Initiatives in Science and Technology

Funding of science and technology, and innovation, are discussed by White House adviser

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This paper includes discussion of two of the President's Initiatives in Science and Technology: the funding of science and technology, and innovation.

We all have been reading in the papers about the President's efforts to bring inflation under control. He announced a five-point program: restraints on credit, wage and price actions, energy conservation measures, structural changes to enhance productivity and savings, and increased discipline in Federal spending. The latter element — with its result of major reductions in the budgets for Fiscal Years 80 and 81 — has been particularly prominently featured. Let me discuss briefly how research and development fared, describe the administration's attitude and strategy toward R&D.

The government's research and development activities serve several distinct purposes. First, R&D is often necessary to serve direct Federal needs. In the case of defense, or space, for example, the government is primary user of the products of this R&D and it must be prepared to meet the full expenses from research through the costs of production.

Indeed, since our strength in defense must depend in large part on the technological edge that we are able to maintain over potential adversaries, it is essential that we make the necessary investments. As I am sure you are aware, the administration is committed to real growth in defense spending; and this is reflected as well in R&D funding. The budget, as revised in March, would provide over 19% growth (in current dollars) between Fiscal Years 1980 and 1981. Overall, the conduct of R&D by all agencies will grow over 11% in this period.

Second, the government must fund R&D to meet specific national needs. For example, the government might seek to complement the R&D efforts of the private sector because of the need to accelerate the development of technology, or to increase the range of technological options, available to the nation. Energy is an excellent case in point.

Here, the appropriate federal role is often difficult to define because of the complicated relationship with the private sector and the need to augment, but not to displace, the private sector. In energy, for example, this has resulted not only in aggressive efforts to advance technology — the funding for solar, for example, has grown from a few million dollars in 1972 to almost $1 billion in 1981 — but also to put in place the appropriate institutional structures to assist in this effort. With the passage of legislation establishing the Energy Security Corporation and the Energy Mobilization Board, these fundamental institutions will be established.

Support R&D

Third, there is the need to support R&D to meet general economic and social needs, where the government must act because of insufficient incentives for the private sector to act in the national interest. We should not overlook the overall economic significance of R&D: economists estimate that 1/3 to 1/2 of the economic growth sustained in this century is the product of advances in knowledge that arise in large part from R&D. Indeed, R&D is also similarly responsible for a major share of our nation's productivity growth in this century.

A particularly important portion of our federal investment in this area, about $5 billion a year, goes to the support of basic research. This is the research for which the private sector does not invest adequately for several reasons.

For the most part, the results are unappropriable and cannot be patented. Moreover, the benefits are likely to be achieved only in the long term — a fact which discourages investment by business managers. And, finally, an individual basic research project is risky in the sense that there is a large measure of chance in whether the research will lead to commercial payoffs.

In the aggregate, basic research is not risky; but, with the exception of a few industrial giants, no one firm is likely to be able to support a sufficient portfolio of basic research to be able to achieve the aggregate benefits. As a result of these facts, there is a clear public need to fund basic research.

Federal funding for basic research, however, had been declining rapidly in real terms since nearly 1968. In recognition of the importance of this work, the Carter administration over the first three years has increased the federal support for such work by nearly 35%. The Fiscal Year 1981 budget, if enacted as proposed by the President, would allow over 8% growth over the 1980 budget. This is after the March revisions. Much of the March cutbacks were caused by the

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deferral or slowdown of several expensive space science missions; and, if we neglect NASA, the growth is nearly 10%.

In order to give you an idea of the priority we give to R&D, let me mention a few other figures. The March revision resulted in cutbacks in R&D and basic research of about 2% from the January budget. By way of comparison, the "controllable" parts of the budget were reduced over 8%. This clearly reflects the administration's commitment to R&D and basic research. We now need to carry our case to the Congress.

INNOVATION

Let's turn to innovation. By way of background, let me first describe how we in the office of the President's science and technology adviser first became concerned with the issue. "Innovation" is itself an ill-defined process, and there is no single indicator which can give a measure of its health and vitality. However, there were several coupled trends that we observed in early 1978 that gave us cause for concern. I might add that our concerns were shared by many others, in particular, representatives of the Department of Commerce.

First, we looked to the inputs of the innovation process. Research and development, as a percentage of our gross national product, had been steadily declining. As I have mentioned, there was the steep decline in the same period in the support of basic research — the investment in the long-term work that leads to whole new industries. And these trends were supplemented by the views of industrial managers who sensed that their firms were focusing their research on incremental product improvement, rather than major advances. Capital investment was also growing much more slowly in the United States than elsewhere, and over a seven-year period there was a marked decline in the startup of new high-technology companies.

