CHAPTER 3. GLOBAL SCENARIOS

3.5 Science and Technology 2025 Global Scenarios

Written in 2003 based on studies conducted in 2000–03

Note: The four scenarios included in this subchapter are part of the study *Future S&T Management Policy Issues—2025 Global Scenarios* detailed in Chapter 6.

SCENARIO 1: S&T DEVELOPS A MIND OF ITS OWN

Most people in 1975 would never have believed that by 2000, millions of people would simultaneously search millions of computers through many intermediaries at no cost in less than one second. Similarly, the general public in 2000 would have been quite surprised that just 25 years later collective human-machine intelligence would be dramatically increased. But customized neural nutritional supplements, genetic medicine, universal cognitive development access, and TEF (Tele-Everywhere-Feedback protocol) with CyberNow clothing and glasses achieved miracles in human performance, social stability, and economic growth. The forces behind Moore's law not only accelerated computer capacity, they also accelerated all phenomena connected to computers.

TEF-CyberNow affected or connected only about 10% of the world in 2015, but by 2025 the economies of scale brought the price so low that many people were given CyberNow glasses or clothing free as part of employee benefits, rights of citizenship, insurance policies, marketing programs, and credit systems. This accelerated diffusion within poorer countries. UNICEF, the World Health Organization, UNESCO, and international development agencies also helped with distribution in poorer regions. Speech recognition and synthesis, integrated in nearly everything, made technology transfer far more successful than originally deemed possible by the UN Development Programme's Tele-volunteers, who did much to help the poorest regions understand and use the benefits from these new technologies. As a result, many remote villages in the poorest countries have cyberspace access for tele-education, tele-work, tele-medicine, tele-commerce, and tele-nearly-anything.

By 2025, nearly 70% of the world was connected via TEF and 44% wore some form of CyberNow at least once a week. More than half the world spent more than half its waking hours in cyberspace. At this rate, it would be only a matter of time until the self-organizing properties of intelligent software complete the connectivity of humanity, except for those remaining neo-Luddites forming and living in historical theme parks, who enriched the world with historical and intellectual depth.

People used to think that Internet's World Wide Web was the most powerful force for global change in history, but TEF-CyberNow went far beyond those crude connections of text and images by becoming a continuous virtual reality, as user-friendly as breathing. Between 2010 and 2015 the massive international S&T cooperative research program on human-computer intelligence was initiated by the largest research transinstitution in history (composed of governments, corporations, NGOs, universities, and international organizations). It was named the Brain Trans-science Service (BTS). This identified the factors and systems that ultimately enhanced human-machine collective intelligence. Since the effort was more complex than the Human Genome Project, older organizational structures were not acceptable to the many different actors. Finally they had to form a transinsitution to prove that it would be of common benefit to all of humanity.

Major funding came from the United States, China, the European Union, India, Japan, Russia, and United Korea. The initial corporate leaders were Oil World, GM, Mitsubishi, ChinaMind, IBM, Merc, MicroWorld, Nestlé, and Sony.

An NGO association of university, government, and private research centers around the world was specially created as the NGO participant in BTS. The transinstitution was incorporated in Switzerland, and its inaugural tele-meeting was held under the auspices of the Office of the UN Secretary-General, UNESCO, and the International Science and Technology Organization (ISTO). The R&D collaborators of Brain Trans-science Service produced the foundation for inexpensive genetic medicine, customized neural nutritional supplements, and universal cognitive development access, and they built synergies with TEF and CyberNow that enhanced cognitive development even in many remote areas or the world. BTS also helped further multidisciplinary approaches among the natural and social sciences, engineering, and medicine. An offshot of this was ecoscience that tries to combine hardware, software, and mindware into a single normative framework to further human, cyber, and environmental conditions.

Businesses and universities that used the early brain-computer interfaces prospered and stimulated more R&D for even better products, which led to wider public acceptance. However, it was in the area of entertainment where the prices fell fastest and the numbers of users really accelerated. Global cyber games engaged millions. The distinctions among work, play, and leisure blurred in cyberspace. Some thought it was not natural and resisted, but many parents around the world who wanted the best for their children pushed for the use of TEF and CyberNow in schools and home entertainment.

Once people believed it was possible to enhance human intelligence by computer augmentation, the corporate R&D race took off to create the mass products for everyone to use. Just as Mosaic and Netscape accelerated the use of the World Wide Web in the 1990s, TEF and CyberNow accelerated the human-machine continuum in the early 2020s. By 2025 CyberNow clothing monitored health to alert the user and medical systems about potential health problems.

Computational chemistry, simulation biology, and genetic engineering customized medicine and reduced cost. Tele-medicine became a commonplace for over half the world, who diagnosed and treated themselves for many problems via DNA diagnostic options through their CyberNow clothing. Genetic medicine eliminated inherited diseases from the human gene pool. Tele-care, fought by many, was now more accepted as TEF and CyberNow systems improved. Low-cost robotic systems provided medical care support in both homes and hospitals. It did not replace human contact, but with 2 billion people over the age of 60 and the growing shortages of medical personnel, it was inevitable that these Tele-care systems would augment medial staff. Even poorer nations unable to handle an aging population were forced to introduce Tele-care.

Nanotechnology lowered the cost and increased the reliability of many products, which contributed to improving the standard of living—even in the poorest areas of the developing world. For example, nanotech drill bits and tubes allowed deeper water access, preventing massive water shortages. This bought some time to develop more lasting solutions, such as nanotech desalinization filters and precision agriculture.

TEF and CyberNow provided the basis for the best educational programming the world could make. Since there was a vast array of materials and beliefs, standards of education differed around the world. It became common practice to spend $100 million to develop just 10 minutes of educational software that was used by 2 billion people—a cost of 5¢ per person. Many of these programs were subsidized by UNESCO, national development agencies in the poorer regions, and advertising agencies in the richer areas. The most effective science education programs were the interactive cyber games with role-playing possibilities for millions of students inside virtual reality bio-chemical reactions created by a Disney-MIT spinoff. Students with the best bio-chemical strategies were offered jobs and scholarships. Other programs for the slightly younger students were BANG (Bits, Atoms, Neurons & Genes), a primer for fundamental science concepts that relied mainly on advanced VR representations, and the Evolutionary Game, which encouraged pupils to role-play various parts throughout Earth's history.

