

MANAGING THE PLANET

Advances in science and technology are culminating in humanity's growing ability to manage the globe. Managing the globe is taking an active role in influencing, guiding, supervising, or governing the natural and built environments, where human activity continues its expansion underground, underwater, and in space. It also includes managing the social environment, which encompasses the planet's 8.4 billion people and their demographic, economic, and political systems as they grow increasingly complex.

Most people who agree that we are in the early stages of global management question whether we can do it wisely; others question whether we are even doing it at all. Gaining an understanding of one piece of a global system or issue often reveals a much larger scope of implications.

Defining the bounds of global management will continue to be difficult, characterized by overstepping and retrenching. A UN executive, in response to a question about the progress to global management on G-NET (the global news network) said that "we are perhaps 10% of the way towards true global management. It is hard to say what 100% is, but it is clear that we are just scratching the surface. There are many things that we will accomplish over the rest of the century. Managing the globe indicates a shift from reactive to proactive and, increasingly creative approaches to the future."

Although the debate over what constitutes global management continues, it is clear that we are increasingly able to manage complex global systems and issues. Global managing is growing more effective but is still incomplete with regard to environmental issues, population control, war, crime, design and location of business facilities, trade regulation, disease prevention, and business practices.

The benefits of global management include improvements in weather prediction, controlling the effects of natural disasters, instantaneous worldwide communications, and conflict resolution. The trade-off is a more regulated world. For example, free trade has given way to managed trade. In many

cases, however, global regulation has rationalized confusing or conflicting national or regional approaches. Regulations and standards worldwide are slowly converging. Many businesses have been bringing overseas operations up to world-class environmental standards over the last 25 years. These companies have not been caught short when global standards were enacted.

Most global management has emerged from incremental expansion of regional and national systems. More systems and issues are managed regionally than globally. Global infrastructure management evolved from grouping national infrastructure management programs like the Federal Infrastructure Administration of 1998. In other cases, new organizations or approaches were devised. The founders of the IGWF, for example, deliberately bypassed existing institutions and their built-in biases so that they could respond immediately to the risks of global warming.

The transition to global management is occurring in bits and pieces and starts and stops. Management initiatives are more advanced in some areas than others. For example, there have been many more successes in settling trade disputes than border disputes. The table below characterizes progress in global management.

Systems/Issues	Grade	Characteristics of global management
Natural environment	C	Progress falls in the middle of the 3 environments; getting non-affluent nations aboard has been more difficult than anticipated.
Environmental monitoring	B-	Remote and in situ sensing networks are well-established; great progress in managing data overload in the last 25 years.
Global commons	C	Solid action regarding global warming but still foot-dragging on nuclear waste; atmospheric programs get most attention, although encouraging steps in ocean management recently.
Natural resources	D+	Lowest score in this sector due to delays in getting programs enacted; too many species lost over the last 35 years.
Built environment	C+	Furthest along of the 3 environments; more and more nations tapping into global systems; trend is away from private management toward greater public management, which should enlist greater participation.
Information	B	Fiber optics traverse the globe supplemented by satellite, cellular, infrastructure personal communicators; the challenge is to expand coverage.
Global logistics	B	Key advance has been streamlining and modularizing cargo shipments to more efficient delivery.
Energy management	C-	Not truly global, due to ocean barriers; regional grids and wheeling are becoming more common.

Global technology	D+	Establishing global oversight of technology has languished; there is still considerable debate over whether it is necessary or desirable.
Macro-engineering	C-	There have been a few successes but still in the early stage of development.
Social environment	C-	Least advanced of the three environments, because it deals with the intricate area of human relationships, values, and ideals.
Population control	C	Success in affluent and middle nations is offset by continuing exponential growth in some destitute nations.
Immigration	C	A code has been regularized, but enforcement is still spotty.
Crime control	C-	Tentative steps toward global control have not gone far enough; weak measures, while they may be portents of stronger ones in the future, also damage credibility.
Public health	D-	Has been totally reactive to date, responding to crisis and diminishing in between.
Trade	B-	Solid progress toward a rational global division of labor in affluent and middle nations, but destitute nations still struggle.
Economic dispute resolution	C+	Has been effective when used, but many parties prefer to traditional legal channels, especially as a stalling tactic.
Intellectual property	C	Another case where regulations are in place, but enforcement is weak.
Financial markets	C+	Growing, but still incomplete understanding of how these incredibly complex systems work.
Countertrade	C	Solid but underutilized mechanism; many established businesses are still reluctant to use it.
Political conflict resolution	D+	Peacemaking has a mixed record; conflict continues to flourish.
Arms control	D-	Bringing reluctant or recalcitrant nations into compliance has been difficult.
Managing natural disasters	B	Great progress in detecting and managing disasters with the aid of information technology; prevention efforts just getting established.

Forces shaping global management

Three primary goals are shaping the move to managing the globe:

- maintaining global economic health and well-being
- preserving the environment
- resolving international conflicts

Although information technology has increased our ability to manage complex global systems and issues, it is not in itself the solution.

The explosion of global economic activity over the last 30 years has often outpaced attempts to manage it. Ties between national and regional economies continue to strengthen, and the lines between economies continue to blur. As a result, it has become increasingly difficult to determine a product's or company's national origins. The growing interconnectedness of economies increases their vulnerability to mismanagement. A severe downturn in Japan, for example, in turn affects the EC and the North American economies. Therefore, preserving global economic health is in most nations' collective interest.

Act globally, act regionally, act locally

The most popular slogan of environmentalists for the last three decades of the 20th century, "Think Globally, Act Locally" adorned bumper stickers and T-shirts. It has been amended to "Act Globally, Act Regionally, Act Locally." The change reflects two factors:

- increased emphasis on regional and global matters
- a shift away from only thinking and problem identification toward acting and problem resolution

Sustainability is a fundamental organizing principle for global environmental management. Environmentalists have long recognized that global environmental problems require global solutions. Education campaigns have helped raise awareness and move environmental issues into mainstream global society, but it took the threat of global warming to get people's attention and lead them to press for action.

Obstacles to managing the globe

The more complex an issue, the more stakeholders. Complex situations imply radical moves that go past individual, incremental, or minor actions. The more trouble the complex situation is, the greater the need for radical solutions. But the future has little reality to most of us. Global actions with long-term payoffs are difficult to sell. It is also difficult to take bold action in new situations. The tendency is to go slowly and tentatively. Scientific knowledge and horizons have far exceeded and are out of synchrony with political time frames.

So-called peacemaking (the term's euphemistic sense is often objected to) is the primary advance in international conflict resolution over the last 35 years. *Peacemaking* is the international community's military intervention in a conflict against the will of one or more of the participants. Coercion distinguishes it from *peacekeeping*, in which the involved parties request assistance. Collective action became feasible with the end of the Cold War in the early 1990s. The Persian Gulf War coalition, which formed through the UN in 1990, marked the transition from peacekeeping to peacemaking. It set the precedent of international intervention to redress aggression. The formation

of a UN standing army in 2011 institutionalized peacemaking as a widely accepted strategy.

