



# 2015-16 State of the Future

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## Executive Summary

Another 2.3 billion people are expected to be added to the planet in just 35 years. By 2050, new systems for food, water, energy, education, health, economics, and global governance will be needed to prevent massive and complex human and environmental disasters. The Millennium Project's futures research shows that most of these problems are preventable and that a far better future than today is possible. Brilliant insights, policy and social innovations, scientific and technological breakthroughs, and new kinds of leadership are emerging around the world. The interactions among future artificial intelligences, countless new lifeforms from synthetic biology, proliferation of nano-molecular assemblies, and robotics could produce a future barely recognizable to science fiction today.

The future can be much better than most pessimists understand, but it could also be far worse than most optimists are willing to explore. We need serious, coherent, and integrated understandings of mega-problems and opportunities to identify and implement strategies on the scale necessary to address global challenges. This report should be used as a reference to further that understanding.

After 18 years of producing the *State of the Future* reports, it is increasingly clear that humanity has the resources to address its global challenges, but it is not clear that an integrated set of global and local strategies will be implemented together and on the scale necessary to build a better future. As Pope Francis said in His Encyclical Letter, "Halfway measures simply delay the inevitable disaster."

Our challenges are transnational in nature, requiring transnational strategies. Doing everything right to address climate change or counter organized crime in one country will not make enough of a difference if others do not act as well. We need coordinated transnational implementation. Government and corporate future strategy units are proliferating, but they have yet to sufficiently influence decisions on the scale and speed necessary to address the complex, integrated, and global nature of accelerating change. Intergovernmental organizations and public-private collaborations are also increasing, but they too have to become far more effective. Humanity needs a global, multifaceted, general long-term view of the future with bold long-range goals to excite the imagination and inspire international collaboration.

For example, the U.S. and China could set a goal to reduce atmospheric CO<sub>2</sub> from the current 400 ppm to 350 ppm and invite the rest of the world to participate in a NASA-like program to achieve it. They did make a joint announcement in November 2014; they pledged GHG emissions caps, collaboration on cleaner energy research,

carbon capture and reuse, Eco-smart City designs, and a phasedown of the use of hydrofluorocarbons. This is progress, but it lacks a bold goal to inspire goal action. The UN is proposing 17 sustainable development goals, such as ending poverty and hunger by 2030.

The executive summary of the *2008 State of the Future* stated:

*Half the world is vulnerable to social instability and violence due to rising food and energy prices, failing states, falling water tables, climate change, decreasing water-food-energy supply per person, desertification, and increasing migrations due to political, environmental, and economic conditions.*

Unfortunately, these factors contributing to social instability have continued to worsen over the past seven years, leading to the social unrest we see today in many parts of the world.

While much of the world's attention focuses on the horrors of extremists and intrastate conflicts, thought-leaders such as Stephen Hawking, Elon Musk, and Bill Gates are warning the world about the potential dangers of artificial intelligence growing beyond human control. Whether AI can evolve into the nightmares of science fiction or not, it is certain that it and other future technologies (e.g., robotics, synthetic biology, computational science, nanotechnology, quantum computing, 3D and 4D printing, Internet of Things, cognitive science, self-driving vehicles, and synergies among these) will change what we think is possible over the next several decades, but they could also lead to massive unemployment.

Concentration of wealth is increasing. Income gaps are widening. Jobless economic growth seems the new norm. Return on investment in capital and technology is usually better than labor. Future technologies can replace much of human labor. Long-term structural unemployment is a business-as-usual forecast.

The Future Work/Technology 2050 Real-Time Delphi conducted by The Millennium Project explains in the last section of this report that the nature of work and political-economic systems may have to change by 2050 or else there could be massive long-term unemployment. Avoiding this could lead to the beginnings of a new kind of self-actualization economy in transition from issues of scarcity to issues of abundance.

