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EDITORIAL

Global Technology Competition

Future standards of living will be determined by many factors, including the relative effectiveness of a nation's industrial R&D. The excellence of this R&D is influenced by the skill and alertness of management, the funds available, and the quality of personnel. In the United States substantial monetary support for industrial R&D has been forthcoming. Since 1994 company support of R&D has increased by about 27%. Charles F. Larson, executive director of the Industrial Research Institute,* forecasts that industry funding of R&D in 1997 will total $120.5 billion. Governmental agencies will contribute an additional $20 billion. This year industry will fund about 63% and perform 73% of R&D in the United States.

The quality and number of excellent young people available to industry in the future will be determined by the extent of federal support for research at universities. In the past, branches of the U.S. Department of Defense have provided nearly half the funds for university efforts in the physical sciences, mathematics, and engineering. Funding cuts have been proposed that would constrict the stream of talent.

In comparison with the restricted amount of funds available for research in the physical sciences and engineering at universities, industrial R&D expenditures are huge. However, industry R&D typically differs from research conducted at universities. In industry most of the effort is devoted to engineering tasks such as design, prototyping, and pilot plant operation. About 20% of the effort is allocated to short-term research on existing or planned lines of business, and about 6% of expenditures is devoted to longer range directed basic research. Opportunities to conduct exploratory research and achieve important breakthroughs are limited.

The United States is performing well in some fields of technology, but not in others. It is already the world's largest international debtor, and the imbalance is mounting. The need is increasing for universities to help develop advanced technologies and to prepare more students for effective participation in global competition.

A modest but effective program, in part funded by the National Science Foundation (NSF), is already functioning. Engineering Research Centers (ERCs) at universities are conducting R&D that focuses on important frontiers of technology. Other sponsors include large and small companies, states, and host universities. Industry furnishes money, personnel, judgment, and know-how.

The ERCs have three major goals: to involve scientific and engineering disciplines in team efforts to conduct fundamental research relevant to the next generation of technological advances; to produce graduates who are adept at multidisciplinary team problem-solving and who are prepared to contribute quickly to industry; and to conduct research that is relevant to industry's needs and that advances its competitiveness.

The first ERCs were established in 1986, and there are now 25 of them. The latest four were chosen in 1996 from among the 117 universities that applied. Another competition will be completed in March 1998. The four awards in 1996 went to the University of Southern California (USC), the Massachusetts Institute of Technology (MIT), the University of Michigan (U of MI), and the University of Washington (U of WA). NSF intends to distribute $12 million to each of these institutions over a 5-year period. The new ERCs will seek to develop the next generation of multimedia technology (USC); to improve the way companies integrate design, manufacturing, and product development (MIT); to develop a modular system for rapid manufacturing (U of MI); and to create better biomaterials for medical implants (U of WA).

The ERCs have won and maintained active support from industry. Many papers have been published in peer-reviewed journals, and the research has led to new or substantially improved technologies. The success of this NSF initiative could influence the structure of graduate and undergraduate research in the physical sciences and perhaps help loosen some archaic departmental structures. The tiny investment in ERCs will not alone solve the nation's competitive problems, but it is a useful response to a changing world.

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