Information technology's coordinating capabilities—information gathering, manipulating, storing, and disseminating—enable global management to transcend time and space barriers that made global management impractical in the past. Massive distributed computing power oversees financial networks. Sensing networks and databases monitor the environment. On-line global surveys, facilitated by automatic language translation, are an important tool for global managers. Macroengineering managers, for example, routinely assess public opinion about proposed projects, so objections can be dealt with in advance. Reliable and timely information is crucial. For example, reports that air pollution is increasing in Mozambique must be reliable in order for the African EMO (Environmental Monitoring Outpost) to coordinate the appropriate response with local authorities.

Why manage the globe?

Many systems or issues, such as global currency and global warming, have long grown beyond the capabilities of individual nations to manage. Growing global linkages and complexity are redressing the paradox aptly characterized by sociologist Daniel Bell in the last century, "government is too big for the small problems of our society and too small for the big ones."

Radicals object to managing the globe

Fringe groups are springing up worldwide to protest global management. Although many object to specific techniques, or to mismanagement, others object to the principle itself. Many groups were started or have their roots last century. Three are:

Earth Firsters: Believe that people have no moral right to tamper with nature and advocate a hands-off approach. Many subscribe to the notion that the Earth is a living organism and that humans are a cancer.

Free Traders: Believe in the sanctity of the free market and that global management is wrong because it interferes with the market. They refuse to acknowledge that free trade has not been free for decades—if ever.

Neo-Orwellians: Believe that international information networks are an inherent invasion of privacy and represent the fulfillment of Orwell's 1984 prophecy. They have cut cables, disrupted communications cells, and even sabotaged a satellite launch.

Global management saves money for governments strapped for cash and for global companies trying to keep costs down. Smart infrastructures, smart management, pooling resources, and reducing redundancy are cost-effective. A key criterion is that the global management has long-term benefi-

cial effects for sizable groups—typically defined as groups of nations or regions—while not having adverse effects on others.

Three years ago an international commission was charged with forming “A Vision for the Planet” statement due in 2027. The commission is canvassing worldwide for a framework for humanity’s relationship with the planet. Debate has been raging on virtual communities and issue forums.

Who is managing the globe?

Global managing operates on public, private, and mixed levels, formally and informally. There is no command center. Responsibility is diffused across many people and organizations. Global management is an evolving enterprise that began without deliberate effort but is moving towards institutionalization. A trained cadre of global managers is emerging from universities and other learning centers worldwide, such as the Centers of Excellence, sponsored by the International Institute for Applied Systems Analysis (IIASA).

The global management curriculum

Global management programs began in occasional courses at the turn of the century. They appeared within environmental, civil engineering, systems science, or future studies programs. Lehigh granted the first Master’s degree in global management in 2013. Typical core courses include:

- macroengineering
- systems science
- sustainability
- international institutions
- global infrastructures
- macroeconomics
- networks
- social change

The UN leads global management in the public sector

Formal activities combine thousands of international organizations and international regional, and multilateral agreements and treaties. The UN family of institutions is the dominant organization. There is no single dominant treaty or agreement. The box below shows some important international agreements of the last 25 years.

Some international agreements for managing the globe

2000 International Global Warming Federation	transferred technologies to alleviate greenhouse emissions
2002 International Space Agency	part of UN system; provided a negotiating forum
2007 Lima Space Weapons Treaty	preserved space as a weapon-free zone
2007 Geneva Conference on Hunger	established principles for food assistance only in natural disasters
2009 International Energy Agency	nuclear nations submitted to standards after a grandfather clause is added
2009 ISO	established materials characterization standards for recycling and reclamation
2011 International Agreement on Standards in Construction	developed standard measures of performance and capability for materials in construction, appliances, vehicles, and other durable goods
2011 International Agreement on the Troposphere	established a council to oversee climate manipulation
2012 Convention of Hazardous Waste Export	ensured safe hazardous-waste disposal
2016 Bangkok Accords	set up an institution to formalize limited trade protectionism
2017 ISA (International Space Agency) and the Red Cross	formed the International Disaster Tracking Program, which uses space-based monitoring to provide advance warning and help coordinate relief efforts.
2017 International Commission on Animal Care in Agriculture	established approval mechanisms and regulations for transgenic animals in agriculture
2019 International Hypersonic Craft Consortium	formed to commercialize hypersonic craft by 2030
2019 GMAN (Global Manufacturing Network)	upgraded national pre-alliance service networks like FAN in the U.S. to include nations across the globe
2024 Convention on Environmental Balance	got its 30th through 32nd signatories in efforts to make materials and other resource use more sustainable

Global companies drive global management in the private sector

Global companies are the dominant actors in the private sector. They form around the need for natural resources, to ease exports, to expand production, and to enhance competitive position, such as improving market ac-

cess or taking advantage of local labor pools. Large global companies routinely operate in 70 to 80 countries. They have largely broken free from national control and are global entities in their own right. The similarities of big global companies are becoming more prominent than the differences, as ties to home nations weaken.

Interest groups with global reach continue to proliferate. They range from quasi-governmental political groups like the Greens to nongovernmental organizations (NGOs) to humanitarian groups like the Red Cross and Project Hope to religious groups like the Salvation Army to on-line virtual communities. They heighten international awareness of issues and can mobilize effective actions, including economic pressures or boycotts, quickly. Easy global communications make them welcome allies and dangerous enemies.

How is global management being done?

Global management uses incentives and disincentives. Economic sanctions are a primary disincentive, used mostly against small nations that cannot withstand collective economic action. Creating incentives that work is an ongoing challenge. A rule of thumb is that rewards work better than punishments. The challenge is in devising innovative rewards. Another truism is that global managers must be delicate in matters affecting national sovereignty.

Changing minds

Social change is rarely smooth; it is usually two steps forward and one back. People reformulate their views of the world.

Sociologists today describe a widespread shift in world views over the last 50 years. The world as a precise, reductionist, clocklike machine operating according to natural laws has given way to a world of webs of chaotic, interconnected and interacting holistic systems.

Social change to accepting greater global management has also been engineered by political leaders. Regulations, laws, taxes, and other policy tools are used. People are increasingly willing to accept the need for trade-offs, acknowledging that there are limited resources for unlimited problems. Risk-benefit analyses are standard practice today. Health-care rationing, for example, once unthinkable, is common worldwide.

Many transformationalists have argued that some form of collapse or disaster is needed to motivate radical social change. They argue that an incremental, muddling-through approach falls short of what global management could accomplish if given its due.

But it turns out that complex global systems are more resilient than many thought. Anticipated disasters have not happened, or they did and society adapted to them, as with the stock market crashes of 1987 and 1999. The resilience often comes unexpectedly or unpredictably.

Global management tools can be grouped by how they are enforced. International agreements, laws, and treaties are the top layer, as they are supported by collective economic or military action. Regulations and legal standards are the middle layer. They are more difficult to enforce because they rely on market forces. Voluntary standards or arrangements, such as product specifications, are the bottom layer, because there is no formal enforcement.