On the output side, we also saw reason for concern. The trade balance in R&D-intensive manufactured products — the products where our technological edge can compensate for increased labor costs — was suffering declines, and Japan was posing a particular threat. The productivity growth in the United States was less than that of any Western nation. (Indeed, in the last year, productivity growth in the United States has been negative.) And the 1971-1977 period saw a 26% decline in United States patents granted to United States citizens.

Worthwhile

Finally, regardless of the significance of these trends, efforts to augment our innovative activities were clearly worthwhile. A wide range of studies have revealed that innovation could be an important component in addressing several of the challenges confronting our nation. Among these, the need to increase productivity, to foster economic growth, and decrease inflation. Moreover, innovation clearly is essential in developing new technologies for energy supply and conservation, in improving health care, and providing technologies to increase food production in an increasingly hungry world.

We concluded that the issue was worth closer examination and the development of policy at the presidential level. This was an accomplishment in itself. We tend to think of innovation as an American birthright — we pride ourselves on Yankee ingenuity (at least north of the Mason-Dixon Line). But we cannot afford to be complacent. Other countries were the paramount world innovators in the 19th Century; and, today, we largely look elsewhere for innovative skills.

Let me turn now to some of the initiatives that the President announced. I must caution at the outset that innovation is an exceptionally subtle process and there is no one initiative, or cluster of initiatives, that by themselves will guarantee the enhancement of innovation in the United States. As a result, a broad spectrum of initiatives must be undertaken and adjusted over time. A sensible program cannot stand on actions in a single area. Let me discuss some of the initiatives.

1. University-Industry Cooperation

I have already mentioned the importance of basic research and the administration's commitment to its enhancement. As it happens, much of this work is appropriately done in universities — the academic environment, the attitudes toward science, the freedom afforded researchers — all make university scientists particularly productive. But this creates a dilemma. The ultimate application of such work in the economy requires the involvement of industry. There thus is an important need for a linkage between the industry and the university communities. Unfortunately, these linkages were strained or sundered in the Viet Nam era and are only slowly starting to be regenerated.

In order to speed this process, the President has announced the significant augmentation of an industry-university cooperative research. This program at the National Science Foundation will grow to nearly $15 million in Fiscal Year 1981 and move to an eventual government-wide goal of nearly $150 million. The program provides special incentives for research proposals that have joint investigators: one from industry, and one from university. The proposals go through the normal peer-review process to assure that they have scientific merit, but they benefit from a protected pot of money. This program is properly targeted because it builds the linkages at the appropriate level — from university scientist to industrial scientist. It is warmly endorsed by both sectors.

Cooperative Ventures

Let me add in passing, although I do not have time to discuss these in detail, the administration has also embarked on a few cooperative ventures with particular industrial sectors. One of these is a $1 billion program to perform basic research on automotive technology. The program will be jointly funded by the government and by the auto industry and the performers again, will be both universities and industrial laboratories. The administration is also launching in its FY 1981 budget a cooperative program with the oil industry to investigate the ocean margins — deep water regions on the edge of the continental shelf that have never been explored, but which are believed to be important in the geophysical history of the earth. Although the program is one driven by scientific objectives, the resource potential of the margins is vast and should be assessed. Moreover, the program will develop needed technology to drill in deep water.

2. Antitrust

The antitrust laws enjoy a very complicated relationship to the innovation process. On the one hand, competition can provide the incentive to innovate and thus can be an important stimulus to the innovation process. On the other hand, however, there occasionally are circumstances in which cooperation among firms is necessary for advance. For example, clusters of small firms may not have sufficient available funds for each to maintain independent research capabilities and by combining, they can achieve economies of scale and support research groups of the necessary "critical mass" for productive work. Unfortunately, the antitrust laws are commonly understood as forbidding such cooperative ventures.

One of the most personally rewarding aspects of the innovation study was the dialogue that we were able to establish with the antitrust division of the Justice Department. There was mutual education process that went on — we became sensitized to the department's legitimate antitrust concerns, and I believe the department learned about research and development and the innovation process. The product of this effort will be available to the public shortly. The department will issue a guide to cooperative activity in research and development that should provide substantial help to businessmen who contemplate cooperative ventures. The issuance of such a guide is a noteworthy occurrence: only two similar guides have been issued by the department in the past. We trust that the dialogue we have started will continue with industry in the future.

