– Research Report – APRC-FY2023-RR-03

Asia and Pacific Research Center

Strategies for Nurturing and Supporting STI Talents in China

January 2025

Japan Science and Technology Agency

Established in April 2021, the Asia and Pacific Research Center (APRC) of the Japan Science and Technology Agency (JST) aims to contribute to building a foundation for innovation in Japan by expanding and deepening science and technology cooperation in the Asia-Pacific region based on the three pillars of research, information dissemination, and networking.

This report is compiled as part of a research that surveyed and analyzed science and technology innovation policies, research and development trends, and associated economic and social circumstances in the Asia-Pacific region. It is being made public on the APRC website and portal site to enable wide use by policymakers, associated researchers, and people with a strong interest in collaborating with the Asia-Pacific region; please see the websites below for more details.

APRC website:
https://www.jst.go.jp/aprc/en/index.html

Research Report:
https://sj.jst.go.jp/publications/researchreports/index.html

Executive Summary

The purpose of this paper is to clarify what kind of policies China has formulated and what kind of projects it has developed to foster and support human resources in science and technology, and to analyze the implications of these policies for Japan.

To clear the above mission, the report consists of four chapters, the contents of which are as follows.

Chapter 1 presents an overview of China's science and technology human resources through indicators and data related to science and technology human resources. China has been continuously investing in R&D and human resource development, finally surpassing RMB 30 trillion in R&D expenditures by 2022. The number of both R&D and research personnel ranks first in the world. In China, which has become a highly educated society, the number of post-doctoral and graduate students (master's and doctoral students) is also increasing year by year; the number of new graduates with higher education in 2023 amounted to 11.58 million. However, while the number of new graduates is increasing, the unemployment rate has also been soaring in recent years: as of June 2023, the unemployment rate for youth (aged 16-24) was 21.3%, the highest rate in history. The reasons for the difficulty in finding employment for young people, which is becoming more serious along with the number of human resources being produced, are analyzed in the column. Note that the number of foreign students has not decreased, despite the impact of the Corona disaster and other factors, and "study abroad fever" in China remains high. In terms of the index of research strength, China ranks first in the world in terms of both number and quality (number of citations), showing a great leap forward.

Chapter 2 summarizes the major policies that China has implemented during the 14th Five-Year Plan period (2021-2025) to foster and support human resources in science and technology. The most important policies related to science and technology human resources in the 14th Five-Year Plan mainly include: (1) building a high-level talent pool, (2) reforming the talent assessment system and strengthening incentives, and (3) optimizing the innovation, start-up, and creation ecosystem. In addition, China has also formulated policies for fostering young science and technology talent, supporting basic research talent, technology talent, and female science and technology talent, and attracting outstanding talent from abroad.

Chapter 3 describes large-scale projects that have been implemented to foster and support human resources in science and technology. The projects for fostering domestic human resources are divided into domestic human resources fostering projects and overseas human resources attraction projects. The projects for fostering domestic human resources include the 10,000,000 Person Project for supporting high-level human resources, the National 100,000,000 Person Project for fostering young science and technology personnel, the Basic Science Human Resources Development Base Program for fostering basic research personnel, and the 653 Process The projects to attract foreign talents include Projects to attract overseas talents include the Changjiang Scholars Encouragement Plan, the Thousand Talents Plan, and the Enlightenment Plan.

Chapter 4 summarizes the characteristics and challenges of China's unique science and technology human resource policies based on the above contents and analyzes the implications of these policies for Japan.

(1) Strong government impetus and focus on human resource development and support

Policies released by the central government are positioned as "presentation of policies and desirable directions," and it is the local governments that will put them into practice. It is not unusual for China's local governments to be

larger than Japan, and the scale of projects and support provided by local governments is as substantial as that of the central government. They continuously invest in science and technology and R&D, and their large budgets contribute to the world's top human resources and national competitiveness. Bold investment in science and technology would be the first step to develop and secure lots of science and technology human resources, including development and researchers in the field of science and technology.

(2) Overwhelming scale of human resources and large number of long-term projects

In the case of China, in addition to the Ministry of Education and the Ministry of Science and Technology, many ministries and agencies, including the Ministry of Human Resources and Social Security and the Ministry of Industry and Information Technology, have launched human resource-related policies, and the number and variety of human resource development and support projects are very rich.

For example, the overseas human resources attraction program, which was linked to the Hundred People Plan, the Thousand People Plan, and the Enlightenment Plan, has been continued since the 1980s, and the Changjiang Scholars Encouragement Plan and the 653 Process, which were introduced in this report, have been implemented for a similar period. In the case of China, the plan was implemented at a comparatively early stage. In the case of China, the policy of attracting overseas human resources was launched at a relatively early stage, and since China was able to secure lots of excellent human resources, it has maintained an absolute advantage in terms of the scale of its human resources. The global situation is constantly changing, and it is difficult to predict when and how things will change. The same is true for human resource needs, and securing a vast pool of human resources is an essential element for improving national competitiveness and research capabilities, as well as for the development of science and technology.

(3) Speed of central policy development and flexibility of policy change

One of the advantages of China's unique party system is that central policies are transmitted to local regions at an extremely rapid pace and are steadily developed and established. Because power is centralized, policy formulation and changes are relatively smooth. The central government is also very efficient in terms of efficiency, as central policies are spread throughout the country and related projects are implemented on a province-by-province basis without taking a long time. This is also true in the case of policy changes or changes in business direction, which can be accomplished without complicated procedures, allowing China to respond flexibly to changes in various circumstances.

(4) There are few top-level scientists and researchers equivalent to Nobel Prize winners.

Although China has secured a vast pool of human resources and reigns as the world's top country in terms of the number of human resources, it has few researchers and scientists equivalent to Nobel Prize winners. In terms of Nobel Prizes, there have been several American Chinese winners, but so far, the only scientist from mainland China (i.e., the People's Republic of China) to win a Nobel Prize is Slaughter Xie, a Chinese scientist who discovered an anti-malarial drug in 2015. Due to China's unique political system and education system, it is extremely difficult to produce top researchers because the environment is not conducive to liberalization and educational autonomy, and politics constantly intervenes in both research and education. To nurture top researchers, it is of utmost importance to establish a system and mechanism that guarantees researchers more than enough time and freedom for research.

(5) The existence of a title system causes a strong domestic flow of human resources.

The title system, which was introduced to encourage excellent researchers, has somehow become a "title" that is directly linked to annual income and various evaluations, and nowadays, many researchers concentrate on networking and building personal connections to obtain titles. In many cases, they move from one place to the next, hoping only

for a higher annual salary. Too intense domestic mobility makes it impossible to conduct stable research, which in turn prevents the development of researchers and is ultimately detrimental to the strengthening of scientific and technological capabilities. Although the mobility of human resources is important in terms of work reform, etc., in the world of research, it is important to first create the necessary support and systems so that researchers can devote themselves to research in a stable environment with sufficient time for research.

(6) Serious mismatch between supply and demand in the human resources market

In China, the number of highly educated people is increasing year by year because academic backgrounds have a great influence on careers, social status, and so on. Many highly educated people and graduates of prestigious universities are seeking white-collar jobs because of their pride in their educational backgrounds. However, many white-collar jobs are already nearly saturated in China. On the other hand, blue-collar jobs that are in high demand, such as those in the automotive, production, manufacturing, and logistics/transportation/transportation industries, have always suffered from a serious shortage of human resources, but the number of applicants has not increased as much as expected despite the implementation of various policies. If this situation continues, there is a risk that the number of "highly educated people" who have no role to play will continue to increase.

Table of Contents

Tables and Figures

Introduction

The background and objectives of this study are presented below.

The Asia-Pacific region accounts for approximately 60% of the world's population, as well as 30% to nearly 40% of global GDP and R&D expenditures. The region has become a major influence on world politics, economy, and society. (The Ministry of Foreign Affairs defines "Asia-Pacific" as the region that includes both Asia and Oceania.) In particular, in terms of the economy, the region's share of global GDP was 34.4% in 2021. This was a rapid increase of approximately 80% from 1980 (18.8% of global GDP) and of 30% from 2000 (25.5% of global GDP). The region has propelled the global economy as a global growth center. This rapid development in the Asia-Pacific region can be attributed largely to the economic activities of the countries and regions within this region. A key factor is the steady progress made in nurturing and supporting the science, technology, and innovation (STI) talents that will serve as the foundation for R&D activities to support this growth.

All countries in the region have policies in place to strengthen measures to nurture and support STI talents. China, in particular, has seen the most rapid development in this region. (Its share of global GDP has increased sevenfold in the last 40 years.) The country has implemented policies to (1) strengthen the domestic development of highly skilled human resources by promoting domestic higher education institutions and (2) attract excellent human resources (including Chinese emigres) from overseas as foreign researchers, foreign students, etc. This has allowed China to acquire a vast pool of human resources and to continue its rapid development in science and technology. The development of science and technology in China today would not have been possible without investment in the nurture and support of STI talents and the implementation of effective measures.

In Japan, GDP as a percentage of the world economy has been stagnant over the long term. In science and technology, Japan's share of the world market in terms of total number of papers and of H-index papers has been declining in recent years. Meanwhile, China's remarkable development makes it a useful reference for considering how to secure and develop STI talents in Japan. This requires a correct understanding of the situation of nurture and support of STI talents in China. It is also essential to understand these issues to smoothly promote scientific and technological cooperation with China.

Based on the above, this report on strategy for nurturing and supporting STI talents in China shall be implemented with the following objectives

(1) From the viewpoint of maintaining and improving Japan's research capabilities, to understand China's policies and strategies for nurturing and supporting STI talents and identify matters that can be used as reference in promoting the nurture and support of STI talents in Japan.

(2) To understand China's policies and strategies for nurturing and supporting STI talents and provide basic information for promoting science and technology cooperation between Japan and major countries in the Asia- Pacific region, including China.

In FY2022, the Center conducted surveys on policies and programs for nurturing and maintaining STI talents in

South Korea and Singapore, which have many similarities with Japan. The research reports are available below[1].

[1] Korea: https://spap.jst.go.jp/investigation/downloads/2022_rr_05.pdf?utm_source=Manual&utm_medium=Manual&utm_campaign=PDFClick _2022_rr_05.pdf
Singapore: https://spap.jst.go.jp/investigation/downloads/2022_rr_02.pdf?utm_source=Manual&utm_medium=Manual&utm_campaign=PDFClick_2022_rr_02.pdf

1 Overview of STI Talents in China

"**STI talents**" in this report mainly refers to researchers (those who have completed a graduate course and are engaged in professional activities based on the relevant major, and master's or higher-level students). It also includes, as necessary, human resources who support scientific and technological activities in general, as well as the body of students who have studied domestically or abroad from whom such human resources are drawn.

In order to understand how China's science and technology is positioned in the world as global competition intensifies day by day, this chapter first clarifies the status of China's nurturing and maintenance of STI talents over the past few years (about five years). This clarification is based on various data and indicators on human resource nurturing, maintenance, and mobility over the past 10 to 20 years.

1.1 Research and Development Expenditures

China's R&D expenditures[2] have grown rapidly, from RMB 89.6 billion (1.792 trillion yen) in 2000 to RMB 3.782 trillion (62 trillion yen) in 2022. For the first time, China's R&D expenditures exceeded RMB 3 trillion, **ranking second in the world** after the United States. R&D expenditures as a percentage of GDP were 2.55%, an increase of 0.11% from the previous year. In the 13th Five-Year Plan (2016–2020), the national plan's goal was to increase R&D expenditures to 2.5% by 2020. The 14th Five-Year Plan (2021–2025) aims to increase R&D expenditures for society as a whole by at least 7%, exceeding the actual figure for the 13th Five-Year Plan as a percentage of GDP. However, a specific target for R&D expenditures as a percentage of GDP is not provided[3].

2 According to the *China Statistical Yearbook on Science and Technology*, R&D expenditures refer to actual expenditures on R&D activities developed internally by companies, organizations, research institutes, and institutions of higher education. This includes direct expenditures for R&D projects (assignments), as well as administrative and service costs used indirectly for R&D activities, equipment expenditures and processing costs related to R&D activities.

3 APRC, *Science and Technology Indicators of China 2021*, p. 2.

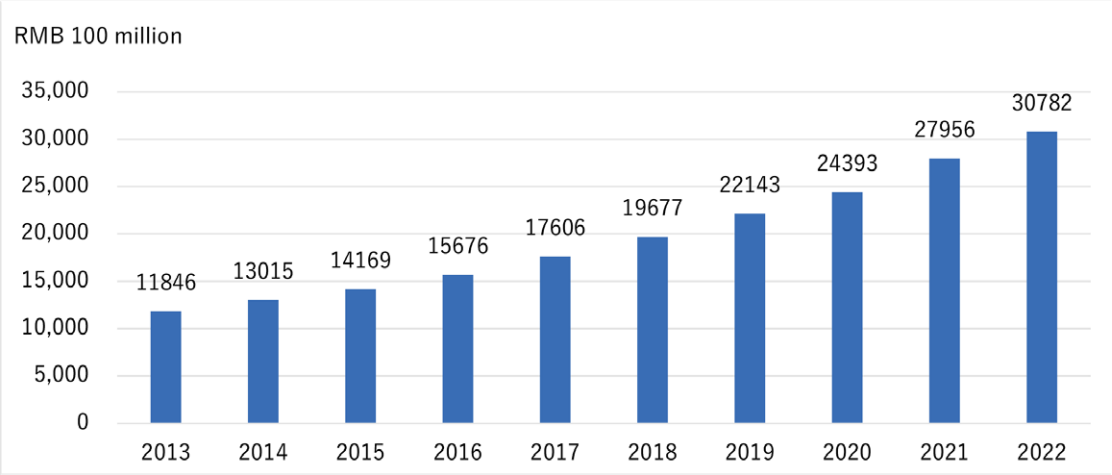

Figure 1: R&D Expenditures in China

Source: *Statistical Bulletin of National Science and Technology Inputs (2013-2022)*, National Bureau of Statistics of China.

1.2 Percentage of Researchers and Female Researchers

In China, numbers of researchers as well as R&D expenditures are on a steady upward trend. Before presenting specific data, let us specify the definitions of "R&D personnel" and "researcher" in China.

According to the Ministry of Education, Culture, Sports, Science and Technology's explanation of the term[4], in Japan, "a member of R&D personnel" is an employee who has completed a course at a university (excluding junior college) engaged in R&D work, or who has equivalent or greater specialized knowledge and who is conducting R&D with a specific R&D theme (excluding R&D personnel who have a main job (concurrently) outside their organization). In surveys by the Ministry of Internal Affairs and Communications (MIC), such R&D personnel are also referred to as "researchers." In China, however, the scope of "R&D personnel" is a little broader.

According to Article 19 of the National Bureau of Statistics of China's *R&D Input Statistics Standards* (2019), a **member of R&D personnel** is defined as a person who is engaged in basic research, applied research, or experimental development activities in an organization that conducts R&D activities. Specifically, it includes (1) researchers who directly participate in the above three research activities, (2) managers involved in the above three research activities and (3) those involved in administrative work. Persons involved in providing information literature, supplying materials, and maintaining and repairing facilities in R&D activities are also considered to be R&D personnel. Security staff, food and beverage service staff, etc. are not so considered.

According to Article 20 of the above Standards, a **researcher** is a professional person involved in the conception or creation of new knowledge, new crafts, new methods, or new systems, or a key person in charge of an R&D project, or a senior management official of an R&D institution. Researchers should hold a doctoral degree or an intermediate or higher position, but doctoral students conducting R&D activities, in particular, are also considered researchers.

4 https://www.mext.go.jp/b_menu/toukei/chousa06/minkan/yougo/1267199.htm

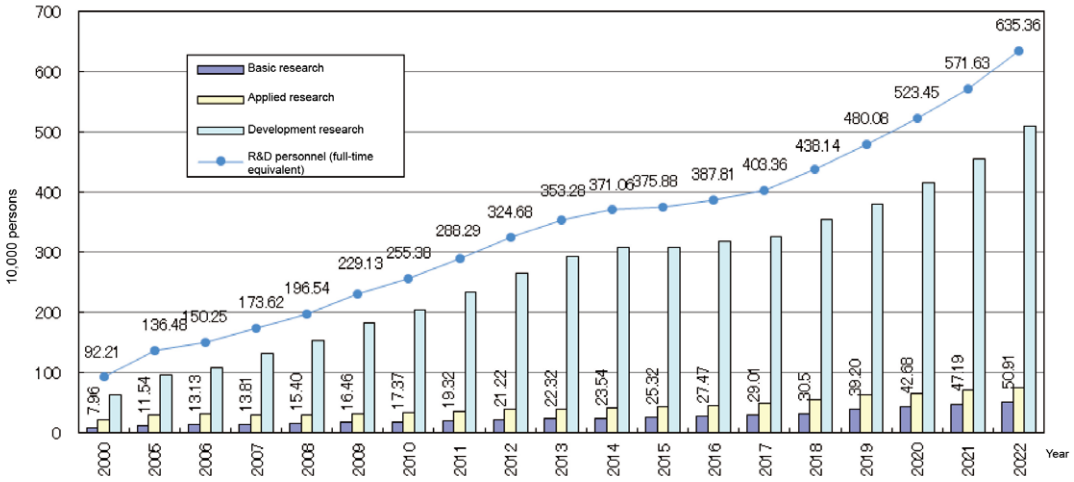

Figure 2: Trends in R&D Personnel in China by Research Type[5]

Source: APRC, *Science and Technology Indicators of China 2023*

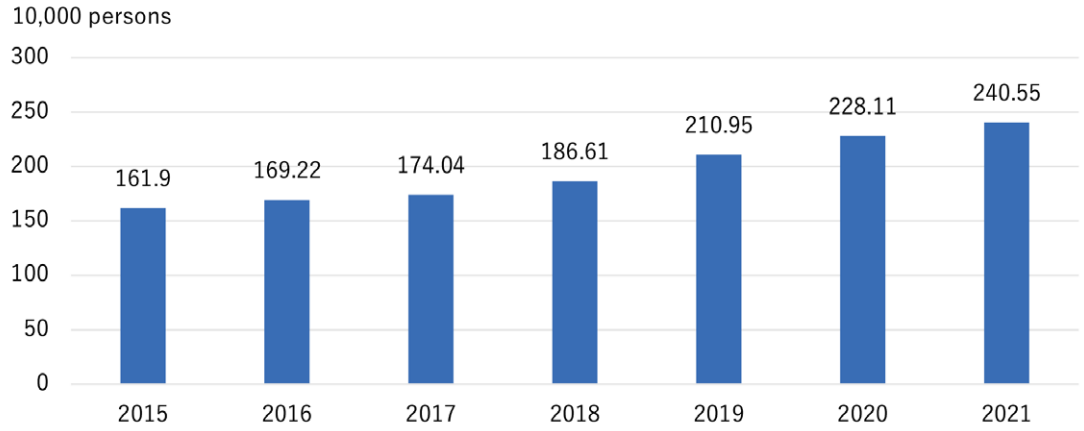

Figure 3: Number of Researchers (FTE) in China[6]

Source: OECD, Main Science and Technology Indicators.

China has the largest R&D workforce in the world, exceeding 6.35 million in 2022. This figure is double that of 2012. The average increase over the past few years has exceeded 7%. Of the total, women R&D personnel account for 40.1%[7]. Although the number itself is high, women still account for only around 40% of R&D workers, a low figure

5 "Researchers by research type" are R&D personnel divided into the broad categories of basic, applied, and development. This classification is based on the definitions provided by the Organization for Economic Cooperation and Development (OECD) Frascati Manual for each country.

6 The OECD definition of a researcher is a professional engaged in the conception or creation of new knowledge. A researcher is a person who conducts research and improves or develops concepts, theories, models, techniques, measurements, software or operating processes (Frascati Manual 2015). "Full-time equivalent" (FTE) is a method of converting and measuring research work into full-time equivalents. China has been collecting the number of FTE researchers according to this criterion since 2009, but has not disclosed the specific collection method. In Japan, the number of researchers is measured by the MICs'R&D statistics (NISTEP TEITEN Survey). For more information on measurements and definitions, see https://www.nistep.go.jp/sti_indicator/2018/RM274_21.html

7 https://baijiahao.baidu.com/s?id=1736666926772383874&wfr=spider&for=pc

compared to other major countries, where the percentage is 50% or over[8]. By research type, those engaged in the basic, applied, and development research fields numbered 591,000, 741,000, and 5,103,000, respectively.

For researchers, the number of FTEs surpassed 2.4 million in 2021, ranking first in the world. Of these, female researchers accounted for 26% of the total (based on the 2022 Standards).

1.3 Number of Post-Doctoral, Graduate, and Undergraduate Students and Employment Rate

(1) Number of post-doctoral, graduate, and undergraduate students

In China, the number of graduates, from post-doctoral to undergraduate students, is increasing every year. According to data from the Ministry of Human Resources and Social Security[9], through 38 years of project promotion, the cumulative number of new postdocs[10] in China as of June 2023 reached 340,000. The scale of the post-doctoral programs continues to expand, with 4,338 research centers nationwide accepting post-doctoral researchers. In terms of academic disciplines, more than 110 departments offer post-doctoral curricula. According to an announcement by the China National Postdoctoral Affairs Management Committee[11], a cumulative RMB 8.3 billion (166 billion yen) has been invested in funding projects to support postdoctoral fellows. Xiao Wang, Deputy Secretary General of the Postdoctoral Affairs Management Committee, announced that the number of new postdocs in 2022 exceeded 30,000 for the first time, bringing the total to 32,340, with 20,105 completing their terms[12].

This trend is the same for graduate and undergraduate students; numbers are on the rise, as given in the figure below. In 2022, there were 82,320 doctoral graduates, 779,845 master's graduates, and 4,715,658 four- year bachelor's graduates. The Ministry of Education[13] expected 11.58 million new graduates with higher education in 2023.