Coercion may include economic sanctions, arms embargoes, or communication cutoffs. Blocking access to the Net has been particularly effective in the few cases when it has been used. For example, when China, the world's number one greenhouse gas offender, continued to evade IGWF standards for five years, it was cut off from global communication and financial networks in 2019. Chinese negotiators were back to the table in a week and in compliance within a month.

Regulation has been a growth enterprise over the last 35 years, but this has not necessarily been bad news for business. Moving regulation to a higher level, from national or regional to global, in many cases has simplified situations. Rather than dozens of national regulations, businesses can deal with a single code. Rationalizing the thicket of building and housing codes in the United States last century improved efficiency within these industries. It also enabled companies to more easily expand into new markets.

Regulations have often made economic competition fairer. Seeking competitive advantage by relocating from nations with strict regulations to those with loose ones, has become much more difficult and costly as loopholes and havens are being closed. Last century, NAFTA, for example, was ratified by the U.S. Congress only after guarantees were made that Mexican environmental standards would be brought up to U.S. levels—many feared that companies would relocate to avoid tough U.S. environmental laws.

Standards are imposed by governments or negotiated and adhered to voluntarily through markets. They provide for control, such as fuel economy standards, a guarantee of quality, such as product classification, and for processes, such as bills of lading or EDI (Electronic Data Interchange).

The United States had some difficulty with standards setting in the last and early part of this century. U.S. companies were used to being market leaders with the clout to set de facto standards. They were less skilled in negotiating standards, which has become the norm since the United States began sharing world economic leadership with the European and Asian trading blocs in the 1990s. The U.S. government had a hands-off approach. As the need for government help was acknowledged, there were turf battles within government agencies. The Government Standards Bureau, formed in 2001, emerged as the government's chief negotiator for standards. It works closely with private groups like the American National Standards Institute (ANSI).

What are the effects of managing the globe?

Global management is generally stronger in World 1 and weaker in Worlds 2 and 3. Most affluent and many middle-income nations are substantially committed to global management. The remainder of nations participate selectively. A common objection is the alleged hypocrisy of global environmental regulations. World 2 and 3 countries assert the right to pollute as affluent nations did on their road to economic development. They typically participate when the economic benefits outweigh the cultural costs. A small group of nations, including Algeria and Myanmar, refuse to participate at all, citing cultural and religious objections.

There have been some failures. There are cases in which the international community has refused to take responsibility for cleaning up an environmental problem or mess or to intervene in a bloody conflict. Last century, Yugoslavia broke apart while actions were deliberated. Just 15 years ago, the on-again, off-again civil war in Sri Lanka culminated in what many have termed genocide. Sometimes intervention fails—witness the tragedy of over 30 years of civil war in the Sudan.

Technical failures have also occurred sporadically. Portions of the global telecommunications network have been out of service for varying lengths of time. A single-day blackout in most of Europe in 2016 led to billions of lost dollars of data and output. Energy grids have failed across areas larger than possible last century—NAPNET was down for a week in 2005. It was estimated that less than half of businesses and homes had portable backup systems.

THE NATURAL ENVIRONMENT—Managing global environmental issues

Environmental issues have been prominent on international agendas for the last 30 years. The global community has been mitigating and cleaning up the environmental wreckage of the past and today is moving more strongly into prevention and restoration. A continuing challenge is enforcement of existing regulation. Last century, for example, the former Soviet Union had the strictest environmental laws in the world, but they were not enforced. As the situation was opened to public scrutiny, it was clear that severe environmental problems existed.

Five forces provide the impetus for global management of the environment:

- risk response: global warming, nuclear-waste disposal, limits to carrying capacity
- value drivers: sustainability as a global value; caring for the global commons, e.g., Antarctica, space
- institutional drivers: Rio Summit, IGWF
- technological drivers: global sensing and monitoring capabilities tied into massive databases
- economic drivers: markets in environmental technologies and pollution control

Global warming continues to be the single most important driver of global environmental management. The threat of it last century, until its confirmation in 2010, was seen as serious enough to require international action. It established a precedent for global action that is relied on today. The well-reasoned and successful actions of the IGWF defused opponent's arguments that global actions were a new imperialist scheme. Cooperation extends beyond simply pooling resources to dealing with threats. Weather prediction, for example, has provided a model. Sharing data improved common understanding. Today, however, experiments with climate control are resisted by some.

Global environmental agreements proliferate

International agreements cover ozone holes, global warming, deforestation, soil erosion, over-fishing, disaster monitoring, and the 3Rs. Examples include:

Orbital Object Radar Tracking (1999)

International Global Warming Federation (2000)

International Agreement on the Troposphere (2011)

Convention on Hazardous Waste Export (2012)

Convention on Environmental Balance (2024)

Sustainability has emerged as a core global value. Sustainable societies, especially in World 1, rely on growing capabilities to manage global environmental issues. Sustainability principles are part of school curricula worldwide. The Rio Summit in June 1992, sponsored by the United Nations Environment Program (UNEP), is today hailed as a milestone. Its Agenda 21 report is the framework for much of global environmental management today. It proved to be a key stimulus for further institutionalization of environmental actions. The early paper tiger organizations that Rio spawned have matured into effective action bodies today. The box above highlights some of the major international agreements that have in large part emanated from these groups.

Complete around-the-clock global monitoring of the environment has been considerably refined over the last 25 years. A primary challenge at the turn of the century was making better use of the masses of data that were pouring in while the international archive of remote sensing data bulged with unprocessed data. Pricing issues have finally been worked out. Fine-tuning global monitoring technologies makes this possible. Fuzzy logic programs, neural networks, and expert systems are helping to sort data. Global positioning systems bring the essential dimension of location to data gathered on the Earth or from Earth orbit. Geographic information systems also help collate, organize, and interpret the data.

Businesses have capitalized on this new partnership with the environment—20% of U.S. GDP growth has been devoted to environmental cleanup over the last 30 years. The numbers are similar in other World 1 nations. Environmental groups present the environment as an opportunity for businesses today. National governments continue to sponsor environmental technology research as well as cleanup and restoration programs. Pollution control is a multibillion-dollar industry.

Monitoring the environment around-the-clock and around-the-globe

Remote and in situ sensors feed into networks of databases, which in turn relay instructions for mechatronic systems to carry out. The systems are moving from self-monitoring to self-diagnosing to self-repairing. The Resource Tracking Model developed in 2001 with the assistance of the EOS is an integral part of international efforts to assess the planet's carrying capacity.

Managing the commons: oceans

Oceanographers can measure just about everything in the ocean today. Satellites, ships, interactive real-time observation, automated smart instruments, detailed maps, and supercomputer-based models provide the tools. Understanding how oceans work is an important element to understanding climate change. The confirmation of global warming in 2010 spurred intense interest in oceans and hydrology that continues today.

