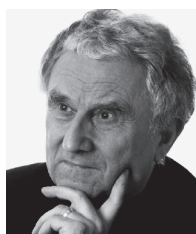


All Tomorrow's Crises

The challenges of the future are known, but our responses are rarely adequate



Rolf Kreibich | **Climate change, the depletion of natural resources, globalization, migration:** these mega-trends of global change are already deeply impacting our lives. Yet politicians have responded with short-sighted agendas in inverse proportion to the existential importance of the problems. A scientific analysis of the effects of these trends on the future of humankind is in order—but we must then not only formulate but also carry out strategies for tackling the attendant problems.

ROLF KREIBICH is a physicist and sociologist. He was president of the Free University Berlin and is now director of the Institute for Futures Studies and Technology Assessment in Berlin.

Since time immemorial humans have been fascinated by predicting the future and attempting to recognize and shape future developments. The literature of antiquity contains a wealth of evidence that the ancient Greeks and Romans, as well as numerous other cultures, shared this interest. Until the late Middle Ages, information about the future was largely the product of speculation. Think, for example, of the Oracle at Delphi. In particular, people sought predictions about natural phenomena, such as periods of sunshine, rain, or storms, but prognoses about economic, technological, military, and political events were also popular. People clearly believed that knowing about future events would give them practical advantages by permitting them to influence the future or promote desired outcomes.

In the eighteenth and nineteenth centuries, as the spread of technology rapidly accelerated during the Industrial Revolution, future opportunities became increasingly important for decision-making in the present. The explosive growth of industry, technological infrastructure, and new scientific military techniques began to change living conditions at a previously unimaginable rate, especially in rapidly expanding cities and industrial regions. The future of each individual and of society as a whole looked far less like the past or the present than it ever had before. Those who did not want to deal with the possibilities of the future were at far greater risk of being sidelined or being pushed toward

possible futures they had neither desired nor chosen. Yet discussions about possible futures remained largely speculative or exclusively focused on the technological and industrial aspects of impending developments. Questions about the future were increasingly determined by innovations in science and technology. More importantly, conceptions of the future increasingly focused on one single path, that of the scientific-technological-industrial expansion of all aspects of life. This tunnel vision of a future determined by science and technology affected agriculture, home economics, the production of goods and services, domestic security, military technology, consumption patterns, the health care system, and even leisure and culture. The path of technological-industrial advance was soon promoted as representing progress itself and questions about the future, and possible ways of shaping the future, culminated in the search for technologically innovative solutions.

Largely as the consequence of having chosen this path of science and technology, other impending problems became evident in the nineteenth century—economic and social disparities rife with conflict, imbalances in military technology that threatened world peace, grave environmental liabilities, and the rise of certain diseases characteristic of modern societies. And yet it was not until the 1930s and 1940s that specific research methods were developed, primarily in the United States, to reach scientific understanding of the future that facilitated practical midrange strategies. Prior to this, philosophy, theology, and the social sciences had been dominated by utopias—speculative, comprehensive designs for the future and historico-philosophical models of society—such as Thomas Moore’s *Utopia*, Tommaso Campanella’s *The City of the Sun*, or the social scenarios of the utopian socialists; other examples are the historical and social models of Hegel, Marx, and Engels, and of Herbert Spencer, Henry Adams, and Oswald Spengler. In the history of science and theory, there were only the two extremes of speculative philosophical utopias and models of society on the one hand, and the limited projections of scientific-technological processes on the other. There was no room for a science-based approach to the future or for designing midrange strategies for achieving possible, desirable futures.

In the past, there was no room for a science-based approach to the future.

The Formation of Modern “Futures Studies”

The influence of both the American pragmatists (Peirce, James, Mead, and Dewey) and the American scientific tradition led to new paths for a systematic method of studying the future. It is no coincidence that concepts such as game theory, systems and models theory, cybernetics, the Delphi method, and the scenario creation method were all developed in the United States. Modern futures studies could only have been born in the US academic environment, where there was acceptance for crossing traditional academic disciplines and for inter- and multi-disciplinary cooperation, and where collaboration between science, business, politics and economics was not taboo.