These games allowed the student to go from a state of relative ignorance to the cutting edge of the field through on-line data, information, and knowledge. Problem sets were continually changed not only by teachers, but also by students who programmed their own experiments within the software's simulation environment. As students progressed toward the state of current scientific research, they might begin interacting with real scientists working on real problems. Activities that taught electronics contained means for students to construct circuits, and if they met specifications, their files could be exported to actual professionals. Hence, this was a source of job offers.

Some people resisted all this change and hence, unfortunately, there were still poorly paid teachers in broken down classrooms with out-of-date textbooks, providing expensive and inferior education in some of the poorer regions of the world. But for those who welcomed it, the computer-aided brain became as normal to many children around the world as the desktop computer was to their parents and the telephone was to their grandparents.

These educational systems diagnosed cognitive difficulties via analysis of inquiry patterns and automatically altered the curriculum. They also diagnosed the potential for violent anti-social behavior, and automatically notified child development and mental health authorities, which may have prevented many forms of destructive behaviors—even terrorism—later in life. Many accepted the loss of privacy for the gain in human security. Others did not, but their protests were ineffective, and some joined neo-Luddite historical theme parks.

Progress in neuroscience and biocomputing provided the technology for implanting computer chips into the human brain, but most people did not like this concept and prefered to continue improvements in the TEF-CyberNow alternative. Yet success with nano-bio-transceivers for health maintenance, flowing with blood through the veins, gave rise to new speculation about future nano-computer-transceivers that can flow through the ventricles in the brain's tissues to enhance brain functioning.

Customized intelligent personal software agents became integrated with so many systems that it was no longer clear who was giving instructions and who was answering questions. Sometimes it seemed that human brains were like little neurons in a global cyber brain. Although human and machine intelligence are quite different, the synergies between them accelerated collective human-computer intelligence. Some scientists trying to reverse-engineer the human brain and complete mathematical models of cognitive processes claimed that their work would make it possible to accelerate learning dramatically, create robots with a form of self-awareness, create real artificial intelligence, build a completely artificial human brain, store backup copies of human brains that could be later downloaded into an artificial brain, and create a self-evolving human-machine global-brain.

Computers had the same computational capacity as the human brain and were able to simulate much of the neural activity of an entire human brain. The senses of sight, hearing, smell, taste, and touch were all duplicated in virtual reality communications. Rumors persisted that some humans used some AI-created technologies to copy their brain patterns into computer simulations in which their copies or uploads “lived” in some VR version of paradise. Meanwhile, the International Science and Technology Organization evolved over the years into a body with a unique influence on S&T developments. ISTO was organized and managed differently than previous UN institutions.

With a small staff and large information systems, it was more accurate to think of the organization as a framework for others to use and to contribute improvements to rather than a bureaucracy holding up decisions. Its information systems were composed of data banks of other international organizations, governments, corporations, NGOs, universities, and independent researchers.

ISTO helped organize the world’s S&T knowledge, information, and data. It made the content in these systems far more user-friendly through state-of-the-art virtual reality interfaces and knowledge visualization software. For example, it became possible to quickly “swim” through three-dimensional menus, understand relationships through knowledge visualizations, and “dive” into specific research status with a full range of threats and opportunities detailed via linked data bases of virtual reality around the world. Someone could quickly zoom in from a general overview of carbon sequestration to some cost/benefit/time-to-impact calculations from several experimental nanotech carbon processing labs working on fossil fuel energy plants.

Investors found these databases helpful in picking smart investments. It was not ISTO staff who updated the information, but a vastly complex set of national academies’ peer review teams, professional self-organized groups, university consortia, corporate R&D associations, and combinations of all these, each updating very specific elements of the system. But ISTO staff gave the information a comprehensive cyber skin that made it feel like one giant integrated system of the world’s S&T knowledge. Constant cross-referencing and feedback continued to improve the accuracy, utility, and intelligence of ISTO’s systems.

Multinational corporations with large R&D budgets were interested in getting their product and research intentions well documented and clearly communicated to the world, so they cooperated from the beginning in establishing ISTO. Corporations used it as a source of information to help establish strategic alliances for better international market access and lower production costs.

As intelligence increased, science and technology accelerated, which in turn further accelerated collective intelligence. With an increased number of intelligent people, the rate of scientific discoveries and technological applications became so fast that by the time government regulations were put into place, the science and technological capacities had moved far beyond the conditions called for in the original regulations. In addition, S&T activities outlawed in one country quickly moved to others. Globalization and advanced cyberspace via TEF-CyberNow made it simple to bypass rules by constantly redistributing activities around the world.

Although ISTO started as an information system, governments began to rely on it so heavily that it became an informal regulatory and priority-setting agency by default. In the past, sustainable development depended on the ability of government leaders to implement intelligent vision. ISTO became more dependent on the synergies and feedback among computer systems. Yet it was unclear if ISTO would continue to be so as S&T dramatically accelerates even further in the coming years, developing what may become a "mind of its own." For example, some potential disasters were successfully avoided by early warning software that had been integrated into various products and processes. In addition to providing early warning, this intelligent technology managed self-diagnostic and repair systems, and also prompted governments and international organizations to act on their responsibilities. Which brought up the question of who was really in charge—humans or technology?

It also brought up the question of who determines the directions in which science evolves and to what end technology is applied. Such questions were raised in university courses on S&T ethics required for science and engineering students. Students also had to learn codes of conduct and sign the Scientist's Oath.

This interest in ethics resulted in the growth of S&T special interest groups (SIGs) linked with intelligent software that created standards and attempts to monitor the S&T enterprise, as part of ISTO's effort to manage scientific risk. No one really "allowed" these SIGs to monitor S&T; they emerged and generated their own power by the quality and responsibility of their work.

ISTO was originally designed to make it easier for anyone to gain access to the world's S&T knowledge, along with conjecture about future S&T threats and opportunities. As a result, unexpected as it was, scientists and engineers became less likely to pursue dangerous activities since the bright light of publicity and information made apparent who was pursuing science for the betterment of the human condition in a rational way and who was flouting the rules. This exposure influenced funding, university hiring, collegial cooperation, and publication within the world S&T community. Basic science still remained relatively free and benefited from this international information utility.

Because the rate of scientific discoveries and technological applications became so fast, some governments became afraid that other countries would develop faster than their own. They tried to create international regulations to slow down S&T. But these efforts failed, just as the anti-computer communications efforts failed in the 1980s. Anti-science backlash movements were also attempted, but the speed of S&T developments was just too fast and the objections became irrelevant.