Collaborative research on coastal issues is ongoing. For example, coastal over-development has created environmental problems worldwide. Growing shares of populations live near coastal zones. In the United States, for example, 75% of the population lives within an hour's drive of the coast, up from 50% last century. Overdevelopment harms fish populations and drinking water and often overwhelms civil works like sewage systems.

Tending the global commons

The global commons—the atmosphere, oceans, land, and space—as well as the particular global-scale issues such as global warming, ozone depletion, and nuclear waste are managed internationally. There are several cross-border arrangements to manage water power and water supplies, telecommunication and transportation infrastructures, and even waste disposal. The Global Commons Agreement on Infrastructure in 2013 established the prin-

principle that national infrastructures should strive for integration with the emerging global infrastructure by adhering to construction and other standards.

Managing the globe: the atmosphere

Climatologists use state-of-the-art global data collection, satellite and remote observations, high-performance computing, and data visualization and analysis, as part of their systems approach to understanding climate and the atmosphere. The growing body of knowledge informs global management.

The U.S. Clean Air Act Amendments last century set the precedent for the International Agreement on the Troposphere this century. They were one of the last major national acts dealing with the atmosphere, as global oversight is now predominant.

Trading blocs have proven to be useful bases for managing regional projects. Linking regional projects, where it makes sense, has been and will increasingly be, a logical next step.

Conserving natural resources

Biodiversity and deforestation are primary global resource management issues. Debt-for-nature swaps are slowing the extinction of species in rainforests, although substantial damage has been done. International authorities are managing portions of rainforests in Madagascar and New Guinea. Plans are being laid for a multibillion-dollar reforestation project in the Sahara in the next decade. It will be based on artificial tree technology used to reclaim several deserts in Australia.

Managing the global food supply is in its embryonic stages. The UN's WHO has been the lead agency in food distribution as well as public health, reflecting the close links between the two. The second Green Revolution from 1995-2025, based on bioengineered crops and automation, has kept the food supply, but not its distribution, ahead of population growth.

THE BUILT ENVIRONMENT—Managing global infrastructures and technologies

The built environment is humanity's technological intermediary with nature. It adjusts the natural environment to better accommodate the social one. Increasing technological capabilities have raised some projects to the global scale, which in turn has led to global management of them.

Three types of global management are in place regarding the built environment:

- oversight of technological infrastructures
- cooperative R&D and regulation of enabling technologies
- macroengineering projects

Historically, these technological systems have been local in scale. Over the last 35 years they have been moving to national, regional, and today, global capacities. The primary technological infrastructures being managed globally are information, transportation, and energy. More traditional business and industrial infrastructures, such as manufacturing facilities, chemical plants, and electric generating facilities, are not globally managed yet, but they are part of managed systems and subsystems.

The information infrastructure: the backbone of global management

Information technology is so pervasive that it is largely invisible. Today's networks are widely available and easy to use, melding computing into the background. The information infrastructure is taken for granted as electricity became last century.

A global network of information technologies is the backbone of the global move to information- or knowledge-based economies. The Internet has merged into a larger information infrastructure, which in turn has expanded into a worldwide broadband network of networks—the GlobeNet. They are framed on fiber optics and supplemented with satellites, cellular, personal communicators, and microwave arrays as ancillary.

The breakup of monopolies and subsequent globalization of national telecommunications led to hundreds of cross-border acquisitions that sped up the transition to global networks. The networks are moving toward universal standards. In some nonaffluent nations, networks are still bridged by software protocols that allow incompatible networks to communicate with one another.

Milestones on the way to the global net

1990 analog and digital
1995 64K ISDN
2005 multigigabyte ISDN
2010 terabit broadband ISDN
2015 total fiber nets*

*in most affluent nations and in up-and-coming middle nations

Millions of computers are linked into the global network. Groupware and videoconferencing are important business collaboration tools today. They enable work teams spread across the globe to work together less constrained by time and space barriers.

INTELSAT continues to be a benchmark of international cooperation on telecommunications. This long-standing arrangement to coordinate access to satellites has become especially important as low Earth orbit fills up. Access to LEO must be carefully regulated to avoid multimillion-dollar accidents. Another successful international agreement is the International Telecommunications Union, whose forerunner the International Telegraph Union

goes back to 1865. It is considered by most scholars to be the oldest functioning international organization today.

Security on the global net

Global management of the Net centers on guaranteeing security and reliability of transmissions. Because so much of human enterprise is dependent on the information infrastructure, nations are willing to pay for oversight. Fees vary based on the levels of privacy, encryption, and guaranteed delivery.

Security and reliability standards negotiation is ongoing. To keep up with technological advances, which often outpaced standards-setting in the past, flexible, scalable standards are continually updated. EDI last century was the initial area of cooperation. Spectrum allocation and reallocation have also been successfully negotiated.

Motorola's Iridium satellite network deployed in 1998 has significantly enhanced global positioning capabilities. It has improved logistics and navigation, and supplements remote sensing satellites monitoring the environment. Linking remote sensing and mechatronics has created smart elements and monitoring systems.

The sensing network is also supported by data storage capabilities that have been growing exponentially for years. Intelligent, self-learning databases update themselves autonomously, absorbing new information and deleting obsolete information. Global modeling simulation capabilities, increasingly using virtual reality, are valuable tools for global management.

A principle of collective response to attempts to interfere with global infrastructure systems was established by the international police action that followed the cutting of trans-Atlantic fiber-optic cables by terrorists in 2011.

Moving goods and people: managing global logistics

The widespread move to just-in-time and just-when-needed economies over the last 35 years has required a substantial boost in logistics capabilities and the physical transportation infrastructure. Air, land, and sea traffic control has been enhanced by information technology. Cooperation built from simple steps such as sharing weather data.

Adopting the standards in place today has eliminated redundancy and improved coordination on the global scale. Cooperative global agreements are becoming increasingly common; for example, the IHCC that formed in 2019 hopes to commercialize hypersonic craft by 2030.

Travel survives the infotech onslaught

Many experts predicted the demise of the travel industry with the advent of information technologies such as networking, groupware, and videoconferencing. Why travel when you could meet remotely? Most expected a drop in travel. Others felt information technology, by expanding the number of contacts that people could make, would actually stimulate increased travel. The verdict today, based on the travel numbers, and the continued position of tourism as the world's number one industry, supports the latter. Travel has been spurred, not reduced, by infotech.

National systems expanded into continental ones. The EC maglev system was an early continental project. NAFTA and SAFTA (South American Free Trade Agreement) later built continental highways as well.

Sea traffic control has been using the GPS since last century. The fully linked modular cargo networks now used by most nations greatly facilitate international trade.

Global energy management: sharing grids, guarding impacts

Global management has emerged in support of utilities' wheeling and dealing. Utilities across the globe are being made common carriers, as power generation is separated from transmission and distribution. NAPNET became the largest electric grid in the world 10 years ago with the connection of Mexico to the United States and Canada. As superconducting transmission line costs fall and reliability rises, they will lead to growing continental grids.

