

# 9 A Prospective Look at Science and Technology Policy

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For those of us born in 1950, the millennial propensity to look backward and forward takes on special meaning. We are passing our half-century mark just at the time the world is passing its own important milestone. When I look back over a half century in science policy, I notice some striking trends. First, the science and engineering enterprises have grown enormously, now surpassing the wildest dreams of the founders of science and technology (S&T) policy in terms of numbers and funding. Second, the atmosphere of stability and trust in which the relationship between universities and government began has largely been maintained, despite some difficult times. It has even extended beyond research universities to more educational institutions on the one hand, and beyond the federal government to state governments on the other. Third, universities themselves have evolved significantly and are now more open and interdependent with their environments than ever before, with a greater range of partners playing an ever greater role on campus. Fourth, we have seen a gradual but steady decline in the dominance of global military force as a context for research, and a steady rise of global business as the most relevant environmental factor. These trends form a plausibility framework for the points I want to make about the future.

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Those of us who have the job of looking forward have the luxury of not only describing what has been and what is, but also what we want to bring into being. In addition, I challenge us to think outside our usual boxes and to consider directions for our enterprise, rather than the details.

I fully intend to be around 25 years from now, still coming to the AAAS Colloquium on Science and Technology Policy. But by that time the world will no longer be mine. Instead, it will belong to my daughter, who is now 20, and to her generation. They will be in full swing by then, shaping a world they will pass on, in turn, to their children. What kind of world do I want my daughter living in 25 years hence? What kind of world do I want my grandchildren to inherit? What roles will science and technology policy play in setting the character of their worlds? These are the questions I will address. Some elements of the world I want for them are not particularly related to S&T policy, but other elements are very much in the hands of the people who decide the direction of S&T policy.

First and foremost, I want my grandchildren to live in a world that respects people. I want their world to appreciate differences and to celebrate many cultures, many histories, and many learning styles. I want it to welcome the contributions of all races and both genders. These points are fundamental. They do not refer to areas that we typically see as influenced in particular by S&T policy, but certainly they represent areas where we in science and engineering have lots of work to do within our own institutions.

Second, I want my grandchildren to live in a world where prosperity is shared—or at least shared more broadly than it is now. S&T policy has a direct role to play here. We in the science and engineering community often see ourselves as the creators of prosperity through our roles in innovation and economic growth. But we do not often think about the disparity that growth is creating between rich and poor people and rich and poor nations. We must remember that in the developed world, about five percent of the population lives in extreme poverty—some in our own towns and cities. We must also remember Latin America and East Asia, where 20 percent live in such poverty, and Africa and South Asia, where 40 percent do. The economic growth of the North can create not only disparity, but indeed despair, in nations and communities that see no hope of catching up. We often do not think of our research agendas in this global context, and thus do not let ourselves

see how skewed they are to the problems and issues of the developed world. Yet it would take so little to redirect some of our enormous research energy to the pressing health and food problems of the world's poor, rather than the sophisticated medical demands and high-tech consumption needs of the world's affluent.

Third, I want my grandchildren to live in a world free of war—or at least freer than it is now. Science and technology policy bears directly on the probability that this will be so. One invisible reason for the enormous growth and productivity of the U.S. research enterprise over the last half-century is that we have been a country at war abroad but in peace at home. We have not had war on our soil. Although we have lost sons and daughters in several military confrontations over these decades, our homes and our laboratories have been safe. Most of the world cannot say the same. Over the past five decades dozens of local armed conflicts, mostly civil wars, have killed nearly as many people combined as World War II did. Military governments have been in control in many countries. In these nations, our fellow scientists have been jailed and some have disappeared completely. It is only when we forget this global context that we take our peace and democracy for granted.

Peace and war are elements of the future that are very closely related to S&T policy. This is where the trends I noted above hold out so much hope. For my grandchildren, let me put these hopes into words:

- Let the global economy expand.
- Let nations and leaders continue to learn how much they have to lose and how little they have to gain from armed conflict.
- Let us increase our ability to keep the peace through negotiation and economic interdependence.

If these things happen, we should be able to continue in our current pattern and slowly, steadily, and with great respect and caring for the people in uniform, shrink our armed forces and liberate our economy from dependence on arms sales.

What kind of S&T policy do we need to create the world I would like my grandchildren to live in? The answer is simple: One that is not dramatically different from the one we have now, but one that has evolved in a humane direction. Unfortunately, we cannot take it for granted that it will evolve that way. We have choices to make, and if we make the wrong ones we could end up living in quite a different world.

A powerful and positive influence moving S&T policy in the directions I have described comes from the changing relationship between government and business (or, in the more traditional terms of political theory, between the state and the market). With the collapse of communism, humanity's faith in markets to provide what they need has become axiomatic. The state is shrinking, and will continue to do so. The public interest is coming to be implemented as a complex web of incentives that governments put in place to shape what businesses do. The action that achieves the public interest is largely in the private, not the public, sector. I expect these trends to continue.

Against this backdrop of shrinking government, the steady growth of public spending on the research enterprise is highly significant. Even as government hands off so many functions to the private sector, it maintains its commitment to new knowledge and education. We see this in sickness and in health, through Republicans and Democrats, and amidst a dramatically changing global scene. I think that we see in this development the outlines of a new type of state, with a new relationship to markets, and with a special and central link to science and engineering. I will conclude with a few words about this new state.

Markets and businesses are wonderful sources of innovation, energy, and change. Private enterprise makes the global economy grow and, in order to operate effectively on a global basis, takes on important societal learning functions. Global environmental standards, for example, are emerging both from intergovernmental negotiation under public pressure and from consortia of firms who want to stabilize their business environments. Markets tear down old businesses but replace them with new ones. They make things available to us, and we choose the ones we want to make our lives better.

What markets do not do is invest broadly in the human capacity to take advantage of what the changed world offers. Markets under-invest in new knowledge and in human potential. In the next 25 years and beyond, we will need governments not only to support discovery, but also to provide the education, health care, and services that build community life. I call this type of government "the humane state," and I see it as a key to creating the world I want my grandchildren to live in. The humane state creates a healthy environment for business through its fiscal policies and regulatory structures, but takes as its main function the provision of resources for education, knowledge, and community.

Science and engineering are centrally important for the humane state. That state needs experts who can keep the public interest in view and who can listen to diverse voices. It needs scientists and engineers from many backgrounds to help develop the skills of the new economy in many kinds of communities, with different habits and cultural patterns. (Those open-boundary universities I described above are particularly well suited to this task.) And it needs scientists and engineers to develop public technologies to be purchased on behalf of the community—for example, appropriate technologies in energy, transportation systems, and health.

In summary, my vision for the world in the next 25 years has two parts. First, it is a world of shared prosperity, with a better distribution of comfort. And second, it is an educated and empowered world, in which individuals and communities make effective choices about how they live. Science and engineering have crucial roles to play in both aspects, and science and technology policy can—and should—help these individuals and communities play those roles.