Study on Development Japan's Science and Technology in the Light of Commendation Institutions

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Purpose of the Study

The postwar development of science and technology in Japan is considered to depend chiefly upon introduction of advanced science and technology from the United States and Europe. Nevertheless, Japan made effort to develop its own science and technology, chiefly in the industrial sector, and other sectors. This study traces Japan's own achievements in its effort to develop science and technology and attempts to clarify the features of Japan's postwar scientific and technological developments, thereby endeavoring to find a clue to the promotion of innovative research and development in Japan. This study analyzes the scientific and technological themes that have become the subjects of the commendation institutions vis-a-vis their criteria. This time the study concentrated in "Award for Persons of Scientific and Technological Merits" and studied this award in a historical perspective.

Role of "Award for Persons of Scientific and Technological Merits," the Subject Theme

The commendation institutions of Japan may be broadly broken down into those awarded by the government, or national awards, and those awarded by the private organizations, or private awards. The national awards include the Decoration Institution and the Medal Institution, in which the concerned ministries and agencies recommend their respective candidates to the prime minister. The recommendation, after having been approved by the Cabinet Meeting, is sanctioned by the Emperor and the awards are granted in the name of Emperor. There is another national award system, in which the concerned ministries and agencies independently select their respective candidates who are decorated by the concerned ministers.

The Science and Technology Agency plays the major role in the national awards on science and technology. The Science and Technology Agency is concerned with both decoration and three medals; namely, "National medals of honor with Yellow Ribbon," "National medals of honour with Purple Ribbon" and "National medals of honor with Blue Ribbon." The commendation institution of the Agency has seven awards; namely, "Awards for Persons of Scientific and Technological Merits," "Awards for Persons of Scientific and Technological Research Merits," "Awards for Persons of Distinguished Services to the Promotion of Science and Technology," "Awards for Persons of Nuclear Safety Merits," "Awards for Persons of Radiation Merits," "Awards for Persons of Radiation Safety Control Merits," "Awards for Persons who have proposed technical ideas in relation to their job." "Awards for Schools for services in creative education" The awards are given by the director general of the agency.

The "decoration" and "medal" are markedly characterized as praising on principle those who have made significant contributions in the field of science and technology over a long time when these people become senior citizens. In contrast, the awards by the director general of the Science and Technology Agency praise irrespective of their ages the persons who have done the research and development in a technology when the technology has been commercialized, except for "Awards for Persons of Scientific and Technological Merits." The time of realization of the technology and the time of awarding is not far apart in the cases of the awards by the director general of the Science and Technology Agency unlike other commendation institutions. For this reason the study team considers that the awards by the director general of the Science and Technology Agency are more appropriate indicators of the trends of Japan's science and technology and therefore should be the subjects of this study.

The study team has also decided to focus on the trends of the levels of technologies which made direct contribution to the postwar socioeconomic development and improvement of

people's living standards. Among the awards mentioned, the study selected "Award for Persons of Scientific and Technological Merits" which was awarded to the outstanding achievements. The "Awards for Persons of Scientific and Technological Research Merits" which decorates the achievements of research and development and the "Award for Persons of Distinguished Services to the Promotion of Science and Technology" and "Awards for Persons who have proposed technical ideas in relation to their job" which decorates regional scientific and technological achievements and improvements of scientific and technological conditions of workplaces were excluded. "Awards for Persons of Nuclear Safety Merits" and "Awards for Persons of Radiation Safety Control Merits" were also excluded because these two only concern awards on specific areas of science and technology and were not considered appropriate indicators of the whole science and technology.

Among the private awards, "National Invention Award" of the Japan Institute of Invention and Innovation and "Ohkochi Memorial Award" of the Ohkochi Memorial Society are time-honored awards. Many of the achievements given these awards were also awarded "Award for Persons of Scientific and Technological Merits" through the process shown in Figure 1, by being recommended to the Science and Technology Agency by the organizations supporting them.

As discussed above, Japan's major scientific and technological achievements which contributed to socioeconomic developments and improvement of people's living standards may be considered to have been awarded "Award for Persons of Scientific and Technological Merits." It would suffice, therefore, to analyze the achievements awarded "Award for Persons of Scientific and Technological Merit" in order to understand the trends of major scientific and technological achievements which promoted the high rate of growth of Japan.

