

# Research on Talent Cultivation based on "Science and Technology Basic Plan"

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**Abstract:** The "Science and Technology Basic Plan" is the general outline of Japan's science and technology system, and it is also the strategic policy for the cultivation of scientific and technological talents. This article focuses on sorting out and analyzing the whole process of Japan's formulation of the "Science and Technology Basic Plan", and explores and summarizes Japan's scientific and technological talents training experience. Provide reference for my country to formulate science and technology talent policy.

**Keywords:** "Science and Technology Basic Plan", Scientific and technological talents, Revelation

## 1. Introduction

"The foundation of the future, talent is the first." Under the situation of the world's major changes unseen in a century and my country's construction of a modern socialist power, the Party Central Committee with Xi Jinping at its core proposed that the key to the strategy of building a world power in science and technology lies in talents. With the efforts of my country's strategy of rejuvenating the country through science and education and strengthening the country with talents, my country has built the world's largest scientific and technological talent team. However, the lack of high-tech talents in my country is a severe challenge for my country's talent training. How to deal with this challenge is a new era and a major issue in the new situation.

In the 21st century, Japan's scientific and technological level has developed rapidly, and the number of Nobel Prize winners has increased like a blowout. Japan's ability to become a powerful country in science and technology is closely related to its implementation of "Science and Technology Basic Plan"[1]. Based on the sorting out of the "Science and Technology Basic Plan", this paper studies the evolution process of Japan's scientific and technological talents training policy, and to provide a useful reference for my country on cultivating high-quality scientific and technological talents.

## 2. Cultivation of scientific and technological talents in the "Science and Technology Basic Plan"

In order to promote the development of science and technology, improve the level of economic development, and respond to international challenges, Japan has formulated the "Science and Technology Basic Plan" with a period of five years. Each issue of the "Science and Technology Basic Plan" emphasizes that the key to the development of science and technology is scientific and technological talents, and based on this, specific measures to cultivate scientific and technological talents are formulated. So far, Japan has formulated and implemented six "Science and Technology Basic Plan". Looking at the training methods of scientific and technological talents in these six "Science and Technology Basic Plan", we explore the experience and enlightenment of the training of scientific and technological talents in Japan.

### 2.1. The first phase of the "Science and Technology Basic Plan" (1996-2000)

In the face of economic depression, industrial development stagnation and global challenges, in order to solve industrial development problems and global challenges, Japan has focused on science and technology. Japan proposed the "Science and Technology Basic Plan" at the 1995 Science and Technology Conference. The first phase of the "Science and Technology Basic Plan" clarifies the training plan for talents from the reform of the system and mechanism and the reform of the innovative R&D system, including: introducing a tenure system for the appointment of scientific research talents,

improving the mobility of scientific research talents, and formulating talent training, develop a talent evaluation system.

Limited by time, number of personnel and experience, the production process of the first phase of the "Science and Technology Basic Plan" was relatively simple, not perfect on the whole, and the strategic goals and directions were not clear enough. However, after the development of the first phase of the "Science and Technology Basic Plan", Japan's economy has made great progress.

### ***2.2. The second phase of the "Science and Technology Basic Plan" (2001-2005)***

In order to cope with severe challenges such as low industrial competitiveness, stagnant employment, low fertility rate, and population aging, the second phase of the "Science and Technology Basic Plan" proposed to make science and technology a strategic focus, and proposed to train 30 Nobel Prize winners within 50 years[3]. The specific strategy is to promote basic research, focus on key core areas, and pay attention to frontier technology. In order to realize this strategy, the following measures are formulated in terms of talent development:

Firstly, carry out the reform of the research and development system: stimulate the vitality of talents, improve the tenure system of young talents (extend the tenure to 3-5 years); give young research talents more autonomy, provide them with more funds and personnel support, and provide independent Research environment; open up diversified career development paths; vigorously attract outstanding foreign talents; improve the environment for female researchers, etc. Secondly, according to the industry-academia-government mechanism, cultivate industry-academia-government talents to promote the transformation of scientific and technological achievements[2]. Thirdly is to cultivate outstanding scientific and technological talents through education reform: focus on the quality of education with universities and graduate schools as the main targets, and at the same time hire a third party to conduct talent evaluation in colleges and universities, so as to cultivate innovative scientific and technological talents. Fourthly, based on the perspective of science and technology ethics, focus on improving the science and technology ethics and social responsibility of high-tech talents.

