability of a more peaceful world is increasing due to the growth of democracy, international trade, global news media, the Internet and new forms of social networks, NGOs, satellite surveillance, better access to resources, and the evolution of the UN and regional organizations. The U.S. and Russia signed the new START nuclear arms reduction treaty, and new arms races are being preemptively addressed. Yet the Global Peace Index's rating of 144 countries' peacefulness again declined slightly, reflecting intensification of some conflicts and the economic crisis.

In 2011, there are 122,000 UN peacekeepers from 114 countries in 15 operations. Total military expenditures are about $1.5 trillion per year. There are an estimated 8,100 active nuclear weapons, down from 20,000 in 2002 and 65,000 in 1985. However, there are approximately 1,700 tons of highly enriched uranium and 500 tons of separated plutonium that could produce nuclear weapons. The nexus of transnational extremist violence is changing from complex organized plots to attacks by single individuals or small independent groups. Mail-order DNA and future desktop molecular and pharmaceutical manufacturing, plus access (possibly via organized crime) to nuclear materials, could one day give single individuals the ability to make and use weapons of mass destruction—from biological weapons to low-level nuclear ("dirty") bombs. The IAEA reports that between 1993 and the end of 2010 the Illicit Trafficking Database confirmed 1,980 incidents of illicit trafficking and other unauthorized activities involving nuclear and other radioactive materials. During 2010, the IAEA received reports of 176 nuclear trafficking incidents (compared with 222 during 2009), ranging from illegal possession and attempted sale and smuggling to unauthorized disposal of materials and discoveries of lost radiological sources.

Governments and military contractors are engaged in an intellectual arms race to defend themselves from cyberattacks from other governments and their surrogates. Beyond defense, the rules of engagement for responding to such aggressors are not clear. Because society's vital systems now depend on the Internet, cyberweapons to bring it down can be thought of as weapons of mass destruction. The security requirements for deterring single individuals from making and deploying WMD is unprecedented. We have to develop mental health and education systems to detect and treat individuals who might otherwise grow up to use such advanced weapons, as well as using networks of nanotech sensors to alert authorities to those creating such weapons.

Military power has yet to prove effective in asymmetrical warfare without genuine cultural engagement. Peace strategies without love, compassion, or spiritual outlooks are less likely to work, because intellectual or rational systems alone are not likely to overcome the emotional divisions that prevent peace. Conflict prevention efforts should work in and with all the related factions, including conversations with hardliner groups, taking into consideration their emotional and spiritual sensibilities. Massive public education programs are needed to promote respect for diversity and the oneness that underlies that diversity. It is less expensive and more effective to attack the root causes of unrest than to stop explosions of violence.

Early warning systems of governments and UN agencies could better connect with NGOs and the media to help generate the political will to prevent or reduce conflicts. User-initiated collaborations on the Web should be increasingly used for peace promotion, rumor control, fact-finding, and reconciliation. Backcasted peace scenarios should be created through participatory processes to show plausible alternatives to conflict stories (see CD Chapter 3.7). It is still necessary, however, to bring to justice those responsible for war crimes and to support the International Criminal Court. The Geneva Convention should be modified to cover intra-state conflicts. Some believe that the collective mind of humanity can contribute to peace or conflict, and hence we can think ourselves into a more peaceful future. Meanwhile, governments should destroy existing stockpiles of biological weapons, create tracking systems for potential bioweapons, establish an international audit system for each weapon type, and increase the use of non-lethal weapons to reduce future revenge cycles. Networks of CDC-like centers to counter impacts of bioterrorism should be also supported. Challenge 10 will be addressed seriously when arms sales and violent crimes decrease by 50% from their peak.

REGIONAL CONSIDERATIONS

AFRICA: The Tunisian and Egyptian revolutions and Libyan internal fighting open North Africa and the wider Arab world to a variety of scenarios. Some believe the death of Osama bin-Laden decreases Al Qaeda's role from Mauritania to Somalia, while others see a rising Muslim Brotherhood. Sub-Saharan Africa has slowly decreased conflicts over the past 10 years. South Sudan has achieved independence. In 2010 there were more than 250,000 Ethiopian IDPs, and there are 300,000 Somali refugees in a Kenyan camp. Serious unrest has broken out between Christians and Muslims in Nigeria, where $22 billion in oil revenues has vanished into local treasuries. Youth unemployment and millions of AIDS orphans may fuel a new generation of violence and crime.

ASIA AND OCEANIA: The popular uprisings have spread from North Africa to Syria, Bahrain, and Yemen. With the potential for the collapse of Yemen, oil piracy along the Somali coast could increase. An internationally acceptable solution to Iran and North Korea's nuclear ambitions is still lacking, and Pakistan's internal instability and uncertain relationships with India and Afghanistan hinder the peacemaking and counter-extremist efforts in all three countries. The $7.5 billion in civilian aid given to Pakistan over the past five years has been largely ineffective. There is no clarity on a NATO withdrawal from Afghanistan, and Iraq's future stability is in doubt. India is facing spreading Maoist violence. Muslim populations from Chechnya to the Philippines are struggling for political and religious rights. Young Palestinians are using online social networks to form a movement separate from Hamas and Fatah to promote the vision of a future Palestinian state. Kurdish aspirations are still a cause of unrest in Turkey and Iraq, but 300,000 Kurds received Syrian citizenship. Relations between North and South Korea have deteriorated. China's internal problems over water, energy, demographics, urbanization, income gaps, and secessionist Muslims in the northwest will have to be well-managed to prevent future conflicts, while tensions with Taiwan are easing.

EUROPE: The EU has created a unit of the External Action Service to actively prevent conflicts. Poland, joined by the Czech Republic, Slovakia, and Hungary, has set up the Visegrad Battle Group, a mini-analogue to NATO. The large numbers of migrant laborers entering the EU will require new approaches to integrate them better into society if increased conflicts are to be prevented. This is aggravated by the new surge of immigrants from the Arab uprisings that Italy has taken in but other countries are unwilling to accommodate. The Roma population continues to be a challenge across the continent.

LATIN AMERICA: Although national wars are rare in the region, internal violence from organized crime paramilitaries continues to be fueled in some areas by corrupt government officials, military, police, and national and international corporations. Mexico's war against organized crime has accelerated, with 35,000 deaths over four years (10,000 of them in 2010). Recent political changes have begun to improve opportunities for indigenous peoples in some parts of the region, while political polarization over policies to address poverty and development persists. Colombia plans on returning to the rightful owners 2.5 million hectares of land seized by gangs. Violence is impeding development in Central America.

NORTH AMERICA: As Arctic ice continues to melt, vast quantities of natural gas and oil will be accessible where national boundaries are under dispute. This could be a source of U.S.-Canadian tension, along with Russia, Norway, and Denmark. The U.S. Institute of Peace's SENSE multi-person training simulation has educated thousands of participants worldwide in the fundamentals of decisionmaking, resource allocation, and negotiation in post-conflict situations. Cooperation on environmental security could become a focus of U.S.-China strategic trust.

11. How can the changing status of women help improve the human condition?

Empowerment of women has been one of the strongest drivers of social evolution over the past century, and many argue that it is the most efficient strategy for addressing the global challenges in this chapter. Only two countries allowed women to vote at the beginning of the twentieth century; today there is virtually universal suffrage, the average ratio of women legislators worldwide has reached 19.2%, and over 20 countries have women heads of state or government. Patriarchal structures are increasingly challenged, and the movement toward gender equality is irreversible.

With an estimated control of over 70% of global consumer spending, women are strongly influencing market preferences. Analysis shows a direct interdependence between countries' Gender Gap Index and their Competitiveness Index scores and that Fortune 500 companies with more gender-balanced boards could outperform the others by as much as 50%. Yet the Gender Equity Index 2010 shows that significant differences still remain in economic participation and political empowerment.

