

# Opinion

by Frank Press  
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*The following remarks were excerpted from a talk to The Caltech Associates October 30, 1984. Press was director of Caltech's Seismological Laboratory from 1957 to 1964.*

**I**F THE UNITED STATES is to assure itself of a primary place in the scientific and technological contests of the future, we will need sensitivity at the highest levels of government about what innovation means and how the government can be supportive. The tidal changes of scientific advances and introduction of new technologies are causing national stresses all over the world. The industrialized countries are being forced to create new strategies. Japan has done it consciously; West Germany, France, and other European nations are trying to do it. We are doing it too but, as is our national style, we're doing it messily.

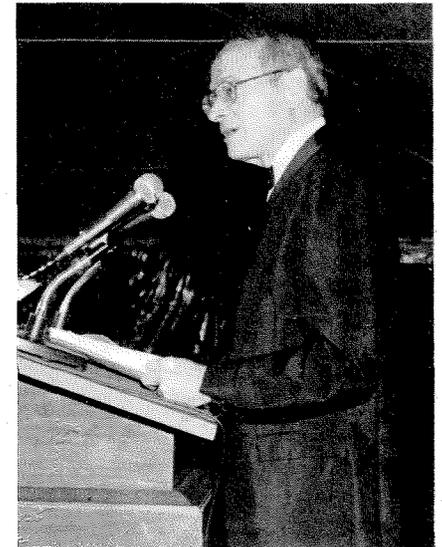
The difficulties we now see in the weakness of many of our industries reflect a deep, global change born of the bonanza of new technologies. And the pace of technological change is quickening. Five years ago few had heard of expert systems. They are now on the verge of becoming a major industry, a technology of knowledge. Less than ten years ago monoclonal antibodies were only dreamed of. Ten years ago molecular beam epitaxy was basic science, and now it is entering manufacturing technology. The rapidity of these changes couples to the fact that purely domestic businesses are increasingly an anachronism. A multiplicity of forces has created world markets in a fluid, global economic system.

Investments of American corporations abroad totaled \$227 billion in 1981. A U.S. company selling small computers gets its printers from Japan

and its monitors from Taiwan. The Boeing 757 is a co-manufacturing effort of the United States, Japan, and Italy. So the notion of a world market is slowly infusing our national consciousness. Nevertheless, I think it will be a long time before it really seeps into national policies. Our policies have not kept up with these global changes, and they are largely rooted in the nation-state.

There are those who believe completely in laissez-faire — the government has to stay out of everything. Only the invisible hand of the market would prevail. That ideal in today's world is a mirage. Equally so is the converse of laissez-faire, a completely intrusive government policy where the government steps in and picks winners and makes investments or forces investments. We've tried that in the past, and it hasn't worked in most cases and has been disastrous in some. I think a middle course is emerging that is consistent with our traditions.

In that middle course the government should provide a nourishing climate for innovation, but it should not try to determine the outcomes. And that has some basic themes. First, the government is the patron of basic research. Basic research is relatively cheap, and it has enormous returns. The government should invest well in our research universities and also encourage the kind of linkages that are developing directly between our universities and industry. No other country has the strength of the American research university; tying our universities with our industrial prowess



is absolutely the strongest force that we can bring to bear, and it's a force that's unique to our country.

Macro-economic policy, and that's determined by the government, is also of great importance. We have to insure the growth of capital; we have to have an economic environment that encourages investment. We have to be concerned with such things as the effect of the exchange ratios in controlling our innovation. For example, if a company increases its productivity by 10 percent (and that's a lot), and the yen/dollar ratio is changed by 10 percent to our disadvantage, it wipes out that productivity gain completely. So macro-economic policy is just as important as scientific creativity.

Some people think we don't have an industrial policy. We have 12 industrial policies. The Department of Justice has an industrial policy with its antitrust statutes. The Department of Commerce has one. The State Department has an industrial policy in the way that it negotiates international trade relationships. Our Defense Department through its procurement processes has an industrial policy. Our research agencies (the National Science Foundation and the National Institutes of Health), our regulatory agencies, our Treasury Department through its tax policies — all of these agencies affect the way we innovate. In the past 20 years they have never collectively added up their separate actions to see what the total effect was. I think we need coordination of all of these separate actions to enhance our ability to innovate. □