Thanks to the implementation of the second phase of the plan, Japan's scientific and technological level has been greatly improved. At the same time, after 2000, Japan has produced 4 Nobel Prize winners, including 3 chemistry awards and 1 physics award.

### ***2.3. The third phase of the "Science and Technology Basic Plan" (2006-2010)***

On the one hand, the Japanese people have high expectations for dealing with fierce international competition and security issues through science and technology. On the other hand, the Japanese people have a relatively weak understanding of science and technology. Considering this contradiction, the third issue of the "Science and Technology Basic Plan" focuses on the following two aspects: The first is to make science and technology recognized and supported by the public, and the focus is to cultivate talents who promote scientific knowledge; the second is to focus on the cultivation of talents. It can be seen that in the third phase of the "Science and Technology Basic Plan", the cultivation of talents is placed in the most prominent position, because talents are the foundation and core of the development of science and technology. In view of this, the third phase of the "Science and Technology Basic Plan" has shifted its focus from prioritizing hardware facilities to investing in talent training. The specific measures are as follows: First, optimize the talent training process: implement a highly transparent personnel system, financially support young talents to carry out research work independently, reform the employment system to improve talent mobility, propose a target of hiring 25% female researchers, and actively promote foreign excellence Talent Participation in Technology; Second, strengthen the university talent training mechanism: focus on university talent training, reform graduate school education, and increase support for doctoral talents; Third, cultivate talents who meet the needs of society: cultivate industry-academia-government talents[2], advocate scientific research talents to participate in industrial practice, cultivate diverse talents who can apply knowledge and give back to the society.

After the implementation of the third "Science and Technology Basic Plan", Japan has produced many innovative technologies in key research fields, and the number of citations of basic research papers has increased, all of which show that Japan has achieved good results in the cultivation of scientific and technological talents.

#### **2.4. The fourth phase of the "Science and Technology Basic Plan" (2011-2015)**

At this stage, Japan is facing domestic and foreign difficulties. Domestically, Japan suffered from the Fukushima nuclear disaster and energy resources shortage. Internationally, with the further development of economic globalization, emerging countries compete fiercely, and the international competition for scientific and technological and innovative talents is increasingly fierce. For this purpose, Japan raised the "Science and Technology Basic Plan" to a national strategic position, proposed a new growth strategy, and deepened and specified the new growth strategy from the perspective of science, technology and innovation. The plan further strengthens basic research and scientific and technological talents training.

Firstly, focus on cultivating comprehensive talents: by creating an industry-university platform and scientifically planning a graduate student revitalization outline, to comprehensively improve graduate education, provide financial support for high-level talents such as doctors, and provide diversified career advancement paths; Secondly, cultivate outstanding talents with innovative ability: establish an open and transparent evaluation system, improve the promotion system, and create a better research environment for female workers (increase the proportion of female talents to 30%); Furthermore, due to the aging of the population, the retirement of senior scientific and technological workers has resulted in a shortage of scientific and technological talents. Therefore, strategic measures to cultivate the next generation of talents in advance are proposed; In addition, based on the perspective of national understanding and trust, an important measure is to cultivate talents related to social, scientific and technological reform policies; Finally, based on the fierce competition for international talents, Japan proposed the "300,000 International Student Program", and increased the ratio of overseas researchers to 10% through financial support, a perfect employment system and various incentive measures.

Summarizing the effect of the fourth phase of the "Science and Technology Basic Plan", Japan has achieved good results in scientific and technological research and development, talents and the number of papers, and the number of Japanese Nobel Prize winners' ranks second in the world, all of which demonstrate Japan's scientific and technological strength and international status[3].