Gender stereotyping continues to have negative impacts on women around the world, and although progress is being made on closing the gender gap in terms of establishing global and national policies, real improvement will only be achieved when conflicts between written laws and customary and religious laws and practices are eliminated. Environmental disasters, food and financial crises, armed conflicts, and forced displacement further increase vulnerabilities and generate new forms of disadvantages for women and children.

Women account for over 40% of the world's workforce, earn less than 25% of the wages, and represent about 70% of people living in poverty. An OECD survey found that women spend more time on unpaid work than men do worldwide, with the gap ranging from 1 hour per day in Denmark to 5 hours per day in India. FAO estimates that giving women the same access as men to agricultural resources could reduce the number of hungry people in the world by 12–17%, or 100–150 million people. Child malnutrition levels are estimated to be 60% above average where women lack the right to land ownership and 85% above average where they have no access to credit. Microcredit institutions reported that by 2010, nearly 82% (about 105 million) of their poorest clients were women. However, many of their businesses are too small to transform their economic status, points out FEMNET.

Empowerment of women is highly accelerated by the closing gender gap in education. Most countries are reaching gender parity in primary education, and 50% of university students worldwide are women. Yet regional disparities are high, and UNESCO estimates that women represent about 66% of the 796 million adults who lack basic literacy skills.

Although the health gender gap is closing, family planning and maternal health remain critical. Determining the size of the family should be recognized as a basic human right, and more attention should be given to women's health and social support for affordable child care worldwide, including industrial countries, which are facing demographic crises due to low fertility rates. Of the more than 500,000 maternal deaths per year, 99% happen in developing countries, with the highest prevalence in Africa and Asia due to high fertility rates and weak health care systems. Unless providing effective family planning to the 215 million women who lack it is seen as a key component of development, the UN goal to reduce maternal mortality to 120 deaths per 100,000 live births by 2015 will not be achieved.

Regulations should be enacted and enforced to stop female genital mutilation, which traumatizes about 3 million girls in Africa each year, in addition to the 100–142 million women worldwide affected by it today. While the prevalence of this in Egypt, Guinea, and some parts of Uganda is at over 90%, communities in India, Indonesia, Malaysia, and even in the EU are also affected.

Violence against women is the largest war today, as measured by death and casualties per year. While the proportion of women exposed to physical violence in their lifetime ranges from 12% to 59%, a function of region and culture, sexual assaults remain one of the most underreported crimes worldwide, continuing to be perpetrated with impunity.

According to UNODC, 66% of the victims of the $32 billion global industry of human trafficking are women and children. The Protocol to Prevent, Suppress and Punish Trafficking in Persons, especially Women and Children, has 142 parties and 117 signatories thus far, but it has yet to be adopted and enforced by some key countries.

Female vulnerability increases during conflict, when sexual violence is often used as a weapon. Recovery from conflict and disaster should be used as opportunities to rectify inequalities. Nevertheless, women make up only 8% of peace negotiators, and only 25 countries have developed National Action Plans supporting UN Security Council Resolution 1325 on women's protection in conflict and participation in peace processes.

Traditional media have had limited success influencing gender stereotyping, and women represent only one-third of full-time workers in journalism, reveals an IWMF survey. However, 78% of women (versus 66% of men) are active users of social media, a new powerful medium for change.

Mothers should use their educational role in the family to more assertively nurture gender equality. School systems should consider teaching self-defense in physical education classes for girls. Infringements on women's rights should be subject to prosecution and international sanctions. (See Appendix N in the CD for an annotated list of resources addressing gender equity and the study conducted by Millennia 2015 on potential policies to improve the status of women.)

Challenge 11 will be addressed seriously when gender-discriminatory laws are gone, when discrimination and violence against women are prosecuted, and when the goal of 30%+ women's representation in national legislatures is achieved in all countries.

REGIONAL CONSIDERATIONS

AFRICA: Despite significant progress with enrolment in primary education, dropout rates are 40% and one in three children is engaged in child labor. Half of the world's maternal deaths occur in sub-Saharan Africa, and women have little say in their own health care. African countries experiencing conflict or natural disasters have a very high incidence of sexual violence. Women represent 19.1% of legislatures in sub-Saharan African, with Rwanda being the world's only women-majority parliament. However, conflicts between constitutional and customary law are an issue across the region, and only 29 of the 53 African Union countries ratified the Protocol on Women's Rights.

ASIA AND OCEANIA: The average lifetime risk of maternal death in rural South and East Asia and the Pacific is over 4%. The preference for male children, largely due to inheritance laws and dowry liabilities, is causing a gender imbalance in many countries in the region, most notably in China and India where, in some communities, the birth ratio is as low as 60–70 females to every 100 males. According to UNICEF, child marriage is a severe issue in Nepal and some parts of India, where about 40% of girls become child brides. Women's representation in Arab States' legislature reached 10.7% (from 3.6% in 2000), the average of economically active adult female rose to 28%, and the social uprisings of 2011 are expected to further unsettle the patriarchal society dominating most Muslim-majority countries. In places such as Afghanistan, where 85% of women are illiterate and only 37% of students in schools are girls, women's rights should be central to peace and development agreements. Half of the world's top 20 richest self-made women are Chinese.

EUROPE: Women hold 41.6% of parliamentary seats in Nordic countries, 20.8% in OSCE countries (excluding Nordic ones), and 35.2% of EU Parliament seats. The proportion of women on the boards of the top European companies was 12% in 2010; at current rates, this would reach parity in 16 years. Women make up 7% of the directors in Russia's 48 biggest companies, and a new draft law proposes at least 30% of parliamentary seats are to be occupied by women, as well as providing advantages for men to play a greater role in family life. The UN estimates that there are between 200,000 and 500,000 illegal sex workers in the EU, the majority from Central and Eastern Europe. France's rule banning full-face veils in public is aiming to enforce women's rights and might be emulated by other EU countries.

LATIN AMERICA: Women's participation in Latin American parliaments improved due to the introduction of quotas in many countries, while Argentina, Brazil, and Costa Rica have female presidents. More women than men attain tertiary education across the region, but wage discrepancies persist. Although all countries in the region have ratified the Convention on the Elimination of all Forms of Discrimination against Women, as a result of restrictive legislation, one in three maternal deaths is due to abortion and the lifetime risk of maternal death is 0.4%. Mexico's programs and actions for the rights of women are among the best practices in Latin America, and many countries in the region are interested in emulating them.

NORTH AMERICA: Women make up half of the U.S. workforce, with an unemployment rate 1% lower than men's; more women than men are gaining advanced college and bachelor's degrees, redefining the roles in the family. Nevertheless, although they hold 51.5% of management, professional, and related positions, women account for only 3% of the Fortune 500 chief executives. The U.S. government estimates that approximately 75% of the 14,500–17,500 people annually trafficked into the country are female. Women's representation in U.S. legislature is 16.9%, while Canada's is 25%. Both U.S. and Canadian governments made critical cuts in domestic and international family planning programs for women.

12. How can transnational organized crime networks be stopped from becoming more powerful and sophisticated global enterprises?

