Social Technologies • Looking Ahead

A 21st Century Agenda for Science and Technology Policy

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Times change, but the technology and science issues of the 1980s and 1990s will not disappear. Some will reach a degree of resolution; others may become more prominent in the next decade or two.

Examples could be the formation of pseudo-estrogens in waste and water, or possible effects on the brain of electromagnetic radiation from power-lines or cell phones held too close to the head. On the other hand, issues that seemed to have diminished in the last century, such as nuclear power, may rise to greater importance than ever, particularly if greenhouse warning should not only prove real but significant.

My purpose here is to suggest what may become new or newly significant issues in this new century. Some of the issues may seem to be a country mile from industrial or business concerns. If the reader has any of those illusions, think again.

The following proposed S&T issues are organized into 10 categories:

Social Technologies

There has been a consistent resistance on the part of public officials, the U.S. Congress, business, and even academics to recognizing and acknowledging that much of what occurs in society by way of institutional creation and development, innovations in institutional practices, and mechanisms for creating, managing, funding, and manipulating technology, are themselves social technologies. As such, they demand the same kind of analysis and scrutiny for normally unanticipated consequences, and the systematic consideration of alternatives that we now, more or less routinely, give to physical technologies.

The resistance to acknowledgment of social technologies has many sources. Many of the social technologies had their beginnings in law, in regulation, or in responses to law or regulation. Others came about as a more-or-less natural evolutionary process of institutional change.

Because social technologies do not involve hardware, it is natural to see them as so different as to have no relationship to physical or biological technologies, at least insofar as any assessment of consequences is concerned. The reality is quite different. Any proposed social technology—i.e., conscientiously planned steps, stages, institutions, or mechanisms for achieving a social objective—lends itself to the same model that one would use in exploring the unplanned and unanticipated consequences of a physical technological development, discovery or invention.

More systematic anticipation of the effects of legislation and institutional change could benefit business and industry by reducing or eliminating the shock of the surprising and often-perverse consequences of legislation and regulation. We should look more systematically at them before we leap at voguish, ideologically grounded, or superficially attractive choices.

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Legislators show a particularly strong resistance to acknowledging social technologies. Any attempt to anticipate the downstream consequences of their legislation would almost always force a rethinking of that legislation and give some power to non-legislative analysts and futurists. The mentality of legislators is to seek to create a definitive piece of legislation that wipes the issue off its calendar and not have to deal with it again for at least another decade. The concept of social technology flies in the face of the self-imposed customary and putative functions of legislators. Assessment also runs the risk of assaulting their Olympian self-image.

Science Assessment

Increasingly, science is the direct antecedent of many, if not most, new technologies. Consequently, there should be substantial value in doing science assessments in terms of their implications when developed into technologies. Science assessment would lead to a more conscious awareness of the tracks and paths by which a scientific development moves into practical use.

While science assessments may be more spare, more conceptual and less definitive than technology assessments, their social utility should be quite high. One only needs to consider many of the topics currently at the forefront of science, such as stem cell research; nanotechnology; human, animal, plant, and microbial genetics; life extension strategies; and the outpouring from the cornucopias of science in a score of other areas, to realize the potentially high payoff of foresight.

Inverted TAs

The concept of the inverted technology assessment (TA) came about as a result of an exploration of how technology assessment was used in industry, it wasn't! The inverted TA looks into the ways that the public and public institutions may respond to a technology, and in turn at how those responses should change current planning. A paramount example of this is Monsanto's failure to look deeply enough at how some of its plant genetics developments would be received as they moved into U.S. agriculture, and more importantly into other parts of the world where there is not a strong pro-technology orientation and even great skepticism about, and hostility toward, a putative American imperium. We may have had a quite different worldwide view of plant genetics and manipulated organisms had an inverted TA been performed.

The concept of inverted TAs should be useful to any business planning to introduce a novel product, service or system.

New Areas of Development

The ebb and flow of science emphasizes different fields and topics. The most exciting area of general development is biological science, whose subfields are attaining parity with the other natural sciences. For example, an assessment of ecology would be timely and would probably promote its development if it concluded that ecology could become the scientific foundation for environmental management, sustainability and related matters.

New areas of development that are not biologically-based merit attention for the technologies they will spawn, such as electricity-conducting plastics. An assessment of new strategies to aid the handicapped will be of value to the general population as well, by enhancing their sensorium and motor skills. The recent development of miniature flying vehicles, nominally the size of bumblebees, will have many uses, including specific targeting of vulnerable human parts, e.g. eyes, in combat. Likewise, the new ability to produce prions in quantity will benefit biological research, but could also be the basis for a new terror weapon.