#### **2.5. The fifth phase of the "Science and Technology Basic Plan" (2016-2020)**

At this stage, Japan's scientific and technological foundation has weakened sharply, and the world has entered a new round of scientific and technological revolution and industrial transformation. The role of technology in effectively addressing international challenges such as energy shortages, aging, natural problems and security issues is becoming more and more significant. Japan, as one of them, also feels the crisis. The fifth "Science and Technology Basic Plan", as the first plan after the reorganization of the Comprehensive Science and Technology Innovation Conference (CSTI, reorganized in 2014), focuses on promoting "science and technology innovation policy", based on an international perspective, and proposes to build Japan into a "super-intelligent society" ( Society 5.0). Emphasize the importance of future development, pay more attention to the development of new industries, emphasize the practicality of science and technology, and pay more attention to the reform of the science and technology system. To achieve this strategic plan, specific initiatives in terms of talent include:

Step one: Young talent team building: Activating the creativity of young talents by reforming the personnel system, evaluation system, policy and financial support and other specific measures to build a high-tech young talent team.

Step two: Cultivate diverse talents related to scientific and technological development: Focus on cultivating talents in finance and management, provide them with diversified career development paths, and promote talent exchanges and cooperation through the industry-academia-government system.

Step three: Reform the education system: carry out systematic reform measures on the basis of the previous four "plans", and promote the integrated reform of high school education and university education, based on the following perspectives of highly specialized knowledge, strong ethical and moral quality, high degree of industrial integration, compliance with To meet the needs of regional development, carry out postgraduate education reform.

Step four: Ensuring talent diversity and promoting talent mobility: Provide more support and safeguards for female talent through the Law on Promoting Women's Active Professional Life to increase the proportion of female talent.

Step five: Strengthening the construction of international networks: from both going out and bringing in, we will strengthen all kinds of support for overseas research talents, and give them various preferential

treatment after returning to Japan, Provide all-round care to the introduced talents in terms of residence, spouse employment, children's education, and job positions.

Step six: Promote exchanges across fields, organizations, and departmental barriers: Cross-border facilitates the burst of inspiration and is conducive to scientific and technological innovation. For this purpose, institutional mechanisms and implementation measures to improve the mobility of scientific and technological innovation talents have been constructed.

Looking back at the "Science and Technology Basic Plan" developed over the past 25 years, Japan's ICT has made progress in the world, and the IT industry has a place on the international platform, and is expected to play a key role in the fourth industrial revolution.

### ***2.6. The sixth phase of the "Science and Technology Innovation Basic Plan" (2021-2025)***

Facing the severe challenges of the restructuring of the world structure, the spread of the new crown epidemic and the climate issue, the sixth phase of the "Science and Technology Basic Plan" focuses on leading the development of science and technology in the next five years and the realization of Society 5.0 through the scientific and technological innovation system. In June 2020, Japan revised the "Basic Law of Science and Technology" and renamed it "the Basic Law of Science and Technology Innovation". Correspondingly, the sixth phase of the "Science and Technology Basic Plan" was renamed the "Science and Technology Innovation Basic Plan", focusing on the role of "innovation". Therefore, in the cultivation of talents, the sixth phase of the "Science and Technology Innovation Basic Plan" takes the strengthening of research capabilities, the development of cutting-edge knowledge, and the creation of sources of scientific and technological achievements as the starting point, and the following measures are formulated: Improve the treatment of doctoral students and broaden their career paths. Improve the scientific research environment for young talents. Promote female researchers to participate in scientific research activities. Revitalize basic and academic research. Promote international joint research and international talent circulation. Ensure sufficient research time. Promote the development of humanities and social sciences and create comprehensive knowledge. Carry out an integrated reform of the competitive research funding system.

## **3. Inspiration to our country**

The competition of scientific and technological strength is essentially the competition of talents. Under the situation of fierce global talent competition, Japan has raised the cultivation of talents to a strategic height in the "Science and Technology Basic Plan", and proposed to attach importance to cultivating young talents, optimize the structure of talents, actively introduce foreign talents, promote the spirit of scientists, and strengthen scientific and technological ethics and morality, so as to provide reference for the development of scientific and technological talents in my country.