Although the world is waking up to the enormity of the threat of transnational organized crime, it continues to grow, while a global strategy to address this global threat has not been adopted. The UN Office on Drugs and Crime has called on all states to develop national strategies to counter TOC as a whole in its report *The Globalization of Crime: A Transnational Organized Crime Threat Assessment*. The transition of much of the world's activities to the Internet and mobile phones has opened up a wealth of opportunities for TOC to profitably expand its activities from drugs and human trafficking to all aspects of personal and business life. The financial crisis and the bankruptcy of financial institutions have opened new infiltration routes for TOC crime, and the world recession has increased human trafficking and smuggling. UNODC also notes states are not seriously implementing the UN Convention against Transnational Organized Crime, which is the main international instrument to counter organized crime. INTERPOL has started construction of an international complex in Singapore that will open around 2013 with 300 staff, to serve as a center for policy, research, and worldwide operations. UNODC, with other agencies, has founded the International Anti-Corruption Academy, near Vienna, having as one of its goals tackling the connection of TOC and corruption. That combination, allowing government decisions to be bought and sold like heroin, makes democracy an illusion.

Havocscope.com estimates world illicit trade to be about $1.6 trillion per year (up $500 billion from last year), with counterfeiting and intellectual property piracy accounting for $300 billion to $1 trillion, the global drug trade at $404 billion, trade in environmental goods at $63 billion, human trafficking and prostitution at $220 billion, smuggling at $94 billion, and weapons trade at $12 billion. The International Carder's Alliance is based mostly in Eastern Europe, the heart of cybercrime, which the FBI estimates costs U.S. businesses and consumers billions annually in lost revenue. These figures do not include extortion or organized crime's part of the $1 trillion in bribes that the World Bank estimates are paid annually or its part of the estimated $1.5–6.5 trillion in laundered money. Hence the total income could be $2–3 trillion—about twice as big as all the military budgets in the world. The UN Global Commission on Drug Policy concluded that the law enforcement of the "War on Drugs" has failed and cost the U.S. $2.5 trillion over 40 years. It recommends a "paradigm shift" to public health over criminalization. OECD's Financial Action Task Force has made 40 recommendations to counter money laundering.

There are more slaves today than at the peak of the African slave trade. Estimates range from 12 million to 27 million people are being held in slavery today (the vast majority in Asia). UNICEF estimates that 1.2 million children are trafficked every year. The online market in illegally obtained data and tools for committing data theft and other cybercrimes continues to grow, and criminal organizations are offering online hosting of illegal applications. International financial transfers via computers of $2 trillion per day make tempting targets for international cyber criminals.

It is time for an international campaign by all sectors of society to develop a global consensus for action against TOC. Two conventions help bring some coherence to addressing TOC: the UN Convention against Transnational Organized Crime, which came into force in 2003, and the Council of Europe's Convention on Laundering, which came into force in May 2008. Possibly an addition to one of these conventions or the International Criminal Court could establish a financial prosecution system as a new body to complement the related organizations addressing various parts of TOC. In cooperation with these organizations, the new system would identify and establish priorities on top criminals (defined by the amount of money laundered) to be prosecuted one at a time. It would prepare legal cases, identify suspects' assets that can be frozen, establish the current location of the suspect, assess the local authorities' ability to make an arrest, and send the case to one of a number of preselected courts. Such courts, like UN peacekeeping forces, could be identified before being called into action and trained, and then be ready for instant duty. When all these conditions are met, then all the orders would be executed at the same time to apprehend the criminal, freeze access to the assets, open the court case, and then proceed to the next TOC leader on the priority list. Prosecution would be outside the accused's country. Although extradition is accepted by the UN Convention against Transnational Organized Crime, a new protocol would be necessary for courts to be deputized like military forces for UN peacekeeping, via a lottery system among volunteer countries. After initial government funding, the system would receive its financial support from frozen assets of convicted criminals rather than depending on government contributions.

Challenge 12 will be seriously addressed when

money laundering and crime income sources drop by 75% from their peak.

REGIONAL CONSIDERATIONS

AFRICA: The West Africa Coast Initiative is a partnership among UNODC, UN Peacekeeping, ECOWAS, INTERPOL, and others to address the problems that have allowed traffickers to operate in a climate of impunity. The drug traffic from Latin America through the West African coast to Africa and Europe has been declining. Piracy, centering on Somalia and now invading the Indian Ocean, has become a major crisis, with 286 piracy incidents worldwide in 2010 and 67 hijacked ships and over 1,130 seafarers affected. Yemen's unsettled future could leave the oil shipping lanes of the Arabian Sea bordered by two failed states. A multinational naval force is combating the problem, which is complicated by the lack of clear international legal structures for prosecution and punishment; Kenya has withdrawn its support in this area, but Somaliland and Puntland are helping. Some 930,000 sailors have signed a petition to the IMO to stop piracy. Smoking of "whoonga" has become a serious problem in South Africa, with robberies committed to support £90 per day habits. The 15 million AIDS orphans in sub-Saharan Africa, with few legal means to make a living, constitute a gigantic pool of new talent for the future of organized crime. Corruption remains a serious impediment to economic development in many African countries.

ASIA AND OCEANIA: The International Conference on Asian Organized Crime and Terrorism held its eighth meeting to share intelligence. Disease cut Afghan opium production by almost half, but the acreage stayed the same; four more provinces became almost drug-free, but domestic addiction is spreading. China is the main source for counterfeit goods sent to the EU. India is a major producer of counterfeit medicines. North Korea is perceived as an organized crime state backed up by nuclear weapons involved in illegal trade in weapons, counterfeit currency, sex slavery, drugs, and a range of counterfeit items. Myanmar is accused of deporting migrants to Thailand and Malaysia, where they are exploited, and has reportedly become a center for the ivory trade and elephant smuggling. Myanmar and China remain the primary sources of amphetamine-type stimulants in Asia; Myanmar rebels are exporting hundreds of millions of tablets to Thailand to raise money. A report says Australia has a multi-billion-dollar drug enterprise, and Australians are among the world's highest per capita consumers of illicit stimulants.

EUROPE: Europol published a 2011 TOC Threat Assessment at www.europol.europa.eu, indicating greater TOC mobility, operational diversity, and internal collaboration. The EU has strengthened controls on money transfers across its borders to address trafficking and money laundering, especially in Eastern Europe. Russian officials have declared the drug situation in that country "apocalyptic." An estimated €30 million in EU carbon emission allowances were stolen in January. The Italian Guardia di Finanza arrested 24 people from a €2.7 billion Chinese counterfeit fashion operation, and Milan police arrested 300 members of 'Ndrangheta. London police smashed a £100 million drug and money laundering gang.

LATIN AMERICA: About 35,000 people have died in the Mexican drug war over the last four years, of which 15,000 died in 2010. Mexico's cartels receive more money (an estimated $25–40 billion) from smuggling drugs to the U.S. than Mexico earns from oil exports. About $1 billion worth of oil was stolen from pipelines (396 taps) and smuggled into the U.S. over a two-year period. Mexican drug cartels are rapidly moving south, into Central America, and are branching out, with La Familia exporting $42 million worth of stolen iron ore from Michoacán in a year. UNODC says crime is the single largest issue impeding Central American stability. Cocaine production in Colombia has dropped by two-thirds and is now done by small gangs, using farms hidden in the jungles. The drug gangs have largely replaced the paramilitaries. Ecuador has become an important center of operation for TOC gangs (3,000 people have reportedly moved in from Colombia). Police seized a drug smuggling submarine in Colombia. Drug cartels exist in Latin America because of illegal drug consumption in the U.S.

NORTH AMERICA: The International Organized Crime Intelligence and Operations Center integrates U.S. efforts to combat international organized crime and coordinates investigations and prosecutions. The 22-month anti-cross-border-drug Project Deliverance ended successfully in June 2010 after the arrest of 2,200 individuals and the seizure of more than 69 tons of marijuana, 2.5 tons of cocaine, 1,410 pounds of heroin, and $154 million in currency. Only about 53 miles of operational "virtual fence" were put in place in Arizona, at a cost of about $15 million a mile; the project has been dropped. Drug criminal gangs have swelled in the U.S. to an estimated 1 million members, responsible for up to 80% of crimes in communities across the nation. Organized crime and its relationship to terrorism should be treated as a national security threat. Canada continues as a major producer and shipper of methamphetamines and ecstasy.

