Chapter 1 Results of Promotion of Science and Technology

Section 1 ■ Significance of Promotion of Science and Technology

1 Benefits produced by science and technology

(1) Science and technology in modern society

Today, as achievements in science and technology have spread throughout the whole society, our lives and economic activities owes much to achievements in science and technology. Therefore, modern states promote science and technology by establishing a variety of programs and mechanisms and by spending a vast amount of public funds under the commission of people. There is strong awareness that as a basis for promoting science and technology, it is necessary to have S&T understood by people and supported by society.

(2) Creation of intellectual and cultural values

Since the prehistoric era, mankind has explored outer space as well as oceans in an attempt to resolve questions about nature and “matter” and gone on to study the world of fundamental particles that constitute matter and the origin of the universe. Moreover, mankind has studied how life has come about in the first place and how the human species has evolved.

This activity of intellectual exploration aimed to resolve mysteries, rather than taking advantage of the knowledge acquired to develop practical technologies. However, it has created new knowledge and had great impact on people’s concept of nature and mankind and thus transformed the behavior of individual people as well as the activity of society.

New knowledge, after being sorted out, systematized and passed on to new generations, constitutes part of mankind’s common intellectual assets. Based thereon, we acquire further knowledge, and intellectual assets thus accumulated and inherited satisfy the intellectual curiosity of the subsequent generations of people and provide guidance on how to understand mankind, nature and society. Therefore, the richness of the culture of a society depends on to what degree the society has accumulated such intellectual assets.

Modern society is often called a knowledge-based society. It can be said that further development of Japanese society will depend on the level of accumulation of intellectual assets, and, therefore, the importance of scientific research will grow in the future.

While achievements in science and technology have made our daily lives convenient, science and technology have grown invisible to ordinary people. Alienation of ordinary people from science and technology could pose a threat to the very foundation of our society by undermining the breadth and diversity of our knowledge base.

In order to foster a social environment in which intellectual values are highly regarded and inquiring spirit is respected, it is important to implement measures for broadening and deepening people’s understanding of science and technology.

(3) Creation of economic and social values

The progress of science and technology has brought a variety of benefits to society and promoted economic development. Japan, in particular, achieved remarkable economic growth, supported by the technological progress due to vigorous research and development activities, among other things. Since then, there have been many cases in which the results of unique research by Japanese researchers eventually led to the development of new products and produced economic effects.

For Japan, which has limited natural resources, its technological prowess backed by science achievements acts as the engine of economic development and serves as the source of its national power amid intensifying competition with other countries.

Besides, improvements in medical treatments and food supply conditions due to the progress in science and technology have remarkably extended life expectancy and helped to overcome many diseases. Moreover, forecasts of natural disasters and disaster prevention and mitigation technologies have made our lives safer, and advanced traffic systems have made it much more convenient. In addition, the progress in information and communications technologies in recent years has made great contributions to the creation of new means of entertainment.

(4) Positive and negative aspects of science and technology

Although science and technology have generated a lot of benefits for us, an expansion of human activity due to the rapid progress in science and technology caused depletion of resources and environmental problems such as global warming and the destruction of the ozone layer, and also widened the economic gap between developed and developing countries. Moreover, there have arisen ethical problems related to the fundamentals of life due to genetic engineering, for example.

If we are to enjoy the benefits of the progress in science and technology, we should naturally deal with the problems brought about by it as well. In this context, it will become more important to make efforts to forge a consensus, based on open debate, as to how a certain technology should be utilized and how its impact should be controlled.

Global environmental problems and many other worldwide problems have arisen due in part to the rapid progress in science and technology. However, appropriate utilization of science and technology is essential for resolving those problems, and we pin high hopes on the future role that science and technology will play in efforts to resolve such problems.

2 Science and Technology Basic Plans and government R&D investment

Since the Meiji Era, science and technology have acted as the engine of the modernization of Japan, the country's postwar reconstruction and the ensuing high economic growth. In recent years, Japan has been promoting science and technology through public-private joint efforts, with a view to becoming an advanced science and technology-oriented nation.