Future artificial intelligence that can autonomously create, edit, and implement software simultaneously around the world based on feedback from global sensor networks is a unique historical factor in job displacement. It will affect the whole world, just as the Internet has, however more so. It might be possible that more jobs will be created than eliminated, as in the past, but the speed and integration of technological change and population growth is so much greater this time that long-term structural unemployment is a very plausible future. Ideas like universally guaranteed basic income and other new economic mechanisms have to be seriously considered now—because it may take a generation or two to make such changes. Accelerating scientific breakthroughs in brain and longevity research make healthy life extension increasingly likely. As a result, massive programs will be needed to teach the elderly how to contribute to society—finding markets for their skills and interests on the Internet.

The global economy is expected to grow about 3.5% during 2015, while the population of 7.3 billion is growing at 1.14%; hence, the world average per capita income growth is 2.36%. This is still about half the per capita annual income growth

prior to the global financial crisis and world recession. But growth for growth's sake is increasingly unwise. Incentives have to be implemented around the world to speed the transition from blind economic growth to eco-smart development, otherwise water and other environmental shortages are likely to increase social instability. Half of humanity that lives within 120 miles of coastlines could eventually be permanently disrupted. Without a U.S.-China Apollo-like goal on climate change to focus R&D and implement policies, current goals to limit CO<sub>2</sub> growth to 450 ppm seem unlikely, and longer-range changes in the ocean could lead to increases in microbes that produce deadly hydrogen sulfide (H<sub>2</sub>S) worldwide. Large-scale investments are needed to accelerate the transition from fossil carbon to renewable energy, from livestock systems to growing meat without animals, and from freshwater-only agriculture to saltwater agriculture.

To prevent the possibility of quantum computing with artificial intelligence and sensor networks growing beyond human control, we have to design human-friendly control systems and ways to merge wisely with future technology while living simultaneously in cyber-worlds and physical "reality." Because advances in synthetic biology, ICT, and other future technologies make it plausible that single individuals acting alone could make and deploy weapons of mass destruction, global sensor networks will be needed to identify intent before action, advances in mental health will be needed to reduce the number of socio- and psychopaths, and new roles for the public will have to be found to reduce these threats. Future molecular manufacturing and 3D printing promise to give everyone a better living standard, but these also distribute the possibility of creating nano-armies, and they dramatically reduce world trade.

When all of humanity becomes connected to the Internet of Things, and when breakthroughs are discovered, integrated, and implemented from the human brain projects of the U.S., EU, and China and the artificial intelligence projects of Google and IBM, every individual could eventually have the possibility of being an augmented genius. How might a world full of augmented geniuses change culture, politics, religions, mindsets, and economics? A global collective intelligence system is needed to keep track of all of this and to widen the conversation among world leaders, experts, and the public to begin the massive changes in societal constructs necessary to address these and other foreseeable global challenges to build a better future.

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Through a series of international Delphi surveys beginning in 1997 and global scanning systems, The Millennium Project has identified and has been updating the following 15 Global Challenges. They can be used both as a framework to understand global change and as an agenda to improve the future:

1. **How can sustainable development be achieved for all while addressing global climate change?** The IPCC reports that each decade of the past three was consecutively warmer and that the past 30 years was probably the warmest period in the northern hemisphere over the last 1,400 years. Even if all CO<sub>2</sub> emissions are stopped, most aspects of climate change will persist for many centuries. Hence, the world has to take adaptation far more seriously.
2. **How can everyone have sufficient clean water without conflict?** An additional 2.3 billion people received access to safe drinking water since 1990—

an extraordinary achievement—but this still leaves 748 million without this access. Water tables are falling on all continents, and nearly half of humanity gets its water from sources controlled by two or more countries.