13. How can growing energy demands be met safely and efficiently?

Investments into alternatives to fossil fuels are rapidly accelerating around the world to meet the projected 40–50% increase in demand by 2035. The combined global installed capacity of wind turbines, biomass and waste-to-energy plants, and solar power reached 381 GW, exceeding the installed nuclear capacity of 375 GW (figure prior to the Fukushima disaster). The Japanese nuclear disaster has put the future of nuclear energy in doubt, increasing costly safety requirements and reducing public and investor confidence. This, plus the BP oil disaster and the growing awareness of climate change, are accelerating the transition to renewable energy sources. However, without major breakthroughs in technological and behavioral changes, the majority of the world's energy in 2050 will still come from fossil fuels. Therefore, large-scale carbon capture and reuse has to become a top priority to reduce climate change, such as using waste CO_2 from coal plants to grow algae for biofuels and fish food or to produce carbonate for cement. The short-term gainer may be natural gas. Energy efficiencies, conservation, and reduced meat consumption are near-term ways to reduce energy GHG production. To keep atmospheric CO_2 concentration below 450 ppm, an estimated $18 trillion investment on low-carbon technologies will be needed between 2010 and 2035. Meanwhile, the world spends more than $310 billion on energy subsidies every year; eliminating these could reduce GHGs by 10% by 2050.

Global investments in clean energy reached $243 billion in 2010, up from $186.5 billion in 2009. China leads the world in total investments in renewable energy and energy efficiency. IPCC's best-case scenario estimates that renewable sources could meet 77% of global energy demand by 2050, while WWF claims 100% is possible. Setting a price for carbon emissions will stimulate investments. For the past decade, coal has met 47% of new electricity demand globally. Assuming that countries fulfill their existing commitments to reduce emissions and cut fuel subsidies, IEA estimates that the world primary energy demand will still increase by 36% from 2008 to 2035, or 1.2% per year, with fossil fuels accounting for over half of the increase. World energy consumption increased 5% in 2010 after shrinking 1.1% in 2009.

IEA says $36 billion/year will connect the remaining 1.4 billion people around the world with electricity. About 3 billion people still rely on traditional biomass for cooking and heating, and 1.4 million people die every year due to indoor smoke from traditional cookstoves. The UN has declared 2012 as the International Year of Sustainable Energy and set 2030 for universal access to modern energy sources.

Auto manufacturers around the world are racing to create alternatives to petroleum-powered cars. Mass production of fuel-flexible plug-in hybrid electric cars at competitive prices could be a breakthrough in decarbonizing the transport sector. The global share of biofuel in total transport fuel could grow from 3% today to 27% in 2050. Massive saltwater irrigation along the deserted coastlines of the world can produce 7,600 liters/hectare-year of biofuels via halophyte plants and 200,000 liters/hectare-year via algae and cyanobacteria, instead of using less-efficient freshwater biofuel production that has catastrophic effects on food supply and prices. Drilling and liquefaction of natural gas via integrated ships promises to get more LNG in less time and cost.

Innovations are accelerating: concentrator photovoltaics to dramatically reduce costs; pumping water through micro-channels on the surface of a solar panel to make it more efficient and make seawater drinkable at the same time; producing electricity from waste heat from power plants, human bodies, and microchips; genomics to create hydrogen-producing photosynthesis; buildings to produce more energy than consumed; solar energy to produce hydrogen; microbial fuel cells to generate electricity; and compact fluorescent light bulbs and light-emitting diodes to significantly conserve energy, which can also be done by nanotubes that conduct electricity. Solar farms can focus sunlight atop towers with Stirling engines and other generators. Estimates for the potential of wind energy continue to increase, but so do maintenance problems. Drilling to hot rock (two to five kilometers down) could make geothermal energy available where conventional geothermal has not been possible. Plastic nanotech photovoltaics printed on buildings and other surfaces could cut costs and increase efficiency. The transition to a hydrogen infrastructure may be too expensive and too late to affect climate change, while flex-fuel plug-in hybrids, electric, and compressed air vehicles could provide alternatives to petroleum-only vehicles sooner. Unused nighttime power production could supply electric and plug-in hybrid cars. National unique all-electric car programs are being implemented in Denmark and Israel, with discussions being held in 30 other countries. Behavior changes and conservation can reduce demand.

Japan plans to have a working space solar power system in orbit by 2030. Such space-based solar energy systems could meet the world's electricity requirements indefinitely without nuclear waste or GHG emissions.

Eventually, such a system of satellites could manage base-load electricity on a global basis, yet some say this costs too much and is not necessary with all the other innovations coming up.

Challenge 13 will have been addressed seriously when the total energy production from environmentally benign processes surpasses other sources for five years in a row and when atmospheric CO_2 additions drop for at least five years.

REGIONAL CONSIDERATIONS

AFRICA: Over 70% of sub-Saharan Africa does not have access to electricity. The World Bank's Lighting Africa initiative mobilizes funding from the private sector to provide affordable and modern off-grid lighting to 2.5 million people in Africa by 2012 and to 250 million people by 2030. The $80 billion Grand Inga dam could generate 40,000 MW of electricity, but the project is progressing slowly due to political instability, mismanagement of public finance, and possible environmental and social impacts. Algeria will invest $60 billion in renewable energy projects by 2030. By 2050, some 10–25% of Europe's electricity needs could be met by North African solar thermal plants.

ASIA AND OCEANIA: There are more people without electricity in India (400 million) than live in the U.S. China uses more coal than the U.S., Europe, and Japan combined; it also builds more-efficient, less-polluting coal power plants. It is expected to add generation capacity equivalent to the current total installed capacity of the U.S. in the next 15 years. China invested more than $64 billion (1.4% of its GDP) in clean energy in 2010 and plans to expand its offshore wind turbines to 5 GW by 2015 and 30 GW by 2020. It added nearly 20 million vehicles in 2010 and now produces more cars than the U.S. and Japan, and it could lead the world in electric car production. India will invest $37 billion in renewable energy to add additional capacity of 17,000 MW by 2017. Oil and gas production in the Caspian region will grow substantially in the next 20 years; Kazakhstan and Turkmenistan lead the growth in oil and gas respectively. China has 13 nuclear reactors in operation and 25 under construction. India plans to increase nuclear energy's share from 3% to 13% by 2030.

EUROPE: Conservation and efficiencies could reduce EU's energy consumption about 30% below 2005 levels by 2050. Low-carbon technologies could provide 60% of energy by 2020 and 100% by 2050 according to the EU's low carbon roadmap. Germany and Switzerland plan to phase out nuclear energy. Increasing imports of renewable energy from MENA and natural gas from Eastern Europe seem inevitable. The future pan-European smart grid should allow massive deployment of low-carbon energy supply. A Swedish team certified Italian claims that low-energy nuclear reactions produced sufficiently more energy than consumed over 18 hours to trigger commercial planning. EU plans to have 10–12 carbon capture and storage demonstration plants in operation by 2015. Amsterdam plans to have 10,000 electric cars by 2015. Five geothermal power plants in Iceland supply 27% of the country's electricity needs. Europe is on track to generate 20% of its energy from renewable sources by 2020.

