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EDITORIAL

International Industrial Competition

Industrial research is being conducted in a changing, hectic, highly competitive global environment.* From the end of World War II until the 1970s, U.S. research and development, technologies, and related industries were dominant internationally. But during the past 15 years, strong global competition has emerged. The pace of introduction of high-technology products has increased. Shorter life cycles occur. The benefits to a corporation of being first with a product lead to emphasis on short-term goals for industrial research. Because of time pressures, corporations now often seek help from other companies rather than develop specific needed technologies. They engage in joint ventures and cross-licensing.

Another change has been in the locations of manufacturing facilities and industrial research laboratories. U.S. companies have established plants and laboratories in many other countries. A study has shown that 30 large U.S. multinational companies have 114 foreign laboratories. Some of the large U.S. companies have greater sales abroad than in the United States. To promote sales, they often find it desirable to modify products to cater to local tastes. A decision to establish a research facility in a host country is based on a desire to support product development and market penetration. A prerequisite is a reservoir of technical personnel in the host country.

In 1994, U.S. corporations will devote a total of about $115 billion to research and development. An estimated $83 billion of this will be company funds. About 72% of spending by industry will be for development of new products or processes. About 24% will be devoted to applied research. The remaining 4% will fund basic or basic applied research. In general, when basic research is funded by a corporation, the goal is to solve a company's problem, not to advance human knowledge.

The environment in which managements of many U.S. companies have operated has been stormy during the past 10 years. There have been deleterious differences between circumstances in the United States and in other countries in financial matters, regulatory requirements, and litigation. The restructuring of many companies led to an excessive burden of debt and in turn to curtailment of industrial research. Concern about potential take-overs also caused managers to seek to achieve temporary improvement of the quarterly bottom line and stock price by reducing expenditures for long-term industrial research. A continuing stream of thousands of regulations has been costly and has diverted management's attention from research likely to enhance global competition. In the United States, companies thought to have deep pockets and to be vulnerable are subject to lawsuits of various kinds and find they must maintain costly legal staffs.

The future ability of U.S. industry to compete globally will be a determinant of the nation's economic well-being and security. At present, the United States competes well in innovative high-technology fields. For example, it has recaptured the lead from Japan in the global semiconductor market. It is also now ahead in chip-making equipment. It is a leader in biotechnology. Small start-up companies have flourished. But the U.S. international trade deficit has reached record levels. Prospects are that it will worsen. The developing countries of Asia are rapidly emerging as formidable competitors in both low- and high-technology merchandise. They protect internal markets. Moreover, they are training large numbers of engineers who will be essential to the improvement of competitive processes and products. In 1990, six Asian countries (including Japan) produced more than 250,000 first degree engineers.† The United States graduated 65,000. In the decade ending in 1991, the fraction of engineering Ph.D. degrees awarded in the United States to foreign students grew from 40% to about 55% out of a total of 5000 such degrees. At present, about half of foreign engineering Ph.D.'s remain in the United States, but as attractive opportunities arise in their homelands, more of the most competent of them will leave. The United States is drifting toward a major trade and financial crisis that GATT may or may not alleviate.

Philip H. Abelson

*H. I. Fusfeld, *Industry's Future: Changing Patterns of Industrial Research* (American Chemical Society, Washington, DC, 1994). †R. M. White, paper presented at the Annual Meeting of the National Academy of Engineering, Washington, DC, 5 October 1994.