The methods of Study

The study analyzed on principle the data covering a 31-year period from 1959, the year when Awards for Persons of Scientific and Technological Merits was instituted, to 1989. Among the recipients of the awards, the subjects of this study are the inventors and researchers directly involved in valuable scientific and technological researches and developments, and those who developed and supported these inventors and researchers.

The study excluded those who contributed to the promotion of science and technology among people, promotion of inventions, promotion of policy measures, creation of better environments for science and technology and promotion of scientific knowledge on the ground that these people were not directly involved in creation of science and technology.

(1) Comparison of the Awarded Technologies and Trends of Scientific and Technological Development at Home and Abroad

Based on the "Outline of the Achievements by Persons of Scientific and Technological Merits" prepared by the Science and Technology Agency every year and similar reports, innovative technologies were selected in the chronological order from the technologies awarded the Award for Persons of Scientific and Technological Merits during the past 31 years, and their backgrounds for development, contents and effects were studies. The following criteria were applied to the selection of innovative technologies, irrespective of the areas and nature of technology; namely, whether the technology in question is public or private, innovative or mature, system technology or basic technology, and macro-technology or micro-technology.

1)The technology was developed ahead of the world.

2)The technology is extensively applied not only in Japan but abroad.

3)The technology is an internationally standard one.

4)The technology is unique.

5)The technology has a large effect on livelihood and industry.

6)The technology is a major one in its area.

7)The technology has effects on other areas of technology.

In addition, the general trends in science and technology during the period from 1959 to 1989 in Japan and abroad were summarized and the awarded technologies were examined in the light of these trends.

(2)Analysis of the Awarded Technologies

The recipients of the awards and the awarded technologies for the past 31 years recorded in the ″Outline of the Achievements by Persons of Scientific and Technological Merits″ were analyzed by type of research, by belonging (industrial, official or academic), year of award and place of residence; namely, 1) technological classification, 2) achievement, 3) occupation, 4) year of award, 5) age of the recipient at the time of award, 6) residence, 7) belonging, 8) innovative technology or not, 9) development of technology or development of human resources, and 10) independent research or joint research.

Furthermore, the relation of the number of awards with the investment in research and development and number of researchers was analyzed for the 19-year period from 1970 to 1988 from the viewpoints of industrial classification and standard industrial classification to measure the extent of the effect of research and development efforts on the number of awards.

(3) Summary

Since this study was done only on the Award of Persons of Scientific and Technological Merits, it would be difficult to find a correlation between the award and research and development activities as the number of the data seemed not large enough. Very few awards have been granted in the fields of ″agriculture, forestry and fisheries industry″ ″ceramics,″ ″pulp and paper making and printing and publishing;″ therefore, other award systems should be included to enable a more detailed analysis. Nevertheless, the data are analyzed to the extent possible with this constraint in mind.

From the viewpoint of award index by technological classification, ″agriculture, forestry and fisheries industry″ and ″ceramics″ have high indexes. This is firstly because these industries do not need large research and development investment or researchers, and secondly because biotechnology-related technologies like genetic engineering and fine ceramics-related technologies make rapid progresses recently and are increasingly awarded, in addition to the awards in such traditional areas as fermentation technology, breeding technology, glass manufacturing technology, and cement burning technology.

The ″communication, electronics and electronics equipment″ represents an industrial class in which the number of awards and input of research and development resources are well balanced. This technological class shows an award index slightly in excess of 1.0 with the electronic technology (computers, semiconductors, etc.) as the core of the industrial class. The electronic technology, being an already developed but still innovative technology with marvelous achievements, has naturally received a large number of awards. On the other hand, the electronic technology has required a huge input of research and development resources, as a general characteristic of innovative technologies. As may be noted from Figures 41 and 42 this technology is situated farthest apart from the origin both in the ratio of wards and ratio of research and development expenses to the number of researchers.

The technological classes low in award index are ″mining,″ ″textiles manufacturing″ and ″pulp and paper manufacturing and printing and publishing.″ These represents in a sense that mature technologies in which technological innovation is not likely to occur. Accordingly, the conditions surrounding these industries make technological innovations worthy of the Award for Persons of Scientific and Technological Merits difficult to take place. As a result, the award index is low.

It may be noted that the award index of the ″electrical machinery manufacturing″ is low at 0.8, if each class is examined. This is presumably because this class includes ″household electric appliances″ and ″manufacture of miscellaneous electrical machinery and supplies″ both low in award index offsetting the high award index over 1.0 of ″communication and electronics equipment.″