LATIN AMERICA: Brazil is the world's second largest producer of bioethanol, with 33% of the world market, producing it at 60¢ per gallon and meeting 40% of its automotive needs; 90% of the automobiles produced in Brazil are flex-fuel. Argentina is the world's second largest producer of biodiesel, with 13.1% of the market. Geothermal, solar, and wind are vast untapped resources for the region, as are gains from efficiencies. Installed wind power capacity in the region is expected to grow by 12.6% per year and reach 46 GW by 2025, with Brazil and Mexico having a dominant share. Ecuador announced that it would refrain from drilling for oil in the Amazon rainforest reserve in return for up to $3.6 billion in payments from industrial countries. Venezuela's Orinoco heavy oil reserves (requiring advanced production technology) are larger than Saudi Arabia's reserves. Argentina, Brazil, and Mexico have nuclear reactors but have not changed their nuclear policy, while Venezuela froze its plan to develop nuclear energy.

NORTH AMERICA: Lesser-known potential clean energy sources in the U.S. include high-altitude wind off the East Coast, OTEC in the Gulf Stream, solar thermal in the Midwest (four corners), drilled hot rock geothermal, and nano-photovoltaics. The U.S. investment in clean energy increased by 51% in 2010, but the U.S. dropped to third place after China and Germany. Algae farms for biofuel may cost $46.2 billion per year to replace oil imports. California requires oil refineries and importers of motor fuels to reduce the carbon intensity of their products by 10% by 2020. San Francisco's mayor called for the city to go 100% renewable by 2020. Pacific Gas & Electric Company of California agreed to buy 200 megawatts of space-based solar power by 2016 from Solaren. Recycling waste heat from nuclear power plants to home air conditioners and recycling body heat to recharge batteries could reduce CO_2 by 10–20% in the U.S.

14. How can scientific and technological breakthroughs be accelerated to improve the human condition?

The acceleration of S&T continues to fundamentally change the prospects for civilization, and access to its knowledge is becoming universal. The ability to learn this knowledge is also improving with Web-based asynchronous highly motivational educational systems, adaptive learning models such as cellular automata, genetic algorithms, neural networks, and emerging capabilities of collective intelligence systems. Computing power and lowered costs predicted by Moore's Law continues with the world's first three-dimensional computer chip introduced by Intel for mass production. Computational chemistry, computational biology, and computational physics are changing the nature of science, and its acceleration is attached to Moore's law. China currently holds the record for the fastest computer with Tianhe-1, which can perform 2.5 petaflops per second; IBM's Mira, ready next year, will be four times faster. Watson is the IBM computer that beat the top knowledge contestants on a TV quiz show; it is a massively parallel processing computer capable of reading an essentially unlimited number of documents, digesting the information, and answering questions posed in natural language. It is now being readied to use vast amounts of medical data to accelerate improvements in health knowledge and decisionmaking. Watson supports the idea that intelligent computer systems can be smarter than humans.

Craig Venter created a synthetic genome by placing a long strand of synthetic DNA into a bacterium that followed the synthetic DNA's instructions and replicated. A U.S. Presidential Commission concluded that it was not yet the invention of "life" but that synthetic biology research should continue with scientific self-regulation. Venter forecasts that as computer code is written to create software to augment human capabilities, so too genetic code will be written to create life forms to augment civilization. In a process known as transdifferentiation, scientists have manipulated human cells, converting pancreatic cells into liver cells and skin cells into heart cells; skin cells were converted into functioning neurons that could integrate into neuron networks of the sort found in the human brain. A new anti-virus strategy is being pursued to develop artificial "proto-cells that can lure, entrap and inactivate a class of deadly human viruses."

Nano robots now roam inside the eyes in tests to deliver drugs for conditions such as age-related macular degeneration. Swarms of manufacturing robots are being developed that should be able to manage nano-scale building blocks for novel material synthesis and structures, component assembly, and self-replication and repair. At an even smaller scale, nanometer robots have been demonstrated and appear able to link with natural DNA. Nanobots the size of blood cells may one day enter the body to diagnose and provide therapies and internal virtual reality imagery. Although nanotech promises to make extraordinary gains in efficiencies needed for sustainable development, its environmental health impacts are in question.

Scanning electron microscopes can see 0.01 nanometers (the distance between a hydrogen nucleus and its electron), and the Hubble telescope has seen 13.2 billion light-years away. Photons have been slowed and accelerated. External light has been concentrated inside the body for photodynamic therapy and powered implanted devices. DNA scans open the possibility of customized medicine and eliminating inherited diseases. MRI brain imaging shows primitive pictures of real-time thought processes. Paralyzed people have controlled computers with their thoughts alone.

Anti-matter has been trapped (in the form of 309 atoms of antihydrogen) in electro-magnetic containment and observed for an astonishing 17 minutes in CERN's particle physics laboratory. This may facilitate research into how gravity and time affect antimatter. Some scientists predict that if the Large Hadron Collider succeeds in producing the Higgs boson, it may also create a second particle called the Higgs singlet that should have the ability to jump into an extra, fifth dimension where they can move either forward or backward in time and reappear in the future or past. On another frontier one group is attempting to entangle billions of particle pairs (quantum entanglement is the simultaneous change of entangled objects separated in space). Quantum building blocks, qubits, have been embedded into nanowires, important steps toward quantum computers. Quantum theory also encompasses the "many worlds interpretation" of our existence. In the MWI, every event is a branch point that may go this way or that, creating an almost infinite set of branches. Follow any one and it describes a simultaneously existing alternate world, a remarkable and counterintuitive reality. Although seemingly remote from improving the human condition, such basic science is necessary to increase knowledge that applied science and technology draws on to improve the human condition.

We need a global collective intelligence system to track S&T advances, forecast consequences, and document a range of views so that politicians and the public can understand the potential consequences of new S&T. Challenge 14 will have been addressed seriously when the funding of R&D for societal needs reaches parity with funding for weapons and when an international science and technology organization is established that routinely connects world S&T knowledge for use in R&D priority setting and legislation.

REGIONAL CONSIDERATIONS

AFRICA: The first Inter-Parliamentary Forum on Science, Technology and Innovation promises to increase the percent of GDP for S&T. African Innovation Outlook 2010 found S&T for medicine has passed agriculture, but Africa's share of global science continues to decrease. These low levels of R&D investment, weak institutions, and poor access to markets are among the key challenges in actualizing Africa's innovation potential. The UN Economic Commission for Africa is supporting science training via collaboratories to connect African scientists with counterparts overseas to use S&T more efficiently. Primary commodities account for 80% of Africa's exports; S&T innovation is needed to create added value exports and to leapfrog into future biotechnology, nanotech, and renewable energy prospects. UNESCO's 2010 World Social Science Report found a 112% increase in Africa's publications in social studies and humanities between 1987 and 2007.

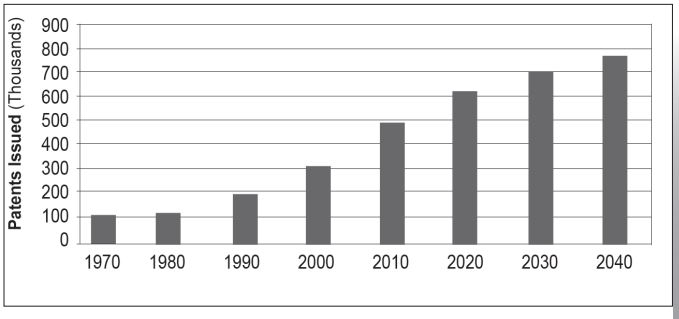
ASIA AND OCEANIA: Chinese patent filings have gone up 500% in the last five years; China is investing more in cleaner energy technology than the U.S. does and it has the second largest R&D budget in the world. Asian countries with double-digit economic growth also have double-digit growth in R&D expenditures. Energy and environment is the focus of U.S. and China relations. Japan has launched a Venus probe that also carried a space sail that gains its energy from solar "wind" pressure in space.