3. **How can population growth and resources be brought into balance?** The current world population is 7.3 billion. It is expected to grow by another 1 billion in just 12 years and by 2.3 billion in 35 years. To keep up with population and economic growth, food production should increase by 70% by 2050.
4. **How can genuine democracy emerge from authoritarian regimes?** A global consciousness and more-democratic social and political structures are developing in response to increasing interdependencies, the changing nature of power, and the need to collectively address major planetary existential challenges. Meantime, world political and civil liberties deteriorated for the ninth consecutive year in 2014 (61 countries declined; 33 countries improved).
5. **How can decision-making be enhanced by integrating improved global foresight during unprecedented accelerating change?** Decision-makers are rarely trained in foresight and decision-making, even though decision support and foresight systems are constantly improving—e.g., Big Data analytics, simulations, collective intelligence systems, indexes, and e-governance participatory systems.
6. **How can the global convergence of information and communications technologies work for everyone?** The race is on to complete the global nervous system of civilization and make supercomputing power and artificial intelligence available to everyone. How well governments develop and coordinate Internet security regulations will determine the future of cyberspace, according to Microsoft.
7. **How can ethical market economies be encouraged to help reduce the gap between rich and poor?** Extreme poverty in the developing world fell from 51% in 1981 to 17% in 2011, but the income gaps between the rich and poor continue to expand rapidly. In 2014, the wealth of 80 billionaires equaled the total wealth of the bottom 50% of humanity, and Oxfam estimates that if current trends continue, by 2016 the richest 1% of the people will have more than all the rest of the world together.
8. **How can the threat of new and reemerging diseases and immune microorganisms be reduced?** The health of humanity continues to improve; life expectancy at birth increased globally from 67 years in 2010 to 71 years in 2014. However, WHO verified more than 1,100 epidemic events over the past five years, and antimicrobial resistance, malnutrition, and obesity continue to rise.
9. **How can education and learning make humanity more intelligent, knowledgeable, and wise enough to address its global challenges?** Much of the world's knowledge is available—either directly or through intermediaries—to the majority of humanity today. Google and Wikipedia are helping to make the phrase “I don't know” obsolete.
10. **How can shared values and new security strategies reduce ethnic conflicts, terrorism, and the use of weapons of mass destruction?** The vast majority of the world is living in peace, and transborder wars are increasingly rare. Yet half the world is potentially unstable, intrastate conflicts are increasing, and almost

1% of the population (some 73 million people) are refugees or IDPs. The diplomatic, foreign policy, military, and legal systems to address the new asymmetrical threats have yet to be established.

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 is acknowledged as essential for addressing all the global challenges facing humanity. The percent of women in parliaments doubled over the last 20 years from 11% to 22%. However, violence against women is the largest war today—as measured by deaths and casualties per year—and obsolete patriarchal structures persist around the world.
12. **How can transnational organized crime networks be stopped from becoming more powerful and sophisticated global enterprises?** Transnational organized crime is estimated to get twice as much income as all military budgets combined per year. Distinctions among organized crime, insurgency, and terrorism have begun to blur, giving new markets for organized crime and increasing threats to democracies, development, and security.
13. **How can growing energy demands be met safely and efficiently?** Solar and wind energy systems are now competitive with fossil fuel sources. Fossil fuels receive \$5.3 trillion in subsidies per year compared to \$0.12 trillion for renewable energy sources, according to the IMF. Energy companies are racing to make enough safe energy by 2050 for an additional 3.5 billion people (1.3 billion who do not have access now, plus the additional 2.3 billion population growth).
14. **How can scientific and technological breakthroughs be accelerated to improve the human condition?** Computational chemistry, computational biology, and computational physics are changing the nature and speed of new scientific insights and technological applications. Future synergies among synthetic biology, 3D and 4D printing, artificial intelligence, robotics, atomically precise fabrication and other forms of nanotechnology, tele-everything, drones, falling costs of renewable energy systems, augmented reality, and collective intelligence systems will make the last 25 years seem slow compared with the volume of change over the next 25 years.
15. **How can ethical considerations become more routinely incorporated into global decisions?** Although short-term economic “me-first” attitudes are prevalent throughout the world, love for humanity and global consciousness are also evident in the norms expressed in the many international treaties, UN organizations, international philanthropy, the Olympic spirit, inter-religious dialogues, refugee relief, development programs for poorer nations, Doctors Without Borders, and international journalism.