As for **percentage of science and engineering graduates** among the 82,320 doctoral graduates, 17,063 were in science, 30,121 in engineering, and 14,819 in medicine, accounting for 75.3% of the total.

In the case of master's degrees, of the 779,845 graduates, 49,185 were in science, 261,539 in engineering, and 81,388 in medicine, meaning that 50.3% of the total were in the science and engineering fields.

In the case of undergraduates, of the 4,715,658 graduates, 298,672 graduated in science, 1,565,928 in engineering, and 333,657 in medicine, with science and engineering graduates thus accounting for 46.6% of the total.

8 *Science and Technology Talent Development Report*, Ministry of Science and Technology of China.

9 https://www.chinapostdoctor.org.cn/website/showinfo_xwdt.html?infoid=bd0a222b-2672-4e57-b6ce-3b217ebe4e9d

10 This refers to the number of people who have obtained new postdoctoral positions.

11 https://www.chinapostdoctor.org.cn/website/showinfo_zcwj.html?infoid=bd0a222b-2672-4e57-b6ce-3b217ebe4e9d

12 https://shenkexin.com/news/info-news-9231.html

13 http://www.moe.gov.cn/jyb_xwfb/s5147/202211/t20221118_995344.html

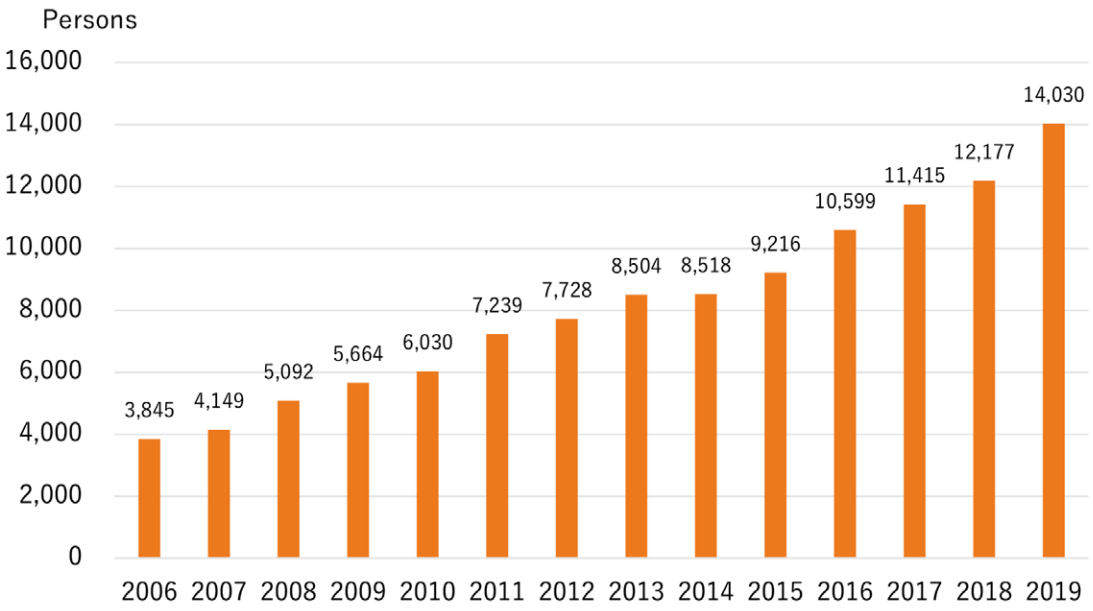

Figure 4: Number of Postdoctoral Fellows in China

Source: China National Postdoctoral Affairs Management Committee

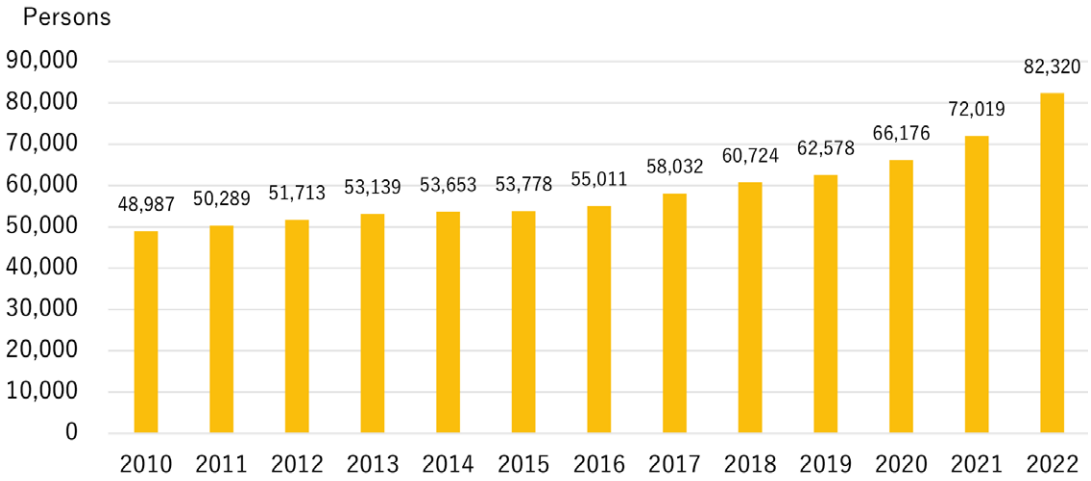

Figure 5: PhD Graduates in China

Source: Ministry of Education, Education Statistics Data.

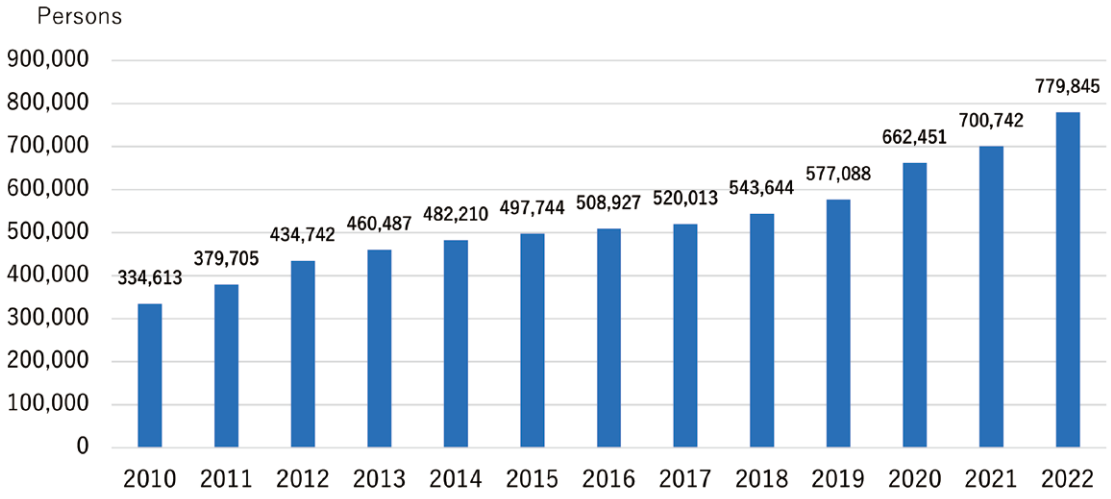

Figure 6: Master's Degrees in China

Source: Ministry of Education, Education Statistics Data.

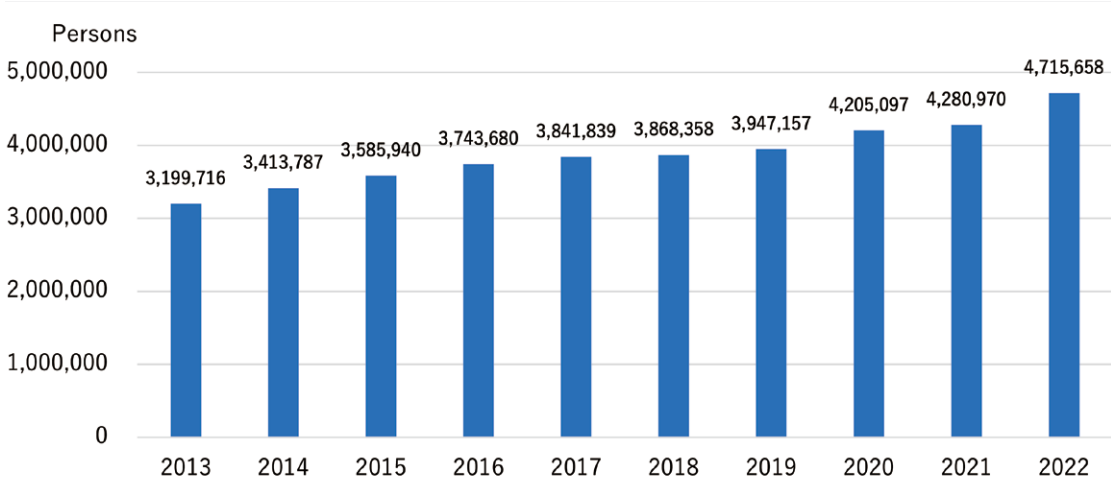

Figure 7: Graduates of Four-Year Colleges* in China

Source: Ministry of Education, Education Statistics Data.

*According to the Ministry of Education's *Statistical Bulletin on Educational Programs*, higher education includes graduate school (doctoral and master's degrees), four-year university undergraduate (bachelor's degree), vocational undergraduate/specialized, adult undergraduate/specialized, and internet undergraduate/specialized degrees. The graph covers only undergraduate students who graduated from regular four-year universities.

In China, the number of highly educated people continues to increase. An article published on the recruitment site TENjee, "Why China Is Called a Hyper-Educated Society,"[14] points out that China has already gone beyond being a highly educated society and become a hyper-educated society. It then analyzes the causes of this trend, including (1) the impact of the one-child policy; (2) the increase in university capacity; (3) the expansion of the scale of graduate education; and (4) expectations for employment. The one-child policy was implemented by China from 1979 to 2014. As a result of this policy, parents'desire to send their only child to a prestigious university worked synergistically to

[14] Full text: https://article.tenjee.com/2023/06/20/china-education-and-society-china-academic-society-why/

improve opportunities to enter higher education institutions, with the number of students admitted to universities and graduate schools increasing under subsequent national policies such as the reform and opening-up policy. In addition, there is a strong perception in Chinese society that if one enters a prestigious university and acquires a high-level academic degree, one will find a good job and achieve high social status[15]. In fact, large Chinese companies and government agencies set their hiring standards at the graduate degree level or higher, and even small and medium-sized enterprises (SMEs) require a four-year college degree[16]. Students are bound by the cycle of "highly educated people find good jobs ⇒ large companies, etc., seek highly educated people ⇒ seeking to further improve their education" and continue to seek higher education.

(2) Youth unemployment rate

Instead of the employment rate, the National Bureau of Statistics of China publishes the unemployment rate, which is[17] the percentage of the labor force (employed plus unemployed) aged 16 or over that is unemployed. The criteria for determining "unemployed persons" are those who have been unsuccessfully looking for work within the past three months based on the timing of the survey, are currently unemployed, and would be able to start work within two weeks if suitable work were available. "Employed persons" (including persons on vacation or temporary leave) are defined as those who, within the past three months, worked at least one hour for remuneration for labor or management income. The unemployment rate gives some indication of the employment rate.

In June 2023, the unemployment rate for youth (16 to 24-year-olds) reached a record high of 21.3%. Based on these results, the Bureau of Statistics announced in August 2023 that it would stop publishing the youth unemployment rate for the time being.

In December, the site reopened to the public on the condition that current students be excluded[18]. As of February 2024 (latest data available), the unemployment rate is 15.3%.

Excluding data from December 2023 onward because of different collection conditions, a comparison shows that the youth unemployment rate for 16 to 24-year-olds was 12.8% in November 2020 and 21.3% in June 2023, an increase of nearly 10% in just over two years. The youth unemployment rate for persons from 25 to 29 years old remained in the 4% range until around June 2023, but has been 6% since December 2023[19].

15 https://article.tenjee.com/2023/06/20/china-education-and-society-china-academic-society-why/

16 https://article.tenjee.com/2023/06/20/china-education-and-society-china-academic-society-why/

17 National Bureau of Statistics of China, "What is the Unemployment Rate?" https://www.stats.gov.cn/zs/tjws/tjzb/202301/t20230101_1903672.html

18 https://baijiahao.baidu.com/s?id=1788305240346752349&wfr=spider&for=pc

19 National Bureau of Statistics of China: https://data.stats.gov.cn/easyquery.htm?cn=A01

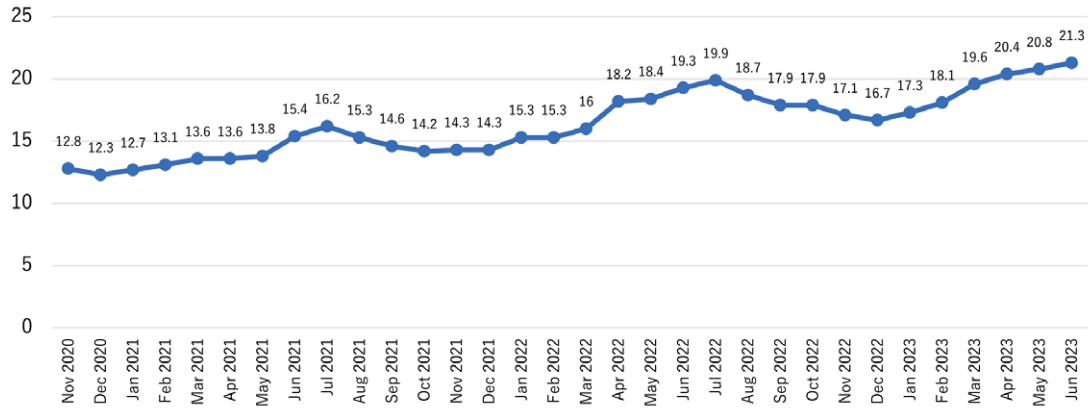

Figure 8: Youth Unemployment Rate (16 to 24-year-olds) in China

Source: National Bureau of Statistics of China

Associate Professor Zhang Dandan of Peking University noted that the unemployment rate for 16 to 24- year- olds in urban areas could reach up to 46.5% as of March 2023 if non-students who are not included in the labor-force population are also considered[20]. Of the government's announced population of 96 million urban 16 to 24-year-olds in 2023, 64 million were not in the labor force, while 32 were; of the 64 million not included in the labor force, 48 million were current students and 16 million non-students. Of the 32 million in the labor force, 25.7 million were employed and 6.3 million unemployed. If the 16 million non- students not in the labor force were considered unemployed, the unemployment rate would rise by up to 46.5% ((1600+630)/(1600+3200)), Zhang argues[21].

20 Zhang, Dandan, "The Youth Unemployment Rate May Be an Underestimate" (Caixin, July 17, 2023). https://www.szhgh.com/Article/opinion/xuezhe/2023-07-20/331286.html

21 https://www.szhgh.com/Article/opinion/xuezhe/2023-07-20/331286.html

Column: Young Talents'Difficulty in Finding Employment

Young talents'difficulty in finding employment is recognized as a major social problem in China, and Japanese experts and think tanks[22] have also analyzed the issue. Various common causes of difficulty in finding employment are cited in many articles, including the following.

(1) Mismatch between supply and demand

Students, who are becoming more highly educated and have a growing pride in their education, are becoming more white-collar oriented. Few students want to work in blue-collar industries, which are generally considered dirty, dangerous, and physically demanding.

China's Caixin website also pointed out that "The difficulty students are having in finding jobs is not because the number of job seekers exceeds the number of job openings, but because there is a mismatch between the needs of companies and the thinking of students."[23] According to the 2023 University Graduates Employability Report[24], a survey of prospective new graduates conducted by the thinktank Zhaopin, the largest percentage (25%) of respondents hoped to find employment in the "IT, electronics, internet, and telecommunications-related" sectors. The second-largest category was "culture, entertainment and media-related," at 10% of the total. On the other hand, the quintessential blue-collar industry sectors "automobiles, production, and manufacturing," accounted for 8.1% of the total, and "logistics, transportation, and traffic-related" for only 2.9%.

With so many applicants seeking white-collar employment, what are the market needs? According to a 2022 Metropolitan Public Employment Service Center announcement[25], the ratio of job openings to applicants for engineers in the manufacturing sector was above 1.5, and above 2.0 for high-level technical personnel. Blue-collar personnel are thus in high demand. The 2022 data released by the Ministry of Human Resources and Social Security shows that of the 747 million people in employment, more than 400 million (53%) were blue-collar workers[26].

22 (1) Commentary by journalist Kota Takaguchi, an expert on the situation in China, "Unemployment Immediately Upon Graduation: Job Hunger Strikes Young Chinese"https://news.yahoo.co.jp/articles/7f78507da27d67c00f7e46c46d1e96e483762763
(2) Japan Center for Economic Research, "Emerging Joblessness among New Graduates in China: A Social Problem."
https://www.jcer.or.jp/jcer_download_log.php?f=eyJwb3N0X2lkIjo5MTYwNSwiZmlsZV9wb3N0X2lkIjo5MTYxN30=&post_id=91605&file_ post_id=91617
(3) NLI Research Institute, "A Growing Sense That 'Graduation = Unemployment'(China)"
https://www.nli-research.co.jp/report/detail/id=75833?pno=2&site=nli
(4) Reuters, "Joblessness Among College Graduates Worsens in China; Temporary Respite for Non-Regular Public Servants"
https://jp.reuters.com/markets/japan/funds/EPSPAFH34NPH7HVJR7L2HSXK7M-2023-11-15/
(5) *Asahi Shimbun*, "Young People Living in an 'Employment Ice Age'in China"
https://www.asahi.com/articles/ASR996HD2R8YULFA02L.html

23 https://www.jcer.or.jp/jcer_download_log.php?f=eyJwb3N0X2lkIjo5MTYwNSwiZmlsZV9wb3N0X2lkIjo5MTYxN30=&post_id=91605&file_ Adapted from post_id=91617.

24 https://max.book118.com/html/2023/0508/7020014005005104.shtm; https://baijiahao.baidu.com/s?id=1765423063483372868&wfr=spider&for=pc

25 https://bj.bjd.com.cn/5b5fb98da0109f010fce6047/contentShare/5b5fb9d0e4b08630d8aef954/AP64a4c93ce4b042ca9e8ea480.html

26 https://bj.bjd.com.cn/5b5fb98da0109f010fce6047/contentShare/5b5fb9d0e4b08630d8aef954/AP64a4c93ce4b042ca9e8ea480.html

It could be said that companies are falling victim to a policy dilemma involving the production of an overly educated workforce. While companies are looking for an immediately available workforce, there are not enough people to meet their needs. There are shortages of human resources in core industries such as manufacturing, transportation, and automobiles. Yet meanwhile there is a glut of highly educated graduates.

(2) Young people reluctant to endure grueling working conditions

In the Chinese labor market, the term "996" has taken hold. This refers to a system of working from 9:00 a.m. to 9:00 p.m., six days a week. The term originated in the IT industry, which is famous for its long hours, but now applies to the labor market in general. This suggests that young people who are not prepared to work under the grueling 996 system will find it difficult to survive.

In recent years, the number of "*tang ping*" (lying flat) slackers and "slow job seekers" has been increasing due to the growing number of people who are unable to endure such harsh working conditions. The term "lying flat" (i.e., slacker) refers to young people who do not have high aspirations. These people often choose to become NEETs or to take undemanding jobs after running out of steam due to the accelerating trend toward higher education and fierce competition for jobs.

"Slow job seekers" are those who do not settle for any employment if they fail to find their ideal job. Instead, they slowly search for jobs while depending on their parents for the time being. This phenomenon is probably due to the fact that many only children grew up in a privileged environment as China's economy developed, and increasing numbers of people desire a stress-free life.

(3) Government policies fail to find traction

In response to the prolonged difficulty in sourcing young human resources, the Chinese government has taken various measures, but they have not led to ideal outcomes.

In 2020, the government announced its intention to increase the number of public servants. However, the 200,000 positions made available attracted 7.7 million applications. In 2022, the Communist Party's subordinate organizations arranged for 100,000 people to find jobs, but with over 10 million college-graduates applying, the initiative fell drastically short. On the other hand, policies encouraging rural postings and increased hiring of domestic servants were unpopular, and ended with few applicants[27].

In order to reduce the learning burden on students due to heated competition for university places, a policy banning for-profit tutoring schools was instituted in 2022. Large numbers of instructors were laid off. The theory behind the policy—that the focus should be on public schools—is understandable. However, in practice, it has actually contributed to an increase in unemployment, as tutoring schools were also a place of employment for many new graduates[28].

27 https://news.yahoo.co.jp/articles/7f78507da27d67c00f7e46c46d1e96e483762763?page=3

28 https://www.jcer.or.jp/jcer_download_log.php?f=eyJwb3N0X2lkIjo5MTYwNSwiZmlsZV9wb3N0X2lkIjo5MTYxN30=&post_id=91605&file_ post_id=91617

The real-estate industry has also cut recruitment due to the difficulties faced by the Wanda Group[29], and the general slump in consumption has made hiring more difficult in the service and restaurant industries as well. In addition, with the enactment of the Personal Information Protection Law of 2021, the government became stricter on personal information and data management. It tightened its grip on Alibaba and other major Internet-related companies, making it more difficult to find employment in these firms than before[30].

1.4 Numbers of Students Studying Abroad and Returnees

(1) Number of students studying abroad

As part of its human resource development efforts, China has long implemented the "sea turtle policy," whereby it sends excellent researchers abroad to study, and then encourages their return after their studies are completed. In China, people who return from overseas to work as researchers or entrepreneurs are colloquially called haiguai ("sea turtles"). This is a pun on "overseas returnees", also pronounced "haiguai." Recently, China's policy of encouraging the return inflow of overseas human resources has come to be known in Japan also as the "sea turtle" policy[31].