Of the 7.8 billion people in 2025, just under 1.4 billion lived in India and just over 1.4 billion lived in China. As incomes rose in these two nations, the global demand for animal protein outstripped conventional supply until breakthroughs in stem cells for meat production successfully produced muscle tissue on a massive scale without the need to grow animals. This lowered costs and the environmental impacts of protein production. Meanwhile, other forms of genetically modified foods accounted for easily 50% of the world's food because nanotechnology and bio-engineering merged—creating all kinds of organic compounds that were considered safe. This made it possible to produce more food at lower cost. Farmers were running out of agricultural land in any case and hence could not supply enough for the growing population, who preferred genetically modified food to starvation. Also, 20 years of experience with genetically modified food convinced most people that any initial concerns had been addressed in a transparent way through ISTO.

The world environment computer simulation (WECS)—from cloud tops to under the sea—was integrated with the Global Environmental Monitoring System (GEMS) and was publicly accessible so that anyone could know who was polluting what natural resource and so that local observers could provide feedback to help improve the system's cause-and-effect calculations. GEMS automatically notified the news media, environmental NGOs, and relevant legal bodies if the impact according to WECS was sufficient to be considered an environmental crime. In a similar fashion, patterns of financial transactions provided early warnings of potential economic problems as well as identifying money laundering patterns, helping to counter transnational organized crime.

By 2015 global warming had increased weather-related damage and changed agricultural and disease patters enough that powerful groups of insurance companies and agricultural industries lobbied for changes, pointing to increasing famines and the AIDS-C pandemic. Some even brought lawsuits against governments and industries that were the major greenhouse gas producers—and won. There were some benefits to climate change, however. For example, the Canadian Northwest Passage became open to shipping, saving many months of travel through the Panama Canal and adding to the global economy by opening new trade routes between Japan and Europe. Nevertheless, more comprehensive international action finally began to seriously address global warming. Hence, cleaner energy systems received greater attention.

Wireless energy transmission began to connect new geothermal, wind, and solar energy sources on earth with the orbital power grid via relay satellites and ground receivers. The orbital power grid was also strengthened with the first five solar power satellites in orbit, which reduced resources and maintenance per unit of production. Nearly 56% of the cars in the world ran on hydrogen, electricity, natural gas, or a combination of these. Deepwater offshore wells became electricity exporters. They produced oil and natural gas to feed power plants at the drilling site, which generated electricity that is beamed to the orbital power network for global distribution. Such global power access and distribution kept competition high and prices low. As twentieth-century futurist Buckminster Fuller predicted, connecting the world's electric power grids helped to make a more peaceful world.

Bundles of nanotubes were strong enough to connect satellites in geosynchronous orbit to earth via “space elevators.” Gondolas of people and equipment were lifted into orbit by the counterforce of earth-bound loads gliding back down the nanotubes of the space elevator. These drastically reduced the cost of many space programs. The International Space Station (ISS)-III that was originally intended to house the space solar power satellite construction crews was expanded to support construction of tourist hotels, gravity-free health facilities, and retirement centers. Plans were under way for ISS-IV to be a mobile space station to supply Mars settlements and experiment with long-term space flight.

In the twentieth century, economists said that the rising tide lifts all boats; by 2025 the accepted wisdom was rising TEFs increase all intelligence. Unfortunately not all ethicists were raised as well, as sometimes the distinctions blurred among competitive business intelligence, advanced marketing, information warfare, and various forms of organized crime. Privacy and security of information could not be guaranteed, and attempts to do so might lead to artificial intelligence beyond humanity’s control. Yet most people seemed more prepared to accept software’s invasion of privacy than a human’s invasion. Some others objected to the abuse of CyberNow by governments and companies who attempted to manipulate consumer behavior. As a result, the “Unplug-and-Relax” movement was born as an attempt to temporarely retreat from “the system.” This proved more difficult than it might seem, especially for urban dwellers. They could certainly wear non-CyberNow clothing and unplug from personal computing, but CyberNow was integrated throughout much of the built environment. As people walked through the cities, their infrared patterns triggered sensors that played personal audio and video signals to them from the buildings, making it difficult to “drop out.”

Individuals and software agents crossed political and corporate boundaries in pico-seconds, forming new alliances unknown to traditional power structures. Because the convergence and synergies of genetic engineering, nanotechnology, computational intelligence, and cognitive sciences improved the human condition for the majority of the world by 2025, people became more habituated than hostile to such advances. The world appeared to be moving from political hierarchies to knowledge ecologies that some speculated might evolve beyond human control.

Although religious and political hierarchies still had much ceremonial control and many social maintenance responsibilities, the real growth of the human mind, technologies, and actions that were building the future seemed far too complex, self-organized, and creative to be understood by older institutions. The TEF-CyberNow and all that it connects might evolve a global mind, which could overcome previous ethnocentrisms. However, there was an increasing fear that biological-human intelligence and even human-computer combinations would eventually be outstripped by pure computer intelligence. Interconnections of intelligent software agents acted like group behavior of neurons in the human brain typically associated with thought. Although constant access to knowledge and feedback systems increased functional intelligence, and although decision efficiencies seemed to have improved with increased transparency and feedback for accountability, it was not clear that humans would have the wisdom to manage affairs in an increasingly complex civilization. Would the technologies that people created end up managing them, just as children do when they grow up to take care of their parents in the later years of their life? Or would human-computer symbioses evolve into a conscious-technology continuum for peace and plenty?

Scenario 2: The World Wakes Up

The murder of 25 million people over a three-month period in 2021 in the major population areas around the world by a self-proclaimed Agent of God (AOG) finally woke up the world to the realization that an individual acting alone could create and use a weapon of mass destruction. AOG created the genetically modified Congo virus by using common simulation software and a genetic engineering kit he stole from his university's bio-engineering department. This phenomenon became known as SIMAD (Single Individual Massively Destructive).

With the acceleration of scientific understandings and miniaturization of technology, fewer and fewer people became able to destroy more and more. It was inevitable that as the capacity for destruction increased, so did the methods for its control. It was a pity that it took such a disaster to finally get real controls established. Even the dirty radiological bomb set off in Nucpolis by the "Paranoid X" in 2009 did not lead to serious controls. It was constructed with materials he purchased from Terrorists International, who in turn got it from a transnational crime network. Although decontamination efforts were massive, downtown sections of the city remain vacant. This and other minor acts by Terrorists International did lead to some UN conferences on creating better international controls, but little was done until AOG struck. Then it was argued that without serious international and governmental controls, future catastrophes would be even worse. Even R&D managers said that control was inevitable and agreed to cooperate.

