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Description	特別講演

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Science and Technology]

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I. EMERGENCE OF JAPAN AS A TECHNOLOGICAL SUPERPOWER

In the past two decades, there has been a major change in the relationship between the U.S. and Japan. In the 1950s and 1960s, the U.S. enjoyed an unquestioned world leadership in science and technology. Massive investments in defense applications had an enormous impact, or spinoff, on civil technology. Nuclear power, jet aircraft, space travel, computers, telecommunications all were revolutionized by breakthroughs in defense programs. Seen as the cornerstone of the "technotronic" or advanced industrial society was the three-cornered system of government, industry, and science joined together by contract R & D. . Scientific research was lavishly supported because it was considered the base or the engine of technological development and national security.

At the same time, another revolutionary development was taking place -- the emergence in the non-communist world of a real global economy characterized by relatively open markets and a continued effort to lower trade barriers. However, in the post-war years with the advances in transportation and communications as well as in production technologies, with the lowering of tariffs and other barriers to trade, international trade came to represent a sizeable proportion of each nation's GNP and often became the most dynamic sector of economic growth. Distance and raw materials became less important. The capability of manufacturing efficiently and of organizing effectively became critical variables.

With the emergence of this new global economy and the concomitant increase in global competition, defense programs ceased being a principal driver of technological innovation. Indeed by the 1970s, defense application became increasingly dependent on the civil science and technology. Nowadays many analysts perceive defense R & D less as a stimulus and more as a drain on the civil sector.

Japan was well-placed to take advantage of the new global economy. Not only did it invest very little in defense R & D, but it concentrated its investment on improving production and expanding markets. The private sector led the way. Over the last 25 years, Japanese companies increased R & D spending by ten percent a year, for U.S. companies that figure is less than five percent. In the same period, Japan's share of the world's exports of high technology goods tripled to nearly 20 percent, now roughly equal with that of the U.S.

Another source of strength is the access enjoyed by Japanese firms to U.S. science and technology. In JFY 88, the U.S. supplied

about \$1.5 billion, or 63 percent of Japan's total imports of technology. In return, the U.S. imported about \$550 million worth of Japanese technology. One study estimated that Japanese firms own roughly \$10 billion in U.S. patents.

As a result of its investments in R&D, Japan has taken the world lead in several critical technologies. The U.S. Department of Defense, in a report dated October 1990, found Japan to lead the U.S. in five of 20 broad areas of technology, including semiconductor materials and microelectronic circuits, machine intelligence and robotics, photonics, superconductivity, and biotechnology materials and processes.

Moreover conditions are such that Japan will continue to emerge as a world technological leader in one field after another. Driven by the intense forces of competition on the domestic market, Japanese companies increased their R & D investment last year by an astounding 14 percent. By comparison, industrial R & D investment in the U.S. declined in real terms. Japan spends nearly three percent of its GNP in civil R & D; the U.S. less than two percent. This year Japan will probably reach equality with the U.S. in absolute investment in civil R & D despite the U.S. being twice as large in population. This is a key statistic in an age when the leading edge of science and technology is in the civil sector rather than the military sector.

II. RESPONSIBILITIES OF JAPAN AS A HIGH TECH LEADER

Leadership brings responsibilities. As the strongest of the democratic, industrialized nations, the U.S. has had to devote enormous resources to protecting the security of the Free World. When the U.S. was the world's richest country, we likewise devoted huge sums to the post-war reconstruction and later to developmental aid. Now that Japan has become a major economic power, it too has accepted the responsibility to aid the developing world.

Technological leadership similarly entails new responsibilities. It would seem to me that foremost among the responsibilities is providing open and reciprocal access. It is often said that traditionally Japanese firms have guarded their technological assets and been reluctant to sell their patents whether to domestic or to foreign competition. The vertically integrated structure of the major manufacturers in Japan also tends to keep technology in-house. Much of the R & D that in America is done in universities as basic research is performed in company labs here, and hence becomes proprietary information. The inability of Americans to deal with linguistic and cultural differences in Japan also limits access to Japanese science and technology. Indicative, however, that Japan is accepting its responsibility as a technology leader is that, as of last year, Japan is no longer a net importer of technology. However, the three-to-one imbalance in technology trade with the U.S. remains indicating that there may be additional barriers. The consequent asymmetry of technological access, while not a problem when Japan was a second-tier power, could be a source of friction now that Japan has emerged as a first class technological power.

In the new global economy it is increasingly difficult to determine what is an American firm or product or what is a foreign firm or product. Most factors of production are highly mobile. Corporations are becoming global entities that are only loosely linked to nations, if at all. Does CBS become "foreign" because it is owned by Sony. Is a Honda made in the U.S. more or less American than a Dodge made in Japan or a Whirlpool dishwasher made in Mexico? Are U.S. weapon systems any more secure in using semiconductor devices made in a foreign country for a U.S. company than in using the same devices made in the U.S. for a foreign firm.

Robert Reich of Harvard contends that in the new global economy corporate ownership is less important than the value added by the labor force. He calls on the U.S. to worry less about the competitiveness of American firms and more about developing a skilled work force and a superb-infrastructure that will attract global capital and create good jobs. Such an idealistic formulation -- and there is much to be said in its support -- would seem to depend on openness; that is, on nations providing to individuals and firms, both foreign and domestic, balanced and reciprocal access to markets and technologies.

Another economist, however, foresees a bleaker future in which the global economy will be dominated by rival regional groups competing fiercely from behind high walls of protectionism. To the extent markets, technologies and science can be open, we will have Reich's new global economy. The alternative will leave human welfare poorer.