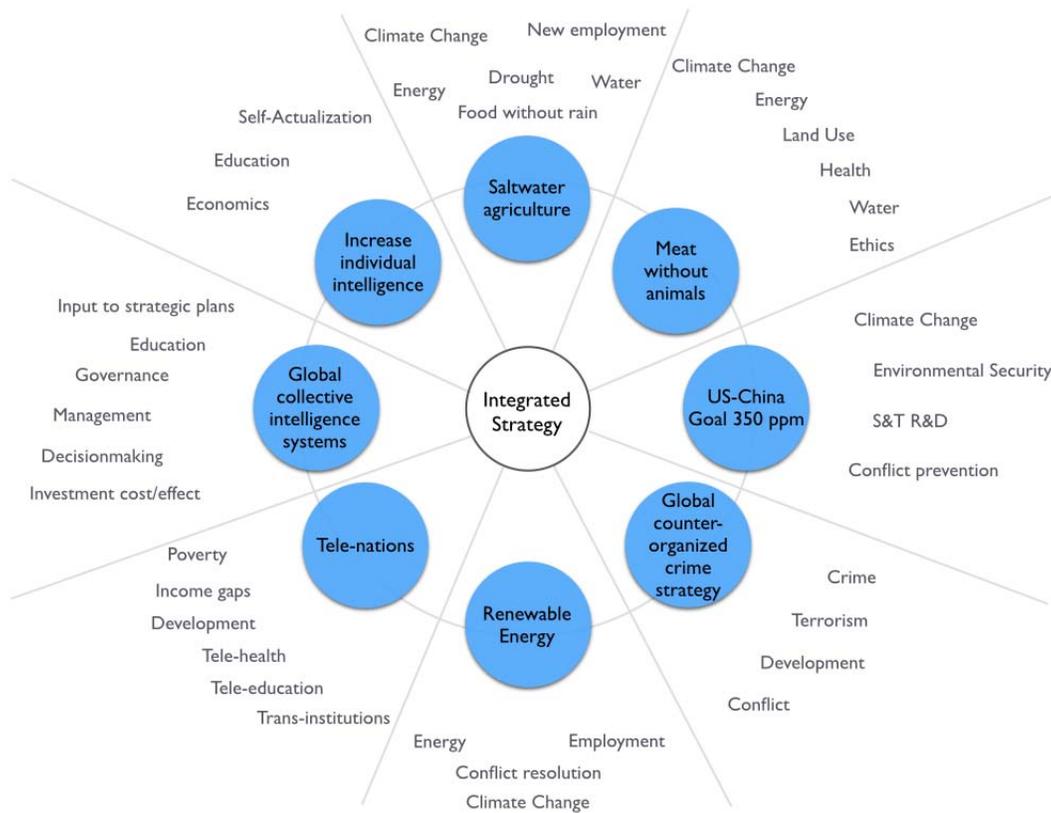
The Millennium Project has gathered the insights from creative and knowledgeable people around the world via its 56 Nodes to update the situation, prospects, and strategies to address these Global Challenges. The following section on the 15 Global Challenges presents an overview of each Challenge so that readers can save time and more easily improve their understanding of our common future compared with more narrowly focused books and sources scattered around the Internet. These are continually updated online in the Global Futures Intelligence System ([themp.org](http://themp.org)) along with more detailed overviews, international news aggregation, annotated scanning

system, situation charts, Web resources, models, papers, books, and comments from subscribers. GFIS can be thought of as a global information utility from which different readers can draw different value for improving understanding and decisions.

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Although the *State of the Future* executive summaries may provide the best overviews of the global situation and prospects for the future, there is a need for a better integrated conceptualization and analysis of holistic problem/solution spaces. Since all of these challenges have to be addressed, strategies that can address multiple challenges should be emphasized. Figure 1 is an initial example of an overview integrated global strategy.