3. Small Business

A variety of independent observers have noted the important role that small businesses has played in the innovation process. Major breakthroughs often require an entrepreneur in a small business who is willing to take the substantial risks and to create a market where one has not existed before. In light of this fact, the President has announced a cluster of programs that have special focus on small business. Chief among these is a program at the National Science Foundation to support creative high-risk, potentially high-reward research and concept development by small business. This program is itself a new approach and is widely acclaimed by the small business community. In fact, venture capitalists have been interested in providing financing to the companies who have participated. We have set a goal of $150 million in the program.

4. The Patent System

There are a number of initiatives that the President has announced to reform and streamline the patent system. Patents pay a particularly important role in innovation. Indeed, that is their purpose. They provide the inventor with an incentive. They also stimulate a firm to make the often risky investment that is required to bring an invention to market. Usually copying is much cheaper than inventing, and thus the monopoly provided by the patent system is essential. Finally, patents provide a method of the disclosure of information. The President announced several initiatives to better achieve these objectives:

- The administration submitted a bill to the Congress to allow the voluntary reexamination of patents. This will enable the Patent Office to deal with prior art of which it was unaware at the time of patent issuance. And should greatly improve the reliability of patent determinations in the courts.
- The administration again urged Congress to establish a single court to deal with patent appeals. The court would establish nationwide uniformity in patent law, make litigation more predictable, and eliminate expensive forum shopping.
- The administration will work with Congress to resolve the nagging issue concerning allocation of patent rights arising from Federal sponsorship. The departments and agencies of government are currently guided by some 20 statutes embodying a wide variety of schemes for allocating of patent rights. For the most part, these statutes provide that the government shall retain title to the patents, with unrestricted licenses available to the general public.

Unfortunately, unless an entrepreneur has exclusive rights, it is unlikely that he will make the investment to bring a patented object to market. Thus, the paradox that making the patent available to all, results in the unavailability of the patented invention.

The President, therefore, has proposed that the contractor be allowed to obtain exclusive rights to patents arising from his work in fields in which he commits himself to commercialize the invention. In the case of universities and small businesses, the administration would allow retention of patent title.

- The President also announced he intends to commence the substantial upgrading of the patent office. We are very much aware of the fact that funding in the patent office has in the past been inadequate. There is a need for funds for improved filing and classification systems, and I believe we will see more efforts to use modern technology to speed or improve the patent process.

5. Regulation

Regulation can both spur innovation and inhibit it. In some cases, such as in automotive emission devices, the regulatory system was used to force change. In other instances, regulation can cause industry to focus on protecting its existing product lines, rather than creating new ones. Moreover, the uncertainty created by some regulatory schemes can discourage the long-term commitment that major innovation requires.

The administration has embarked on many efforts to eliminate needless regulation (as in the case of airlines), and to streamline and rationalize needed regulation. We are seeking to assure that regulation has an adequate scientific basis and, where appropriate, to assure that cost-impact analysis is undertaken. Other efforts deal with coordination of regulatory activities, use of performance goals that allow and encourage industry to be innovative in meeting the goals, and establishment of a forecast of upcoming regulation so industry has the time to develop new technology.

I could go on at some length with a large number of other initiatives that the President has announced, such as those dealing with labor or procurement, but I will not. The important point, and one which I seek to emphasize here, is the need to experiment with a wide range of policies. No single approach is equally important for businesses of all sizes, or for various industrial sectors. Different and novel approaches are necessary.

Let me discuss in conclusion what remains ahead.

I must mention first the important step we did not take. If one speaks to industry leaders about the important problems which confront them, they would speak chiefly of two major issues: regulation and taxes. Although we have made significant advances in the regulatory area — and we continue to strive to improve the system — the President, in announcing his initiatives, chose not to adopt tax measures. He did state that in examining his fiscal policies in the future, he would again consider the issue. Once we have established fiscal discipline and brought inflation under control, I expect tax measures to encourage innovation, capital formation, and productivity.

Finally, I must state the obvious: no one study or the initiatives launched as a result of it, can transform the entire economy. The issue is not behind us. There must be a continuing commitment to encourage innovation in the country. In fact, encouraging innovation, increasing productivity, and stimulating investment, will I believe become commonplace elements of the policy formation in all of the agencies in the years ahead. We are starting to see this happen. But we have only seen an early skirmish in what must be a continuing battle to maintain the technological strength of the American economy.