Students who have studied abroad and other returnees are a valuable source of human resources for China, contributing greatly to the country's economic development and scientific and technological advancement.

The Chinese government has not released the number of students studying abroad and returnees since 2019, so the latest data are for that year. However, according to the *Annual Report on the Development of Chinese Students Studying Abroad (2022)*[32] by the Center for China & Globalization (CCG), in the period FY2019 to FY2020, the major countries in which the largest proportion of overseas students were Chinese were the United States, Germany, Japan, Australia and New Zealand. Chinese students also ranked among the top three in terms of numbers of overseas students in Canada, France, and Russia. The report analyzed that although the number of Chinese overseas students in each country may have temporarily fluctuated due to the COVID-19 pandemic and overseas student policies in each country, overall, the "study abroad fever" in China itself has not cooled (and in fact, is still high).

The same trend can be seen in the latest data from major countries.

(i) United States

According to the *Open Doors 2023 Report*[33], the number of overseas students from China is 289,526, accounting for 27.4% of the total number of overseas students in the period FY2022 to FY2023, ranking first. While the number of students *per se* was down compared to the period FY2019 to FY2020, the ranking remained the same.

29 https://ja.wikipedia.org/wiki/%E5%A4%A7%E9%80%A3%E4%B8%87%E9%81%94%E3%82%B0%E3%83%AB%E3%83%BC%E3%83%97

30 https://www.jcer.or.jp/jcer_download_log.php?f=eyJwb3N0X2lkIjo5MTYwNSwiZmlsZV9wb3N0X2lkIjo5MTYxN30=&post_id=91605&file_ post_id=91617

31 SPC "Policy for Attracting Back Foreign Talent"https://spc.jst.go.jp/policy/talent_policy/callingback/outline.html#:~:text=%E4%B8%AD%E5%9B%BD%E3%81%A7%E3%81%AF%E6%B5%B7%E5%A4%96%E3%81%8B%E3%82%89%E5%B8%B0%E5%9B%BD,%E6%A7%98%E3%81%AB%E3%81%AA%E3%81%A3%E3%81%A6%E3%81%8D%E3%81%9F%E3%80%82

32 https://weibo.com/ttarticle/p/show?id=23094048343002763760002

33 https://opendoorsdata.org/action/pre-order-the-2023-report/; https://www.sohu.com/a/736744196_121124027

(ii) Australia

According to statistics from the Department of Education (PRISMS)[34], the number of overseas students from China in 2022 was 656,567, 21% of the total, ranking first. In addition, as of July 2023, 134,730 overseas students had already been admitted, a number higher than in 2019, before the COVID-19 pandemic.

(iii) United Kingdom

According to data from the Higher Education Statistics Agency[35], the number of overseas students from China in the period 2021 to 2022 ranked first vis-a-vis other countries, at 151,690[36]. The growth rate of Chinese students in the UK was significantly higher than in other countries, with 107,215 students in the period 2017 to 2018. This was a 41% increase in numbers in just five years.

(iv) Germany

According to statistics from the German Federal Statistical Office (Statistisches Bundesamt)[37], in the period from 2022 to 2023, there were 39,137 overseas students from China, or 10.6% of the total, ranking second only to India. China was the leader in the period from 2019 to 2020 but was overtaken in the winter semester of 2022.

(v) Canada

According to data from Immigration, Refugees and Citizenship Canada[38], the number of Chinese overseas students in the period from 2021 to 2022 was 96,930, accounting for 12% of the total, and ranking second. Meanwhile, overseas students from India (323,100) dominated the numbers, accounting for 40% of the total.

(vi) Japan

According to data from the Immigration Services Agency of Japan[39], there were 125,940 overseas students from China at the end of 2022, a 30.4% increase over the previous year. Students from China account for 24.8% of total overseas students, making it the largest source country for overseas students in Japan.

34 https://prisms.education.gov.au/Logon/Logon.aspx; https://www.163.com/dy/article/II9RRTV30518I0I9.html

35 https://www.hesa.ac.uk/; https://hf.xhd.cn/info/recommend/923259.html

36 Adding students from Hong Kong, the number was 170,000.

37 https://www.destatis.de/DE/Home/_inhalt.html; https://de.hujiang.com/new/p1417105/

38 https://www.canada.ca/en/immigration-refugees-citizenship/corporate/reports-statistics/statistics-open-data.html; https://hf.xhd.cn /info/recommend/923259.html

39 https://www.moj.go.jp/isa/content/001393064.pdf

Table 9: Numbers and Percentages of Chinese Overseas Students in Major Countries, FY2019 to FY2020

Country	Ranking of Chinese overseas students	Number of Chinese overseas students (ten thousands)	Number of overseas students in the country (ten thousands)	Percentage of Chinese overseas students against total of overseas students
United States	1	37.25	107.55	34.64%
Australia	1	16.58	46.36	35.76%
United Kingdom	1	12.9	55.15	23.39%
Canada	2	9.86	50.33	19.59%
Japan	1	9.4	22.84	41.16%
Germany	1	3.99	30.22	13.20%
Russia	2	3.75	35.33	10.61%
France	3	2.84	35.8	7.93%
New Zealand	1	2.00	5.3	37.74%

Source: *Annual Report on the Development of Chinese Students Studying Abroad (2022)*

(2) Numbers of returnees and overseas students studying in China

According to an announcement by China's Ministry of Education[40], the number of Chinese students studying abroad is increasing every year, reaching 703,500 in 2019. The total number of students from China studying abroad in the period from 1978 to 2019 amounted to 6,560,600. Of these, 1,656,200 were currently in school and 4,904,400 had completed their studies. Of those who had completed their studies, 4,231,700 chose to return home. This was 86.28% of the total.

In terms of China's intake of overseas students, 492,185 overseas students came to China in 2018, an increase of 0.62% over the previous year. Of these students, 59.95% were from Asia, 16.57% from Africa, 14.96% from Europe, 7.26% from the Americas, and 1.27% from Oceania. The top five countries of origin of overseas students in China were listed as follows: South Korea (50,600 students), Thailand (28,608), Pakistan (28,023), India (23,198), and the United States (20,996). The most popular regions, in order, were Beijing, Shanghai, Jiangsu, Zhejiang, and Liaoning. Of these overseas students, 12.81% came to China on Chinese government scholarships.

[40] http://www.moe.gov.cn/jyb_xwfb/gzdt_gzdt/s5987/202012/t20201214_505447.html

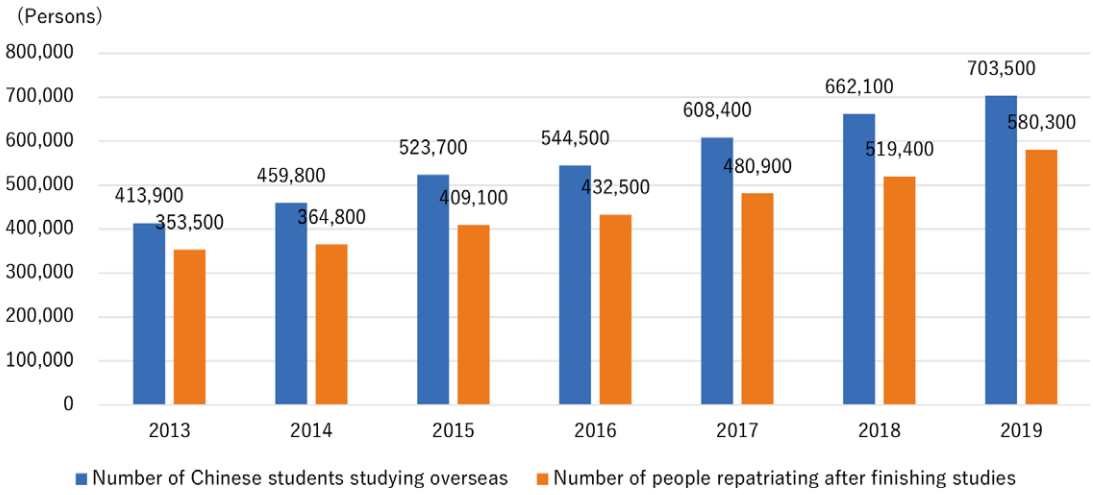

Figure 10: Numbers of Overseas Students and Returnees in China

Source: National Bureau of Statistics of China

(3) Scholarships for overseas students studying in China

The Chinese government offers a wealth of scholarships for foreign students who are willing to study Chinese and who achieve excellent results. Below are some examples, focusing on those offered by the central government. Overseas students are eligible for scholarships even while they are enrolled as language trainees (the period during which they study Chinese), which can be termed favorable treatment.

(i) Chinese government scholarships

These are full or partial scholarships provided by the Ministry of Education based on educational exchange agreements between the Chinese government and other governments and international organizations. Scholarships include bachelor's, master's, and doctoral scholarships, advanced Chinese-language student scholarships, general student scholarships, and advanced student scholarships. Applications are submitted to the government department in charge of dispatching overseas students or to the Chinese embassy (or consulate) in each country.

(ii) Chinese Government Great Wall scholarships

Scholarships are awarded by the Chinese Ministry of Education via UNESCO and are limited to general and advanced students who apply to UNESCO Headquarters or to the National Commission for UNESCO in the applicant's country of residence.

(iii) Asia Study Abroad scholarships

This program has been organized by the Ministry of Education to deepen mutual understanding among Asian countries, expand opportunities for educational exchange and cooperation, improve the overall quality of education in Asia, and encourage the movement of students and researchers from Asian countries. Applications are made to the Chinese embassy (consulate) in the relevant country.

(iv) China-ASEAN (AUN) scholarships

This scholarship program is offered by the Ministry of Education to applicants from ASEAN member countries. Applications are made to the ASEAN University Network Secretariat.

(v) China-Pacific Islands Forum scholarships

This scholarship program is offered by the Ministry of Education to relevant Pacific Island countries. Applications are made via the Pacific Islands Forum Secretariat.

(vi) Chinese Government Scholarship-WMO Program

Scholarships are offered by the Ministry of Education to the World Meteorological Organization (WMO) and applicants apply via the WMO Secretariat.

(vii) Chinese government scholarships (for students coming to China to study in specified provinces/autonomous regions)

These scholarships are offered by the Ministry of Education to strengthen educational exchange and cooperation between China and its neighbors. Applicants are required to apply to the relevant institution of higher education within a specified time frame.

(viii) Chinese government scholarships (programs to assist local governments)

The Ministry of Education encourages and supports local governments in establishing scholarship programs for overseas students studying in China. It provides full tuition fees as scholarships to areas that have already established local-government scholarship programs. Applicants are required to apply to the relevant institution of higher education within a specified time frame.

The scale of scholarships provided to overseas students is as given in the table below.

Table 11: Scale of Scholarships for Overseas Students

Degree	Department	Tuition support per annum	Housing support per annum	Living expenses covered per annum	Medical insurance per annum	Total per annum	Maximum period of coverage
Bachelor	Type 1	RMB 20,000	RMB 8,400	RMB 30,000	RMB 800	RMB 59,200	4 to 7 yrs (including Chinese language training period)
	Type 2	RMB 23,000	RMB 8,400	RMB 30,000		RMB 62,200	
	Type 3	RMB 27,000	RMB 8,400	RMB 30,000		RMB 62,200	
Master	Type 1	RMB 25,000	RMB 8,400	RMB 36,000		RMB 70,200	2 to 5 yrs (including Chinese language training period)
	Type 2	RMB 29,000	RMB 8,400	RMB 36,000		RMB 74,200	
	Type 3	RMB 34,000	RMB 8,400	RMB 36,000		RMB 79,200	
PhD	Type 1	RMB 33,000	RMB 12,000	RMB 42,000		RMB 87,800	3 to 6 yrs (including Chinese language training period)
	Type 2	RMB 38,000	RMB 12,000	RMB 42,000		RMB 92,800	
	Type 3	RMB 45,000	RMB 12,000	RMB 42,000		RMB 99,800	

*Class 1: Philosophy, Economics, Law, Education, Literature (excluding Arts), History, Management
Class 2: Science, Engineering, Agriculture
Class 3: Literature (Arts), Medicine

Source: International Education College, Dalian Medical University[41]

The government provides generous support to ensure that students can live a comfortable life throughout their time as Chinese language trainees, undergraduates, and graduate students. Scholarships cover tuition fees, dormitory costs, and medical insurance. Living expenses are also provided separately.

41 https://gjy.dmu.edu.cn/jxj_l/zgzfjxj.htm

1.5 Research Publications and Patents

(1) Research publications

Next, we will discuss the main indicator of research results, namely, research publications (papers). Papers are also used to determine a country's research capabilities and academic level.

According to *Benchmarking Scientific Research 2023* by the National Institute of Science and Technology Policy (NISTEP), on a 2021 basis, China **ranked first in the world in terms of the number of science and technology papers,** regardless of whether the figure was arrived at through integer counting or fractional counting[42]. In the past, the number of adjusted Top10% papers[43] and the number of adjusted Top1% papers, which measure the **quality of papers**, were not as high as those of the United States. Today, however, they have surpassed the United States to **rank first in the world**, and China's science and technology papers are showing steady growth in number and quality.

In 2021, the number of Chinese science and technology papers (integer counting) was 590,385, an astonishingly fast increase, considering that the number was 136,655 in 2010.

Below are detailed figures for each counting method.

Table 12: Number of Papers, Counting Method, and Share

Subject	Counting method	Number of papers	Global share	Ranking
Number of papers	Integer	590,385	28.74%	1st
Number of papers	Fractional	521,573	25.39%	1st
Number of Top10% papers	Integer	74,951	36.49%	1st
Number of Top10% papers	Fractional	60,862	29.63%	1st
Number of Top1% papers	Integer	8,471	41.24%	1st
Number of Top1% papers	Fractional	6,360	30.7%	1st

Source: NISTEP, *Benchmarking Scientific Research 2023*

The Institute of Scientific and Technical Information of China's 2023 *China Science and Technology Paper Statistics Report* compiled a listing of outstanding science and technology papers for the year. These are defined as those included in the Chinese Scientific and Technical Papers and Citations Database (CSTPCD), SCI, Ei- Compendex, MEDLINE, Scopus, CPCI-S, SSCI, and ESI and whose number of citations exceeded the average for their department (field).

42 Fractional counting is a method of counting Japan as 1/2 and the United States as 1/2 when one paper is co-authored by Japanese institution A and the other by U.S. institution B, indicating their contribution to the production of the paper. The integer counting method means that if a paper is co-authored by Japanese institution A and American institution B, Japan is counted as 1 and the United States as 1, indicating the degree of involvement in the production of the paper. In both counting methods, the count is based on the country information of the author's or authors'institution of affiliation.

43 The "number of adjusted Top10% papers" refers to the number of papers extracted from the top 10% of papers in each field and year in terms of the number of citations and then adjusted to be 1/10 of the actual number of papers. It is an indicator used to measure the quality of papers and refers to the number of papers frequently cited by other papers (high-impact papers).

In 2022, China **ranked first in the world with** 595,800 **outstanding science and technology papers**. By field, clinical medicine, chemistry, and environmental science tended to be the most common. The number of papers published in the most influential journals in their respective fields totaled 16,349, accounting for 30.3% of the global share, surpassing the United States for the first time and ranking first in the world. The number of internationally coauthored papers totaled 159,200, of which 73.3% of all internationally coauthored papers had a Chinese author as the first author.

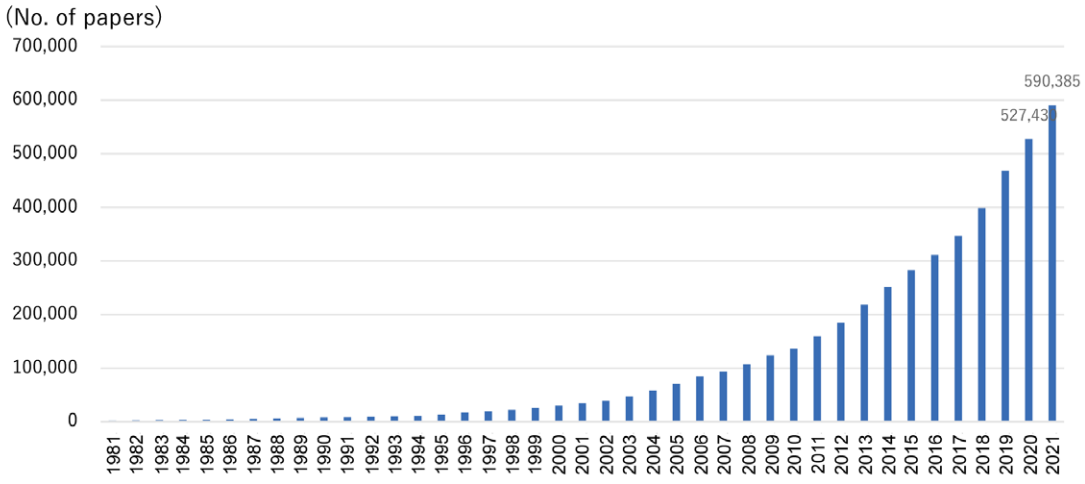

Figure 13: Number of Science and Technology Papers in China (integer counting)

Source: NISTEP, *Benchmarking Scientific Research 2023*

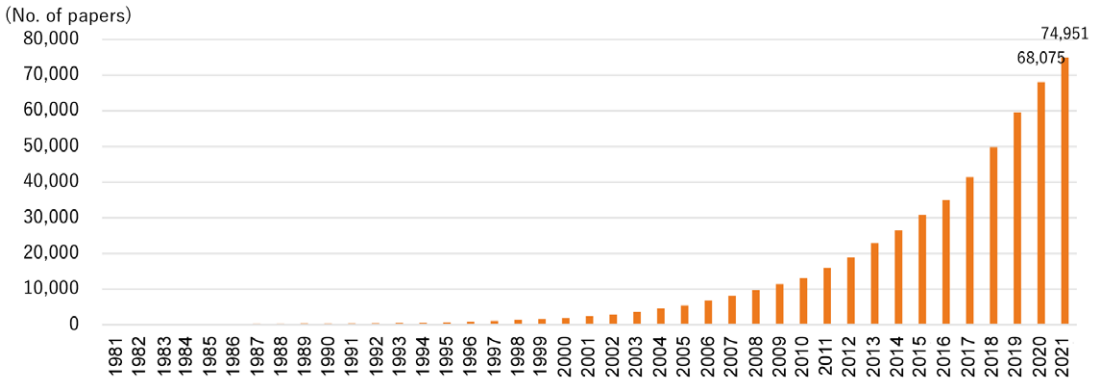

Figure 14: Number of Top10% Science and Technology Papers in China (integer counting)

Source: NISTEP, *Benchmarking Scientific Research 2023*

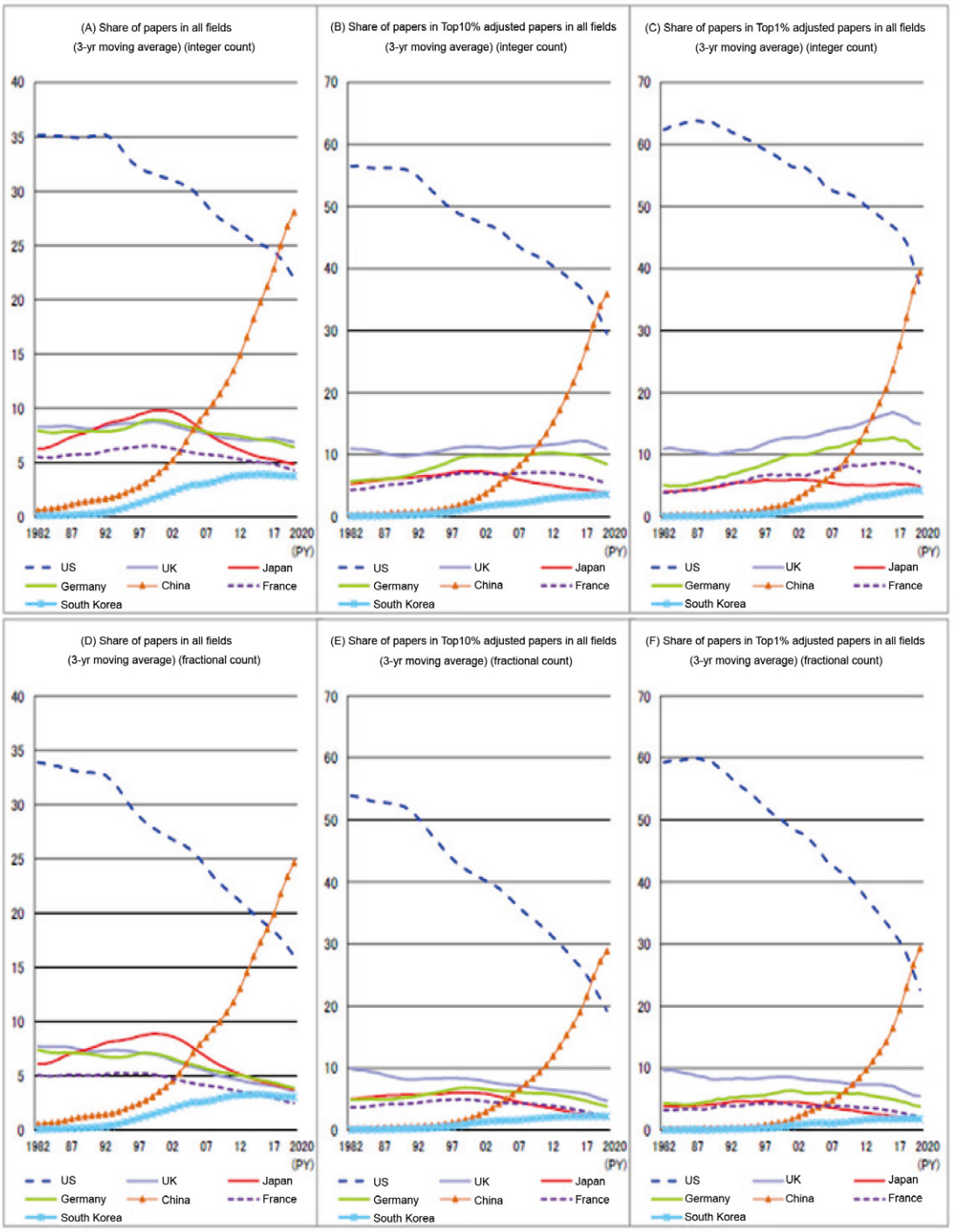

Figure 15: Quantity and Quality Indicators of Science and Technology Papers in Major Countries