**Figure 1. Initial Draft Concept for Discussion of an Integrated Global Strategy**

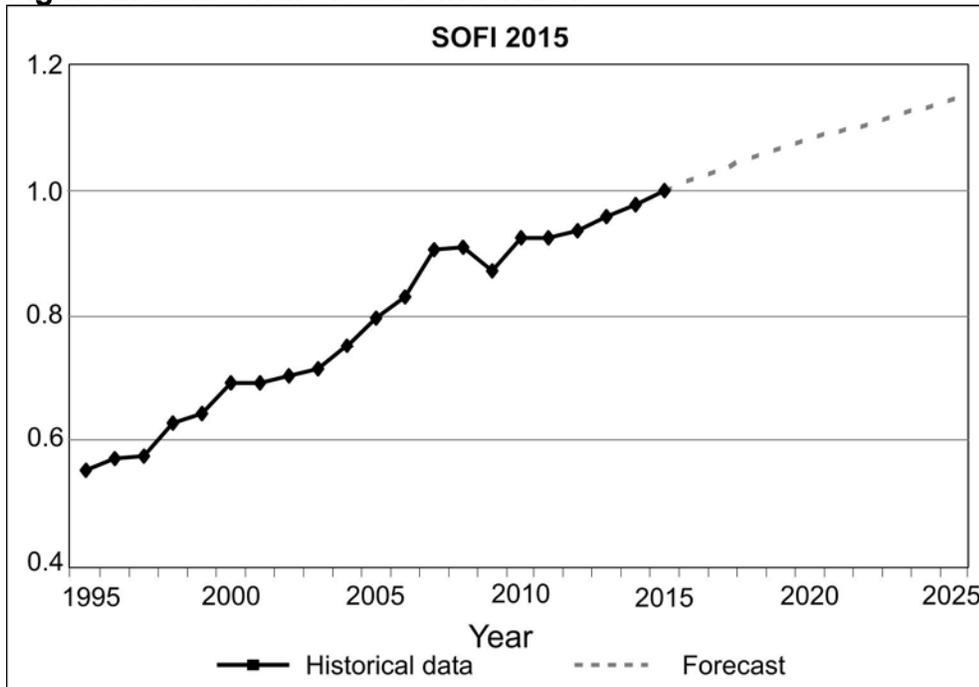


Improvements on this initial draft are welcome and will be used to update and improve it in GFIS.

So how are we doing in addressing these 15 Global Challenges? What's the score card? Where are we winning and losing? What is the future outlook? The Millennium Project has created a State of the Future Index to answer these questions.

The 2015 SOFI below shows slow but steady improvement in general human welfare over the past 20 years and next 10 years—but at the expense of the environment and with worsening intrastate violence, terrorism, corruption, organized crime, and economic inequality.

**Figure 2. State of the Future Index 2015**



See the State of the Future Index section that follows the 15 Global Challenges section for more details on how the SOFI is created and computed, along with analysis of the 2015 SOFI and national applications in several European countries. The variables that created this year’s index are listed in Box 1.

A review of the past 20 years and 10-year projections of the variables used in the global SOFI gives information useful to create a “Report Card on the Future of the World.” Figure 3 shows where we are winning and Figure 4 shows where we are losing or have seen little or no progress.