The IGWF has coordinated and aided shifts away from fossil fuel power. Renewable technologies are in place and their use is poised to expand. This shift is crucial, since nonaffluent nations, typically lagging World 1 nations in shifts to advanced energy technologies, now account for 60% of the world's energy use. In many cases, however, these nations pioneered renewable technologies, when the technologies were cheap and obviated the need for a supporting grid or infrastructure. Portable photovoltaics and fuel cells, for example, were popular in many nations that lacked the funds for an infrastructure. Global management of energy in most cases has been confined to the affluent nations and selected middle nations who could afford access to regional grids, usually with the assistance of affluent trading partners.

Nuclear power is globally regulated. Damage from the last incident, a meltdown induced by sabotage in Pakistan, was well contained, but still raised international alarm. The International Energy Agency (IEA) in 2009 finally got all nuclear nations within its jurisdiction, i.e., subject to its inspections and standards.

Cooperation on global technologies: R&D, standards, and regulations

Some technologies require global oversight due to their centrality to economic activity or to regulate their possible global impacts. Biotechnology and materials are technologies with worldwide consequences whose pros-

pects have been advanced by international cooperation on precompetitive R&D. In addition, biotechnology's novel effects warrant global oversight.

International genome research programs built on the early national programs. Procedures for setting regulatory lifetimes and for updating and changing regulation have been standardized. The U.S. biotechnology regulatory structure evolved from a tangle of differing jurisdictions to a harmonized new federal Biotechnology Regulatory Agency formed in 2004. It is addressing long-standing public safety concerns and industry's competitive concerns.

The biotechnology industry was the prime mover behind the evolution of international regulatory structures. The industry argued that uncertainty about the future and a growing hodgepodge of biotechnology regulations was slowing expansion. It pushed for the International Biotechnology Commission organized by UNEP three years ago. The commission is charged with developing a comprehensive vision of the implications of biotechnology for global society over the next 25 years. Its report should be out within the decade.

Risk analysis becomes standard practice

Risk analyses accompany global technology projects. In addition to anticipating and monitoring health and safety risks, social, political, environmental, and institutional dimensions of risk are within its scope. It is standard business practice and required for government projects today. A key enabler of risk analysis is improved modeling, including virtual reality simulations. Risk analysis is integrated with decision analysis and technology assessment.

In parts of World 1, explicit programs have begun for the aggregate enhancement of populations' physical and mental abilities (as opposed to disease prevention) based on the understanding of human genetics. International sports have been debating whether or not to admit genetically enhanced athletes. Some bioengineering of people, animals, crops, trees, ecosystems, microorganisms, chemicals, and materials is regulated internationally. For example the ICACA, established in 2017, set up approval mechanisms and regulations for transgenic animals in agriculture. Other agreements cover releasing new organisms into the environment.

For materials, the International Agreement on Standards in Construction of 2011 developed standard measures of performance and capability for materials, including their energy efficiency and insulative capacity and established guidelines for use of standardized materials and parts in construction, appliances, vehicles, and other durable goods.

Macroengineering projects gaining credibility

More macroengineering projects are in the planning than building stages. They are global scale by definition. They are too expensive for a single country and require international cooperation. They have substantial, measurable, lasting impacts on the environment with cross-border social, political, or eco-

conomic consequences. There is not yet a formal institution for the oversight or funding of macroengineering projects. The private Global Society of Civil Engineers plays an important advisory role. The Mitsubishi Research Institute in Tokyo's Global Infrastructure Fund begun in 1977 has helped fund projects. The key is not so much the know-how, but the politics and economics.

Reclaiming the desert

Planting natural and artificial trees has been used to reclaim deserts in Australia, taking advantage of weather and climate manipulation to stimulate and increase rainfall. Artificial palm trees, for example, cause rain to fall. The trees have perforated plastic and foam trunks, branches, and leaves, and polyurethane roots which, injected as a liquid into perforated steel tubes will percolate into the ground and solidify to form roots. By shading the ground and through evaporative cooling, cool fronts form and cause rain to fall. Gradually natural trees replace the artificial ones. This project was funded internationally as a test bed for further large-scale application in Africa.

The reversal of the Ob and Yenesi rivers in 2018 in Russia is an example of a macroengineering project. The project redirected the rivers from their natural drainage into the Arctic to the Aral and Caspian Seas in order to water the central plain. Other projects include the solar power satellite deployed to provide power for the Moon base, and a Saudi-led Middle East consortium that is towing icebergs to cities and deserts for water.

New water and power sources were made available five years ago with the Great Replenishment and Northern Development (GRAND) Canal, funded by public and private contributions and coordinated by the NAFTA Board of Governors. The states involved were essentially bought off by promises to boost infrastructure spending in the affected areas. The Great Lakes were converted into a water storage and distribution reservoir. A 160-kilometer dike across the southern end of James Bay in Canada captures the inflow of fresh water and pumps it southward to the Great Lakes along new channels and existing rivers. With water management systems it provides fresh water for some of the United States and Mexico as well as providing hydroelectric power. The cost was about \$100 billion. As with most hydroelectric projects this century, there were environmental protests, but modification of the projects after the environmental impact statement satisfied all but a few extremist groups.

THE SOCIAL ENVIRONMENT—Managing global society

The primary issues in the social environment today center around managing population, social, economic, and political issues. Population issues include keeping the planet, regions, and nations within their carrying capacities. A related global issue is managing immigration and refugees. Social is-

issues being addressed on a global scale include crimes of terrorism, drugs, and financial, and public health issues, namely infectious diseases. Substantial global oversight of economic issues includes trade blocs, economic dispute resolution, intellectual property rights, financial networks, and countertrade. The difficult area of political issues includes conflict resolution and peace-making, arms regulation, and disaster relief.

Managing population issues

Population growth in the nonaffluent countries has pushed the world total to 8.4 billion today. Ninety-four percent of population growth has been in middle-income and destitute nations. World 1 nations have completed or are well along in the demographic transition to replacement fertility levels. Ten nations have fallen below replacement level and have shrinking populations, whereas others—the United States, for example—are still growing. Middle-income nations are in varying stages of the transition. India's population is still growing 2% per year. It passed China as the most populated country five years ago. Thailand has made remarkable progress over the last 35 years. Its growth rate is under 0.9% today. Some World 3 nations are still growing exponentially. Nigeria's population, for example, has almost tripled over the last 35 years.

Crowding into cities

A companion trend of increasing populations is urbanization. More than 60% of people live in urban areas, up from less than 50% in the 1990s. There are now 25 cities with populations of 10 million or more.

Heavy urban concentrations have overwhelmed supporting infrastructures. Eighty-five percent of Mexicans, for example, are urban. Shantytowns have sprung up worldwide as a result. Estimates of carrying capacities have been fairly accurate in the cases of small nations or regions. These figures are no longer easily dismissed as doomsaying.

The effects of overpopulation are primarily local, but they have spillover effects worldwide. Overpopulation is a primary driver of environmental problems, hence reducing it is an international priority. Expanding energy demand from 1.5 billion people, for example, led China to burn more and more coal, which causes acid rain in some Japanese coastal areas and adds to global warming. China is the world's largest contributor to global warming today.