AOG also woke up moral forces around the world that organized global digital protests and information warfare; these closed down and continued to close down many vulgar entertainment systems seen as key causes of spiritual pollution. Security risks shifted from nation-states to terrorist networks, organized crime, and individual maniacs. Since banning all research that could lead to SIMAD technologies would have driven it underground and into the arms of transnational organized crime and terrorist groups, usage control policies were adopted instead. The success of the Montreal Protocol on the ozone hole and new international organizations like the World Energy Organization that provided strategic funding for the development of carbon sequestration and energy technologies (such as wireless energy transmission, solar power satellites, third-generation nuclear power, and cars that run on electricity and fuel cells) made more people optimistic that global systems could work. Without these global efforts, few believed the world would have met the urban electricity demand that doubled over the last 25 years. And it was done while reducing greenhouse gas emissions and sustaining global economic growth.

The first step that led to the new S&T global control systems began with a series of meetings of eminent persons. They decided how to control science and technology and limit access to developments that could be applied to SIMAD. The participants were selected through the InterAcademy Panel (composed of national academies of science), the International Council of Scientific Unions, S&T interest groups, Nobel laureates, and private-sector R&D firms working in areas associated with potential catastrophic risks. The meetings created definitions, guidelines, intervention criteria, drafts for international treaties, and the charter for the International Science and Technology Organization. Each time the eminent group reached a consensus on some element of the strategy, it was discussed around the world and a broader social consensus was created. This led to treaties and the establishment of the regulatory power of ISTO in concert with the UN Security Council.

By 2025, the Security Council had authorized intervention to terminate lines of scientific inquiry in viral modification, nanoweapons, and potentially runaway particle physics experiments. Each time, the research lab in question decided to come into ISTO compliance prior to the need for international enforcement. Several countries that proved to have insufficient security measures accepted UN Security Council–appointed advisors to improve the situation. Nevertheless, direct intervention to prevent SIMAD was far more difficult.

Three categories of approaches were used to counter SIMAD: technical monitoring and intervention led by ISTO and the UN Security Council, human infiltration and informant protocols coordinated by the InterIntelligence Commission, and integration of educational and monitoring systems organized among many systems but coordinated by intelligent software overseen by the InterIntelligence Commission. Although there were many examples of expert mental health computer programs connected to surveillance and educational software systems, universal monitoring was not achieved. This was partly due to accelerating counter-surveillance technology and partly because many treaty negotiators and leaders were just uncomfortable with the idea.

Nevertheless, several counter-SIMAD protocols began to work. For example, when the Son of Noah (SON) tried to get samples of the mutated Ebola virus, local military who sealed off the infected area under the World Health Organization’s guidance were told by villagers that a stranger was trying to get a bus ticket to the area. SON was quickly arrested and the police in his country were notified, who in turn found Biblical quotes about the Great Flood destroying the world plastered all over his apartment walls.

The overwhelming evidence led to the suicide bio-bomber’s confession before the International Criminal Court and subsequent incarceration for a crime against humanity by material intention. This reinforced the WHO, FAO, and military cooperative agreements established to counter bio-weapons and also helped to reduce the international transfer of diseases.

Another SIMAD was prevented by triggering the “off-switch,” similar to a three-dimensional nano bar code, imbedded in a nanotech generator, which reacts to a unique frequency and coded pulse sequence. The generator had been set to produce clouds of nano-machines capable of excreting multiple forms of toxic chemicals and biological hazards in airports. A third prevention of SIMAD involved an attempt to disperse telemerase in the general population, with the intent of shortening the telemeres in the cells of exposed individuals, which would have resulted in pre-mature aging. This was particularly insidious because if the SIMAD had been successful, it would have taken years to notice the aging, by which time it would have spread broadly through the world. Two transnational organized crime syndicates involved in underground brain medicines were instrumental in the capture of the telemerase SIMAD, establishing the uneasy relationship between SIMAD prevention and transnational organize crime.

By 2025 ISTO provided access to governing authorities to help them monitor biological and chemical storage and transfers. Regulations were effective because enough countries were willing to enforce penalties and because the guidance ISTO gave proved profitable to corporations as well. For example, legitimate enterprises were protected from liability claims when they followed the ISTO regulations, which in turn lowered their insurance rates. Some businesses believed that being ISTO-compliant protected them from sudden and global consumer boycotts. But clearly access to ISTO information improved their strategic decisionmaking.

Although these international regulations strengthened collective security, implementation was still conducted by national authorities. However, when special skills, rapid response time, and ability to act in uncooperative nations were required, the UN Security Council authorized intervention and the use of international police power.

Information obtained through ISTO helped societies based on complex technological systems to become less vulnerable. It was also a source of background information to help media give better coverage of S&T news, which in turn helped create a better-educated public who elect more enlightened leaders. ISTO also provided the definitions and measurement standards for commonly applied tax incentives and labels for more environmentally friendly production in cooperation with WTO. It also helped the World Environment Organization achieve the authority to declare key habitats off-limits for human development and brought increased attention to ecologically based agriculture in cooperation with FAO and the International Fund for Agricultural Development, resulting in reduced agricultural water consumption, energy, and other material inputs per crop. With the polar ice cap, glaciers, and mountaintops already melting in the early twenty-first century, the world couldn’t take a chance on further growth in carbon dioxide in the atmosphere, as it was projected to increase by 70% between 2000 and 2025. Thus carbon sequestration was required and cleaner energy systems grew.

Unfortunately, counters to some potential nanotech problems were still missing. Just as some computer hackers created viruses for fun that caused serious damage to computers around the world, so too there was a growing worry that immature nanotech hobbyists might one day cause extraordinary damage as well. For example, they might create autonomous, foraging self-replicators by mating nanofactory kits with robotics kits to allow foraging and “lab on a chip” technology to perform preliminary chemical processing. The consequences were unthinkable.

Although the speed of S&T may have slowed due to the increased regulation of everything from genetically modified organisms to nanotechnology, progress was still so fast that the media were always full of amazing innovations in medicine, transportation, and education that had vastly improved general human welfare over the last 25 years. Some argued that the global registry of S&T research and its forecasting and assessment sections in ISTO actually improved many prioritization processes, which ultimately benefited more people for less money.