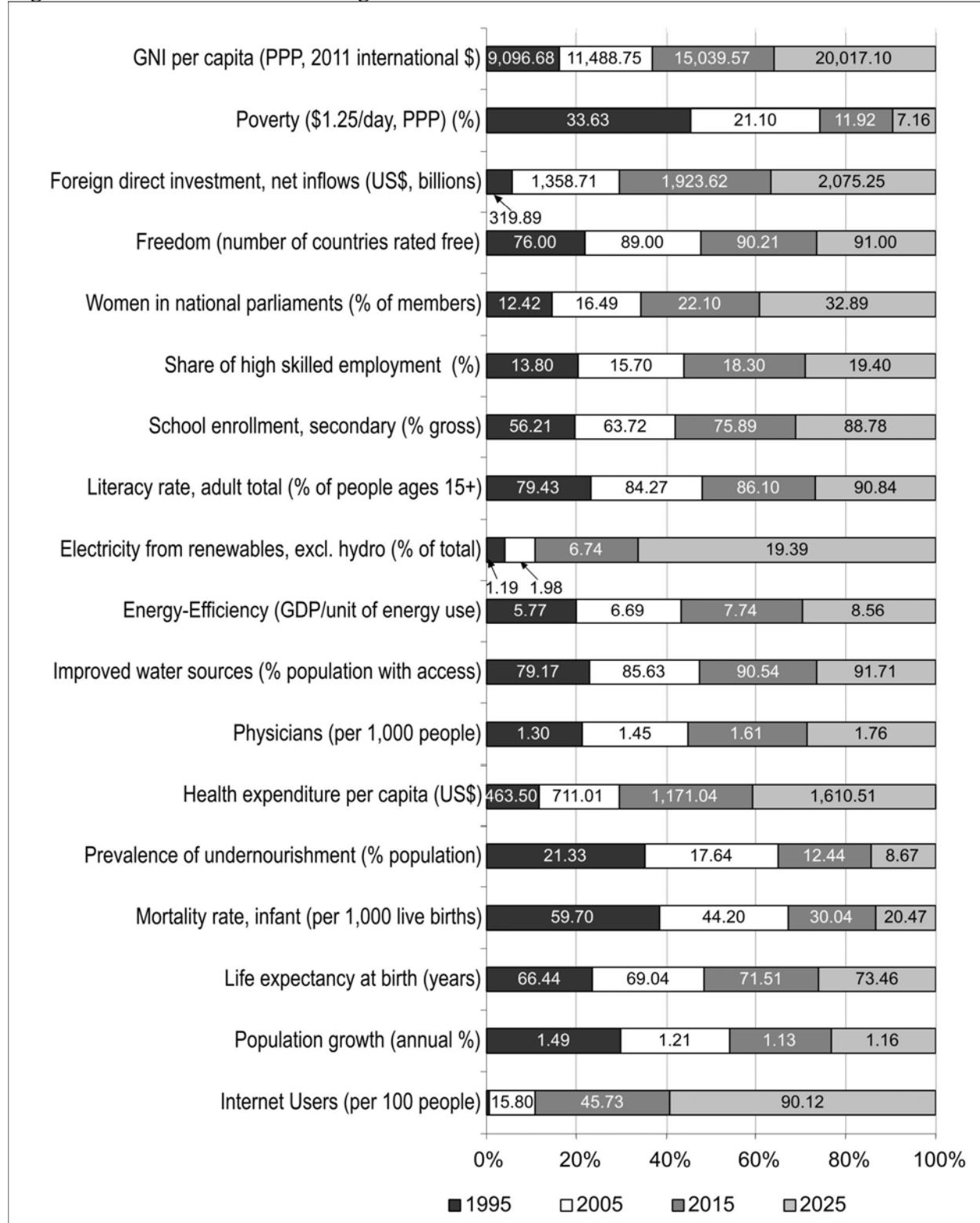
Humanity may be emerging from small-minded adolescence to planetary adulthood. We have been trying on roles of what it is to be Chinese or French, engineers or artists, for thousands of years, isolated into our own narrow beliefs of what we think to be true and right. Now it is time to grow up and become an adult planetary species. If leaders do not make the decisions on the scale necessary to address the global challenges, then future advances in artificial intelligence may be needed, just as the autonomic nervous system manages the basic workings of our bodies. However, this will require attention now to create the conditions to address the warnings of Elon Musk, Bill Gates, and Steven Hawking about AI growing beyond human control. It is time for intolerance of irrelevant speeches and non-actions by leaders. The stakes are too high to tolerate business as usual.