### ***3.1. Attach importance to cultivating young talents***

Youth is the future of the country and the hope of the country. To strengthen the cultivation of young talents is to seek development for the country. Each issue of the "Science and Technology Basic Plan" emphasizes the importance of the cultivation of young talents, and continuously puts forward new ideas and measures for the cultivation of young talents, including: Through the reform of the tenure system, the troubles of young talents in employment and career development are reduced, so that young talents can engage in scientific and technological research work without distractions; Vigorously provide financial support for young talents to ensure the smooth progress of scientific research; Create an excellent scientific research environment to stimulate the innovative ability of young talents; Provide a variety of career development paths and promote the flow of talents; Carry out educational reforms, especially graduate school education reforms, to ensure the quantity and quality of young talents and lay a foundation for later young talents to better transform scientific and technological knowledge into economic strength; Cultivate diverse talents to help the transformation of scientific and technological achievements and serve the development of the country.

### ***3.2. Optimize talent structure***

In the context of Japan's low fertility rate and aging population, the shortage of scientific and technological talents is a fact and even a challenge. In order to meet this challenge, the sixth phase of the

"Science and Technology Basic Plan" proposes to continuously optimize the talent structure. The first is to promote women's participation in scientific and technological research. From the third phase of the plan, it is proposed that the number of female researchers should reach 25%, and the fourth phase proposes to reach 30%. Since the fourth phase's proportion target has not been achieved, the fifth phase It is proposed to continue to complete the target of 30%. The "Law on Promoting Women's Active Professional Life" was introduced to provide more support and safeguards for female researchers. Secondly, young talents are the main force of scientific research, as mentioned above, mainly through various measures to continuously expand the team of young talents. The last step is to lay out the education of the next generation in advance. Everything is prepared in advance, and if it is not foreseen, it will be abandoned. From the fourth phase of the "Science and Technology Basic Plan", strategic measures to cultivate the next generation of talents have been put forward.

### ***3.3. Actively attract foreign talents***

The introduction of foreign talents can directly acquire new knowledge, experience and technology from all over the world, which will help to promote scientific and technological cooperation and exchanges, help to enhance Japan's international competitiveness, and help to enhance Japan's status on the world stage and reputation. Since the second phase of the "Science and Technology Basic Plan", it has been advocated to actively introduce foreign talents, and related measures have been gradually optimized and refined, and the attraction to foreign talents has also been continuously enhanced. The fifth phase of the "Science and Technology Basic Plan" specifically proposes to give foreign outstanding talents a full range of preferential treatment in terms of daily life, spouse employment, children's education, financial support to the job, so as to attract more talents to Japan and contribute to Japan's science and technology cause.

### ***3.4. Promote the spirit of scientists and strengthen scientific and technological ethics and morality***

Scientist spirit and science and technology ethics are the basic projects for promoting the healthy development of science and technology and cultivating science and technology talents. It is also an inevitable requirement to achieve self-reliance and self-improvement in science and technology and build a powerful country in science and technology. Since the second phase of the "Basic Plan for Science and Technology", it has emphasized that the spirit and ethics of scientists are very important. Therefore, it is proposed to continuously improve the scientific and technological ethics and social responsibility of scientific and technological talents, and give play to the guiding role of ethics in science and technology. At the same time, it focuses on cultivating talents who specialize in publicizing science and technology, so that scientific and technological achievements can be understood by the public, so as to better benefit the public, obtain support from the public, and understand the needs of the public to promote the further development of science and technology.

## **4. Conclusion**

The world is facing major changes unseen in a century, and a new round of scientific revolution and industrial transformation is reshaping the world pattern. Under this situation, holding the "bull nose" of scientific and technological development can seize the development highland, and the key to scientific and technological development lies in talents. Therefore, many countries and regions have stepped up the implementation of medium and long-term talent development strategies. Building a world power in science and technology is the strategic support for my country to achieve a modernized power and an important strategy for realizing China's great rejuvenation of the Chinese dream. Therefore, my country must vigorously develop science and technology, learn from the experience of scientific and technological talents in developed countries, accelerate the construction of scientific and technological talents in my country, and help achieve the goal of strength and revival.

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