Substantial insights into the future will most likely result from science and technology.

Although the new scientific approach to strategies for the future was never limited to specific topics, a strong emphasis continues to be placed on questions of science and technology. Few would disagree that in today's industrial society—and even with the transition to a knowledge-based society—substantial insights into the future will most likely result from the opportunities and perspectives opened up by developments in science and technology. Considering this bias, it is even more significant that contemporary futures studies have become increasingly aware of the consequences and risks of the dynamics of technology and industry. This new awareness began in the 1960s and resulted primarily from the emancipatory civic movements such as the social and student movements, the peace movement, the environmental movement and the women's movement.

The Scandinavian countries were the first to place important questions about the future within the framework of scientific, political, and economic consulting, with the objective of shaping society, the economy, and the environment in more humane ways. In Germany, it is equally evident that the most relevant issues of the future are defined by the consequences of technological and economic development. Some examples are the glaring global economic, ecological and social disparities; the potential consequences of nuclear, biological, or chemical weapons of mass destruction; the power imbalance between the industrial and the developing nations. The population explosion in the third world; the increasing pressures on the biosphere; the severe imbalance in rights to exploit natural resources; the trend toward individualization; demographic changes in the industrial nations; and globalization in general are also challenges linked to development.

Limits to Growth

Perhaps the most exemplary of the groundbreaking futures studies that have influenced our thinking is Dennis and Donella Meadows's 1972 study, *The Limits to Growth*. Like no other report, it caught the attention of the public, provoked scientific debate, and caused a major reorientation in politics, industry, and civil society. This in turn led to a flood of scientific follow-up studies. This seminal study was commissioned by the Club of Rome—an association with a membership of approximately one hundred individuals of stature in the sciences, industry, politics, and cultural studies from more than 40 nations—which was founded in 1968 by the Italian industrialist Aurelio Peccei and by Alexander King, then the OECD director general for science and technology. The Meadows study was the first scientific study that did not paint global development in rosy shades, extolling a future fueled by technological progress. Instead, it described the far likelier paths of economic growth, global population explosion, and the consequent depletion of natural resources. At the same time the study sounded an unmistakable warning about limits to the pressure we can put on our natural and social environments. Because of the highly effective way in which these scientific

findings were brought to the public, there is no doubt that *The Limits to Growth* marked a turning point in the way we look at questions about the future of the planet.

The basic simulation model WORLD3, based on Jay Forrester's *Industrial Dynamics*, permitted not only qualitative but also quantitative forecasting of the complex interrelationship between industry, the environment, and populations at a global level. This study, numerous subsequent global models developed by other teams of scientists, and the global scenario *Beyond the Limits* (1992) developed twenty years later, had a tremendous influence on the policies of the United Nations, the European Union, and numerous nation states. For example, the principal results of the UN Conference on Environment and Development in Rio de Janeiro, and the content of the United Nations Millennium Declaration (2000) would have been impossible without this groundbreaking work in the discipline of futures studies.

Short-range Planning

In the social sphere, questions about the future focus less on narrowly defined problems. Instead, they are primarily concerned with complex dynamic systems and processes embedded in social, economic, ecological, and cultural factors. Over the last decades it has become increasingly clear that good results, i.e. scientifically valid results that yield applicable insights, can only be achieved by taking a big-picture approach to the interrelationships and consequences of events and trends. In the age of globalization, this should be a no-brainer, but everyday practice in science, politics, and the economy is still lagging far behind.

There is a similar disconnect regarding the timeframes of inquiries into the future and the time span for which knowledge is urgently needed. Human activity creates futures of 50, 100, or even over 1000 years, for example when we construct residential or office buildings, bridges, public utilities, and waste management facilities, railroad networks, or nuclear power plants. We create long-term liabilities as we produce nuclear waste, exacerbate the ozone hole, or add to the thickening carbon-dioxide layer around the earth. Even more significant for the future are the consequences of irreversible human actions, such as the consumption of fossil and metallic natural resources and the extinction of entire species. There can be no doubt that an in-depth, scientific study of mid- and long-range timeframes and practical guidelines is indispensable, in particular for the lives of those generations that will succeed ours, and for the viability of future human societies in general.