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Box 1. Variables Included in the Computation of 2015 SOFI

1. GNI per capita, PPP (constant 2011 international \$)
2. Economic income inequality (income share held by highest 10%)
3. Unemployment, total (% of world labor force)
4. Poverty headcount ratio at \$1.25 a day (PPP) (% of population)
5. CPIA transparency, accountability, and corruption in the public sector rating (1=low; 6=high)
6. Foreign direct investment, net inflows (BoP, current \$, billions)
7. R&D expenditures (% of GDP)
8. Population growth (annual %)
9. Life expectancy at birth (years)
10. Mortality rate, infant (per 1,000 live births)
11. Prevalence of undernourishment (% of population)
12. Health expenditure per capita (current \$)
13. Physicians (per 1,000 people)
14. Improved water source (% of population with access)
15. Renewable internal freshwater resources per capita (cubic meters)
16. Biocapacity per capita (gha)
17. Forest area (% of land area)
18. Fossil fuel and cement production emissions (MtC/yr)
19. Energy efficiency (GDP per unit of energy use (constant 2011 PPP \$ per kg of oil equivalent))
20. Electricity production from renewable sources, excluding hydroelectric (% of total)
21. Literacy rate, adult total (% of people aged 15 and above)
22. School enrollment, secondary (% gross)
23. Share of high-skilled employment (%)
24. Number of wars and armed conflicts
25. Terrorism incidents
26. Freedom rights (number of countries rated "free")
27. Proportion of seats held by women in national parliaments (% of members)
28. Internet users (per 100 people)

**Figure 3. Where We Are Winning**



**Figure 4. Where We Are Losing or There Is Little or No Progress**



The following section on 15 Global Challenges is a very concentrated set of data, information, intelligence, and hopefully some wisdom that should be understood to improve the human condition. It should be kept as a reference for policymakers, their advisors, teachers, journalists, and those interested in the global future. These overviews are also available via smart phones at [themp.org](http://themp.org) so that anyone can access this information quickly before going into a meeting, giving a talk, or writing an article.

The section after the Challenges focuses on how to measure progress or regress of the future “as a whole.” The State of the Future Index shown earlier is explained in greater detail in this section.

And the next and last section shares the initial analysis of the *Future Work/Technology 2050 Real-Time Delphi* study. It explores a series of questions such as:

- What should we begin to do now to prevent long-term structural unemployment due to future technologies?
- What questions need to be resolved to answer whether AI and other future technologies will create more jobs than they replace?
- If massive unemployment cannot be prevented, what political-economic changes would it be wise to begin to develop?

Artificial intelligence that can autonomously and continually rewrite its own software code based on feedback from global sensor networks, which will increase its intelligence and that of others, moment by moment worldwide. When this begins to happen, the speed of increasing AI's intelligence will be far faster and produce more change than Moore's Law. Synthetic biology allows us (or future forms of artificial general intelligence) to write genetic code as we used to write software code to produce new life forms such as microprobes to eat the plaque in the brain and plants to produce hydrogen instead of oxygen and carbon dioxide. Biological organs and houses have been 3-D printed. Atomically precise fabrication could become far more efficient than current robotic manufacturing, dramatically reducing energy requirements per unit of production. By 2050 all people will be connected to the Internet, but to a far more intelligent semantic Web than today. The human brain and AI projects mentioned previously should improve cognitive science to the point that anyone could become an augmented genius by 2050. The implications and strategies to address these changes were rated and commented by over 300 diverse experts around the world. The results will be used to construct scenarios and inputs to national planning workshops initiated by The Millennium Project Nodes.

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We should care about the whole world because the whole world will affect us—from new forms of terrorism and artificial intelligence to climate change and financial ethics. The *State of the Future* is offered to help us better understand the whole world of potential changes. Greater details are available and updated daily online in the Global Futures Intelligence System. Throughout the text are references to GFIS for more-relevant details than is possible in this short overview of our global situation and the prospects for the future.