Source: NISTEP, *Benchmarking Scientific Research 2023*

Main partner countries/regions for international co-authored papers (2009 to 2011; %)

China	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
All fields	US	Japan	UK	Canada	Australia	Germany	France	South Korea	Singapore	Taiwan
	43.7	10.6	9.6	7.8	7.7	7.7	5.0	4.6	4.5	3.4
Chemistry	US	Japan	Germany	UK	Australia	Canada	France	Singapore	South Korea	Taiwan
	35.1	11.9	8.1	7.0	6.4	6.1	5.5	5.1	4.9	2.9
Materials	US	Japan	Australia	Germany	UK	Singapore	South Korea	Canada	France	Sweden
	32.5	14.7	8.9	8.5	7.7	6.2	5.9	5.0	4.7	2.4
Physics	US	Germany	Japan	UK	France	South Korea	Australia	Russia	Canada	Singapore
	42.7	15.9	14.1	10.4	9.8	7.4	6.5	6.4	6.3	6.1
Computing & Math	US	Canada	UK	Australia	Japan	Singapore	Taiwan	France	South Korea	Germany
	38.6	9.5	8.3	8.0	6.3	5.7	5.6	5.6	5.0	4.2
Engineering	US	UK	Australia	Canada	Japan	Singapore	France	South Korea	Taiwan	Germany
	33.7	14.8	9.8	9.6	8.3	7.7	3.8	3.7	3.5	3.3
Environmental & Earth Sciences	US	Canada	Japan	UK	Australia	Germany	France	Taiwan	Netherlands	South Korea
	46.7	10.8	10.4	9.7	9.4	8.6	4.9	3.4	3.1	2.8
Clinical Medicine	US	UK	Japan	Australia	Canada	Germany	South Korea	France	Singapore	Taiwan
	57.0	10.0	9.9	8.9	7.5	6.6	4.2	3.9	3.8	3.6
Basic Life Sciences	US	Japan	UK	Canada	Germany	Australia	South Korea	France	Netherlands	Singapore
	51.3	10.1	8.4	7.9	6.4	6.2	3.6	3.4	2.5	2.4

Main partner countries/regions for international co-authored papers (2019 to 2021; %)

China	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
All fields	US	UK	Australia	Canada	Germany	Japan	France	Singapore	South Korea	Pakistan
	39.2	12.5	10.7	7.5	7.5	6.3	4.5	4.4	4.0	3.8
Chemistry	US	UK	Australia	Germany	Japan	Canada	Singapore	South Korea	France	Pakistan
	32.6	9.1	8.9	7.9	7.4	6.4	4.9	4.5	4.2	3.7
Materials	US	Australia	UK	Germany	Japan	Singapore	Canada	South Korea	France	Taiwan
	33.5	12.7	10.1	7.4	7.4	6.9	5.2	4.6	3.2	2.9
Physics	US	Germany	UK	Japan	France	Italy	Australia	Russia	Spain	Canada
	42.1	17.8	16.6	11.8	10.8	9.3	8.9	8.3	7.3	6.9
Computing & Math	US	UK	Australia	Canada	Singapore	Taiwan	Japan	South Korea	Pakistan	France
	34.6	12.1	10.4	9.0	5.5	4.3	4.3	4.2	4.0	3.8
Engineering	US	UK	Australia	Canada	Singapore	Japan	Germany	Pakistan	South Korea	France
	29.8	15.9	11.5	8.0	5.6	4.8	3.7	3.3	3.3	3.1
Environmental & Earth Sciences	US	Australia	UK	Canada	Germany	Japan	France	Pakistan	Netherlands	South Korea
	38.8	12.4	12.3	9.0	8.4	5.3	4.8	4.5	3.7	3.1
Clinical Medicine	US	UK	Australia	Germany	Canada	Japan	Italy	Netherlands	France	Taiwan
	57.3	14.8	11.6	8.9	8.8	7.4	5.9	4.9	4.9	4.8
Basic Life Sciences	US	UK	Australia	Canada	Germany	Japan	Pakistan	France	South Korea	Netherlands
	47.1	9.7	8.8	7.2	7.2	5.4	4.9	4.0	3.3	3.0

Figure 16: China's Major International Coauthoring Partners and Each Country's Share of International Coauthored Papers

Source: NISTEP, *Benchmarking Scientific Research 2023*

(2) Patents

What is the situation with patents? According to the *China Intellectual Property Statistical Yearbook 2022* [44], the number of patent applications in 2022 was 1,619,000, an increase of 2.1% from the previous year. Of the total number of applications, domestic applications accounted for 1,465,000, or 90.4% of the total, and international applications for 155,000, or 9.6% of the total, with domestic applications thus dominating. The number of domestic applications increased by 2.6% over the previous year, while the number of international applications decreased by 2%. The number of applications under the Patent Cooperation Treaty was 74,000, an increase of 1.4% from the previous year.

In 2022, 798,000 patents were registered, 696,000 (87.2%) domestically, and 102,000 (12.8%) internationally.

The following chart gives the number of patent applications filed with the China National Intellectual Property

[44] https://www.cnipa.gov.cn/tjxx/jianbao/year2022/indexy.html

Administration and the percentage of applications by technology category.

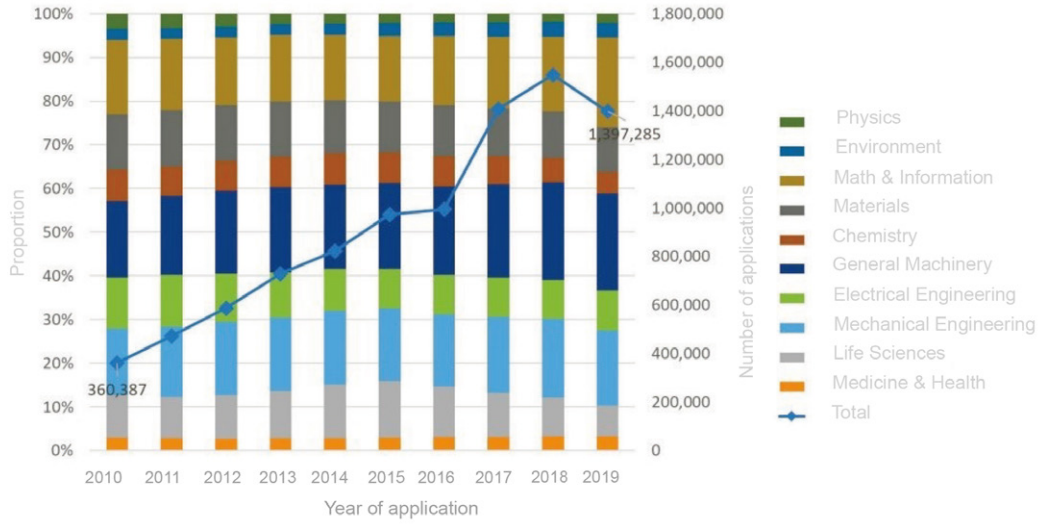

Figure 17: Trends in Patent Applications and Percentage of Applications by Technology Category

Source: APRC, *R&D Trends in the Asia and Pacific Through a Patent Database Analysis*[45]

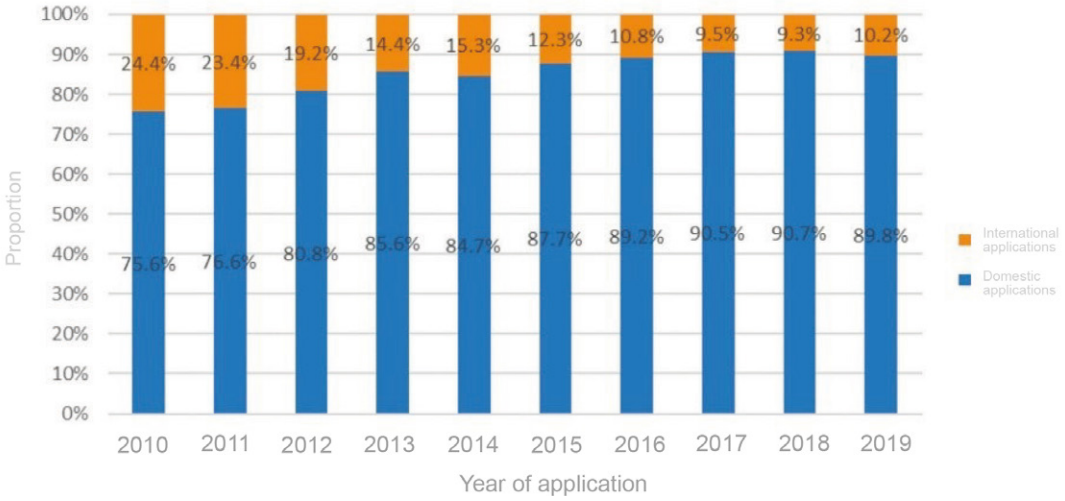

Figure 18: Trends in the Proportion of Patent Applications Filed

Source: APRC, *R&D Trends in the Asia and Pacific Through a Patent Database Analysis*

The number of domestic applications has been on the rise, increasing 4.6-fold to 1,254,399 in 2019 compared with 272,584 in 2010. As for technology categories, "general equipment," "mechanical engineering," and "mathematics and information" account for a high percentage, similar to that for patent applications overall[46].

45 https://spap.jst.go.jp/investigation/downloads/2021_br_06_05-06.pdf?utm_source=Manual&utm_medium=Manual&utm_campaign=PDFClick_2021_br_06_05-06.pdf

46 APRC, *R&D Trends in the Asia and Pacific Through a Patent Database Analysis*, p. 348.

According to the *Global Digital Science and Technology Development Research Report 2023* [47], jointly published by Ali Research and Zhipu AI, China ranked first in the world with 387,989 patent registrations from January 2012 to December 2021, 2.9 times that of the United States, which ranked second. However, the number of high-value patents (market value of $1 million or more) was eight times greater in the United States than in China. In the ranking of the number of high-value patents, China ranked fourth, behind the United States, Japan, and South Korea, with 98% of Chinese patents valued at less than $300,000. The report assessed China to be a patent power, but not a superpower.

In fact, among the companies that registered the top 10% of high-value patents globally, only Huawei (373 patents) and Alibaba (261 patents) were from China. These figures pale in comparison to the global top three, namely Samsung Electronics (1,061 patents), Microsoft (630 patents), and Google (592 patents).

In terms of technology trade value, both technology exports (income) and technology imports (expenditure) are on the rise, with technology exports of $6,644 million and technology imports of $34,328 million in 2019, for a balance of payments deficit of $27,684 million. Although the ratio of technology exports to technology imports increased by 13 percentage points between 2010 and 2019, reaching 19% in 2019, the balance of payments deficit widened by $15,474 million[48].

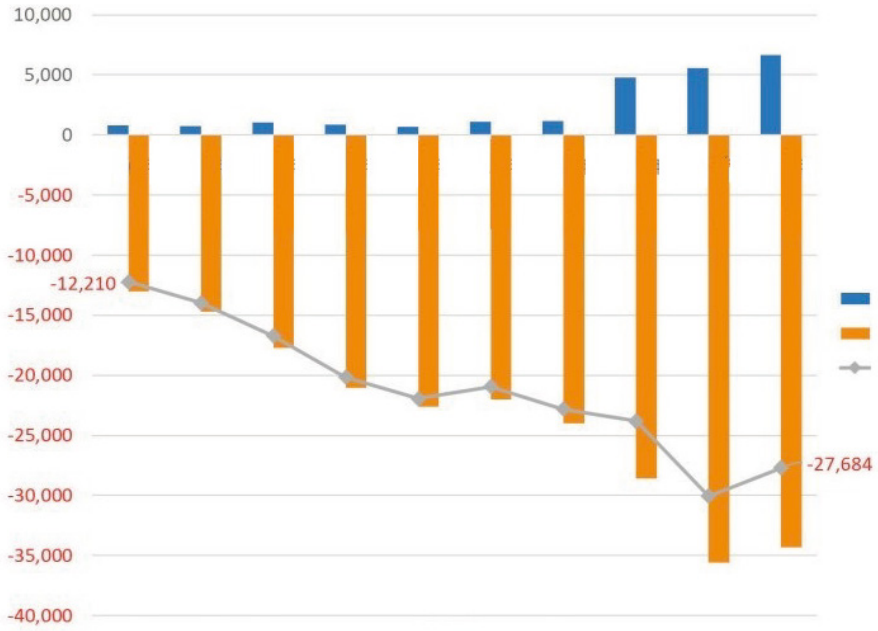

Figure 19: Technology Trade Value

Source: APRC, *R&D Trends in the Asia and Pacific Through a Patent Database Analysis*

47 https://arc-quan-hangzhou.oss-accelerate.aliyuncs.com/aliresearch/2023-04-14/723a5045c6954a48a7db4076885269ad/2023%E5%85%A8%E7%90% 83%E6%95%B0%E5%AD%97%E6%8A%80%E6%9C%AF%E5%8F%91%E5%B1%95%E7%A0%94%E7%A9%B6%E6%8A%A5%E5%91%8A.pdf

48 APRC, *R&D Trends in the Asia and Pacific Through a Patent Database Analysis*, p. 351.

1.6 Other Indicators

Clarivate publishes a Highly Cited Researchers list, which represents the number and quality of the world's most influential high-level talents; in the year 2022, 1,169 people from China were selected. This is remarkable progress compared to the 111 individuals selected in 2014. This number is second only to the United States (2,764), and when expressed as percentages, the United States has 38.3% and China has 16.2% of listed researchers. In terms of affiliations, the top 10 institutions with the most highly cited researchers included two in China: the Chinese Academy of Sciences (2nd in the world, 228 researchers) and Tsinghua University (5th in the world, 73 researchers).

The *Global Digital Science and Technology Development Research Report 2023* [49], jointly published by Ali Research and Zhipu AI, analyzes digital STI talents in each country. "Digital STI talents" refers to people who have specialized knowledge and skills in ICT science and technology fields such as 5G, big data, IoT, artificial intelligence, and cloud computing, or who are capable of research that spans ICT and other fields.

The AMiner science and technology information system[50], operated by Tsinghua University, registers STI talents in various fields around the world. Of the 774,710 personnel registered in this system, 127,529, or 17% of the total, are Chinese, ranking first. The United States came in second, with 84,239 personnel, or 11% of the total. Japan ranked third, with 15,364, about 2% of the total. On the other hand, when compared in terms of the number of digital STI talents with an h-index of 20 or above [51], the United States ranked first with 20,724 individuals (25%), China second with 7,146 (9%), and the United Kingdom third with 3,520 (4%). That is, in terms of the number of digital STI talents, China had 1.5 times that of the United States However, when compared in terms of the number of high-level personnel, the United States had 2.9 times that of China. Although China has an absolute advantage in terms of the quantity of STI talents, the lack of high-level talents can be understood as a challenge. A similar analysis was made in the *Global Talent Mobility and Development Report 2022* [52], published by CCG, which ranked China globally first in terms of the scale of its human resources, but 36th in the world in terms of the quality of its human resources[53].

49 https://arc-quan-hangzhou.oss-accelerate.aliyuncs.com/aliresearch/2023-04-14/723a5045c6954a48a7db4076885269ad/2023%E5%85% A8% E7 % 90%83%E6%95%B0%E5%AD%97%E6%8A%80%E6%9C%AF%E5%8F%91%E5%B1%95%E7%A0%94%E7%A9%B6%E6%8A %A5%E5%91%8A.pdf

50 https://www.aminer.cn/

51 The h-index, known as a balanced measure of research quality and quantity, indicates the relative contribution of a scientist to research based on their number of publications and citations. The definition is "the maximum value of *h* such that the given author/journal has published at least *h* papers that have each been cited at least *h* times." The higher an author's number, the more influence their papers are considered to have. Note that high-level talents are known to have an h-index of 20 or higher.

52 https://book.yunzhan365.com/qcaw/vvjn/mobile/index.html

53 The scale is evaluated using the World Bank world development indicators (WDIs) "number of workers with higher education" and "number of scientific research personnel" as indicators. Quality is evaluated using the WDIs "number of people with higher education per 10,000 workers" and "number of scientific research personnel per 10,000 employed people" as indicators.

2 Policy for Nurturing and Supporting STI Talents in China

Every five years, China releases a Five-Year Plan, which constitutes the basic policy for national economic and social development for the succeeding term. The period from 2021 to 2025 falls under the 14th Five-Year Plan[54]. We will now describe the major policies that China is implementing during the 14th Five-Year Plan period (2021-2025) to nurture and support its STI talents.

2.1 Contents of the 14th Five-Year Plan Regarding STI Talents

The 14th Five-Year Plan aims to build a science and technology powerhouse and an innovation-oriented nation through "self-reliance and self-improvement" of science and technology. The goals of the 14th Five-Year Plan as regards STI talents, are, in brief, as follows: to attract excellent human resources from home and abroad; to reform systems for human resource development along the chain of "human resource discovery - development - utilization - evaluation - encouragement," with a focus on raising quality; and to produce numerous human resources who can work globally.

In the context of intensifying U.S.-China technological competition, technological self-reliance is being emphasized; high-level human resource development is an important task in achieving such self-reliance. The Chinese government is emphasizing the improvement of innovation competencies of STI talents and the establishment of global talent bases (hubs). The four core science and technology projects of the 14th Five-Year Plan are: strengthening national strategic science and technology capabilities; enhancing the technological innovation capabilities of enterprises; improving the innovation skills of STI talents; and building science and technology innovation systems.

In addition, the following issues are highlighted with regard to improving the innovation competencies of STI talents.

54 Full text: https://spc.jst.go.jp/policy/national_policy/downloads/r_gvm_2022.pdf

Table 20: Issues to be Promoted in the 14th Five-Year Plan for Enhancing the Innovation Competencies of STI Talents

	Main Content
Issue 1 Building a high-level talent pool	**(1) Nurturing top-class international strategic talents, STI leaders, and innovation teams; nurturing internationally competitive young STI talents, and next-generation talents** • Stress on talent development through key STI posts and key innovation centers • Support for creation of postdoc innovation posts
	(2) Strengthening the development of innovative, applied, and skilled talents • Implementing refresher projects and up skilling activities; strengthening high-level, highly skilled engineering and technical teams
	(3) Strengthening development of outstanding students in basic fields • Creating centers for basic fields in mathematics, physics, and biology, etc. • Creating centers for cutting-edge science
	(4) Supporting foreign high-level talents to find employment, start businesses, and engage in STI research and interchange in China • Enhancing the permanent residency system for foreign citizens, and examining the creation of system to intake overseas STI personnel
Issue 2 Reforming the talent assessment system and strengthening incentives	**(1) Reforming talent assessment and incentive systems** • Creating sound systems for assessing STI talents, with the emphasis on innovation capabilities, quality, effectiveness, and contribution • Constructing remuneration systems that adequately factor in assessments of factors of innovation such as knowledge and technical skills
	(2) Selecting and utilizing talents with leadership qualities and excellent skills; expanding researchers' autonomy in use of research funding • Granting researchers autonomy in deciding technical approach and use of expenses • Expanding the "Green Lane" in research management (i.e., simplifying administrative procedures so that research projects are processed through simplified, expedited, safe channels)
	(3) Implementing distributive policies that aim to enhance regard for knowledge • Perfecting mechanisms for sharing rights over outcomes of employee inventions • Granting of rights over, or granting of long-term ownership of, outcomes of employee scientific and technical inventions
	(4) Deepening reforms to the Academician system
Issue 3 Optimizing the innovation, start-up, and creation ecosystem	**(1) Fully committing to the scientific spirit for a new era, strengthening honesty and credibility-building in scientific research, and creating a sound body of scientific and technical theory**
	(2) Securing property rights and innovation profits for entrepreneurs
	(3) Strengthening the dissemination of science and culture

As will be discussed in more detail later in this report, the following changes have emerged in China's STI talent development policy in recent years, partly against the background of U.S.-China friction.

(1) There are increasing numbers of policies to encourage domestic human resource development, especially the development of young talents. Due to US-China friction, cutting-edge research fields and strategic fields such as semiconductors, artificial intelligence, and quantum science and technology are being forced to develop their own technologies. Thus, efforts are being made to develop researchers domestically.

(2) The emphasis is on securing high-level STI talents, known as "high-quality, precise, cutting-edge human resources."

(3) The policy of attracting foreign talent continues, but this has been withheld from the public to some extent.

2.2 Domestic Policies for Nurturing and Supporting STI Talents

The Chinese government has released a number of individual policies designed to nurture excellent domestic STI talents, from young researchers and female researchers to basic research personnel.

(1)Policy for nurturing young STI talents

Conventionally, China has evaluated talents based on academic background, post and work history, awards, number of papers published, and whether or not they have a title. This has created a system that puts younger talents at a disadvantage. However, the Chinese government declared that, starting in 2018, it would completely reform the evaluation system based on the number of papers published, work history, academic history, and awards received (commonly known as the "Four-Recognitions-Only")[55]. In other words, the reform has aimed[56] to "break through the Four-Recognitions-Only" so that these four indicators are not referred to when evaluating human resources.

Since declaring the reform of the evaluation system, the Chinese government has launched a number of policies to foster young STI talents, starting in 2021[57]. The common thread that runs through these policies is the creation of an environment that facilitates the success of young people and grants them more opportunities.

