International Plans, Policies, and Investments in Science and Technology

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Sustained economic growth and job creation have long been high on the list of priorities for many nations around the world. With the end of the Cold War, nations have been able to place even greater emphasis on these priorities, and the number of countries implementing policies to achieve these objectives also is increasing.

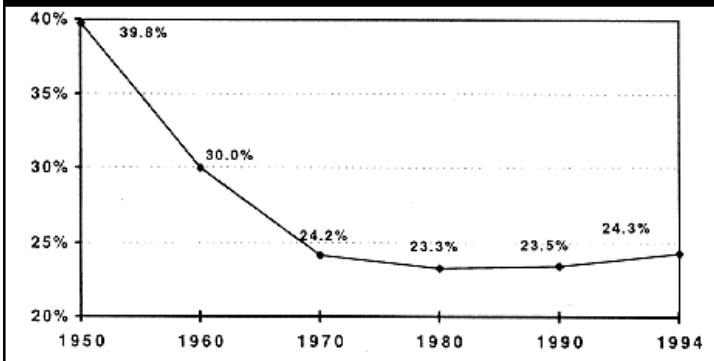
Long-term studies of the United States and other advanced countries show that advances in technology have been responsible for at least half of long-term economic growth—through improvements in capital and labor productivity, and the creation of new products, services and systems. Thus, policies to promote technological advance are playing a significant role in the economic growth strategies of most developed and developing nations. The relative success of nations in achieving their S&T objectives for economic growth will have a direct impact on the competitiveness of the United States and, consequently, on our national economic growth.

Changes in Relative U.S. Position

The United States' relative strength compared with the rest of the world has changed significantly. In 1950, the United States contributed nearly forty percent of the developed world's GDP. In 1994, the U.S. contribution was 24.3 percent of world GDP.

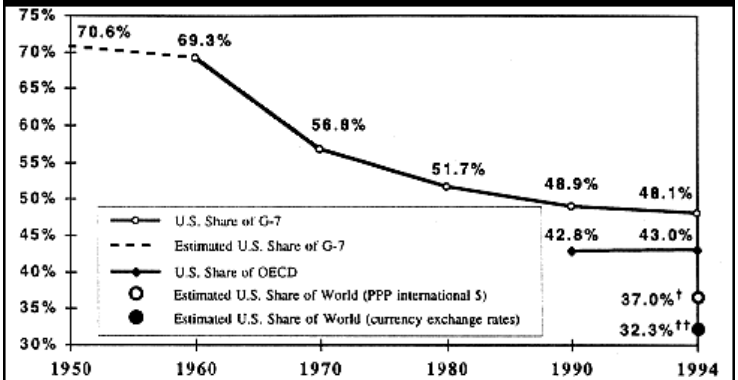
The shift between the United States and the rest of the world has been more dramatic with respect to research and development. In 1950, the United States carried out more than twice as much R&D as the rest of the world. By 1994, the rest of the world was performing approximately twice as much R&D as the United States.

U.S. Share of World GDP, 1950-1994



Source: Penn World Table 5.6, National Bureau for Economic Research, March 1997. U.S. share was 24.1 percent in 1992; 1994 figure is a regression estimate based on 1980-1992 performance.

U.S. Share of G-7, OECD and World R&D



NOTE: 1994 U.S. share of G-7 percentage is estimated. U.S. share of world R&D is an estimate based on most countries that report total R&D. † in purchasing power parity dollars †† in current values currency exchange rates
SOURCES: OECD *Main S&T Indicators* , 1996. OECD *Science. Economic Growth & Government Policy* , 1963. NSF *Science and Engineering Indicators*. 1991 and 1995. NSF *National Patterns of Research and Development Resources*- 1996. Penn World Table 5.6, National Bureau for Economic Research, March 1997. *Global Competitiveness Report-1996*. World Economic Gorum, Geneva, Switzerland, 1996.

Because of U.S. dominance in business and R&D in the first 25 years following World War II, U.S.-based businesses benefited preferentially from advances in science and technology irrespective of their source (e.g., basic research, defense spin-offs, and government civilian R&D). Many of the most important technical breakthroughs occurred in the United States, and U.S. companies had both the time and resources to follow many scientific and technological advances from fundamental discoveries to commercialization. As a result, most U.S. companies looked primarily to domestic and internal sources for new technology.

In recent years, the growth of technical capability outside the United States has resulted in three profound implications. First, sources of technology outside the United States are becoming increasingly important to the growth and survival of U.S. companies. Second, other nations have developed sophisticated technical infrastructures and are well able to directly use the results of basic research, whether developed domestically or elsewhere, including the United States. And third, some foreign nations have developed the ability to rapidly commercialize new and emerging technology, and prosper in an environment of shorter product, process and service life cycles.

International Competitive Landscape

Change in the international competitive landscape has accompanied the shift in the balance of technical and business activity between the United States and the rest of the world. U.S. competitive dominance in the years immediately following World War II was gradually replaced in the 1970s and '80s by a situation in which world competitive leadership was shared by a triad consisting of the United States, Europe, and Japan. By the mid-1990s, this portrayal has given way to an increasingly global economy which also includes a range of rapidly growing nations that are powerful new competitors and, at the same time, provide the prospect of large emerging markets.