EUROPE: The 2012 EU budget increases research by 13%. The EU is establishing a single European system for registering patents. Although the Lisbon Strategy expired in 2010, succeeded by Europe 2020, the EU target of 3% of GDP for R&D has been kept. Only two EU member states have achieved the 3% target so far, while the average R&D expenditure of the EU27 stood at 2.01% of GDP in 2009. The newer members' R&D expenditure remains low, with many under 1%. Russia has lost over 500,000 scientists over the last 15 years, but a reverse trend is beginning, salaries have increased, innovation is encouraged, and high tech is being supported. Russian investments in nanotechnology R&D and corporations have been substantial, even during the recent recession. Russia is building the Skolkovo Innovation Center with funding from multinational corporations to accelerate R&D and applications.

LATIN AMERICA: OECD, UNESCO, EU, the U.S., and China are helping countries in the region with innovation systems. Chile has started a scientific news network for Latin America in order to reverse some of the lagging indicators in the region. Argentina, Brazil, Chile, and Mexico account for almost 90% of university science in the region, and half of the 500 higher education institutes produce no scientific research. University S&T courses could be required to focus some attention on helping the poorest communities. Mexico is leading the Innovation Network for Latin American and the Caribbean.

NORTH AMERICA: Research by the U.S. National Academy of Sciences, National Academy of Engineering, and Institute of Medicine is available for free downloads. The Massachusetts Institute of Technology makes 2,000 courses online–many the top S&T course in the world–available at no cost with videos, lecture notes, and references. The U.S. Peace Corps has created Information Volunteers to help developing countries access science and technology information in the classroom. The space shuttles made their last flights in 2011. About 35% of world R&D is in the U.S. Each week the U.S. Patent Office makes thousands of new patents freely available online. Prizes can speed the distribution of technology that benefits humanity, such as the Tech Awards from the Tech Museum in San Jose, California, or Richard Branson's new prize for a plan to remove a billion tons of carbon dioxide a year, as can tech sports like MIT's robot competitions.

Figure 7: Patents issued in the U.S. (per year)



Source: U.S. Patent Statistics

15. How can ethical considerations become more routinely incorporated into global decisions?

Is the acceleration of global change beyond conventional means of ethical evaluation? Must we invent anticipatory ethical systems? Just as law has a body of previous judgments upon which to draw for guidance, will we also need bodies of ethical judgments about future possible events? For example, is it ethical to clone ourselves or bring dinosaurs back to life or invent thousands of new life forms from synthetic biology? Despite the extraordinary achievements of S&T, future risks from their continued acceleration and globalization remain (see CD Chapter 3.5) and give rise to future ethical issues (see CD Chapters 5 and 11). On the brighter side, new technologies also make it easier for more people to do more good at a faster pace than ever before. Single individuals initiate groups on the Internet, organizing actions worldwide around specific ethical issues. News media, blogs, mobile phone cameras, ethics commissions, and NGOs are increasingly exposing unethical decisions and corrupt practices.

The killing of bin-Laden raises political, legal, and ethical issues with a broad range of views. Some examples: it may have improved the future by hastening the collapse of Al Qaida; the U.S. has killed more innocent people in response to the smaller number killed on 9/11; it will prevent many future deaths; vengeance is not justice. Related to this are the future possibilities and ethical issues of a single individual who is massively destructive. Hopefully a future SIMAD is identified before he or she has the chance to be massively destructive. Picture the person building new bio-viruses in a basement laboratory that if delivered could kill millions of people. Do civil rights apply, or should society impose sanctions before the fact? In bin-Laden's case, was the killing justified because many believed it will help save lives and create a better future? To reduce the number of future SIMADs, healthy psychological development of all children should be the concern of everyone. Such observations are not new, but the consequences of failure to realize their importance may be much more serious in the future than in the past.

The moral will to act in collaboration across national, institutional, religious, and ideological boundaries that is necessary to address today's global challenges requires global ethics. Public morality based on religious metaphysics is challenged daily by growing secularism, leaving many unsure about the moral basis for decisionmaking. Unfortunately, religions and ideologies that claim moral superiority give rise to "we-they" splits.

The UN Global Compact—with 8,000 participants, including over 5,300 businesses in 130 countries—was created to reinforce ethics in decisionmaking; it has improved business-NGO collaboration, raised the profile of corporate responsibility programs, and increased businesses' non-financial reporting mandates in many countries. The Compact has been used to encourage corporations to urge their countries to ratify the UN Convention against Corruption, which has been ratified by 143 states. As of March 2011 there were 26 first-year country reviews of corruption under way via the convention. Article 51 calls on states parties to return stolen assets; the unethically acquired wealth by Arab dictators is being uncovered, and this might be a test of this article. The ICC has successfully tried political leaders, and proceedings are Web-cast.

Some believe that Wikileaks will ultimately improve ethical considerations in global decisions, since, it is argued, it shows that many unethical decisions led to poorer results than expected. The global financial crisis demonstrated the interdependence of economics and ethics.

Although quick fixes have pulled the world out of recession, the underlining ethics has not been addressed sufficiently to prevent future crises. The Universal Declaration of Human Rights continues to shape discussions about global ethics and decisions across religious and ideological divides. UNESCO's Global Ethics Observatory is a set of databases of ethics institutions, teaching, codes of contact, and experts.

Collective responsibility for global ethics in decisionmaking is embryonic but growing. Corporate social responsibility programs, ethical marketing, and social investing are increasing. Global ethics also are emerging around the world through the evolution of ISO standards and international treaties that are defining the norms of civilization. Yet 12–27 million people are slaves today, more than at the height of the nineteenth-century slave trade; the World Bank estimates over $1 trillion is paid each year in bribes; and organized crime takes in $2–3 trillion annually.

Transparency International's Corruption Perception Index measures perceived levels of corruption in the public sector in 178 countries. In 2010 the least corrupt countries were seen to be Denmark, New Zealand, and Singapore; the most corrupt were Equatorial Guinea, Burundi, and Chad. Sixty percent of the people surveyed said that they

thought corruption in their countries had increased over the last three years; in Europe, almost 75% said they thought things were getting worse. Around the world, 25% said that they paid bribes in the last year to police (mentioned most often), tax authorities, and other officials. In poor countries, half the people reported paying a bribe in the past year, usually for permits, improved services, and to "avoid problems with authorities."

Entertainment media could promote memes like "make decisions that are good for me, you, and the world." We need to create better incentives for ethics in global decisions, promote parental guidance to establish a sense of values, encourage respect for legitimate authority, support the identification and success of the influence of role models, implement cost-effective strategies for global education for a more enlightened world, and make behavior match the values people say they believe in. Ethical and spiritual education should grow in balance with the new powers given to humanity by technological progress. Challenge 15 will be addressed seriously when corruption decreases by 50% from the World Bank estimates of 2006, when ethical business standards are internationally practiced and regularly audited, when essentially all students receive education in ethics and responsible citizenship, and when there is a general acknowledgment that global ethics transcends religion and nationality.

REGIONAL CONSIDERATIONS

AFRICA: The North African uprisings in 2011 were calls for ethics in decisionmaking. Transparency International chapters in sub-Saharan Africa work to counter corruption. The Business Ethics Network of Africa continues to grow, with conferences, research, and publications. Most African government anti-corruption units are not considered successful, Eight African countries surveyed by Transparency International report that 20% of those interviewed in eight African countries surveyed who had contact with the judicial system reported having paid a bribe.

ASIA AND OCEANIA: As China's global decisionmaking role increases, it will face traditional versus western value conflicts. Some believe the rate of urbanization and economic growth is so fast in Asia that it is difficult to consider global ethics, while Asians do not believe there are common global ethics and maintain that the pursuit to create them is a western notion.