Some Measures on Further Promoting the Development and Use of Young Science and Technology Talents[58], announced by the State Council in 2023, presented the most specific indicators. The following four points were emphasized.

(i) Supporting young STI talents in playing major roles in national key science and technology projects

In order to enable young researchers to play an active role as Principal Investigators (PIs) in funding projects and

55 October 2018, Ministry of Science and Technology, Ministry of Education, Ministry of Human Resources and Social Security, etc., "Notice on Reforming the System of Evaluation by Publications, Employment History, Academic Career, and Awards"

56 For more information, see APRC, *The Paths of the Policies and Measures Taken by the Chinese Government for Strengthening Basic Research and Improving Research Managements*, https://spap.jst.go.jp/investigation/downloads/2021_rr_01.pdf?utm_source=Manual&utm_medium=Manual&utm_campaign=PDFClick_2021_rr_01.pdf.

57 Examples include *Long-Term Training Goals for Leading Science and Technology Talents* (2021), *Guiding Opinions on Supporting Innovation and Foundation of University Students* (2021), *Initiatives in the Overall Development of Young Science and Technology Talents* (2022), and *Some Measures on Further Promoting the Development and Use of Young Science and Technology Talents* (2023).

58 Full text: http://www.moe.gov.cn/jyb_xxgk/moe_1777/moe_1778/202308/t20230828_1076413.html

science and technology-related projects, the policy stipulates that "Young STI talents will be actively deployed in projects to resolve national key science and technology issues and core and urgent science and technology issues, and, as a general rule, 50% or more of PIs will be young STI talents under the age of 40." Young STI talents are also encouraged to take on innovation tasks in technologies that integrate disciplines and fields, and it is stressed that ministries and agencies should take measures to ensure that young researchers are not subject to various restrictions (age, academic background, etc.) imposed under national science and technology projects. The National Natural Science Foundation of China (NSFC) will also continue to expand the scale of its financial support for young STI talents, so that support for youth-led projects will account for more than 45% of all NSFC funding projects. The NSFC will also support young STI talents to carry out core technology, advanced science, and cross-science research.

(ii) Expanding the percentage of young STI talents participating in national key R&D projects

The policy of increasing the number of projects for young talents in national R&D projects was also announced. In order to increase the proportion of youth-led initiatives in national key R&D projects, the age limit for Project Directors was lowered to 40, and restrictions on positions and educational backgrounds were abolished. Outstanding young scientific research teams that have received positive evaluations in past funding projects will be entrusted with projects directly, without going through a funding agency. They will be provided with ongoing support and allowed to use expenses under the *bao gan zhi* (joint in-kind/cash support) system. (This system places as few restrictions as possible on percentages and use pathways of expenses, thereby increasing flexibility and encouraging researchers to be more independent).

(iii) Actively training and utilizing young STI talents through the National Technology Innovation Centers

Young STI talents are encouraged to take the initiative in scientific research projects at the national technology innovation centers, and each center is expected set a target of at least 60% of all research being conducted with young STI talents aged 40 or under in charge. New indicators have been presented for the evaluation of innovation at each center. These include the staffing ratio of young STI talents, the percentage of young staff in charge of projects, and the generation of results by young researchers.

(iv) Relaxing evaluation criteria for young STI talents

In evaluating personnel at research institutions, number of publications, post, etc. are not to be used as evaluation indices; stage-by-stage evaluations (primary, mid-term, and final, etc.) and examinations are to be eliminated or simplified as much as possible.

(2)Basic policy on nurturing research personnel

The NSFC, the funding agency in charge of support for basic research, discloses its policy on support for basic research every year, including the "14th Five-Year Plan at the NSFC[59]," and touches on the following support measures for human resource development in the field of basic research.

The NSFC has decided to expand its support for the Outstanding Youth Project, in which excellent young basic research personnel are selected, from 2024. Support will be expanded from a maximum of 5 years and RMB 4 million

[59] Full text: https://www.nsfc.gov.cn/publish/portal0/tab1392/

(80 million yen) to a maximum of 15 years and RMB 30 million (600 million yen). The specific support method is as follows: An initial support of RMB 4 million (80 million yen) will be provided over a period of five years, and projects that are evaluated as being in the top 20% at the end of the program will receive an additional RMB 8 million (160 million yen) over a period of five years. Subsequently, projects that are evaluated as being in the top 50% will receive an additional 18 million yuan (360 million yen) over a period of five years. Because basic research involves projects over the long term, the extensive support provided enables researchers to continue their research with confidence. The age limit to apply for the Outstanding Youth Project is 45, but starting in 2024, women up to the age of 48 are eligible.

The NSFC has set a goal for the five years from 2021 of "creating innovation clusters of outstanding scientific and technological talents, young talents and high-level talents in the field of basic research, improving basic research talent training mechanisms, and raising the scale and level of talents."

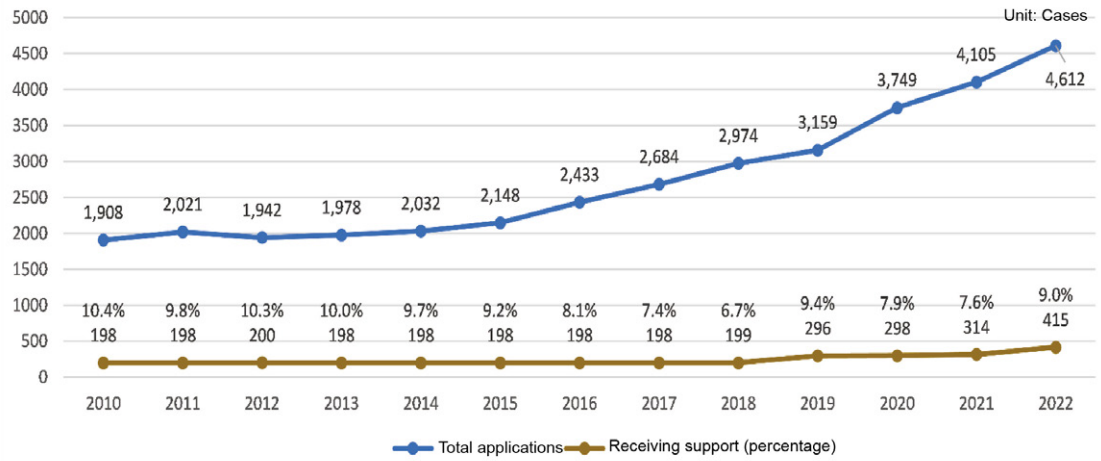

Figure 21: Outstanding Youth Project: Trends in Number of Applications Accepted and Receiving Support

Source: A2PPC, *Survey of Funding Trends and Program Content in China*

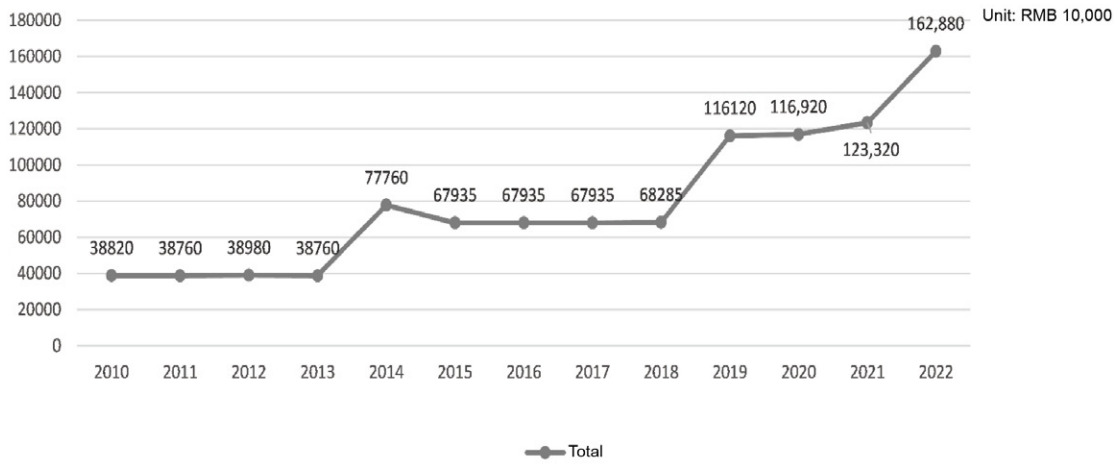

Figure 22: Outstanding Youth Project: Trends in Amounts of Support

Source: APPC, *Survey of Funding Trends and Program Content in China*

(3) Policy for nurturing skilled (technical) talents

In China, "skilled talents"[60] refers to people who have specialized knowledge and skills and a certain level of operational skills, and who can utilize their skills and abilities in actual work. Front-line workers in the manufacturing and service industries fall under the category of skilled talents.

In 2021, the Ministry of Human Resources and Social Security released the Implementation Plan for the "Skills in China" Initiative[61] and set a goal of cultivating more than 40 million skilled talents during the 14th Five-Year Plan, with skilled talents to account for 30% of the total workforce.

The following year, the State Council formulated "Opinions on Strengthening the Building of a Highly Skilled Workforce for the New Era"[62] and clarified that, in addition to the existing target, the proportion of highly skilled talents[63] should be 1/3 of the total skilled talents, aiming not only to increase the quantity (number) of skilled talents but also to improve their quality. "Highly skilled talents" mainly refers to personnel who are qualified as engineers or high-level technicians; in the case of China, graduates of higher vocational education schools are granted these qualifications. Even if they do not have specific qualifications, they are recognized as highly skilled talents if they possess excellent creative abilities, adaptability, and high skill levels.

In order to nurture highly skilled talents, the government has announced that it will establish a system in which "companies, schools, and the government" will collaborate. Looking at the roles of each stakeholder, the government will utilize existing funding channels to support projects to cultivate high-level STI talents, while universities will establish and improve departments and curricula that can nurture STI talents. Companies will provide technical allowances, apprentice training allowances, team leader allowances, and other allowances to strengthen encouragement and support for high-level technical personnel and improve the salary system so that technical personnel receive a salary commensurate with their contributions, abilities, and achievements.

(4) Support for female STI talents

In China, the percentage of female researchers is 26%, which is higher than in Japan, but lower than in other countries. In 2021, 13 ministries, including the Ministry of Science and Technology, released the Guideline on Implementing the Women's Action for Scientific and Technological Innovation[64]. The aim is to prevent career interruptions due to childbirth and childcare and to create a work environment that facilitates women's return to work

Under this initiative, the conditions for female researchers to apply for various funding projects, including the NSFC projects mentioned earlier, are to be relaxed. This is especially so for restrictions related to age and background. Also, all things being equal, women are to be given priority in the selection process. For female researchers who are pregnant or parenting, in addition to the above relaxed conditions, further consideration will be given in extending the duration of the project and in the review and evaluation process.

The government requires each university to establish a nursing room for female researchers (especially those who are pregnant or breastfeeding), provide childcare services, and implement a flexi-time system. These measures

60 Definitions are available at https://baike.baidu.com/item/%E6%8A%80%E8%83%BD%E4%BA%BA%E6%89%8D/6277901?fr=ge_ala

61 Full text: https://www.gov.cn/zhengce/zhengceku/2021-07/06/content_5622619.htm?_zbs_baidu_bk

62 Full text: https://www.gov.cn/zhengce/2022-10/07/content_5716030.htm

63 https://baike.baidu.com/item/%E9%AB%98%E6%8A%80%E8%83%BD%E4%BA%BA%E6%89%8D/6607877?fr=ge_ala

64 Full text: https://www.gov.cn/zhengce/zhengceku/2021-07/19/content_5625925.htm?eqid=d8800fc8000593d1000000066462e8c3

are included in evaluation indicators for universities. In addition, the initiative seeks to relax various conditions for researchers who are pregnant or raising children (especially researchers who are breastfeeding) in hiring, returning to work, and having their work evaluated.

2.3 Policies to Attract Excellent Foreign STI Talents

Although the government's policy of attracting overseas human resources has become less conspicuous in the past, as with the Thousand Talents Plan, the policy of attracting excellent overseas human resources has not been suspended and is still being actively implemented in various regions.

In recent years, the three words "high-quality, precise, cutting-edge" are often seen in the human resource policies put forward by the Chinese government. This phrase refers to personnel with good academic backgrounds, excellent technical skills, and advanced STI knowledge and skills. The Report on Global Talent Mobility Trends and Development, released in China in November 2022[65], analyzed China's competitiveness in human resources. It found that the scale (number) of China's human resources and its treatment of human resources (environment) were rated at 100 and 79.08 points, respectively, while the quality of human resources was rated at only 18.83 points. One of the reasons for the low quality rating was the lack of "high-quality, precise, cutting-edge" personnel, so-called high-level talents. When measured as indicators such as the number of people with higher education per 10,000 workers and the number of scientific researchers among the employed workforce, China's numbers lower than those for the United States, European countries, and, in Asia, Singapore, South Korea, and Japan.

Given the current shortage of high-level talents, even though high-level human resource development is being strengthened domestically, excellent human resources from overseas will continue to be an important source of human resources to meet growing industrial needs.

To encourage young talents from abroad to conduct research in China, the NSFC reformed its youth-oriented projects from 2020 to allow overseas researchers to apply, and also launched a new program called the Excellent Young Scientists Fund Program (Overseas) from 2021 to attract young talents from overseas to China. The program is open only to persons under 40 who have achieved distinction in the natural sciences and process technology, have a doctorate, and have worked for at least 36 months in a full-time position at a university or research institution abroad. The period of support is three years, and the amount of support is about RMB 1 to 3 million (20 to 60 million yen).

Furthermore, the cities of Beijing, Shanghai, Guangzhou, Chongqing, Hangzhou, and Shenzhen have announced a two-year Project to Attract High-Level Foreign Talents[66] starting in 2023. For high-level foreign talents, the project provides one-stop support for science and technology innovation and business start-up activities, as well as permanent residency and naturalization if desired. In the case of Shanghai, work permits were issued to a cumulative total of 370,000 foreigners by the end of 2022, of which 71,000 were classified as high-level talents. The six cities listed above have announced that they will target "high-quality, precise, cutting-edge" and "urgently required" talents. The term "urgently required" refers to human resources who are urgently needed in core scientific and technological fields but are in short supply. The criteria for the certification of "high-quality, precise, cutting-edge" and "urgently required"

65 Full text: https://book.yunzhan365.com/qcaw/vvjn/mobile/index.html

66 https://www.most.gov.cn/xxgk/xinxifenlei/fdzdgknr/fgzc/gfxwj/gfxwj2022/202301/t20230106_184169.html

talents are given in the table below.

Table 23: Types of Foreign High-Level Talents and Criteria for Certification

Classification	Contents and certification criteria
High-quality, precise, cutting-edge personnel	**(1) Those selected for the government's attraction plan:** Those who have been selected for a talent attraction plan approved by the competent agencies for human resources, such as the Organization Department of the Central Committee of the Chinese Communist Party, and the Ministry of Human Resources and Social Security; those who have been selected for the National High-end Foreign Experts Recruitment Plan (former Thousand Talents Plan, etc.), a foreign high-level expert attraction plan, the Changjiang Scholars Encouragement Plan, etc.
	(2) Those who have a track record of conforming to international standards: Winners of Nobel Prizes, Fields Medals, and other world-class science and technology awards; members of well-known international academic institutions; high-level personnel at overseas national laboratories; core research personnel at R&D centers of the world's 500 largest companies, etc.
	(3) Market-oriented foreign human resources: Persons in high-level managerial or technical positions at the global headquarters of the world's 500 largest corporations, national high-tech enterprises, unicorn enterprises, etc.; professional personnel in managerial or associate professor positions or above in universities, research institutes, 3A general hospitals and foreign-invested hospitals; and foreign personnel whose income is six times the average income of the working population in the relevant region.
	(4) Innovation founding personnel: Managers of national university science and technology complexes and national science and technology incubators; founders of enterprises that use intellectual property rights such as major technological inventions and patents or technological investment methods, with a cumulative investment size of at least $500,000 and an individual shareholding of at least 30%, etc.
	(5) Excellent young talents: Post-doctoral researchers under 40 years old at universities, research institutes, companies, and medical institutions in China, and PhDs in STEM fields under 40 years old who graduated from top 200 universities worldwide in the last 5 years.
"Urgently required" talents	Persons with expertise in the fields of next-generation information technology, integrated circuits, artificial intelligence, bio-health, digital economy, new energy, new materials, education, finance, etc.

Source: Certification Standards for "High-Quality, Precise, Cutting-Edge" and "Urgently Required" Talents

To enable foreign talents to stay in China for extended periods of time, the State Council formulated the "Measures

on Encouraging Foreigners to Establish and Invest in R&D Centers"[67] in 2023, first relaxing visa application and screening conditions, and announcing simplified procedures for long-term stays. The government has also focused on improving the convenience of working in China by simplifying the procedures for changing work locations.

In order to encourage foreign talents to settle in the country, the government encourages foreign human resources to apply for professional positions, and allows them to participate in salary-raise negotiations. Many preferential measures have been established in the salary raise screening process, such as relaxing career and age requirements, using overseas work experience and achievements as the basis for evaluation, and allowing persons meeting certain conditions to apply directly for high-level positions.

China has long been known for its excellent benefits and incentives for foreign personnel, but the latest measures reemphasize the provision of housing, employment for spouses, solutions to children's educational issues, and medical security for foreign personnel. It has also specified support for and promotion of participation in priority R&D projects conducted by the state and enhanced convenience of payment in receiving salary bonuses and other benefits.

Thus, high-level foreign talents are still welcomed by China, and they are promised not only good salaries but also benefits in all aspects of life when they take up research and other jobs in China.

67 https://www.gov.cn/zhengce/content/2023-01/18/content_5737692.htm

3 Program for Nurturing and Supporting STI Talents

We have discussed a series of policies for nurturing and supporting STI talents. Under these policies, what kind of programs for fostering and supporting STI talents have been implemented? From here, we will introduce some of the major programs in China for nurturing and supporting STI talents. Because of the vast number of such programs in China, we will focus on large-scale, well-known programs with large impacts.

Before we get into the introduction of individual programs, a trend in recent years for funding programs as a whole is that support for young talents has been greatly enhanced.

In the case of the NSFC, the major programs conducted under its aegis are the Young Scientists Fund Program, the Priority Scientists Fund Program, and the National Excellent Young Scientists Fund Program. A comparison of the numbers of projects supported by these programs in 2018 and 2022 shows increases of 4591, 230, and 216 projects supported, respectively, representing respective increases of 26%, 58%, and 109%. In addition, according to data from the Ministry of Science and Technology[68], there were a total of 235 projects supporting young scientists in the National Key R&D Program for the period 2016 to 2020, with a total of RMB 874 million (17.48 billion yen) in research funding supported and RMB 3.72 million (74.4 million yen) in support per project.

In addition, more than 80% of the areas in the 14th Five-Year National Priority R&D Program (2021) Index have young scientist projects, and 230 young scientist teams were supported in 2021 alone. Under the National Technology Innovation Centers (Hubs) Program, the percentage of projects handled by young STI talents under the age of 40 should not be less than 60% in principle.

From here, we will introduce specific human resource support programs such as the 10,000,000 Person Project, but we will briefly touch on the background of human resource plans (projects) as part of the background of human resource development for science and technology in China. As is well known, with the reform and opening up policy, many Chinese left the country to study in developed countries. Initially, there were large differences in income levels and living standards at home and abroad, and few people wanted to return to China. It was therefore difficult for China to secure talented personnel. The “Hundred People Plan” was put forth as a solution to this problem, with the goal of securing about one hundred young leaders from within China and abroad with outstanding research and technological capabilities. Subsequently, China demonstrated steady development, including accession to the WTO, but made no progress in introducing or securing core advanced technologies; industrial innovation and breakthroughs in core technologies emerged as major issues. To this end, the “Thousand Talents Plan” was launched to attract excellent high-level foreign talents to the country. In fact, it managed to attract far more than 1,000 people. The 10,000,000 Person Project is a strategy that has since been developed with the aim of further developing China into a nation of innovation.

In particular, the United States-China trade friction since 2018 has led to a surge in demand for high-level personnel

68 https://baijiahao.baidu.com/s?id=1699387308992725349&wfr=spider&for=pc

with core skills related to China's security and economic security. The Chinese government is actively promoting institutional reforms to promote domestic start-ups and innovation, and to evaluate, train, and give preferential treatment to high-level talents.

3.1 Domestic Programs

3.1.1 10,000,000 Person Project [69]

The official name of the 10,000,000 Person Project is the "National High-Level Talent Special Support Program," a program to nurture and support more than 10,000 outstanding talents, leaders, and youth elites in the fields of natural science and engineering technology in the country over a period of about 10 years from 2012. In terms of actual results, 5,626 people have been assisted through four recruitment rounds to date.

The 10,000,000 Person Project supports three categories of human resources, the details of which are as follows.

(1) Outstanding Talents: 100 scientists who have made new discoveries in prior technologies and who can develop to become world-class scientists are supported.

(2) Leadership Talents: 8,000 innovative start-up talents necessary for the development of the nation's industry, science and technology are supported.

(3) Youth Elite Talents: 2,000 outstanding young human resources under the age of 35 with major potential in basic science fields are supported.

Universities, research institutes, and science and technology-related companies may recommend applicants to apply for the 10,000,000 Person Project if it is determined that they fall under one of the three categories given above. Those recommended by their home institutions submit their applications through the government's designated platform, and are then selected through evaluation by experts, interviews, and other processes.

In the case of Outstanding Talents, a scientist support office will be established to support their work, and operations are under the responsibility of a Chief Scientist[70]. There is no set ceiling on expenses; support is provided according to need. A variety of incentives are provided for Leadership Talents, including stock and corporate pensions, and also support for the establishment of research teams. Youth Elite Talents are supported by the central government with dedicated funds for young talents, and they are granted autonomy to freely select their own themes.

Those who receive support from the 10,000,000 Person Project are granted the title of "National Special Support Personnel." In China, a title is not just an honor, but an important factor of significant impact on one's subsequent career and annual income.