Conflicting values have stalled global attempts to manage population. Different nations have different values about human life. Attempts to impose one culture's standards on another have consistently failed. The United States, for example, often refused to assist population control programs of nations that allowed abortions in the 1980s and 1990s. This proved especially damaging in the northern Asian republics of the Commonwealth of Independent

States. Other U.S. assistance programs to these republics were ineffective due to the overriding effects of runaway population growth.

Progress has been through large, high-profile activities like improving women's education as well as market forces. Making morning-after pills and multiyear implants available and affordable has helped manage population—in tandem with hundreds of international population control programs. The male contraceptive pill plays a role in affluent nations with educated males. The lesson of the demographic transition is that economics and education, especially of women, are the key factors. Addressing the reasons that people have large families, such as fears that some children will die or to assure that children will take care of them in their old age, has led to success. Programs for old age security, such as social security, pensions, or long-term health care, have been proven to reduce birth rates.

Weak sanctions, such as reduced foreign aid, have been levied on nations that have done little to curb population growth. Economic development aid to India was halted three years ago, as population growth rates climbed back up. The Geneva Conference on Hunger in 2007 established the principle of food assistance only in natural disasters. It has been difficult to enforce the principles, since global media coverage of people starving has led to pressure for governments to intervene. Over the last 35 years, however, the balance of global opinion is weighing towards aid for long-term development, rather than stopgap measures. There is growing impatience with nations that are unwilling or incapable of helping themselves.

Tight borders slow immigration and refugees

Immigration is being managed globally today. The emphasis has been coordinating policies and tightening controls of illegal immigration. The UN High Commission on Refugees, which expanded to include immigration in 2005, passed the Convention on Immigration of 2019. It regularized national and regional policies into a coherent single approach. Regional solutions were insufficient as weak policies and enforcement in some areas led to problems for all.

The U.S. melting pot or assimilation model collapsed and made U.S. leaders willing to join in an international agreement. The convention has provided a cover for the United States and other national governments. When Mexican leaders object to deportations, for example, United States leaders refer to the convention.

Immigration problems are similar and therefore conducive to global coordination. Nations using guest workers to solve short-term workforce needs found themselves with the long-term problem of supporting the worker's children and relatives. Key clauses of the convention closed loopholes that automatically naturalized the children of illegal aliens or guest workers, or by mar-

riage. There is now a 10-year limit by which time noncitizens must return to their country of origin, which cannot refuse reentry.

Illegal immigration continues to be a problem. There are large smuggling rings worldwide. Although information networks and identification cards have tightened security, innovative conspirators have found ways to evade laws.

The long-term strategy for discouraging immigration is to improve conditions in the originating countries. There are smaller-scale examples. Germany integrated East Germany after the collapse of communism, and South Korea integrated the North in this century. Although initially expensive, they were politically desirable and they provide a model for integrating people from faltering economies.

Immigration is still possible for those with money, desirable work skills, or for education. For the less fortunate, there are few options. The convention, however, provides for recruiting migrant labor. The massive project to reforest the Sahara, for example, was supported by migrant laborers who were granted citizenship in any of the participating nations after the project if they wanted it.

Some social groups have great mobility. There is an expanding group of global citizens with global passports. They are the business and political leaders for whom global citizenship is a reward for hard work or good service.

Managing social issues

Social issues being addressed on a global scale today include terrorism, drug trafficking, financial crimes, and preventing the spread of infectious disease.

Policing the globe

Terrorism has been aided by improved transportation as the perpetrators and their materials are easily shipped worldwide. Old institutions, like Interpol, have not been able to expand the scope of their activities beyond information sharing or their reach beyond the affluent nations, North America and Europe. Cultural differences have proven particularly difficult to overcome regarding terrorism. A key problem is that one person's criminal or terrorist is another's patriot or potential martyr.

International sports model social cooperation

The Olympics are a symbol of internal cooperation and competition. Cooperation in this arena provides a model for another. The games have also been used to make political statements, or symbolic acts, through boycotts or in siting. Harmonizing sports rules has provided useful lessons for setting voluntary global trade or product standards.

The United States has led the so-far unsuccessful push for global news blackouts of terrorist incidents. Terrorists are aware that one well-publicized attack can induce widespread fear. Proponents of blackouts feel that by deny-

ing terrorists publicity, they will reduce their effectiveness. Coverage is officially prohibited in the United States, but bootleg disks circulate unofficially. One way that terrorists thwart news blackouts is by targeting communications equipment and facilities. Bringing down information networks for a short time has more devastating effects than blowing up a building or shopping mall—favorite targets of the past.

Advances in combatting the drug trade have come from internal improvements in drug education and treatment programs. On the global scale, laundering drug money has become more difficult because of increased oversight of financial transactions. The Hague Accord of 2016 was an important advance in the global war on drugs. It established World Court jurisdiction for trans-border shipments of drugs. It has proven politically feasible to turn drug suspects over to international bodies, in contrast to the extradition struggles of the past.

Computer crime has accompanied the spread of global financial networks. While oversight and security measures are continually improving, the strategies and tactics of the criminals have kept pace. Wiping out financial crime is still a distant dream. As long as the stakes are so high—the equivalent of the world GNP passes through financial networks each day—criminals will attempt to skim a percentage.

Global management of crime is proceeding slowly. Yet there is growing support for an autonomous international police force. The last vote in the UN General Assembly fell only a dozen votes short. Current enforcement officials are held in check by national governments. There is a fair degree of cooperation and sharing of data for international crimes, and there has been cooperation for decades on financial, or white-collar, crime. Extradition agreements have moved beyond national to regional agreements, but global extradition is probably a decade away according to most experts. Establishing a venue for trials is often tricky, especially in the case of global companies without an easily confirmed home base. In the 2010s, the Ribowka Co., based in 77 countries, was able to put off a trial for more than a decade, relying on objections to improper venue.

Protecting global public health

Few public health issues are truly global, but many cover sizable regions. Global public health programs, anchored by the WHO, have centered in destitute and some middle-income nations. Sanitation programs in affluent nations have brought most public health concerns under control, marred only by occasional outbreaks of disease in poorer urban areas. Public attention and dollars have shifted to the diseases of aging and mental health. Just 10 years after the introduction of an AIDS vaccine in 2000, over 50% of people in the United States with the illness were cured.

The glory days of global public health

Public health officials like to cite the case of smallpox. This killer disease was eliminated worldwide in the 1970s through vaccination programs run by organizations like the WHO. A similar global killer has yet to emerge.

The lesson still being learned in destitute regions, however, is that in cases of highly contagious diseases, prevention efforts must be widespread to be useful. The reappearance of infectious diseases like tuberculosis, the worldwide spread of AIDS last century, and the cholera epidemics in destitute areas this century are cases in point. But it was the devastating spread of hantaviruses in the early 2000s that put public health into the global spotlight. The viruses began in rural areas and were spread to urban areas by rats. They triggered an epidemic in Calcutta which ripped through south Asia, the Middle East, and even found its way into Africa. Public health programs that were languishing received higher budget appropriations after the devastation caused by the hantaviruses revealed their weakened state.