EUROPE: Long-range demographic projections indicate Europe will become the first Moslem-majority content. The European integration processes both help and challenge ethical standards as cultures meet and question each other's way of thinking and acting. Its future immigration policies will have global significance, increasing discussions of ethics and identity for Europe. The European Ethics Network is linking efforts to improve ethical decisionmaking, while Ethics Enterprise is working to mobilize an international network of ethicists and organizes innovative actions to attract attention for ethics in business.

LATIN AMERICA: University courses in business ethics are growing throughout Latin America. Problems such as lack of personal security, limited access to education and health services, lack of faith in politics, badly damaged institutions that do not fulfill their role (such as the Justice system and police), and accelerated environmental degradation in some countries are aspects of a serious lack of ethical values. The prevalence of legal formality, in other countries, does not guarantee equal rights, as large sections of the population remain excluded from the guarantees of goods and people. It also manifests a serious lack of ethical standards in the mass media.

NORTH AMERICA: With the emergence of the G8 and BRIC and the increasing powers of the WTO, ICC, regional organizations, and social media, it is reasonable to forecast a transition from the U.S. being the only superpower to a more multi-polar world. But how that will change global decisionmaking and ethical considerations is not as clear. Although the U.S. has provided some leadership in bringing ethical considerations into many international organizations and forums, its ethical leadership is compromised—there is still no generally accepted way to get corrupting money out of politics and elections or to stop "cozy relationships" between regulators and those they regulate.

Figure 8. Global surface temperature anomalies

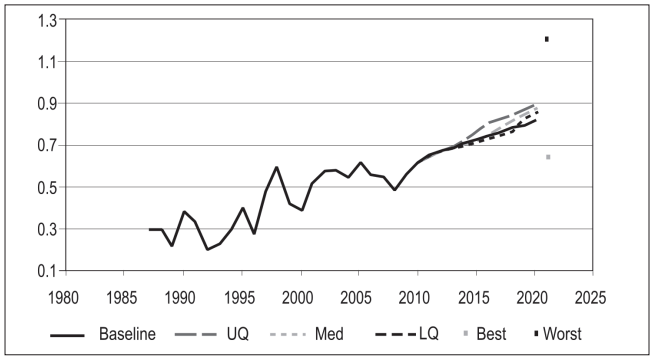


Figure 9. Population growth (annual percent)

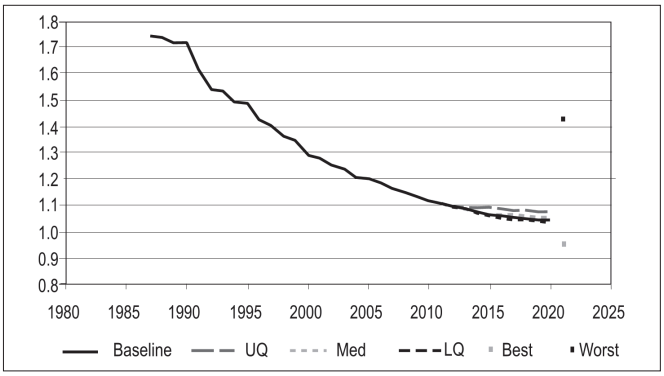


Figure 10. Life expectancy at birth (years)

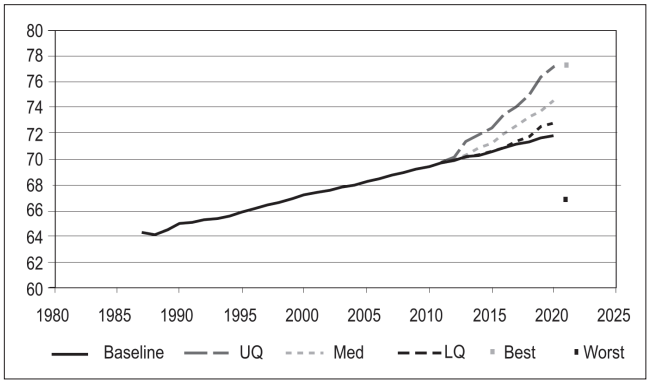


Figure 11. Infant mortality (deaths per 1,000 births)

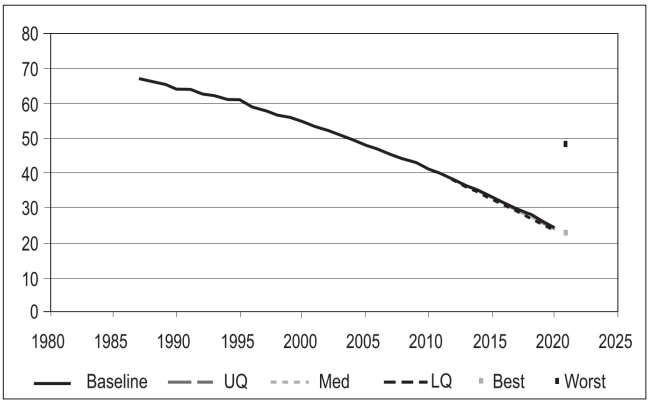


Figure 12. Undernourishment (percent of population)

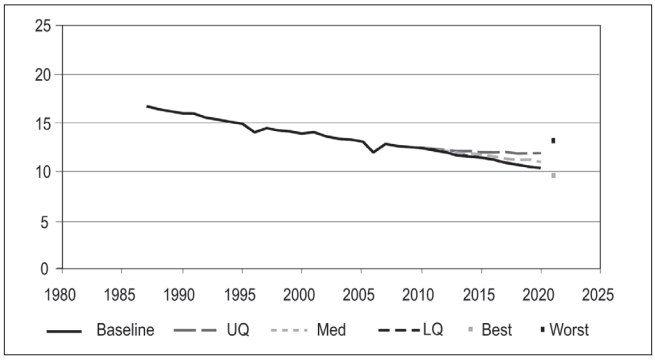


Figure 13. Improved water source (percent of population with access)

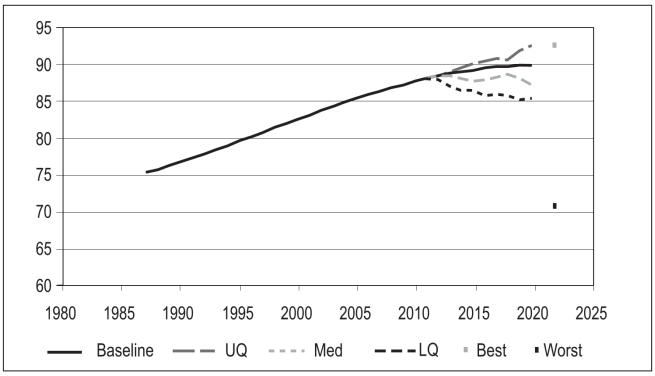


Figure 14. School enrollment, secondary (percent gross)