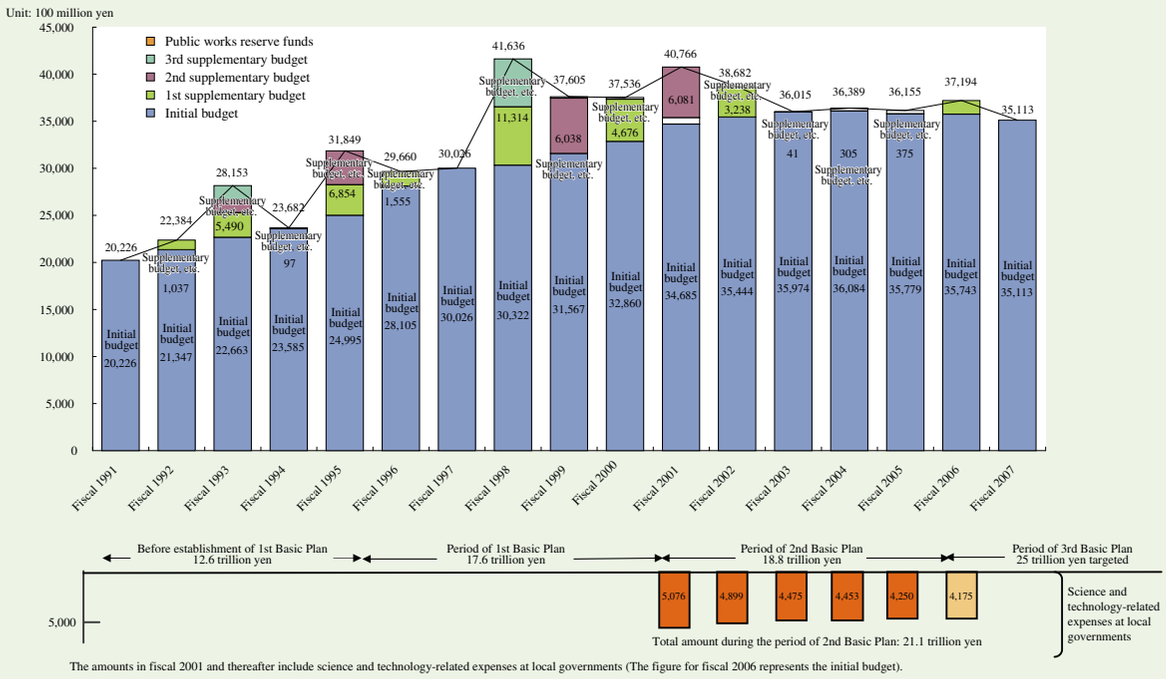
Since the Science and Technology Basic Law was established in 1995, the Government as a whole has implemented measures for promoting science and technology under three successive Science and Technology Basic Plans (the first for 1996-2000, the second for 2001-2005 and the third for 2006-2010).

Investments under the First and Second Science and Technology Basic Plans totaled 38.7 trillion yen (Figure 1).

Under the Third Science and Technology Basic Plan, it is necessary to keep the amount of governmental R&D investments as a proportion of GDP at a level similar to the ones in the United States and European countries. To do so, investments totaling 25 trillion yen are expected during the period covered by the third plan (This figure is based on the assumption that governmental R&D investments during the period of the third plan in GDP will be 1% of GDP and that annual GDP growth will average 3.1% during the period in nominal terms).

The Third Science and Technology Basic Plan calls for "science and technology to be supported by the public and to benefit society" as its primary basic tenet in implementing the plan. Thus, the plan stipulates that it is necessary to obtain public understanding of and support for science and technology through measures such as increasing efforts to feed back the results of R&D to society and people and providing comprehensive explanations concerning science and technology policies and their results.

Figure 1 Trends in science and technology-related expenses



The amounts in fiscal 2001 and thereafter include science and technology-related expenses at local governments (The figure for fiscal 2006 represents the initial budget).

3 Results of promotion of science and technology

In many cases, the fruits of science and technology can be reaped only after many years of dedicated efforts, and it is not unusual that the origin of technologies now available and products now widely used dates back to 20 or 30 years ago (Table 2).

■ Table 2 Time of invention/discovery to commercialization regarding technology seeds

Technology	Time to commercialization	1960 1970 1980 1990 2000 2010 2020 2030	Outline of invention/discovery
Helical CT tech. useful for early detection of lung cancer	Approx. 10 years		1982: Acquisition of helcal CT patent by a private company (Japan) 1991: commercialization of helcal CT (Japan)
Perpendicular magnetic recording tech. (for HDD)	Approx. 30 years		1976: Invention of perpendicular magnetic recording tech. by a university (Japan) 2005: commercialization of HDDs using perpendicular magnetic recording tech. (Japan)
Tech. to increase density and extend operating life of lithium batteries	Approx. 10 years		1979: Development of lithium cobalt oxide as positive electrode material (UK) 1991: commercialization of lithium batteries using lithium cobalt oxide in positive electrodes (Japan)
Photocatalyst materials	Approx. 30 years		1967: Discovery of photo disintegration of water (Japan) 1994: commercialization of tiles/building materials using photo catalyst (Japan)
Residential photovoltaic power generation system	Approx. 40 years		1954: Fabrication of solar cells by Bell Laboratory (US) 1994: Start of subsidy program for Residential photovoltaic power generation systems (Japan)
Laser-based processing tech.	Approx. 20 years		1960: Dr. Maiman's successful attempt to produce laser beams using ruby laser (US) 1980s: Wide applications of laser for processing (Japan)

: Period between innovation/discovery and commercialization regarding technology seeds

Source: “Study for Evaluating the Achievements of the S&T Basic Plans in Japan” by the National Institute of Science and Technology Policy (NISTEP Report No.89, March 2005)