Managing economic issues

Global economic management continually lags the rapid expansion of global economic activity. Ties between nations have strengthened over the last 30 years. Supra-national oversight is taking root in trade blocs, economic dispute resolution, intellectual property rights, around-the-clock financial markets, and countertrade.

Blocs help expand global trade

Trading blocs harmonize trade practices and standards within designated regions. The blocs that began forming in the 1990s differed from their predecessors in that they were not formed to be exclusionary, but to improve internal access to markets. Their primary advantage is removing trade barriers within the bloc. In the EC, for example, German chemical companies improved their access to burgeoning Spanish markets.

Helping themselves by helping others

The EC has been focusing attention on integrating the former communist Eastern European nations. EC parliamentary leaders decided it would make more sense to help them rebuild, then to deal with migrant and refugee problems that would result from having moribund economies on their borders.

Since the blocs are not exclusionary, they are stepping stones to a single global market. Differences in trading practices are diminishing. They will likely be precedents for a single global market.

The biggest three blocs are NAFTA, the EC, and the east Asian bloc. Smaller blocs have formed in South America (SAFTA), a West African bloc led by Nigeria, a south Asian bloc led by India, and an Oceanic bloc of Australia

and New Zealand. There have been negotiations to merge blocs, with NAFTA and SAFTA being the likeliest candidates. At the same time, a Chinese faction within the east Asian bloc has been advocating a split from Japan and Korea.

Trading between blocs continues to thrive. The completion of EC economic union in 2010, for example, did not significantly affect trade with outside nations. Trading outside the bloc dipped only slightly or not at all. Access to the EC for non-members changed little. The EC trade and tariff policies for outsiders's selling to their market fell in between the least restrictive United Kingdom policies and the most restrictive French ones.

Avoiding the courtroom: economic dispute resolution prospers

Economic dispute resolution is an important part of global management. Alliances are standard practice. A recent on-line survey of 1,000 20-50 person companies by Business Inc. Newsforum found that on average 63% of the revenue of these small companies derived in part from alliances. Alliances often lead to disputes, which can have global ramifications. When U.S. marshals padlocked a Toyota plant in 2007 in a controversy over nonpayment of taxes, it set off an investor panic that led to a near-collapse of financial markets. Only immediate intervention by the World Trade Organization group got the doors unlocked, the parties back to the bargaining table, and confidence restored to investors.

Arbitration, mediation, and conciliation are common tools for resolving international economic disputes today. After the turn of the century, it became evident that all parties lost in trips to the courtroom. Alternate means of conflict resolution are continually experimented with. Regional contract standards have avoided many disputes that resulted from sloppy agreements. Expert systems rigorously analyze contracts as well and have further preempted disputes.

Securing intellectual property

Intellectual property includes patents, copyrights, trademarks, and trade secrets. The Intellectual Property Act of 2014 provides a framework to sort these issues out. It has been a difficult issue due to different cultural views about property. In the United States, for example, scientific discoveries are viewed as the private property of the discoverer, whereas in other cultures, for example Korea, such discoveries are viewed as public goods.

Earning by giving it away: encrypting software

Software piracy is an area of intellectual property rights where global management is making progress.

Most software in affluent and some World 2 countries today is downloaded from the Net. Users do not buy their own software, but simply call it up on the Net and pay a royalty based on use. There are alternatives to direct usage fees, in which one pays a flat fee for access to software or software packages.

Software on the Net cannot be easily pirated, although hackers occasionally beat the system. Some users still use old-fashioned software packages, but they are becoming obsolete because they only run on older systems.

Many World 1 pharmaceutical companies were severely damaged by clones. Software and video piracy also cut substantially into revenues. Cloning and piracy also harmed the countries from which they originated. Domestic software industries in nations where piracy was rampant, for example, were unable to flourish due to this piracy.

Piracy in the affluent nations was considered technology transfer in World 2 and 3 nations. World 1 nations agreed to ease access to their discoveries, when faced with the threat of united action by the rest of the world. One strategy has been to encourage other countries to develop their own software industries, hence raising their stake in protecting it from theft. They followed the example of the video industry last century, which found that video piracy dropped when joint ventures or distribution companies were set up in the offending nations. The combined market power of China, India, Brazil, and other nations prevailed. Patent lifetimes have been shortened, and compulsory licensing arrangements were agreed to.

Money and finance go electronic

Financial markets are 24-hour, around-the-clock operations that are complex practically beyond human understanding. They often behave in ways that overseers are surprised by. The increasing complexity requires global oversight. There have been failures, but disaster has been avoided. The system has shown unexpected resilience. Many experts predict universal monitoring of financial and business transactions within a decade.

A de facto global currency, in which national currencies are pegged to a global standard, is in use. There is no Global Reserve Bank, but an agglomeration of regional and national institutions and controls. Twenty-four markets redistribute financial power. Chicago, for example, once controlled about 75% of futures and options contract trading. It now has just 21%. Access to capital has been leveling out the global economic playing field, by reducing the competitive advantage of easy access to capital. Clearing and settlement times have gone from two weeks to less than three days at the turn of the century to real-time today.

Computer-based crimes have been a growth enterprise over the last 35 years. International regimes, such as the fraud division of the International Telecommunications Union and the private sector Prevention of International Fraud and Forgery (PIFF) have been set up. Their security measures include voiceprint validation and encryption. Criminals are often quick to circumvent security. There is an intellectual arms race between network criminals and security.

Many private networks have sprung up to exploit gaps in regulatory structures and avoid broker's fees. There has also been growth in off-exchange trading, which is a step away from global management. These arrangements have typically been small-scale and have not drawn significant traffic away from global networks. Industries have established global information exchange networks, such as the global manufacturing network (GMAN) in 2019 that upgraded national prealliance service networks like the Factory America Network (FAN) in the United States to include nations across the globe.

Countertrade fills in gaps in global trade

Countertrade accounts for about one quarter of world trade today. These arrangements are extremely complex—a single transaction can involve a dozen nations. It is a primary tool for trading with currency-short countries. It was originally widely used by affluent nations trading with middle and destitute ones. Its use has expanded to middle and destitute nations trading with one another. Brazil and Mexico, for example, have a flourishing countertrade in vehicles and agricultural products. Computer matchmaking networks for barter, such as TRANET, have helped rationalize previously chaotic arrangements of barter, counterpurchase, offsets, buy-backs, and switch trading.

Underground economies flourish

Black and gray economies still flourish despite improved global economic management. Many businesses feel they cannot abide by the regulation that is intrinsic to global management, with its attendant costs and complexity. Uprooting underground economies has proven more elusive than many global management proponents anticipated. Underground economies cut across destitute, middle, and affluent nations in different forms. It may be in the form of street peddling, hidden sweatshop production, or servants. It often goes hand in hand with illegal immigration.