Although the technical means did prevent several SIMADs, no one was convinced that technology alone could keep the world safe. Many began to call for massive efforts to raise consciousness and improve education. They pointed out that education had never been funded as well as defense—and at this point, education was defense. A great deal was known about how the brain works and how powerful ideas influence behavior, but little had been applied. People began to ask how to “infect” enough of humanity with memes (influential contagious ideas) for tolerance to stamp out stupidity. Could ignorance and intolerance be treated like a disease? The memes thought to be the most effective were:

Intelligence can be improved like eyesight

Ignorance is not bliss

Intelligence is sexy

Everybody can be intelligent now

Ignorance breeds intolerance; knowledge breeds tolerance

Stamp out stupidity

We got rid of TB & AIDS, let's get rid of stupidity

Wisdom is the highest gorm of technology

I can see through your eyes touristic resorts within

Bad thinking can be deleted like computer files

Aggression can be cured like viral infections

It turned out that collective intelligence was a far bigger influence on human behavior than thought previously. It seemed that memes triggered changes within collective intelligence and that during this change process, social behavior changed. Meme applications experts teamed up with cognitive scientists, epidemiologists, and swarm information technology designers to create R&D strategies that produced the means to accelerate collective intelligence and increase tolerance for diversity. The United Nations University studies that identified the social, cultural, philosophical, neurological, ethnopharmaceutical, and religious factors that increased and decreased SIMAD were integrated into the educational monitoring systems. Yet the world still struggled daily with an important question, How can we prevent the dangerous uses of science and technology without stepping on free inquiry and human rights?

Human nature is not likely to change quickly, but human behaviors can. And so great lobbying campaigns led by coalitions of universities, multinational corporations, and NGOs encouraged governments and media to rise to the challenge.

Globally interconnected programs were created to increase intelligence of the general public via universal feedback systems using new applications of advanced cognitive science such as mental modeling, subliminal (individually approved) suggestion, Bayesian reasoning, and new brain/brain interfaces. Low-cost nano-transceivers for personalized global access to both educational materials and cyber tourism were often given away as a marketing ploy, which allowed access to thousands of interlinked educational cyber-games and ads that said "smart people use smart products and smart products make you smarter."

Kits to customize nutritional supplements for mental health and to increase learning were made available by food industries in many developing countries to get better international market access. The goal was to create a world in which all people could have the equivalent of at least a secondary education and eventually a university degree. There were many global ethics conferences and multimedia events, which helped much of the world to realize that all cultures valued justice, respect, honesty, compassion, fairness, and responsibility. This helped increase tolerance for cultural diversity.

Global assessments of educational curricula led to improved learning. Every jurisdiction, every state and town, every ethnic group thought that its approach to education was correct and its right to teach its version of truth inviolable. SIMAD changed that. Global guidelines brought more rigorous thinking to the design of curricula. Because nearly all information and educational systems were constantly subject to international cross-referencing and feedback, information accuracy helped reduce intolerance. The increasing emphasis on science, participatory democracy, and creativity also reinforced this change. With more precise information, and with less prejudicial misinformation arising from ignorance and frustrations from injustice, more room was made for the expression of altruistic ideals.

Although intolerance still existed to a greater extent among the illiterate or inappropriately educated adult population, some people believed that the aging society itself was a maturing influence that helped increase tolerance. Although adults did not directly benefit from the new elementary and secondary education systems, they did get some gain from it. Older people wishing to keep in contact with their children and grandchildren had to access young people's cyber experiences of multicultural life and a more tolerant world in cyberspace. With an increasingly educated world, entertainment systems had to increase their knowledge content to be competitive; hence some entertainment was finally affecting some of the adult population. For example, "You Were There" let groups around the world role-play historic situations in rich virtual environments, and "Enlightment Now"—a wisdom visualization game—let individuals or groups play to bring together the great insights of history with their current beliefs, relationships, and problems into an epiphany or flash of insight.

Some religious leaders, UNESCO, the World Council of Religions, and others fostered an awareness of the common undergirding beliefs among different religions, which helped increase tolerance among their followers. Not all religions gave up the idea that they are the sole possessor of Truth, yet with increasing universal interactive media access, religions generally accepted that a broader worldview was important and inevitable.

Although religious antagonisms were not eliminated, international polls showed that approximately 63% agreed that religious preferences should no longer claim exclusive truth. There were a number of efforts to create a meta-religion that incorporated the common core of most religions and spiritual beliefs—something scientifically accurate yet sublime that can motivate the peoples of the world in the same way older religions used to—but none appeared to succeed.

The international focus on human security—freedom from fear—as the new organizing principle for world affairs helped strategic cooperation to improve living conditions. This fostered international efforts that were reducing social exclusion and increasing access to the benefits of society, which reduced social conflict. But it was not enough to prevent the mentally ill or religious fanatics from becoming SIMAD. As a result, some leaders began to advocate that the threat was so great that it was time to connect advanced computer education systems with security and monitoring systems. Although universal lie detection software had already been integrated into all international transaction systems, some people wanted to go further. The idea of integrating education and security systems had been proposed as the third category of SIMAD prevention, but it had never been fully implemented. Experiments supervised by UNICEF did show that connecting educational systems and security monitoring allowed early detection of signs of intolerance. Insights in cognitive science about fear and intolerance began to be integrated into some computer-assisted instruction. Although this disturbed many people, individual acts of mass destruction were prevented where this integration of education and security was applied.

SCENARIO 3: PLEASE TURN OFF THE SPIGOT

I am writing this memoir on the last day of the year 2025. Earlier this evening I accepted a great honor from Time magazine—the Man of the Year, they called it. What a great evening it's been. At the Time award banquet they called me an anti-science hero. Well, I guess I can see how they might think that.

Tonight I overheard someone call me a neo-Unabomber, and another person, a Luddite. What insults. I am, in reality, all for science—it is after all largely responsible for our life, gives zest to discovery, creates careers for aspiring fresh minds, helps us understand who we are and why we are. But the science I support is responsible science, and there's very little of that around.