In addition to the above incentives, the project also offers a variety of other benefits, such as start-up capital, office

[69] For more information on the 10,000,000 Person Project, see the links below.
https://zqb.cyol.com/html/2012-09/20/nw.D110000zgqnb_20120920_3-01.htm; https://baike.baidu.com/item/%E5%9B%BD%E5%AE%B6%E9%AB%98%E5 %B1%82%E6%AC%A1%E4%BA%BA%E6%89%8D%E7%89%B9%E6%AE%8A%E6%94%AF%E6%8C%81%E8%AE%A1%E5%88%92/3584383?fr=ge_ala; https://wenda.bendibao. com/life/2019911/62382.shtm; https://mp.weixin.qq.com/s?__biz=MzIzNjgwMjk4Mw==&mid=2247487172&idx=3&sn=fdc2ca2cc1bebe6a 1dba622999deadac&chksm=e8d3080cdfa4811a08b44beea45fa3ad49a3db1baa913f7d3844aa6c997e569c3b122959d3df&scene=27

[70] This is one of the ways to operate (manage) a funding project. The Chief Scientist, who is equivalent to a PI, decides on the technical approach, composition of team members, etc., and is also given autonomy in resource allocation, use of expenses, etc.

and research facilities, and housing. As a result, there are increasing numbers of overseas returnees who see this as an opportunity to become key players in next-generation industries, earn high incomes, and succeed at founding startups is on the rise[71].

3.1.2 National 100,000,000 Person Project[72]

The official name of this program is the "National Key Talent Development Plan - National 100,000,000 Talent Project." This joint program by seven departments of the Ministry of Science and Technology and other ministries was established in 1995 to nurture young scientific and technological leaders, and continues to this day. Since the goal was to train young people, the program was initially targeted at those under the age of 45. By the year 2000, the project was named the "100,000,000 Person Project." It aimed at fostering **100** outstanding young scientists aged around 45 with global influence in leading scientific fields, **1,000** academically advantaged domestic excellent young talents under the age of 45 who can lead technology, and about **10,000** young people between 30 and 45 who have excellent grades and outstanding research results and who can become leaders of the next generation.

One thing that differs from the 10,000,000 Person Project is its focus on "nurturing" talents. While the goal of the 10,000,000 Person Project is to select excellent talents, the National 10,000,000 Process aims to develop talents who can lead the next generation.

The selection process for the National 100,000,000 Person Project is similar to that for the 10,000,000 Person Project. First, when an individual is deemed suitable for the talent profile sought, based on age and performance, their organization recommends the application. The individual then submits it through the relevant department (designated route), where it is evaluated by experts before a decision is made.

The actual data show that many of those selected have received science and technology-related awards or have studied abroad.

With the changing times, the National 100,000,000 Person Project has continued to evolve. In the first phase (1995–1997), the focus was on selecting and training 5,000 to 6,000 excellent talents aged 30 to 40. In the second phase (1998–2011), the top priority was to train world-class experts, scholars, and engineers—approximately 50 in first-class departments and 500 in second-class departments—who would have a significant impact on the national economy and social development From the third phase (2012 onward), the program is designed to cultivate national-level talents, i.e., about 4,000 middle-aged youth leaders (under 50 years old) who will lead the development of advanced science and technology themes, national key science and technology, and core areas. According to the Ministry of Human Resources and Social Security, approximately 6,500 talents have been selected for national-level departments by the end of 2021.

Those selected for the 100,000,000 Person Project will be involved in many research projects and projects at

71 Japan Economic Research Institute, *China's Current Status of Actively Accepting High-Level Talents from Japan and Abroad* (September 2022)

72 For more information on the National 100,000,000 Person Project, see the links below.
http://www.mohrss.gov.cn/SYrlzyhshbzb/rencairenshi/gzdt/202002/t20200210_359050.html;
http://www.mohrss.gov.cn/zyjsrygls/ZYJSRYGLSzhengcewenjian/201301/t20130115_82418.html;
https://baike.baidu.com/item/%E7%99%BE%E5%8D%83%E4%B8%87%E4%BA%BA%E6%89%8D%E5%B7%A5%E7%A8%8B/1616760; http://www.mohrss.gov.cn/xxgk 2020/fdzdgknr/ghtj/tj/ndtj/202206/W020220607572932236389.pdf

national key laboratories, postdoctoral scientific research flow stations[73], etc., to improve their research skills. They will also be given numerous opportunities for international exchange, such as academic conferences and domestic and international training programs, providing them with opportunities to develop into leaders who will support the advancement of science and technology. In fact, the young people selected for the 100,000,000 Person Project have been involved in many funding projects, including national key R&D projects, etc. Looking at the number of awards participants have received, 4,594 at the national level and 17,179 at the provincial level came through the 100,000,000 Person Project. The awards are particularly significant in the fields of aeronautics, manufacturing equipment, biotechnology, information and communications, and new energy materials.

As with the 10,000,000 Person Project, being selected for the 100,000,000 Person Project is a great honor (title) for each individual. This is advantageous for subsequent career development and annual income.

3.1.3 Basic Science Human Resources Development Base Program

The Basic Science Human Resources Development Base Program was created to foster human resources for basic research by designating several outstanding universities that produce a large amount of basic research results as centers of excellence and providing intensive support to them. This basic science base support program has a long history, having been in operation since 1991, and three base development programs have been progressed under its aegis.

(1) National Base Department Program for Basic Science Talent Development[74]

To develop human resources in basic research departments, 106 science department-specific bases have been designated and supported as "science bases" on five separate occasions since 1991. While there are also engineering, talent (integrated arts and sciences), and humanities bases, the number of science bases is the largest. Students at these bases are granted numerous research opportunities, including the ability to work with graduate students as part of a funding project. Many undergraduates can enter graduate school without taking exams[75] and continue to deepen their studies. Because they receive more favorable treatment in terms of education and research than students at non-base departments, higher standards are set in terms of student selection and administration.

[73] This refers to universities and research institutes that accept people with doctoral degrees and support them in pursuing postdoctoral positions. However, not all universities are qualified to do so, and only those departments that are recognized as first-class can accept them. In addition, to be recognized as a post-doctoral scientific research flow station, it is essential to have a high academic level, an excellent research environment, and a system that can support young research personnel.

[74] For more information about the National Base Department Program for Basic Science Talent Development, see http://www.moe.gov.cn/s78/A08/gjs_left/moe_1035/201001/t20100129_11121.html; https://baike.baidu.com/item/%E 5%9B%BD%E5%AE%B6%E5%9F%BA%E7%A1%80%E5%AD%A6%E7%A7%91%E4%BA%BA%E6%89%8D%E5%9F%B9%E5%85%BB%E5%9F%BA%E5%9C%B0/6999563?fr=ge_ala; http ://www.moe.edu.cn/publicfiles/business/htmlfiles/moe/s3855/201011/110813.html

[75] Not all base department students are exempt from exams, but many more are exempted compared with students in general departments. Many students go on to graduate school from base departments, but it is also possible for students to find employment if they so desire.

(2) Talent Development Centers for Basic Science Elites[76]

This project is being implemented by the Ministry of Education, starting in 2019, to develop elite talents in basic sciences. The project selects and supports outstanding departments.

Areas covered include mathematics, physics, chemistry, biological sciences, computer science, astronomy, geography, atmospheric science, marine science, geophysics, geology, psychology, basic medicine, philosophy, economics, Chinese language and literature, and history.

The selected centers receive government support funds to actively conduct international student exchange, research activities, academic exchange, social practice activities, and high-level teacher exchange activities at home and abroad.

A total of 288 centers have been selected through March 2023. According to the Ministry of Education, the goal of the project is to nurture elite human resources in basic science over a period of about 10 years, nurture researchers/scientists, and turn the designated centers into world-class scientific centers and centers of innovation.

The Ministry of Education requires each center to follow up on graduates, constantly improve its talent development methods through the establishment of a talent growth database, and periodically convene expert committees to evaluate the status of implementation, performance, and effectiveness of the use of expenses. Each center is devising systems that can more effectively support elite talents through the introduction of training mechanisms that support global growth and through mentor-mentee counseling.

(3) Centers of Advanced Science and Technology[77]

This program was launched in 2018 to encourage the establishment of centers of advanced science and technology at "double first-class" (world-class university and departments) institutions to develop basic science and foster talents in basic science fields. As of the end of 2022, there were 31 such centers, with fields including brain science, synthetic biology, nanotechnology, quantum science, and mobile communications. The Ministry of Education has set a goal of increasing the number of centers to 40 by 2025.

Since the aim is to concentrate on solving bottleneck issues in basic research and problems in cutting-edge science and technology at universities that have excellent research capabilities and a pool of excellent talents, many of the Centers of Advanced Science and Technology are located at institutions designated "Project 211 universities" or "Project 985 universities"[78]. The Centers of Advanced Science and Technology are actively attracting human resources from China and abroad, conducting interdisciplinary fusion research, and taking on challenging, cutting-edge technological issues.

[76] For more information about Talent Development Centers for Basic Science Elites, seehttps://baijiahao.baidu.com/s?id=1773577998426337084&wfr=spider&for=pc; https://baike.baidu.com/item/%E 6%95%99%E8%82%B2%E9%83%A8%E5%9F%BA%E7%A1%80%E5%AD%A6%E7%A7%91%E6%8B%94%E5%B0%96%E5%AD%A6%E7%94%9F%E5%9F%B9%E5%85%BB%E5%9F%BA%E5%9C %B0/53722556?fromtitle=%E5%9F%BA%E7%A1%80%E5%AD%A6%E7%A7%91%E6%8B%94%E5%B0%96%E5%AD%A6%E7%94%9F%E5%9F%B9%E5%85%BB%E5%9F%BA%E5%9C%B 0&fromid=53702352; http://www.moe.gov.cn/jyb_xxgk/s5743/s5744/A08/202111/t20211129_583154.html; http://www.moe.gov.cn/srcsite/A08/s7056/201810/t20181017_351895.html.

[77] For more information about Centers of Advanced Science and Technology, see http://www.moe.gov.cn/srcsite/A16/moe_784/201808/t20180801_344025.html; https://baijiahao.baidu.com/s?id= 1760489177477617405&wfr=spider&for=pc; https://baike.baidu.com/item/%E5%89%8D%E6%B2%BF%E7%A7%91%E5%AD%A6%E4%B8%AD%E5%BF%83/ See 23728695?fr=ge_ala.

[78] For more information about Project 211 and Project 985 universities, see https://spc.jst.go.jp/experiences/education_human/eh_2301.html

3.1.4 The 653 Process for the Nurturing of Technical Talents[79]

The 653 Process is a program launched in 2005 to develop technical talents. It was named after its goal of training 3 million people in five fields (advanced agriculture, modern manufacturing, information technology, energy technology, and modern management) over the six years to 2010.

Since 2021, the 653 Process has entered its second phase. It now aims to develop 1 million application-, innovation-, and technology-based talents each year in information technology, biotechnology, new energy, new materials, high-end equipment, new energy vehicles, aeronautical technology, marine technology, among other fields.

Specifically, the following four methods of cultivation are used.

(1) Conducting high-level training

The training is designed to develop groups of specialized technical talents with skills in competition and innovation. The program aims to develop approximately 20,000 high-level professional and technical talents and business management personnel by holding approximately 300 training sessions per year at a high level and on a small scale. Training sessions are designed to accurately capture the characteristics of each specialized field.

(2) Providing professional development training

With the study of theory (knowledge) related to advanced technology and the improvement of technical (practical) and innovation skills as its main content, the program develops 900,000 talents annually through training that combines theory and practice.

(3) Providing digital technology training

The program provides structured training and develops around 80,000 talents each year in areas such as AI, IoT, big data, cloud technology, smart manufacturing, and block chain.

(4) Providing continuing education for national-level technical talents

Two hundred national continuing education centers for professional and technical talents have been established nationwide to provide continuing education. In terms of actual results, 12.64 million refresher continuing education activities were conducted from 2011 to 2020 in nine advanced service industry sectors (food safety, intellectual property, logistics, etc.).

The above introduction of domestic STI talent development programs underway in China suggests the importance placed on STI talents and generous scale of investment in them. Since the 1990s, China has been continuously implementing programs to nurture and support young and elite talents. To develop talents in the fields of basic research and specialized technology, the country is constantly creating bases and developing training education every year.

China's programs in this area are characterized by concrete determination of the goals to be realized based on national and societal demands. They feature flexible updating and evolution of program content to enable the realization of such goals and ongoing program development. While it is claimed that these various programs have achieved remarkable results, if we look at the people who have been selected for them, we find that the majority

[79] For the 653 Process, see http://www.news.cn/fortune/2021-10/11/c_1127946072.htm; https://www.gov.cn/gzdt/2005-10/18/content_78967.htm; https:// baike.baidu.com/item/%E4%B8%93%E4%B8%9A%E6%8A%80%E6%9C%AF%E4%BA%BA%E6%89%8D%E7%9F%A5%E8%AF%86%E6%9B%B4%E6%96%B0%E5%B7%A5%E7%A8%8B/6039021?fr=ge_ala#reference-1.

are outstanding students and faculty members from prestigious universities. There are also winners of science and technology awards, people with experience of overseas study, and technical personnel from companies. It cannot be said that these people were able to achieve what they have simply because of the support of these programs. However, we can at least say that the programs have offered a springboard to individuals with potential, elite talent, and those who could be considered as future elite talent, so that they can take further leaps.

3.2 Programs Attracting Talents from Overseas

Here, let us introduce some of the programs that have been developed to attract excellent STI talents from overseas to China.

First, some background information is provided[80]. China began attracting excellent foreign talents on a large scale in the 1980s. The Cultural Revolution, which began in 1966, effectively wiped out the education sector, resulting in what can be called a lost decade. This hiatus of just over ten years in duration (which China calls the "talent fault-line phenomenon") led to a serious talent shortage in the 1980s. At the time, Deng Xiaoping stressed that "We must respect knowledge and respect trained personnel," and this guiding philosophy became the central idea behind the development of human resources programs. At that time, the Chinese Academy of Sciences was the most active promoter of programs to attract talent. One example is the Hundred People Plan. The Chinese Academy of Sciences provided generous research funding support to researchers selected through the Hundred People Plan, despite the difficult financial situation. Its success led to the subsequent Thousand Talents Plan and 10,000,000 Person Project.

The NSFC's Outstanding Youth Project was also initiated during this period. The Outstanding Youth Project helped facilitate the return to China of those who had earned their degrees abroad, in that it targeted individuals who were wondering whether or not to repatriate.

The biggest difference between the 2010s, when the Thousand Talents Plan was in full swing, and today is that while the past focus was on attracting Chinese talent abroad (the "sea turtle policy"), recent years have seen China attracting talent from around the world, regardless of nationality.

3.2.1 Changjiang Scholars Encouragement Plan[81]

In 1998, as ministries and agencies actively launched human resource policies, the Ministry of Education, in collaboration with Li Ka-shing (founder and Chairperson of Cheung Kong Holdings, the largest business group in Hong Kong), announced the implementation of the Changjiang Scholars Encouragement Plan The program has been in operation for many years and has relatively high visibility domestically and abroad.

When the program began, it featured special invitation professorships (full-time), chair professorships (part-time), and the Changjiang Scholar Award. The Chair Professors were enrolled on a part-time basis and did not hold classes;

[80] For background, see Korea Institute for International Economic Policy, *A Study of China's Thousand Talents Plan* (2013), pp. 32-35.

[81] For more information on the Changjiang Scholars Encouragement Plan, see the links below. http://www.moe.gov.cn/srcsite/A04/s8132/201809/t20180921_349638.html?eqid=d0abaa7f000995120000004642d248f; http://talent.zju.edu. cn/2022/1013/c70843a2646009/page.htm; http://www.chinahrd.net/blog/315/1128387/314385.html; https://baijiahao.baidu.com/s?id= 1786764386118791943&wfr=spider&for=pc; https://baike.baidu.com/item/%E9%95%BF%E6%B1%9F%E5%AD%A6%E8%80%85%E5%A5%96%E5%8A%B1%E8%AE%A1%E5%88%92/1033172?fr=ge_ala#reference-2; http://www.gaosan.com/wenwen/5154.html

however, they offered courses on an irregular basis. However, since the academics invited as Chair Professors were at the top 1% level globally, they were superior to the Specially Invited Professors in terms of name recognition.

Officially, the purpose of the program was to raise the level of higher education and promote university education, but in reality, the plan was implemented to encourage researchers who had gone abroad to repatriate. Initially, 300 to 500 positions for Specially Invited Professors were set up at domestic universities. Various universities scouted excellent talents from home and abroad to recommend suitable candidates for these positions to the Ministry of Education, but this was not enough. According to Ministry of Education documents[82], many universities actually recruited suitable candidates through recommendations[83] from Chinese embassies and consulates, etc., overseas. Therefore, 90% of those who were selected actually had degrees or experience working abroad (all Chair Professors were researchers from abroad)[84]. As is well known, universities have restrictions on the number of faculty members (posts) they can recruit, but since the post of Specially Invited Professor involved a special quota, it was not subject to such restrictions.

The initial operating funds were provided by a donation of HK$ 60 million from the Cheung Kong (Holdings) Group, led by Li Ka-shing. Specially Invited Professors received an annual employment allowance of RMB 100,000 (2 million yen). They were promised substantial perquisites in terms of benefits, insurance, and salary, which were comparable with those in other countries.

The Changjiang Scholar Award, which was established by Li Ka-shing with a personal donation of $10 million, was awarded once a year to a Specially Invited Professor who had achieved an outstanding academic record or accomplishments. The first prize (for one person) was RMB 1 million (20 million yen), and the second prize (for two people) was RMB 500,000 (10 million yen).

The first revision of the plan was made in 2004, granting overseas researchers the opportunity to work with Specially Invited Professors. This revision has created new possibilities for national and international personnel to conduct research together. In 2005, the plan's posts, which had been established only for domestic universities, were expanded to universities in Hong Kong and Macau, and a new Changjiang Scholar Incentive Award was established. This award was given to those under 50 years of age and who had obtained internationally recognized research results in the natural sciences.

There were further modifications to the plan in 2011, with the most significant change being that it was recommended that researchers returning to China for a given post should join a research team when they repatriated, rather than working as individuals. There were also changes in the terms of employment. Tenure for Specially Invited Professors was set to five years and that for Chair Professors to three years. Salaries were set to RMB 200,000 (4 million yen) per year for the former and RMB 30,000 (600,000 yen) per month for the latter. Since that time, the program has become more diverse, with the Changjiang Scholars Forum being held regularly, the publication of collections of papers by Changjiang Scholars, and the introduction of a "Changjiang Scholars outstanding lecture evaluation program."

82 See Ministry of Education, *Implementation Measures for the Changjiang Scholars Encouragement Plan* (2011).

83 Although the actual application for the program was made by the individual, it is believed that Chinese embassies actively approached suitable candidates and encouraged them to apply, as there were no channels for academics abroad to learn of such an opening at the time.

84 See Xinhuanet, "Opinions of the Central Talent Operations Coordination Group on the Implementation of the Overseas High-Level Talent Introduction Plan: Reporter Q&A" (2009).

In 2015, a new Young Scholars Program was established. Although the program is open to both domestic and international applicants, the application guidelines at[85] state that "Applicants should have a PhD and work experience at a research institution, but domestic applicants must be technical professionals at the sub-higher level or above." In fact, it was clear that the purpose of the recruitment was to recruit young people who had obtained a doctorate and had worked abroad. Applicants in the natural sciences and engineering technology fields must be under 38 years of age, and those in the humanities and social sciences must be under 45 years of age. Tenure is three years, and a bonus of RMB 100,000 (2 million yen) is paid each year in addition to salary. The number of applicants is approximately 200 each year.

According to Ministry of Education data[86], as of the end of 2017, the program had accepted 2,051 Specially Invited Professors and 897 Chair Professors, as well as 440 young talents through the Young Scholars Program. In addition, 85 of the Changjiang Scholars have been appointed to the Chinese Academy of Sciences and the Chinese Academy of Engineering, and 170 have been selected as Project 973 Chief Scientists[87]. Many have become leading figures in Chinese science and technology. It goes without saying that they have led large funding projects in China, contributed many papers to international academic journals such as Nature, Science, and Cell, and have received countless awards. Yang Chen-Ning, who won the Nobel Prize in Physics in 1957[88], described the Changjiang Scholars Encouragement Plan as "a great project that has made a major contribution to the realization of China's science and education."[89]

Those selected for the Changjiang Scholars Encouragement Program are granted the title of "Changjiang Scholar" or "Young Changjiang Scholar." Universities are eager to acquire title holders, as having a high number of Changjiang Scholars and Young Changjiang Scholars on staff boosts their competitiveness.

Once selected, Changjiang Scholars are constantly scouted by other universities and research institutes, and many of them change jobs. In other words, the institutions to which they are affiliated barely have time to rejoice in the fact that they have produced a Changjiang Scholar before the researcher in question has moved on elsewhere. Frequent job changes on the part of Changjiang Scholars have been raised as a social issue[90].

85 http://www.moe.edu.cn/s78/A04/A04_gggs/A04_sjhj/201506/t20150615_190425.html

86 http://www.moe.gov.cn/srcsite/A04/s7051/201704/t20170401_301718.html?authkey=qeeu3

87 The data are through 2012. There has been no data release since then.

88 As of 2024, he is 102 years old.

89 https://baike.baidu.com/item/%E9%95%BF%E6%B1%9F%E5%AD%A6%E8%80%85%E5%A5%96%E5%8A%B1%E8%AE%A1%E5%88%92/1033172?fr=ge_ala#reference- 2

90 https://www.163.com/dy/article/F13HBKKU055061FK.html

Column: Honorary Titles—A Double-Edged Sword that Promotes Both Human Resource Development and Disengagement[91]

Honorary titles are divided into national and provincial ranks. A national-level honorary title in particular is the highest honor for those pursuing an academic career, as it is proof that the state recognizes the researcher's academic research and research achievements. Honorary titles are a symbol of high-level talent; just one such title can significantly change a researcher's social status and compensation.