More than ever, substantial R&D investments are flowing around the world. In 1993, U.S. companies committed an equivalent of 10 percent of their R&D spending overseas, up from 6 percent in 1985. Foreign companies accounted for 15 percent of all industrial R&D funding in the United States, compared to 9 percent in 1985.

Strategies for sustained economic growth for both developed and developing countries generally focus on two complementary goals: 1) build competitive domestic industries; and 2) attract the engines

of economic growth from around the world. All countries are attempting to promote technical advance by investing in assets that remain relatively fixed within their countries. For example, they are investing in people through education and training, and in infrastructure, including transportation and 21st century information infrastructure.

In developing countries, a primary mode of promoting technical advance is often through technology acquisition. In developed economies, the focus is on innovation, and the creation of new technology and higher value-added activities by increasing basic and applied research. For example, Korea in the past has placed its primary emphasis on technology acquisition. As per capita income rises above $10,000, Korea is putting in place major fundamental research and development programs in government and industry in an attempt to attain world leadership in key areas.

Increasing Foreign Investment in S&T

Nations as diverse as Japan and South Africa are implementing ambitious science and technology strategies to ensure that they are ready to play effectively in a knowledge-based world. Not only are our trading partners drawing from foreign, especially U.S., science and technology innovations, they are increasing investment in their own research and development, most of which is focused on the civilian sector. They also are restructuring their economies in ways thought conducive to innovation.

- European nations are accelerating investment in commercial technologies through national programs and European Union (EU) joint R&D initiatives. France is committed to making its publicly-financed research more profitable.
- Japan is well on the way to doubling its government S&T budget by the year 2000 with a proposed increase in its FY 97 budget of 9.9 percent from FY 96.
- The business sector in Canada is becoming more involved with R&D funding and performance than the federal government.
- Australia is investing in its world-class R&D infrastructure to take full advantage of commercial opportunities with the newly emerging economies of Asia.
- The Republic of Korea has considerably boosted its R&D efforts in key technology areas with a plan to increase expenditures by 19.7 percent in 1997.
- The newly emerging Asian economies and nations such as Chile continue to significantly increase the percent of their GDP devoted to science and technology, and target high-value added areas.
- China is planning to triple its investment in R&D by 2000, targeting computers, software, telecommunications, pharmaceuticals and infrastructure.
- South Africa's National Unity government has initiated a $10.5 billion, 5 year plan to restructure the country's S&T institutions.
- India's government has increased its focus on applied research to encourage competitiveness, technology transfer and innovation.
- Central European countries recognize good S&T strategies are vital to their economies as they undergo political and economic restabilization.

Country	GDP 1994 (in million US$, using currency exchange rates)	GDP Growth Rate (1990-1994)	R&D Expenditures as % of GDP
U.S.A.	6,648,013	2.5	2.54
Japan	4,590,971	1.2	2.90
Germany	2,045,991	1.1	2.33
France	1,330,381	0.8	2.38
U.K.	1,071,306	5.7	2.54
Canada	639,900	5.7	1.5
Brazil	554,587	2.2	0.70
PRC (China)	522,172	12.9	0.6
Mexico	377,115	2.5	0.31
Rep. of Korea	376,900†	6.6	2.6††
Australia	331,990	3.4	1.56
India	267,070†††	3.8	0.73†††
Argentina	281,922	7.6	N/A
Taiwan	234,000	6.5	1.82
Indonesia	174,640	7.6	0.26
Thailand	143,209	8.2	0.15
South Africa	121,888	-0.1	0.96
Poland	92,580	1.6	0.8
Malaysia	70,626	8.4	0.37
Chile	51,957	7.5	0.78
Hungary	41,374	-2.0	0.8
Czech Republic	36,024	-4.7	0.42

SOURCE: WORLD BANK, From Plan to Market: World Development Report 1996; and Science and Engineering Indicators, 1996. † GNP. †† Based on GNP. ††† 1992-93.

Implications for U.S. Technology Policy

Policies that served the U.S. national interest well during the period of U.S. dominance are no longer sufficient as economic/technological power becomes more globally distributed.

Improved Access To, And Awareness Of, Foreign S&T. As the sources of new science and technology proliferate beyond the United States, access to, and interaction with these sources, is increasingly critical to the growth and survival of U.S. corporations. As U.S. corporations strive to be better "hunters and gatherers" of technology from around the world, the U.S. government must focus its programs and policies to provide better access to, and broad awareness of, foreign science and technology.

Beyond Basic Research. As foreign competitors increasingly acquire the capability to capitalize on the results of basic research — regardless of where in the world the research is performed—U.S. basic research programs provide less unique national competitive advantage than they may have in the past. National technology policy must go beyond a strong federal role in basic research.

Need For Partnerships. As foreign competitors have been able to speed up the commercialization process and survive and grow in an era of shorter product, process and service life cycles, industry-university-government partnerships have become critically important as a way to speed up the research through the commercialization process in the United States. Partnerships help ensure that more of the output of U.S. universities ends up being commercialized in the United States.