They called me a guru. In Brazil, my home, that has a religious connotation and I guess that's not too far off the mark either. How many times have I argued that science and religion are parallel, but with different epistemologies: both seeking reasons for being; both having Popes, confessors, and professors; both trying to influence values and education. True or false, religion gives hope and absolution. But science is rigid and its rules only give an appetite for more invention. In another time and place I might have taken the vows, but my mission is to make the world see that the way science is generally conducted can lead, is in fact leading, us in a destructive spiral that amplifies itself through a vicious feedback on the way down.

What's wrong with the enterprise today? Well, I won't go into a discussion of its snobbish isolation, separate language, private club-like rules of admission here. Science is generally amoral; what percentage of scientists ever worry about the larger and perhaps negative consequences of their work? I would guess about 40%. What percentage actually elects to abandon their projects when they perceive negative consequences may result from it? Damned few, I'd say—maybe 20% or so of those who are concerned at all.

Suffice it to say that today most science works hand in hand with global corporations and that together they encourage excesses in consumption—intended or not—even in poor countries. By funding large-scale scientific projects, important social objectives that science could help solve are pushed aside. Take water and sanitation, poverty, starvation, or new diseases, for example. Science could be at work on these kinds of problems, but lack of funding, lack of interest, and lack of a potential profit have essentially excluded this line of inquiry. Instead the science/corporate complex locks the world into a neo-colonialism that is based on consumption for people who live in rich countries as well as poor.

The real and immediate danger of the way science is run today is the host of unexpected consequences that flow from it. For the first time in history, smart kids with a little ingenuity and a bio-chemistry set, the kind parents put under the Christmas tree, can destroy their communities. And most of the damage, despite being called “unexpected consequences,” is in fact predictable. Consider the damage done to the global ecosystem through the release of uncontrolled genetically modified organisms. We knew the danger, didn’t we?

And consider eradication of smallpox. We knew that there were only two test tubes of the virus left, but we saved them with great hubris. And look what happened. Now we have to live with the knowledge that the disease is still a threat.

Do you remember? After I graduated, I worked with a team of scientists, attempting to create a genetically engineered virus to combat common pests. We stumbled across a mechanism that could potentially increase the killing power of a host of human diseases. Working with mice and the disease mousepox, we inserted a gene for interleukin-4 (IL-4) into the test virus. IL-4 ordinarily boosts the production of antibodies in mice and thus should have increased the resistance of the mice to mousepox. But we found that the IL-4 version of the virus greatly increased lethality. What applied to mice and mousepox could apply to humans and smallpox. Without intending to do so, we had created a bio-weapon that could be used to intensify human diseases and override inoculation. I argued that we should bury the results—they were too dangerous. But arguing that if we held up publication someone else would do it anyway, the paper was printed.

And sure enough, terrorists took it up as their own and extorted a billion dollars to assure the destruction of the superstrain they created. This was the basis for the now famous “virus plots” of 2013 that resulted in massive, unnecessary deaths. Incidentally, that caper funded terrorism for decades. They created “black market” laboratories that were a clear and present danger. Legitimate corporations supported these laboratories and experiments without understanding their true nature. Bio-accident scandals; threats of mass destruction; suicide robots; kills of humans, animals, and plants; destruction of food and water supplies; creation of artificial oases of peace and ecstasy (based on new insights into cognitive processes) that promised escape but trapped instead—this has proved that happiness in a bottle is a kind of golden jail.

To be perfectly clear, it wasn’t only the “black market” labs that caused the problems; some scientists took it on themselves to proceed with research that had obviously dangerous uses and consequences. If there was concern in one lab, others were ready enough to take up the work if funding were available or careers were to be made.

The mega disaster was clear enough. The urgent need for reform hardly needed a spokesperson. It was this mega disaster, seeming to occur all at once, that triggered public reaction. We saw it everywhere: religious groups, environmentalists, anti-globalizers, health enthusiasts, anti-nuclear advocates. Many scientists helped raise the alarm. At first it seemed that there was no focus, that the “anti’s” all had their own agendas. But if I may say so, that is where my leadership helped. Despite the seductive promises of scientific discovery (which I support, incidentally), the disparate forces came together with a common theme: reform—reform of the processes by which science is directed. The reform began with lots of self-examination: How have we failed? Is education at fault? Are our scientists morally deficient? What have been and what should be our collective goals as human beings?

All of this happened when science was "hot." Biotechnology was giving us one breakthrough after another. The genetic origins of behavior were being articulated, and biotech was being used to build new kinds of weapons of mass destruction. Biodiversity suffered from aggressive marketing of genetically altered, patented varieties. Cognitive sciences were moving ahead; there was much greater insight into functioning of the brain but without much improvement in decisionmaking. Computers were gaining awareness. S&T was globalizing; scientists in poor countries were conducting much of the leading-edge research since many of the frontier projects were inexpensive and could be performed in small labs. In addition, vastly improved communications made it quite practical for geographically dispersed teams to function efficiently.

Interdisciplinary research was flourishing. Applied nanotechnology was being used in products and in labs to perform quantum feats of what would have been called magic only two decades earlier. In addition, there were remarkable achievements in applied environmental engineering and industrial processes; they helped to create new environmentally compatible products, reduce harmful waste and wastewater output to zero, and enable more countries and cities to recover their environment, which had been damaged by mining, dumping, and all kinds of pollution for decades.

But many new scientific discoveries were being distorted from their original intent deliberately or inadvertently, and these "slip-ups" provided, in the end, new means for killing large numbers of people, capturing or controlling behavior, and forming or distorting broadly accepted ideas. The early promises of disease cures were real and well intentioned, but in the end the overly optimistic projections were often just a means for increasing funding or explaining the high price of drugs and new products.

I recognized that there was a latent distrust of science in the real world, that there were a handful of like-minded scientists around the world. I turned to the Internet, and took to the streets and to the corridors of power. The time for reform was right. People around the world began to feel that adequate safeguards were not in place and called for political action. I said, in effect, enough is enough, and with all modesty I can say that as a result of this early political work, the International Commission of Science was finally formed in 2019. This Commission was designed to review controversial research proposals, establish risk limits, issue permits for risky experimentation, and indict scientists who stepped over the bounds established by the commission. I think the notion of indictment was driven by public fear of the unknown; it reflected the public's desire to hold someone responsible and punish them for the science-based disasters. It was funded in two ways: by the UN, as might have been expected, and from an unexpected source—a group of citizens who won a case against a big international company and used the main part of the compensation for this purpose. Later, in the EU and some countries, a small percentage of fines imposed in this specific kind of case was generally used to fund the Commission.