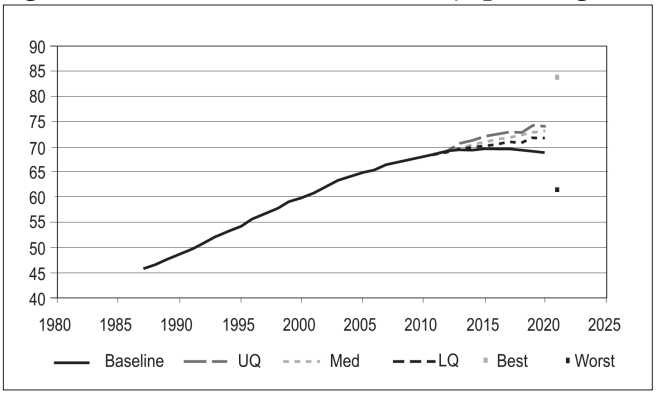
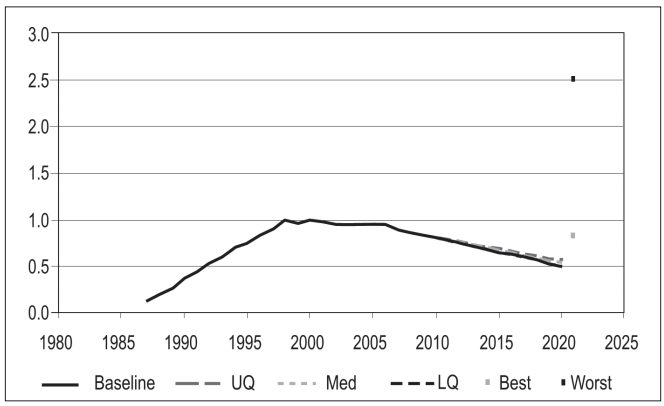


Figure 15. Prevalence of HIV (percent of population of age 15-49)



Compilation and projections by The Millennium Project from international data sources listed in Chapter 2. SOFI on the CD

Figure 16. Women in parliaments (percent of all members)

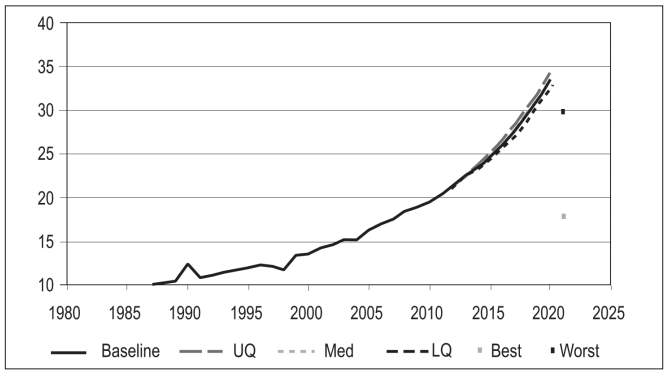


Figure 17. Internet users (billion people)

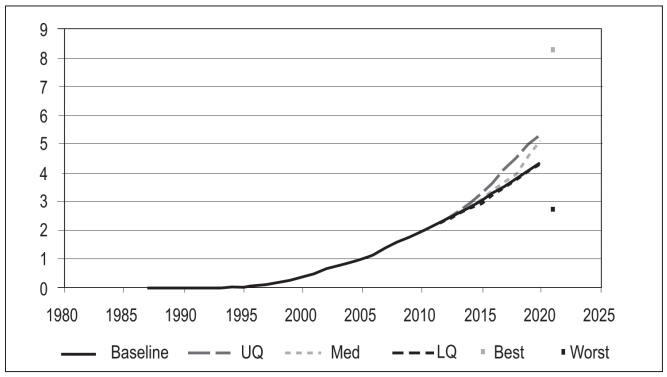


Figure 18. Number of major armed conflicts (number of deaths >1,000)

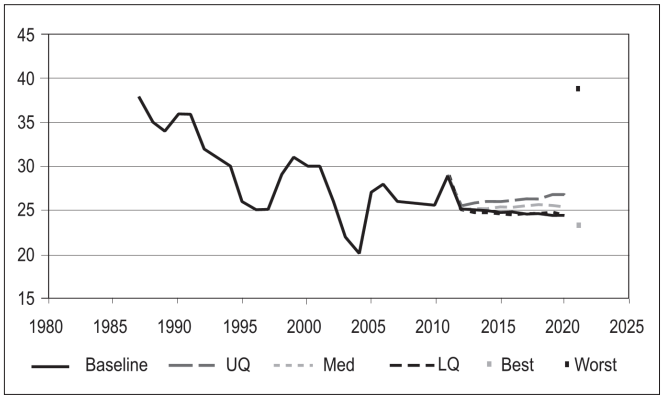


Figure 19. R&D expenditures (percent of national budget)

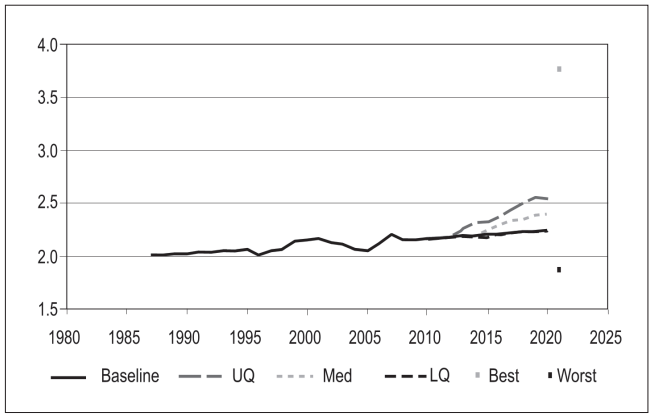


Figure 20. GDP per capita (constant 2000 US$)

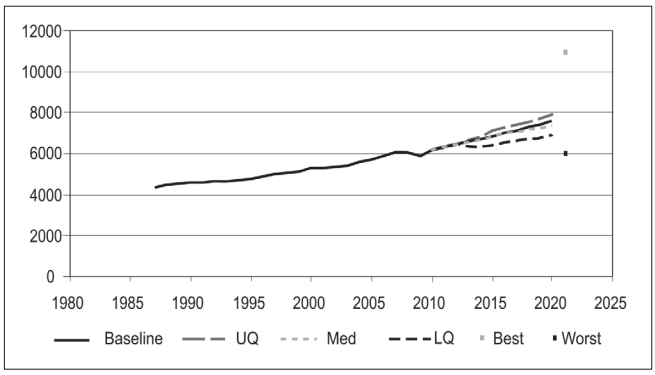


Figure 21. Unemployment, total (percent of total labor force)

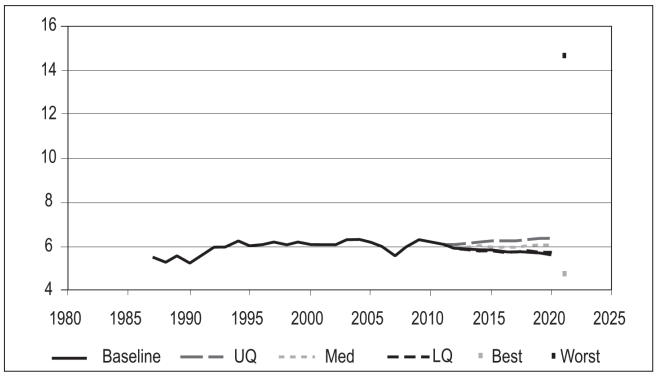


Figure 22. Poverty headcount ratio at $1.25 a day (PPP) (percent of population) (low- and mid-income countries)

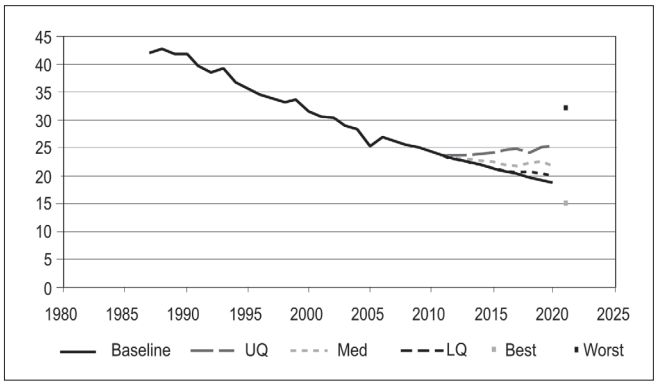


Figure 23. Levels of corruption (15 largest countries) (larger numbers = less corruption)