The honorary title system was introduced to secure talents and to encourage researchers residing abroad to repatriate. In 1993, in order to promote the development of science and technology, the State Council decided to rename the title "Member of the Academic Divisions of the Chinese Academy of Sciences" to "Member of the Chinese Academy of Sciences." It also announced the establishment of the Chinese Academy of Engineering. Thus, the title of "Academician" came into being. Subsequently, honorary titles for talents have also diversified with the launch of various science and technology-related programs (such as the Hundred People Plan) and funding projects (such as the NSFC's Outstanding Youth Project), especially with the development of STI talents. Titles include "Outstanding Youth" and "Member of the Hundred People Plan."

After the 2010 enactment of the National Medium- and Long-term Talent Development Plan (2010–2020) and the Double-First-Class University Construction Plan of 2015, countless new talent projects have been launched by the central government, local governments, and universities, and the title system has fallen into disarray.

The title system played a major role in attracting excellent STI talents from home and abroad. Taking the Hundred People Plan as an example, during the 10-year period from 1994 to 2004, the program supported the onboarding of 1,069 excellent talents, of whom 702 came from overseas. Of course, the substantial benefits on offer were a major factor, but honorary titles also provided a sense of mission and pride. Participants felt that they were needed by the country and were able to contribute to its scientific and technological development. The prospect of titles encouraged talents to maximize their abilities. Titles were instrumental in the emergence of outstanding researchers such as Chen Zhu, Bai Chunli, and Li Jiayang, who later became PIs of large-scale funding projects such as Project 973 and Project 863, and Academicians at the Chinese Academy of Sciences and Academy of Engineering. It is no exaggeration to say that the improvement of the level of science and technology in China, the development of advanced technology, and the creation of research results would not have been possible without their active participation.

Over time, however, the title system, which was established to honor and inspire excellence, began to change. Titles became cash cows and avenues to power. Some researchers became more focused on obtaining titles than on their research, and some even committed fraud to obtain them or lost their motivation for research once they had. Meanwhile, employers (mainly universities and research institutes) were also competing for talents to secure budgets, reputation, and name recognition, resulting in a situation in which dual employment, which had not been allowed originally, became common. In addition, the overly frequent movement of talents from institution to institution made it difficult for researchers to stay focused on their research, resulting in a deteriorating research

[91] For more information on the system of honorary titles in China, see https://www.163.com/dy/article/H4RG2KOU05363Q89.html; https://ie.bjd.com.cn/5b165687a010550e5ddc0e6a/content/5b16573ae4 b02a9fe2d558fb/AP5ba608dee4b06d4dc7b68d41; http://www.moe.gov.cn/jyb_xwfb/s271/202012/t20201218_506346.html; https://www.163.com/dy/ See article/H4RG2KOU05363Q89.html.

environment and a decline in research quality. A sexual misconduct scandal[92] involving Changjiang Scholar Chen Xiaowu (Beihang University) emerged in 2018. A full-scale inspection of Changjiang Scholars, sparked by the event, revealed that as many as 68 researchers were found to have committed misconduct or violated discipline. The harmful effects of the title system emerged as a major social problem. In 2020, the Ministry of Education, concerned about the seriousness of the situation, issued the "Opinion on the Accurate Awareness and Use of Honorific Titles," which enforced a strict crackdown on improper dual employment and prohibited the use of titles as a condition for employment. It also forbade competition for talents by means of "high remunerations." The "Opinion" stressed that the Ministry of Education must not forget the original intention and purpose of introducing honorific titles. It emphasized the need to correct the bias toward human resource evaluations based on such titles.

Currently, China is reforming its evaluation of research personnel to thoroughly eliminate criteria such as number of papers, titles, positions, and hot research topics. New criteria such as quality over quantity, potential and ideas over position, talent over age, etc., have been proposed. However, they are not sufficiently concrete, and it is unclear at this point whether they will be effective enough to replace the existing rules.

3.2.2 The Thousand Talents Plan[93]

When discussing China's project to attract overseas talent, the Thousand Talents Plan cannot be ignored. The full name of the Thousand Talents Plan is the "Overseas High-Level Talent Recruitment Programs." The initiative was launched by the State Council in 2008 to attract international experts and high-level talents to China for scientific research and technological innovation.

However, from 2018, allegations of industrial espionage[94] began to spread. In September 2018, the Chinese government removed information on the Thousand Talents Plan from the Internet. By 2020, all related information had also been taken offline, and no coverage is now available on search sites such as Baidu.

The Thousand Talents Plan was a project initiated in 2008 to attract 1,000 world-class scholars, professors, and businesspeople to China. Long-term project participants in the Thousand Talents Plan were required to hold a full-time position in China for at least three years, while short-term project participants were expected to stay in China for at least two months per year. The conditions were almost the same for foreign participants. However, long-term participants were required to hold a full-time position in China for at least nine months out of a year for a minimum of three years.

The program was open to applicants of any nationality, aged 55 or under in principle, with a doctoral degree from

92 Commonly known as the "Chen Xiaowu case," in which sexual harassment of several (at least seven) graduate students came to light when a graduate student reported the incident. For more information, see https://baike.baidu.com/item/%E9%99%88%E5%B0%8F%E6%AD%A6/2282344?fr=ge_ala

93 For the Thousand Talents Plan, see https://www.aspi.org.au/report/hunting-phoenix; https://spc.jst.go.jp/policy/talent_policy/callingback/callingback_05. html; https://www.kiep.go.kr/gallery.es?mid=a10101010000&bid=0001&list_no=1854&act=view;. https://ndlsearch.ndl.go.jp/books/R000000004-I030809548

94 See the following link for more information. https://ja.wikipedia.org/wiki/%E5%8D%83%E4%BA%BA%E8%A8%88%E7%94%BB#:~:text=9%20%E5%A4%96%E9%83%A8%E3%83%AA%E3%83%B3%E3%82%AF-,%E6%A6%82%E8%A6%81,%E3%81%A8%E4%B8%BB%E5%BC%-B5%E3%81%97%E3%81%A6%E3%81%84%E3%82%8B%E3%80%82

outside China, who met one of the following criteria.

(1) Being qualified as a professor or equivalent position at a prominent overseas institution of higher education or research

(2) Having business management and technical expertise, with experience in senior management positions in high-profile global companies and financial institutions

(3) Possessing proprietary intellectual property rights or understanding of core technologies; having experience in starting a business overseas and a thorough understanding of related industries and international standards

(4) Being active as any other high-level innovation start-up talent that China urgently needs

At the start of the project, the plan was to attract about 1,000 people over a 5- to 10-year period, but as of 2012, the number of people recruited had already exceeded 1,500. The plan was so successful that Guangdong, Shanghai, Tianjin, and other cities also proactively implemented their own Thousand Talents Plans.

The attraction programs under its aegis were as follows. The goals for all programs were to be achieved over a period of 5 to 10 years, starting in 2008.

(1) Program to attract foreign talents in national key innovation fields

The program aimed to attract about 500 excellent talents in IT, aerospace technology, equipment manufacturing, biotechnology, energy, agriculture, infrastructure, and healthcare.

(2) Program to attract foreign talents to key departments and laboratories

The program aimed to attract about 500 personnel to major domestic universities and research institutes.

(3) Program to attract overseas talent to state-controlled enterprises and state-owned commercial and financial institutions

The program aimed to attract about 500 scientific and technological innovation and financial personnel to state-controlled enterprises and state-owned commercial and financial institutions.

(4) Program to attract entrepreneurial talents

The program aimed to attract about 500 entrepreneurial talents, mainly from high-tech industrial development sectors.

(5) Youth Thousand Talents Plan

This new program was added in 2010. Participants were to be under 40 years old, with a Ph.D. from a top university abroad and at least 3 years of research experience.

This program was designed to attract talents (limited to the fields of science, technology, and natural sciences) with a relevant track record and the ability to work full-time in China.

(6) Thousand Talents Plan for Foreign Experts

This program was added in 2011. It aimed to attract 500 to 1,000 outstanding experts in key fields for China's economic and social development over a period of around 10 years.

It is difficult to ascertain the actual results of the Thousand Talents Plan in China, since all related materials have been deleted. However, a research report by the Australian Strategic Policy Institute (ASPI), titled "Hunting the

Phoenix: The Chinese Communist Party's global search for technology and talent,"[95] revealed that at least 7,000 people were recruited through the Thousand Talents Plan between 2008 and 2016, while Qingdao alone attracted more than 1,500 people through various human resource projects between 2009 and 2014.

The report provides insight into the specific methods used by the Chinese government to recruit talent overseas, based on a recruitment contract obtained by the ASPI. The contract was concluded between

the Human Resources and Social Security Bureau of Qinglong District in Chengdu and a Sino-German talent-exchange association. China has established at least 600 overseas recruitment centers globally to attract talented people from abroad. Such recruitment centers acted under the name of hometown associations, business associations, professional organizations, alumni associations, technology transfer and education companies, the Chinese Students and Scholars Association, and Confucius Institutes, and the government contracted with and funded these organizations for recruitment-related work. Overseas recruitment centers were subject to conditions and quotas for gathering talents and technical information. They were paid an operating fee (up to $20,000 per year) and an incentive if they were able to recruit scientists.

According to the ASPI, the Thousand Talents Think Tank, which is affiliated with the United Front Work Department of the Central Committee of the Chinese Communist Party, is known to hold data on 12 million overseas scientists, including 2.2 million Chinese scientists living abroad. The report claimed that overseas recruitment centers are likely to support its information-gathering activities.

What paths have the researchers recruited in the Thousand Talents Plan taken since then? There are four main patterns.

(1) Returning to China and continuing research activities

The most common pattern is for researchers to repatriate to China on the strength of the Thousand Talents Plan and continue their research at a Chinese university. The most prominent scholars are Shi Yigong (professor at Tsinghua University), Rao Yi (professor at Peking University), and David Cai (professor at Shanghai Jiao Tong University).

(2) Establishing a joint laboratory between former and Chinese institutions of affiliation

The second pattern is for researchers to return to their former institutions to continue their research after their Thousand Talents Plan contract period is over. While they are staying at a Chinese university under the Thousand Talents Plan, they may establish a "joint laboratory" in cooperation with their former institution. After researchers' term under Thousand Talents Plan ends, "joint laboratories" are often left in palace in Chinese universities under the rubric of "international joint research." The issue in this case is that while the researcher's home university is using various resources to support them, the attribution of the research results obtained is unclear, and there is the possibility that they will end up being attributed to the Chinese research institution.

(3) Working as a recruiter abroad

The third pattern is to act as a recruiter to attract talent from abroad. Professor Ding Xianchun of the University of Duisburg-Essen is a typical case. He stated the following in an interview[96]. "I manage more than 100 funding projects

[95] The full text is available at https://www.aspi.org.au/report/hunting-phoenix.

[96] https://blog.csdn.net/yuanqingfei/article/details/69773

at a German university. I consider this form of involvement to be one of my great strengths. I could go back to China and contribute to the country as a researcher. However, I think the greatest contribution I can make to China is to contribute to international exchange and cooperation as a liaison for funding projects with China. In this way, I can become a bridge between China and Germany."

(4) Becoming an entrepreneur

The main path chosen by those selected for the program to attract entrepreneurial talents is to become an entrepreneur. Deng Zhonghan, who founded Vimicro Corporation, is an example. Deng Zhonghan received his PhD from the *University of* California, Berkeley While working at IBM, he was selected for the Thousand Talents Plan and received RMB 10 million (200 million yen) in start-up funding, which he used to establish Vimicro Corporation.

3.2.3 Beyond the Thousand Talents Plan: The Plan to Attract High-Level Foreign Experts and the Enlightenment Plan

The Thousand Talents Plan, which attracted significant talent to China and garnered worldwide attention, ended in 2020. What is of interest here is the successor project to the Thousand Talents Plan.

Reuters, in an article titled "China's 'Thousand Talents Plan' Changes Clothes, Continues Operation to Acquire Foreign Engineers[97]," highlighted that the Enlightenment Plan is in fact the successor to the Thousand Talents Program.

(1) The Enlightenment Plan

The Enlightenment Plan is an overseas talent attraction program under the Ministry of Industry and Information Technology. However, since the program accepts applications via corporate platforms, no relevant information can be found on the Ministry's website. Recruiting parties and outcomes are, of course, also undisclosed. This use of companies as a contact point for applicants may be a result of lessons learned from the Thousand Talents Plan.

From 2021, about a dozen recruitment advertisements for the Enlightenment Plan were posted on the Chinese Q&A app Zhihu and LinkedIn. It may therefore be assumed that the plan went into operation around that time. The following are some example recruitment advertisements published by Reuters.

Example 1: A headhunting firm in Hangzhou posted on Research Gate, a social networking site for researchers, that it was looking for people with PhDs from top-tier universities and experience working for Fortune 500 companies as part of an effort to recruit 5,000 overseas researchers for Chinese companies. This applies to the "Enlightenment" and other attraction programs. Successful candidates will receive up to RMB 15 million (300 million yen), and if a referred candidate is selected, the referrer will also receive diamonds, automobiles, housing, and other gifts.

Example 2: A recruitment advertisement for "Enlightenment" and other programs on LinkedIn stated that they were looking for "young talents" under 40 years old with PhDs from prestigious universities and research experience abroad.

The following is a summary of the types of personnel being recruited[98], as posted on Zhihu and similar sites.

97 Full text: https://jp.reuters.com/economy/industry/REUV3Q2ALBO5BBH3CDEFRIDMEQ-2023-08-26/

98 https://zhuanlan.zhihu.com/p/672055419; https://www.zhihu.com/topic/23833886/top-answers?utm_id=0; https://baijiahao.baidu.com/s?id=1775209878687254692&wfr=spider&for=pc

Table 24: Types of Recruits for the Enlightenment Plan

	Entrepreneurial talents	Innovation talents	Young talents
Academic background	Degree obtained overseas	PhD from a Top 200 QS-ranked university	PhD from a Top 200 QS-ranked university
Timing from repatriation	Within 6 years of repatriation	Overseas, or under 1 year after repatriation	Overseas, or under 1 year after repatriation
Age limit	Under 60	Under 60	Under 40
Professional experience	Business founder or leading shareholder	Assistant professor or above at overseas university or research institution; manager at well-known overseas firm; has held highly skilled technical post	Persons affiliated with a well-known overseas university or research institution, or involved in full-time education or research in a corporate capacity
Affiliated to	--	Preferably an internationally prestigious university, research institution, or corporation	A Top 200 QS-ranked university or research institution, or least 36 months in a global Top 500 company
Benefits	Grant of title of "International-class entrepreneurial innovation talent"; grants of up to RMB 10 million to 20 million for leading entrepreneurs, and up to RMB 2 million for youth talents, along with support of RMB 3 million to 5 million (for general expenses, living expenses, personnel allowances, bonuses, etc.); support of up to RMB 1.5 million for purchase of residence; coverage for various forms of insurance; preferential access to education for women and children		
Major	All majors in science and technology are eligible.		

Source: Zhihu, "2024 National Enlightenment Plan"

Reuters reported that interviews with stakeholders revealed that most applicants selected for the Enlightenment Plan had studied at top U.S. universities and held at least one doctorate. They stated that China was seeking applicants who had studied and conducted research at MIT, Harvard, Stanford, and other universities.

(2) Plan to attract high-level foreign experts

Meanwhile, the Ministry of Science and Technology also launched a "Plan to Attract High-Level Foreign Experts," starting in 2019.

The plan includes the following three programs.

(i) Program to attract high-level foreign experts

The program aims to attract high-level overseas talents with expertise in core technologies in the fields of next-generation information and telecommunications, manufacturing, and advanced new materials. The recruitment conditions here are almost the same as for the Thousand Talents Plan.

(ii) Belt and Road Innovative Foreign Expert Exchange Program

The program aims to support foreign experts in the fields of AI, bioengineering, advanced manufacturing, advanced agriculture, etc., to promote human resource exchange with countries involved in the Belt and Road Initiative. Support is mainly offered to specialist technical personnel from well-known international companies, personnel involved in business management, or researchers equivalent to the level of associate professor or higher at prominent universities or research institutions.

(iii) Overseas Young Talent Program

The program aims to facilitate academic exchange and research activities in China, including post-doctoral research, for young foreign talents with high potential. It is open to applicants under the age of 45.

In addition to these talent attraction plans, the Chinese government is working on various other measures to promote the domestic retention of overseas human resources.

One example is the revision of the Ordinance on the Administration of Permanent Residency for Foreigners[99]. Revised in 2020, the conditions for obtaining permanent residency for high-level talents (high-income, well-educated, professional, and entrepreneurs) have been significantly relaxed. The revised ordinance allows foreign professional talents and those who have made a significant contribution to China's development to apply for permanent residency **even if they do not reside in the country**. "Foreign professional talents" here refers to (1) high-level talents attracted by cutting-edge companies, innovative companies, and major companies; (2) talents at the associate professor or associate researcher level or above, attracted by China's key universities and research institutes; and (3) talents needed in key development industries or regions. "Those who have made a significant contribution to China's development" refers to (1) talents who have made significant contributions in the fields of science and technology, education, culture, health, and sports; (2) talents who have contributed to charitable activities, foreign exchange activities, and world peace within China.

In addition, highly educated talents who graduated from the world's top universities and hold doctoral degrees can now apply for permanent residency if they have worked in China for at least three years (with a one-year residency requirement).

While unparalleled benefits are being offered to high-level overseas talents, and aggressive projects to attract them are underway, it has been suggested that the background to this trend may be the domestic situation, which is causing an exodus of human resources[100]. In addition, while China's foreign talent attraction projects, from the Thousand Talents Plan and beyond to the Enlightenment Plan, are well known, their evaluation is extremely difficult. This is because no concrete results or data have been announced.

99 Revisions: https://m.chinaxiaokang.com/wap/news/gundong/2020/0303/907578_3.html;
Full text: https://baijiahao.baidu.com/s?id=1659674039985385245&wfr=spider&for=pc

100 Articles on China's brain drain: https://globe.asahi.com/article/15050237; https://www.cnn.co.jp/world/35046264.html; https://newspicks.com/news/9014854/body/; https://jp.wsj.com/articles/chinas-brain-drain-threatens-its-future-d8b5b68c; https://toyokeizai.net/articles/-/648671; https://jp.reuters.com/article/idUSKCN0QX0GJ/; https://www.newsweekjapan.jp/stories/world/2020/11/ post-95035.php

Column: The Relationship between Aggressive Policies to Attract Foreign Talent and Brain Drain

Some readers will be aware of the *run xue* youth trend that has been growing rapidly in China in recent years. "*Run*" originally meant "moist," but now it has come to mean the verb "run" (as a pun on the English term) in the sense of "to emigrate," i.e., to leave China. "Runology" (*run xue*) means "to study how to leave China and move to a developed country." That is, it is the study of emigration. The Chinese word *run* also has the sense of "shining" or "profit (earn)." In its deeper meaning, it alludes to the idea of "escape to a better place," as in the colloquial phrase "*guo de zirun*," which means "to live in comfort."[101]

In 2023, *The New York Times* published an article titled "China is Suffering a Brain Drain. The U.S. Isn't Exploiting It." It featured interviews with 14 high-level Chinese talents who had moved abroad. According to the article, the number of people emigrating from China has continued to increase, despite restrictions on passport issues and travel imposed in 2022. The Chinese Ministry of Education's claim that over 80%of Chinese students and researchers repatriate after completing their studies (as introduced in Chapter 1 of this report) no longer holds true. Fewer people are returning to China after studying abroad.

According to the *World Migration Report 2022*[102]published by the International Organization for Migration, approximately 10 million people emigrated from China, making it one of the four largest countries of origin for emigrants in the world. The number of Chinese emigrants has been increasing since 2017. The 14 high-level Chinese talents interviewed in *The New York Times* article graduated from world-class universities and worked in major corporations in large metropolitan centers in China. They decided to move abroad because of constitutional changes enforcing Xi Jinping's lifetime rule, lockdowns due to the COVID-19 pandemic, large-scale track and tracing, and a "zero-corona" policy involving quarantines.

The Tokyo Shimbun's "Zero Corona and 'No Future in Sight'...Why are Young People Increasingly Leaving China Again?"[103] also published interviews with young Chinese people who have moved abroad. The report introduces a situation in which many young people in their 30s and 40s are choosing to emigrate. They seek to avoid fierce academic competition from childhood, high education costs (there being no subsidy for private kindergartens in China), and bleak employment prospects. They mentioned that the Chinese government's strict restrictions on overseas remittances are one example of the loss of talent.

The Japan Times article "Exodus of Wealthy Chinese Accelerates with End of the 'Zero Corona' Policy"[104] features testimony from several immigration consultants. According to them, Xi Jinping's clampdown on the technology, real-estate, and education industries and his "common prosperity" policy will not stop wealthy people leaving the country. According to Sobirovs, a Canadian law firm specializing in immigration matters, there has been a surge in Chinese clients seeking to immigrate to Canada since late 2022. Investment and immigration consulting firm Henley & Partners stated that inquiries from Chinese nationals about immigration increased more than fourfold after the removal of China's COVID-19 restrictions. In addition, according to real estate firm Juwai IQI, which helps sell overseas real estate to Asian clients, the number of inquiries from mainland Chinese buyers

101 https://www.mag2.com/p/news/541463

102 The full text is available at https://publications.iom.int/books/world-migration-report-2022.

103 https://www.tokyo-np.co.jp/article/234226

104 https://www.japantimes.co.jp/news/2023/01/26/asia-pacific/wealthy-chinese-exodus/; For a translated article, see Toyokeizai's "Zero Corona Lifting Accelerates Overseas Migration of Wealthy Chinese,"https://toyookeizai.net/articles/-/648671.

declined by 26% in 2021 and 11% in 2022, but increased by 55% in 2023. This increase has remained steady. These articles point toward a serious brain drain from China.