Systems

All technologies are embedded in systems but we rarely have taken any significant social system as a unit of analysis. Among the attractive candidates for doing assessments at systems level are urban technology and urban development.

A specific example would be the Chinese plan for some 600 new cities. A great opportunity that

passed us by ("us" meaning the world, and more particularly China) was a systems assessment of the Three Gorges Dam.

There are many other systems that merit an assessment. Right now, the electrical system in the U.S. is deteriorating, with little likelihood of it being corrected because of the fundamental changes in the conversion of the electric utility industry from a regulated to a deregulated enterprise and hence the change in its optimization criteria, from high-quality reliable service to short-term money-making. Any large grid is a candidate for a systems assessment.

The education system, K-16, is the most neglected social system from the point of view of integrated systemic anticipatory analysis.

Macroengineering Concepts

Macroengineering projects are those that exceed the economic scope of most governments and have effects that override the national boundaries of individual nations. Classic examples are the Panama Canal and the Suez Canal, and more recently space communication satellites. In the last 50 years, some 75 or more macroengineering concepts have been proposed. The central feature of macro projects is that unlike more traditional projects they do not improve a situation by some percentage, but totally change it in such a way that the effects are extreme, large and mostly beneficial.

One concept familiar to many people is the towing of icebergs from the Antarctic to the and zones of Latin America, Saudi Arabia, the Australian outback, and Southern California.

Another concept is running a pipeline from Southern France, which has a surplus of fresh water, under the Mediterranean to North Africa, with the expectation that a large amount of fresh water would go a long way toward reestablishing the granary that existed in North Africa in Roman times.

Considering the urgency of a stable electrical energy supply, a number of macroengineering projects have been explored. Probably the most widely studied, and at the moment the most neglected, is the use of the thermal gradients between the Gulf Stream and the surrounding water.

All the analyses that one would want have been done, short of those associated with actual physical data collection. But again, as with so many of these marvelous concepts, no one seems to have plenary interests, plenary responsibility or be willing to become the national or international advocate for its development. A technology assessment of a wide range of other macroengineering concepts could be of unprecedented value to the global community and to many specific countries or regions.

Urgent Needs and Problems

For many societal problems and issues, there is hope that technology can have a significant beneficial effect. Hence, one needs to link most social problems to alternative technological possibilities, and then look downstream to anticipate the consequences. A primary area of this sort is crime control. Another would be a mechanism for dealing with unrest, particularly urban unrest, in the less-developed countries. Others are linked to limitations on local food and water and to surplus human waste. New forms of nighttime entertainment and recreation in almost every part of the world could enhance the quality of life and reduce birth rates.

The impending danger is not always tied to what one can see in the immediate environment. Heavy rain 500 miles up the river ought to alert us to the flood possibilities downstream. That is the situation with greenhouse warning, so recently affirmed by the National Academy of Sciences' White House panel as being both real and dangerous enough to call for immediate action. This is an example crying out for comprehensive, long-term, broadscale systemic assessment. All the good work of climatologists in the last 15 years does not tell us everything we need to know about the consequences of greenhouse warming and hence does not tell us what we need to know about preventives, remedies and alternatives.

New Look at Old Technologies

Often a system or a technology evolves into something that is sufficiently different to require a fresh assessment. Tying back to the systems concept, a premier example is transportation. There has been no significant integrated assessment ever, as far as I have been able to determine, of the U.S. transportation system, much less of the global transportation system; yet, technological developments are improving each mode, giving them new efficiencies and effectiveness, and creating new means of intermodal integration.

Other areas where old technologies are changing to a point that a first or a new assessment is in order, are urban water supplies, highways, and local community roads, streets and avenues.

Basic Human Needs

The things most essential to our lives are changing, including the technologies of food, clothing, shelter, healthcare, and education. The changes are all critical to life in an advanced nation and more critical to life in Worlds 2 and 3. These topics have gone unexamined from a total systems view in terms of where science and technology might radically influence, improve, enhance, alter, or in some way affect them positively or negatively.

Dark Forebodings

As a society, we are inexperienced in long-range positive thinking but alert to purported serious or disastrous negative effects of new things. For example, the widespread discussion of terrorist acts involving the misuse of biological, chemical or nuclear devices provides a field day for wild speculation. The notion of intelligent machines and devices going wild has moved from science-fiction to press release and conference agenda. A comprehensive assessment by neutral parties could cast the risks into better balance and define the opportunities for monitoring, control and the identification of significant deviations from acceptable use of any or all new technologies.

Revive Technology Assessment

The hope of this essay is that others will pick up the theme and expand the range of needs for an issues agenda for the 21st Century, and then push to get going. We need to not only explore new avenues but to revive the technology assessment concept as a public policy asset to legislators, executives and public interest groups, and to individual businesses and trade associations as well.

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