Modern future studies define a timeframe of 5 to 20 years as midrange, and a timeframe of 20 to 50 years as long-range. However, numerous questions about the future such as climate change, the use of biomass, the disposal of radioactive waste, as well as the global development of sustainable energy or traffic and communication structures, can be usefully analyzed only in the context of timeframes that far exceed 50 years. Unfortunately, political pro-

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grams, and especially governmental programs, are generally laid out for no more than one legislative period, and the economic strategies of businesses are also aimed at very short-term profit perspectives, shareholder value, and ever accelerating innovation cycles of products and services (generally a maximum of two to five years).

We are thus confronted with the absurdity that most strategic planners, conceptual thinkers, and decision-makers in politics and industry claim to understand that our world is shaped by globalization and long-term trends, but their programs and policies do not offer answers. Terms such as “sustainable development” or “science and knowledge society” are common coinage,

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but concepts for their concrete implementation are a far cry from today’s scientific potential. As it is, we make only piecemeal use of our vast existing scientific knowledge, and we often apply it in one-sided and prejudiced ways. It is no surprise that the inconsistencies in the way we apply our scientific knowledge to the future are even

more glaring. Although researchers in the field of futures studies are well aware of the basic uncertainty inherent in scientific understanding of the future, we do have a solid and sturdy body of knowledge with regard to possible as well as probable and desirable futures and to their foundations in the past and the present. If we ignore this scientific knowledge in shaping the future, there is a high probability that it will lead to fatal consequences—up to and including the self-destruction of humankind.

The Mega-trends

Given the necessity of developing a global and longer-term perspective, it is imperative that we identify the principal future trends and assess their relevance for future outcomes. Based on a list of 50 principal trends compiled by evaluating national and international future studies, a series of futures workshops staffed by experts from politics, industry, science, culture, and civil society identified the most important mega-trends. Valid and useful results in evaluating such complex questions can be achieved only through a process such as this, which combines analysis with broad participation.

Mega-trends describe developments that must fulfill at least three criteria: First, the trend must be fundamental in the sense that it will cause potent, even basic changes in human social development and the natural environment, or one of the two. Second, the trend must cause major effects and have major consequences in at least the midrange (between 5 and 20 years) or long-range (more than 20 years). Third, the trend must have strong global effects and consequences for society and nature (biosphere). This resulted in the following ranking of the ten most critical mega-trends:

1. Scientific and technological innovations

2. Pressures on the environment and biosphere and/or the indiscriminate exploitation of natural resources
3. Population growth and demographic change
4. The transition from the industrial society to the service, information, and knowledge society (the tertiarization and quarterization of economic structures)
5. The globalization of industry, occupations, financial systems and mobility
6. Technological, economic, and social disparities between the industrial world and developing nations, as well as extremism and terrorism
7. The individualization of living and work environments
8. Increased global mobility of persons and goods
9. Reduction in the quality of life (according to UN and World Bank indicators)
10. The polarization of societies through disparities in education, qualification, and mass unemployment

The Core Problems of Global Change

Today's political, economic, and cultural challenges are primarily the result of the core problems of global change in the biosphere, including those changes and challenges that are likely to characterize social interaction on a shared globe with limited space in the coming decades. These problem, in no particular order, include:

- Climate change
- The loss of biodiversity
- The increasing scarcity of fresh water and clean drinking water
- The pollution of the oceans and the anthroposphere
- Soil degradation and desertification
- Threats to human health through global epidemics and civilizatory diseases
- Threats to food security
- Growing global disparities in development
- More transnational migration
- The increasing adoption of non-sustainable lifestyles by larger populations

Although these mega-trends and the core problems of global change are even now deeply affecting all areas of life, and although we already have a great deal of knowledge about the future, very little is being done. There is a huge gap between the challenges—even crises—that we know lie ahead and the practical responses offered on the global, national, and regional levels. To date, the political decision-making of governments, parliaments, and supranational organizations, as well as the concrete economic behavior of most businesses and business associations, is in no way adequately informed by the desperate need to find adequate responses to the pressing issues of the futures we have seen coming.