But the Commission was flawed. It was at first argued that the Commission should have only scientists on its panels, but this was seen as too self-serving, so membership was extended to include politicians, journalists, diplomats, and business leaders. Politics and greed stood in the way of true risk assessment. Funding was king; enough funding could buy a lot of risk. Also, penalties handed down to individual scientists were almost a mark of honor. This was a personal defeat for me, as I had been so instrumental in bringing the Commission into being.

In three years I switched from supporter to critic of the Commission. I was finally able to expose the corruption. It started with a case in which a commissioner was shown to be blatantly biased in approving risky research for his cronies at his old institution. That started the ball rolling. As we reviewed their decisions we found lousy accounting at best and at worst possible kickbacks. It was regular practice for retiring commissioners to be hired by the research laboratories and companies they had reviewed and mostly approved.

It sounds a little odd now, but my slogan reached around the world—on Internet sites, in public hearings, in parliaments. “Everywhere the air stinks from corruption. The management of science has failed, give us management of science.” This helped swing opinion. The new Commission has just begun its operation on a new footing. It uses a new artificial intelligence program that is incorruptible and provides the first level of checks and balances by detecting self-dealing. The program also facilitates R&D fund allocation without human favoritism getting in the way of fairness and objectivity. The Commission’s design is not perfect, but it is based on the idea that it is possible to reduce corruption with a carefully designed system in which people are both independent and accountable to a democratic oversight body. The anti-corruption strategies also include very high salaries for the Commissioners, transparency and public visibility, fixed term limits for the members, complete independence, and external publicly visible independent audits. Whether they can produce the needed results is yet to be seen. They are indeed the new high priests and we must remember that power corrupts.

Ancillary measures in the reform package that I consider important include revision of university curricula to include explicit attention to ethics in science, inclusion of adverse impact analysis in every grant, continuous monitoring of the state of the art in many selected fields, and use of technology assessment as well as simulations in evaluating impacts.

This year, one scandal in particular has captured the public’s attention. The Brazil Institute of Security (BIS) uncovered a sophisticated covert laboratory at a prominent Brazilian university engaged in the development of an unidentified but apparently lethal airborne toxin, a super-anthrax. The laboratory directors held that the research was legitimate but when asked by the BIS to produce information about the sponsors of the work, they could only point to a shell pharmaceutical corporation known to BIS to be affiliated with terrorist causes. They said they were ignorant of the terrorist ties. “Naiveté is no excuse,” said the BIS. Several activists, including myself, have called for prosecution of the directors of the university laboratory and researchers, charging them with aiding in the development of weapons of mass destruction. The case is yet unresolved. But I think we’ll win.

In any event, this has been quite an evening and I remain optimistic that science can achieve its promise and that with luck and planning we can all survive its unintentional mistakes.

Jacobo Minskov
December 31, 2025

Scenario 4: Backlash

The best science is free science

Pro science is con-science

Science directed is science enslaved

Science is your friend: it makes the future

Scientific-ness is next to godliness

Without science, life expectancy would still be 30 years

These were some of the slogans on the signs that scientists carried in protest at the Jakarta World Summit on Science and Technology in 2015. The principal topic of discussion was the need to institute some sort of world control over the directions of science and technology. Supporters of the establishment of a global regulatory body to guide science and restrain its possible dangers included a few scientists—some of them quite notable—but was mainly an unusual coalition of environmentalists, detractors of globalization, politicians, and theologians. They were eloquent and had two basic arguments: first, they wanted to avoid some of the threats that advanced science and technology could bring and, second, they wanted to have the ability to direct science and technology toward the solutions of pressing societal problems.

In the first category, those arguing for regulation of science listed physical threats such as the sorcerer's apprentice syndrome: self-replicating nanotechnology overrunning the planet.

They also cited possible terrorist uses of biotechnology in weapons of mass destruction, and in their papers they addressed the possibility of a single individual gaining access to such weapons. There was also concern about the possibility of the accidental creation of deleterious life forms and the development and abuse of effective mind-reading or mind-control techniques. They pointed out that novel organisms many times more virulent than those then known (e.g., organisms with the combined potential of HIV, smallpox, and Ebola, all rolled in one) were on the drawing board and that the world's experience with smallpox gave little confidence that the viruses would stay in the bottle. For many people at the conference, moral threats also played an important role—threats such as human cloning and "brain-fire" or "soul-vacuuming," new kinds of mental diseases, or accidents caused by abuse or the wrong use of computer/body interfaces.

The second category, they argued, was missed opportunities for something like a Manhattan Project on cheap, efficient, environmentally benign, non-nuclear fission and non-fossil energy sources, or one on simple, inexpensive, effective medicines and delivery systems to treat widespread diseases, or a project on improved sources and efficiency of water use. Other opportunities missed were for a better understanding of climate change and solutions, improvements in early detection and tracking of pandemics, a better understanding of the role of human emotions, and programs for dealing with aging populations on an unprecedented scale. "The need for such developments is self-evident," they said. "Why then," they asked, "isn't science giving us what we need?"

Ten respected Nobel Prize winners rose to respond. Their arguments were direct and forceful. With respect to the course of research and its attendant risks, they said: “All progress carries some risk. The directions of science, pure science, are determined by the quest for knowledge and understanding. Expanding the frontiers of science has given us health, long life, and for most people of the world, abundance and comfort. Certainly, there are some risks associated with the enterprise of science as it pushes us into unknown territories, but where these risks exist, the disciplines themselves are capable of self-regulation and are alert to risks. To regulate on a global scale would require regulators more insightful than the scientists doing the research.” Furthermore, they said, the analysis tools of the regulators were inadequate to the job.

In her famous speech to the hushed assembly, Nobel Laureate Antoinette Plebus said: “Were there to be a regulatory commission and were I to be appointed to serve on its panel, I would tremble with fear. Why? Because, I would fear that I did not know enough to tell my colleagues what they could or could not do. I would fear that I could not foresee consequences that would ultimately make their research worthwhile or worthless. I would fear that my evaluation tools would be inadequate. How can one evaluate moral issues of, say, human stem cell research when half the world feels that is a violation of a sacred process and the other half pleads for the medical breakthroughs that the research might yield? How can one evaluate the value of research that has promise but carries an infinitesimal risk—a vanishingly small risk—of irreparable damage? I would fear that economies would no longer be as robust as they might have been if innovation were limited by regulation of science. I fear that research outlawed in one place would simply move elsewhere—and if outlawed globally, it would move underground. But I would fear, most of all, being regulated myself, limiting my horizon and the horizon of mankind, by fear of the unknown.”