Managing political issues

Progress in managing political issues has come slowly. True global governance is decades away. The progress that has been made is in peacemaking, arms regulation, and disaster relief.

Conflict resolution: making the peace

Conflict has been a growth enterprise over the last 30 years. It involves terrorism, insurrection, civil unrest, ethnic and racial violence, border conflict, and balkanizing and irredentist movements. The end of the Cold War blew the lid off many smaller conflicts that had long been simmering. Hesitant, tentative arrangements have gradually been strengthened since then, although funding questions are still hampering peacemaking.

Divisions along religious, ethnic, tribal, and economic or resource lines have been played out in battle. The number of nations in the world today appears to have stabilized at 210, up 30% from the 162 of 1990. Most of the new nations come from Africa, where borders based on colonial convenience were reshaped along tribal and ethnic lines, creating more nations. The United Nations has moved firmly into peacemaking with the establishment of its standing army—the international equivalent of a foreign legion—in 2011. The North Atlantic Treaty Organization (NATO) and Warsaw pact forces combined with troops from other nations to form a UN army. Recruits from less well off nations continue to be eager to join the force, as the troops are well-trained and well-paid.

Amnesty on-line

A perhaps unlikely beneficiary of the global information infrastructure was Amnesty On-line AO (previously Amnesty International). It became more difficult for nations to control information flows into and out of the country. Beginning in the 1990s, stories of people who were imprisoned secretly or unjustly were posted on the Net anonymously. AO would investigate the charges and followed up when it was merited.

In addition to making it more difficult for nations to hide their bad behavior, the information infrastructure also made it possible to bring more pressure to bear on renegade nations. AO chapters sprang up across the world. The AO news forums were hotbeds of activity. Millions of supporters could be organized to flame nations, or to influence governments or people dealing with the renegade nation.

For example, AO organized a boycott of Wallace & Maxwell Industries products in 2011, because they were doing substantial business in Pakistan. The Pakistani government was found to have been systematically violating political prisoner's rights. W&M threatened to move their operations out of Pakistan if the government did not comply. The government complied in this case, but in cases where governments refused to give in, companies were harmed or ruined.

There have been many battles over the lines between national and international sovereignty. Many demagogues have tied their political fortunes to bashing global invaders. Growing interconnectedness has made economic sanctions more effective than in the past, but nations with sufficient economic clout have been able evade them. China, for example, has often acted contrary to global initiatives, especially in arms trade. Its economy is too big to be harmed by sanctions. In some cases, there is little international bodies can do. Although this revives references back to the ineffectiveness of the UN in its

early days, and even the League of Nations, these cases are the exception rather than the rule.

International receivership has been necessary for Haiti, Bangladesh, and Djibouti. Others have been or are on the precipice. The total collapse of these governments led to peacemaking troops taking control, without the invitation or authorization of the country involved.

Nonproliferation struggles

The overall assessment of nonproliferation, including conventional and nuclear weapons, over the past 30 years is dismal. Most nations claim that this area warrants greater priority on the global agenda, but actions are limited. China has been resistant to stop its arms trade, which has led other nations to refuse to abandon theirs.

The Lima Space Weapons Treaty of 2007 set up space as a weapon-free zone. It has remained that way. Another significant achievement was North Korea's reluctant compliance with the Nuclear Nonproliferation Treaty in 1999, as part of Korean unification.

Predicting, easing, and responding to natural disasters

Natural disaster monitoring networks have been built around environmental monitoring networks. Prevention infrastructure is emerging as the next step in managing nature. Earthquake and flood prevention works are particularly advanced. In 2017 the ISA and the Red Cross formed the International Disaster Tracking Program. It uses space-based monitoring to provide advance warning of disaster and help coordinate relief efforts.

A growing understanding of the physics of the Earth, particularly patterns of crust, mantle, and core boundaries, and the overall evolution of the crust, hydrosphere, and atmosphere has been critical. Earthquake prediction now provides warnings weeks, days, or hours before the event, taking advantage of well-established precursors. The Parkfield segment of the San Andreas was the first fault zone equipped with prevention systems. Experiments with earthquake control, such as fluid injection, are part of ongoing global activities.

What lies ahead for global management

There has been progress in global management, but few systems are complete or issues resolved. It is likely that international institutions will increasingly gain jurisdiction over realms now under nation-state sovereignty. International armies, and in some cases crime task forces, are already exempt from national jurisdictions.

An emerging and likely candidate for global management in the next 10 years is coordination of recycling, reclamation, and remanufacturing programs springing up worldwide. Proposals abound, but experience with the

3Rs is still scant, and disparities in progress are wide. Some nations, such as the United States and Germany, have been pioneers, while many middle and destitute nations have no formal 3Rs programs.

Another key future challenge will be to bridge the rich-poor gap, which continues to fuel most international difficulties. Taking advantage of affluent nations' search for new markets is a likely path. The interconnectedness of the planet is bringing home Ben Franklin's axiom that "we must all hang together, or assuredly we shall all hang separately."

Critical Developments, 2000-2025

Year	Development	Effect
2000	IGWF forms.	Transfers technologies in response to global warming.
2007	Lima Space Weapons Treaty.	Preserves space as a weapon-free zone.
2009	All nuclear nations under IEA standards.	International negotiations on nuclear safety standards begin.
2011	International police action responds to network sabotage.	Sets precedent of global police responses.
2011	UN standing army forms.	Regularizes international peacemaking.
2013	Lehigh University offers the first Master's degree in global management.	Begins training of a cadre of global managers.
2013	Global Commons Agreement on Infrastructure.	Establishes principle that national infrastructures should adopt common standards.
2014	Intellectual Property Act.	Sorts out the culturally-based differences on patents, copyrights, trademarks, and trade secrets.
2016	Bangkok Accords.	Sets up institutions to formalize limited trade protections.
2016	Hague Accord.	Established World Court jurisdiction for trans-border drug cases.
2019	Convention on Immigration.	Regularization of national and regional immigration policies into a coherent approach.
2019	China cut off from communication and financial networks.	Cutoff becomes a credible threat, as China quickly backs off.
2022	Vision for the Planet commission forms.	The vision statement will frame global management strategies and actions for the future.

2025

2024	Convention on Environmental Balance.	Gets 32nd signature in support of sustainability standards.
2025	World population hits 8.4 million.	Population is well within planetary carrying capacity, but some regional and national capacities still in danger.

Unrealized Hopes and Fears

Event	Potential Effects
Global government.	Rationalize global management by concentrating power at global level.
Global coup d'état.	One nation or group of nations seizes control of the globe under the cloak of global management activities.
Economic collapse.	Interconnected economies lead to a crisis in one region bringing the rest of the global economy down with it.
Closing the rich and poor gap.	Global management leads to sharing of resources, transfer of wealth, and brings nonaffluent nations up to affluent standards.
Systems failure or sabotage of global infrastructure.	The information infrastructure collapses and is not reconstructed.