They still remember the cheers the delegates gave to her speech. Of course, the acclaim resulted in rejection of the notion of global regulation of science, and the delegates from 187 nations signed a resolution recommending that the disciplines themselves set up a regulatory apparatus that seemed appropriate to their fields.

The resolution known as the Principles of Inviolability of Science (or simply “Principles”) recognized the autonomy of science and charged the disciplines with the responsibility of determining the “line in the sand” that defined acceptable risks in their fields. It also charged them with defining the rules of ethical behavior and the disciplinary action that would be imposed on scientists who crossed the bounds of acceptable behavior. Finally, it was similar in many ways to the “ISO 9000 certificate”: the regulation guaranteed a clean working procedure, a minimum of social and ethical standards, and some transparency in science processes.

Science blossomed under the Principles. One discovery after another made the news. Genetic medicines were developed and widely used. Diseases were cured, one after the other, or if not cured then at least controlled. Automatic assistants (robots) blossomed and formed huge new global markets. New nano- and giga-scale technologies appeared and with little fanfare were incorporated in common and esoteric systems—from coffee makers to quantum computers.

Artificial intelligence research teams produced computers that claimed to be superior to human reasoning. Energy research made good progress. Developing countries found their niches in the expanding technological envelope and to a large extend the brain drain was stemmed. Universities taught science ethics. It was truly the golden age of science and the technology that flowed from it, accelerated by liberal funding, the need of industry for new products, synergy among disciplines, and the advertising and media hype that said more is better and change is good.

But about five years into this idealized world of accelerated science, it became apparent that the Principles had a dark side. The golden age of science proved to be a mixture of good, bad, and illusion. It started as isolated criticism by intellectuals and grew to a river of doubt by populations in general. Like-minded people around the world compared notes, reinforced opinions, argued, and concluded that more is often not better and not all change is good. Some of the most valued discoveries and new capabilities had cost security and privacy, and produced a kind of imposed rationality that was antithetical to many cultures. Directed and unthinking consumption ruled lives, but this counterculture argued that human society itself should determine what is good and proper.

The voices of discontent, however, became most strident and persuasive when a small country took advantage of some of the most modern technologies to kill, threaten, and extort. A border dispute had been in progress between Beret and Stetson for many years, with skirmishes often killing a few dozen soldiers on one side or the other. Then, according to WHO, a new disease, much like the antibiotic-resistant pneumonia of 2003, was discovered in the border region. Curiously it killed people only on the Beret side of the border; residents only five miles away, in Stetson, were somehow immune. WHO soon found that the disease was a weapon and that Stetson had inoculated its soldiers who might be exposed. When exposed by WHO, the government offered the therapy, but only on the condition that its border claims were recognized by Beret. “Blackmail, extortion,” claimed Beret, but it capitulated. In the meantime, as might be expected, the disease spread beyond the region and it was only through the rapid work of international organizations that a major epidemic was averted.

Now the opposition had impetus, and momentum grew for reform. Papers appeared online, the most important of which was titled: The Fallacy of the Principles. This echoed the earlier arguments of Theodore Kaczynski and Bill Joy that we must control technology (and, by implication, science) or it will control us. The media soon took up the Fallacy arguments and the level of public concern rose and became even more vocal.

Last year, in 2024, the Jakarta 2 conference was convened. Outside there were signs that read:

Kill science before it kills us

Science is inhuman

Preserve the best of the past

Culture is destiny; use it or lose it

Science without conscience is the ruin of the soul

Again the scientists had persuasive arguments. “Has our work in this unfettered environment not given the world disease cures, happiness, freedom from drudgery?” they asked. But this time Brazilian scientist Jacobo Minskov rose to tell the audience this story. Some still think it was only a parable, others think it true. He said, "At a high energy particle accelerator, a scientist proposed an experiment that had an extremely low probability of creating a mini black hole. If this were the result of the experiment, the solar system, including Earth and its life, might be extinguished. The laboratory argued that the experiment should proceed because the chances of creating a black hole are very slight and the data to be gained will fundamentally improve our knowledge of the first 30 microseconds after the big bang. After a review panel of like-minded scientists approved the experiment, they decided to proceed and then held their breath as the beam was turned on. The world did not end."

"But," Minskov continued, "it might have. That uncertainty is not worth any advancement of knowledge. Is this the kind of decision we want scientists to make on their own?" The audience rose as one and responded, "No."

The Jakarta 2 resolution was signed by almost the same array of 187 nations as had signed the Principles. The new resolution established a global science commission. One innovation was the inclusion of "public participation" to aid in establishing priorities for science directed to societal needs. The participation was via TV Two-Com (Internet's successor), which with all its faults and potential shortcomings was nevertheless seen as a way to give visibility to the issues and seek broad inputs on the priority of their resolution. The conference ended with an attitude of skepticism: "We'll see how the new plan works."

It worked badly or not at all. Almost all of Dr. Plebus's earlier concerns proved true. The regulators needed the opinions of the very scientists they were sworn to direct. The evaluation tools were inadequate. The moral issues were interminable and divisive, and public discourse was not very helpful. Religious leaders harangued incessantly on TV Two-Com until the public that was supposed to be informed and excited by the chance to participate in setting priorities became glassy-eyed and tuned out.

Innovation was throttled because no one was sure whether they would be stepping over some fuzzy line of law or propriety with leading-edge research. When the spark of discovery dimmed, economies slowed, and innovations that saw the light of day became more proprietary than ever.

Research turned to easy targets: why work on something that could result in an indictment for taking unnecessary scientific risk, when the tried and true would suffice? Work not possible in one place moved elsewhere. This had the effect of creating geographic zones in which marginally acceptable research could be performed, attaching to the scientists a stigma that stayed with them for their whole careers. A person straying into this twilight land of research on the margin was unable to join the mainstream. A sort of neo-McCarthyism of science developed, accelerating the malaise and downward spiral. This promoted a brain drain, frustrated and challenged loyalties, and deepened the depression among intellectuals.

Horizons shrank and goals became diminished. As the global economy wound down, poverty rose and the safety zone of reduced risk that global regulation was supposed to provide proved not to be safe at all.

People asked, *What's next*?