As described in this report, China is focusing on domestic nurturing of STI talents, but it is questionable whether this "nurturing" is really outpacing the momentum of the "brain drain." In addition to the factors mentioned above, the difficulty of nurturing talents domestically also partly stems from the decline in competitive spirit among young people in recent years. This further factor cannot be overlooked. The rapid increase in the number of *tang ping* (slackers), who are satisfied with a low standard of living and do not like competition, has been frequently reported by the media in Japan[105].

The rapid increase in the number of *tang ping* slackers is a reaction to intense competition for academic credentials and employment. Also involved is a disparity in wealth that appears unbridgeable by individual effort, causing many young people to fall into despair. The competition that young people face is so intense that the "*neijuan*" phenomenon is also occurring. *Neijuan* is a sociological term in Chinese, derived from the English word "involution." It refers to the stagnation of a society after it has entered a certain stage of development and is unable to move on to the next stage. Students began using the term online to describe the competition for finite resources arising from stagnation, the meaningless and irrational competition within organizations, and the social stress that results from it[106]. In short, the term can be understood to refer to "absurd internal competition" and "unproductive internal exhaustion."[107]

The brain drain and the rapid increase in the number of slackers nationwide are extremely significant issues in China's efforts to secure STI talents. This is an age when it is fair to say that securing talents determines a nation's competitiveness. Competition for human resources is accelerating due to trade frictions between the United States and China. Being unable to fully compensate for the outflow of excellent talents through domestic human resource development, China is thus forced to rely on overseas talents as ready human resources who can work immediately as a competitive force. This unstable situation is expected to continue in the future.

[105] Tang ping means "to lie down" in Chinese and conveys the concepts of being "not greedy," "not hardworking," and "not competitive." It refers to a lifestyle that resists the competitiveness and excessive consumerism prevalent among China's Generation Z. Those who aspire to the tang ping lifestyle lead a life of low motivation and low desire under the mottos of "not buying a house," "not buying a car," "not falling in love," "not getting married," "not having children," and "a low level of consumption." https://www.nli-research.co.jp/report/detail/id=75166?site=nli

[106] https://gentosha-go.com/articles/-/47289

[107] To give a simple example, when a teacher tells students to submit a 5,000-word paper, students will voluntarily write a 10,000-word paper to obtain a good grade. https://news.yahoo.co.jp/expert/articles/30d08964275ea133a6e8dd5fc8817705132c4848#:~:text=% E5%86%85%E5%B7%BB%EF%BC%88%E3%83%8D%E3% 82%A4%E3%83%81%E3%83%A5%E3%82%A2%E3%83%B3%EF%BC%89&text=%E5%86%85%E5%B7%BB%E3%81%A8%E3%81%AF%E3%80%8C%E4%B8%8D%E6%9D%A1%E7%9086,%E3%82%88%E3%81%86%E3%81%AA%E9%A2%A8%E6%BD%AE%E3%81%AE%E3%81%93%E3%81%A8%E3%80%82.

4 Characteristics and Challenges of China's STI Talent Policies and Implications for Japan

This section examines the characteristics and challenges of China's strategy for nurturing and retaining STI talents, which underpin the policies and projects discussed in this report. Thereafter, we will discuss the implications for Japan.

4.1 Characteristics of China's STI Talent Policy

(1) Strong government impetus and focus on human resource development and support

Although the financial base of local governments for science and technology investment is under strain due to the current economic situation, including the real estate slump, China's greatest characteristic is its strong enthusiasm for human resource development and its ongoing, unstinting investment in this area. R&D spending is over RMB 3 trillion (60 trillion yen), and the share of R&D spending as a share of GDP is increasing annually. The government's publicly disclosed FY2024 Chinese national science and technology budget[108] was RMB 1.1541 trillion (23.820 trillion yen), a 10% increase over the previous year.

In recent years, China has steadily improved its ranking in various indices related to science and technology competitiveness, including the number of papers published. This seems to have been made possible by the country's world-class scale of human resources and the generous support for talent development and R&D that it provides.

The STI talent policies and projects discussed in this report represent only a fraction of the total, which number in the thousands or even tens of thousands. They include initiatives developed by central ministries and local governments, along with projects conducted independently by universities, research institutes, and corporations.

Policies disclosed by the central government are positioned as "presentation of policies and desired directions," and it is the local government that materializes them.

In China, it is not unusual to find provinces with populations of 20 to 30 million. There are eight provinces[109] that are larger than Japan in terms of area. Therefore, even though the projects are mainly developed by local governments, they are as large and substantial as those of the central government. China's great strength is the scale and drive of projects under the jurisdiction of local governments, which is rarely seen in other countries.

Competition among regions for human resources has also intensified, and each region has developed its own

[108] At the 2024 National People's Congress, the Chinese government announced that the central government was increasing its science and technology budget by 10% over last year to RMB 370.8 billion. Adding in the local governments' science and technology budgets, China's national science and technology budget amounts to RMB 1,154.1 billion. https://koreawave.jp/%E6%95%B0%E5%80%A4%E3%81%A7%E7%A4%BA%E3%81%95%E3%82%8C%E3%81%9F%E3%80%8C%E4%B8%AD%E5%9B%BD%E3%81%AE%E6%8A%80% E8%A1%93%E3%81%8C%E9%9F%93%E5%9B%BD%E3%82%92%E8%BF%BD%E3%81%84%E6%8A%9C%E3%81%84%E3%81%9F/ See also.

[109] https://chinastyle.jp/shoumenseki/

support measures to secure excellent talents both domestically and internationally. In particular, from the Thousand Talents Plan to the Enlightenment Plan, acquiring entrepreneurial talents has been a major concern and trend in China's STI talent development. The following table gives the support measures implemented in each region to secure entrepreneurial talents. The scale of support is so extraordinary that it could be described as a "battle for talents."

Table 25: Policies for Supporting Entrepreneurial Talents in Various Locations

City	Policy	Support	Starting FY
Shanghai	Measures for Encouraging Overseas Chinese Talent to Work and Start Businesses in Shanghai	Provision of RMB 50,000 or over as seed capital for startups; support of up to RMB 300,00 for science/tech startups; loans of up to RMB 300,000	2020
	Measures for Pudong, Shanghai Talent Planning and Management	Provision of up to RMB 300,000 support to researchers with overseas experience; support of up to RMB 500,000 for research teams	2021
	Detailed Regulations on Registration of Repatriating Talents in Shanghai	Successful applicants can obtain a Shanghai residence permit even if they are below the required number of years of tax and insurance payments.	2021
Guangzhou	Support Measures for Retention of Overseas Talents in Guangzhou	Provision of RMB 100,000 in relocation support	2017
	Opinions on Overseas Entrepreneur Talent Plan for Guangzhou	Provision of RMB 2 million in startup capital to selected projects, along with other allowances	2017
Shenzhen	Support Measures for Overseas Entrepreneur Talents in Shenzhen	Support of up to RMB 1 million, or up to RMB 5 million for priority cases	2016
Chongqing	Support Measures for Overseas Entrepreneur Talents Repatriating to Chongqing	Support of up to RMB 500,000 for startups; provision of up to RMB 120,000 in cases where	2017
		product/service is recognized as innovative	
Zhuhai	Support Measures for Overseas Entrepreneur Talents in Zhuhai	Support of up to RMB 1 million; provision of up to RMB 5 million for priority cases	2018
Xiamen	Support Measures for Overseas Entrepreneur Talents in Xiamen	Provision of up to RMB 500,000 for startups	2019
Suzhou	Fifteen Point Reform of Human Resources System in Suzhou	Provision of up to RMB 500,000 for startups; also, RMB 100,000 as startup allowance, and RMB 150,000 wage cost allowance available	2021

Source: Local government websites

The Science and Technology Innovation Certificates[110] in the table are concession certificates issued free of charge by the government to "science and technology" SMEs and innovation/entrepreneurship teams. The main purpose is to encourage them to fully utilize the resources of universities, R&D institutions, and other innovation service providers in conducting R&D and technological innovation. The certificates were introduced in 2015 under regional talent attraction programs. These programs aim to support high-tech companies with significant growth potential and advanced technology that face funding and equipment shortages during their start-up phase, which hinders such companies from further innovation. Companies that receive these Innovation Certificates can use them to access expensive equipment at research institutes and for licensing fees, etc. Entities that receive certificates may also cash them in at designated banks.

This system effectively strengthens the innovation ecosystem, as it leads to lower operating costs for companies. It also allows SMEs to use the latest equipment without it being monopolized by a few large companies, thereby promoting joint use of equipment and collaboration/cooperation among companies.

In addition, generous treatment of excellent talents is another characteristic of China's policies for nurturing and supporting STI talents. As this report has discussed, this is particularly so when attracting excellent foreign talents to China. High salaries and bonuses are paid as a matter of course; generous support on a scale unimaginable in other countries is provided to enable these talents to settle in the country. This support includes benefits for families (work support for spouses and educational support for children), relaxations in the visa system (simplified procedures for obtaining permanent residency and citizenship), and the provision of housing rather than housing allowances.

China's decision to provide this level of support for the acquisition of STI talents is based on the need to resolve its lag in science and technology compared with more advanced countries in a short period of time. Undoubtedly, bold investment is the first step to development in the field of science and technology, as well as to nurturing and maintaining large numbers of STI talents, including researchers.

(2) Unparalleled scale of human resources and large number of long-term projects

China's projects for nurturing and supporting talents are characterized by their diversity and long-term nature.

Ongoing projects cover everything from training and support for young, female, and excellent talents to training and support for research, technical, and overseas talents. Since 2021, when the 14th Five-Year Plan began, China has particularly focused on measures to attract young and excellent overseas talents. The number of relevant policies has been increasing in recent years.

Many ministries, including the Ministry of Education and the Ministry of Science and Technology, have formulated talent-related policies. These include the Ministry of Human Resources and Social Security and the Ministry of Industry and Information Technology. Support programs for nurturing talents are extremely abundant in numbers and types.

For example, the overseas human resources attraction program, which was linked to the Hundred People Plan, the Thousand People Plan, and the Enlightenment Plan, has been continued since the 1980s. The Changjiang Scholars Encouragement Plan and the 653 Process, which were introduced in this report, have been implemented for a similar period. The fact that talent nurturing and support programs have been sustained over such a long period of time is

[110] https://spap.jst.go.jp/investigation/downloads/2022_rr_06.pdf, p. 66

proof that sufficient systems and infrastructures are established to follow up on talents on a stable basis. Furthermore, China has accumulated sufficient know-how in human resource development and support. From the perspective of researchers and research institutions, institutional stability is an important factor in allowing them to conduct research with confidence in their environment.

In the case of China, the policy of attracting overseas human resources was launched at a relatively early stage. Given that China was able to secure a substantial pool of excellent human resources, it has maintained an absolute advantage in terms of the scale of its human resources.

The global situation is constantly in flux and has become especially uncertain in recent years. The same is true for human resource needs. Securing a vast pool of human resources is an essential element for improving national competitiveness and research capabilities, as well as for the development of science and technology.

(3) Speed of central policy development and flexibility of policy change

One of the advantages of China's unique party system is that central policies are transmitted to local regions at an extremely rapid pace and are steadily developed and established. Because power is centralized, policy formulation and changes are relatively smooth. The central government is efficient in implementing policies, as they are quickly disseminated nationwide, with related projects carried out on a province-by-province basis.

Strictly, China[111] is not officially a one-party state. While the Chinese Communist Party holds power as the governing party, eight other smaller groupings, known as the "democratic parties," are legally allowed to exist. According to the Chinese government's official position, the democratic parties are not opposition parties per se. Rather, China's political parties are to "coexist over the long term, supervise each other, discuss matters of mutual trust, and share glory and shame." To translate this into a concept that is easier for the Japanese reader to understand, we might term it a kind of extra-cabinet cooperative party system.

Because of the concentration of power, policy promotion and change is relatively smooth in China. For example, when the central government releases the "State Council's Opinions on Talent Development for Business Startups," local governments will often enact the "Implementation Methods of the Opinions on Human Resource Development for Business Startups in XX Province" within a month of the release of the State Council communique, although there may be differences from region to region. The central government's policies and principles are then embodied in concrete form in accordance with local characteristics. Targets and indicators are generally more specific than those of central government policies (e.g., how many human resources in XX field should be trained and by when). This is favorable in terms of efficiency, as central government policies are rapidly taken nationwide, and related projects are implemented at the provincial level.

This is also true in the case of policy changes or changes in business direction, which can be accomplished without complicated procedures, allowing China to respond flexibly to changes in various circumstances.

[111] https://toyokeizai.net/articles/-/414851

4.2 Challenges of China's STI Talent Policies and Implications for Japan

(1) Low number of top-level scientific and technical personnel equivalent to Nobel laureates

Although China has secured a vast pool of human resources and reigns as the world's top country in terms of the number of human resources, it has relatively few researchers and scientists who have achieved recognition comparable to Nobel Prize winners. In terms of Nobel Prizes, there have been several American Chinese winners, but so far, the only scientist from mainland China (i.e., the People's Republic of China) to win a Nobel Prize is Tu Youyou, a Chinese scientist who discovered an anti-malarial drug in 2015. It must be said that there is a clear asymmetry between the size of China's economy and its number of Nobel Prize winners[112].

In his article "Why Chinese Scientists Cannot Win Nobel Prizes,"[113] Ke Long analyzed the reasons for the small number of Chinese Nobel laureates. The following points are excerpted from his article.

"First, there is the issue of the research system. In China, funding for research as well as the research agenda are decided top–down by the government. Since the government works to a research agenda on the basis of the Five-Year Plan, this is a unique research system in which very little or no budget is allocated to scientists who want to work on unscheduled research projects. It is also unique in that the government establishes guidelines (recruitment guidelines) for research projects based on political needs. In addition, because research project guidelines are established on the basis of political needs, the government tends to mobilize all of its resources for projects considered to be of high political importance, while projects that are not considered to be of high importance receive lower priority. Second, there is the issue of the education system. Although the reform and opening-up policy has been implemented, education has not been liberalized, and students' ideological education has been strengthened. As ideological education has been intensified, loyalty to the Communist Party on the part of university students has been demanded. The university's educational system is similar to that of middle and senior high schools, with homeroom teachers assigned to manage students' thinking. In recent years, monitoring of professors' course content has also been stepped up. In some cases, surveillance cameras are installed in classrooms. Particularly pernicious are cases in which universities mobilize and encourage students to snitch on professors who advocate democracy, freedom, and human rights in their classes. Professors who are thus reported will be given a warning in minor cases and disciplined in more serious cases. In other words, educational freedom is greatly restricted in China. Academic credentials are highly valued in China, and the rate of students advancing to graduate school is high. However, due to the combination of interviews (grading by professors) and standardized examinations, scandals like the bribery of academic advisors are believed to be commonplace. In many cases, graduate students are forced to work for free, such as writing papers for their academic advisors. It is extremely difficult to produce top researchers in this environment of unrealized educational liberalization and autonomy, as well as constant political intervention in both research and education."

The lack of top researchers is a problem that the Chinese government is aware of. The *Science and Technology*

[112] https://spc.jst.go.jp/experiences/economy/economy_2210.html

[113] Full text: https://spc.jst.go.jp/experiences/economy/economy_2210.html

Talent Development Report (2020), published by the Ministry of Science and Technology, included the results of a survey conducted by the China Association for Science and Technology. The report found that 63% of universities and 54.8% of research institutes reported a shortage of top researchers capable of leading research.

Funding projects in China can be broadly divided into two types: "mission-oriented," in which the researcher decides on the mission or goal they want to accomplish and carries out the research project accordingly, and "free research-oriented," in which the researcher decides on the theme they want to research. (Theme selection is not completely free, but the researcher's wishes are respected as much as possible.) Although mission-oriented projects dominate in terms of budget size and number, China has been working since 2018 on reforms to increase the number of free research-oriented projects and strengthen the discretion and freedom of researchers.

The details of the reforms are described in a survey conducted by the JST's APRC, *Study on the Mechanism of Discovery and Promotion of the Excellence in China's R&D System* (March 2022)[114]. In summary, the reform plan calls for eliminating administrative and political intervention in academia in all aspects, from the selection of research topics to the composition of research teams (personnel authority), thereby increasing researchers' time for research and enabling them to focus solely on their research without being distractions. This will involve reducing administrative work, streamlining various procedures, and reducing the numbers of inspections and reviews. The reform plan also called for thorough crackdowns on fraud, bribery, and other misconduct that could threaten research credibility. Once discovered, individuals proven guilty of misconduct should be placed on a permanent blacklist.

The effects of these reform measures have not yet been fully verified. However, the results of the above survey questionnaire indicate that the researchers themselves feel that they have increased their autonomy and freedom and that their research time has increased.

Meanwhile, in Japan, the problem of researchers being unable to secure enough time for research has been highlighted in recent years. In NHK's Will the Japanese be unable to win Nobel Prizes? The Ongoing Decline in Science and Technology Capabilities[115], it was noted that research capabilities are determined by (1) the number of researchers; (2) research hours; and (3) research budgets, all of which are declining in Japan. This is because only about 10% of work hours can be allocated to research. Discussing Japan's research capabilities, the *Nature* article "What price will science pay for austerity?"[116] states that "the (Japanese government's budget for science and technology has essentially remained flat since 2001." As a result, its ability to produce high-quality research is declining. During this period, the Japanese government reduced the subsidies that universities provide for staff salaries. The reduction in operating subsidies has significantly impacted university personnel, leading to the departure of top talent from academia, while those who remain are unable to conduct research because they are forced to do unrelated chores due to the lack of research funds. The article states that Japan has fallen into a vicious cycle, where researchers are forced to spend their limited research hours preparing applications on a daily basis to secure research funding.

While having a large number of human resources is obviously important, the role of top talents is significant for global competition and enhanced research capacity. To develop top talents, it is most important to establish systems and mechanisms that guarantee researchers more than enough time and discretion for research.

114 Full text: https://spap.jst.go.jp/investigation/report_2022.html#br01

115 https://www3.nhk.or.jp/news/special/sci_cul/2017/09/story/news_170928_2/

116 https://www.nature.com/articles/543S10a

(2) Intense domestic mobility of talents due to the title system, etc.

The Ministry of Health, Labour and Welfare's *Action Plan for the Realization of Workplace Reform* [117] states that it is vital to promote the mobility of human resources to expand job opportunities and create an environment wherein people can fully demonstrate their motivation and abilities, as well as to improve productivity through investment and innovation.

Although the fluidization of human resources appears to be highly beneficial to both labor and management, it is necessary to keep in mind the disadvantages of exceeding a certain degree of mobility.

This report has discussed the Chinese title system in the above column. Today, with titles being treated as directly linked to annual salary and various evaluations, many academics in China are now focusing on building connections and networks to obtain titles, and the system has deviated from its original purpose. In addition, because of the constant scouting from other schools once a title is obtained, research is often put on the back burner. There are many cases of people changing their affiliation twice or thrice, aiming only for a higher annual salary. Excessive mobility makes it impossible to conduct stable research, hindering the development of researchers and ultimately undermining the strengthening of scientific and technological capabilities.

Since the titles obtained through national talent plans (the Changjiang Scholars Encouragement Plan and the 10,000,000 Person Project) and other programs are for life, there is a serious problem of researchers being discouraged as soon as they obtain them, resulting in fewer research achievements.

China's title system could be considered an optimal system if it provided an environment in which researchers could devote themselves to their research while simultaneously ensuring increased productivity. However, every country's system has its own advantages and disadvantages, and each has its own problems. In the world of research, rather than encouraging researchers' mobility, it is necessary to first create the support and structures required to enable them to immerse themselves in research in a stable environment.

(3) Numerous talents, but a serious mismatch between supply and demand in the human resources market

As mentioned in this report, the number of people obtaining higher education in China is increasing annually, as higher education significantly impacts careers and life in general. Those with higher education and graduates from prestigious universities take great pride in their academic background and often seek jobs in the IT, electronics, Internet, and communications industries, which are perceived as white-collar jobs with high salaries. However, the number of human resources in these fields is already close to saturation in China.

Blue-collar jobs with high demand for personnel, such as those in the automotive, production, manufacturing, and logistics/transportation industries, have always suffered from a serious shortage of human resources. However, the number of applicants has not increased as much as expected despite the implementation of various policies. The government is trying to improve this situation by focusing on improving benefits and support for blue-collar technical personnel, but the situation will not improve overnight. In addition, Confucianism and the legacy of the Imperial examination system have had a significant influence in China; physical work (typically blue-collar work) has historically been viewed as menial labor done by people of low status. Therefore, the popularity of science and

[117] https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0000148322.html

technology-related jobs was low until Deng Xiaoping proclaimed that “Science and technology constitute a primary productive force.“

Although it would be ideal to adjust the number of undergraduate and graduate students to match levels of demand, China has been steadily increasing intakes in recent years. The reason is that it is necessary to maintain a huge pool of human resources at all times. However, it remains questionable whether this approach is really the best choice.

Since it was decided that students who are still enrolled in school will be excluded from the calculation of the youth unemployment rate from now on, keeping students enrolled longer will be helpful in improving the unemployment figures. If the mismatch in the human resources market persists, there is a risk that the only increase in store will be that of highly educated people without jobs.

5 General Summary

This paper has reviewed various policies and projects in China for nurturing and supporting STI talents.

China continues to generously invest in R&D and in the nurturing and support of STI talents. In terms of both the quantity and quality of papers, a measure of research achievement, the country has achieved a world-leading position. The scale of its human resources is also superior to that of other countries. China's ability to secure the world's largest number of researchers is driven by abundant research funding from state and private sources, along with a rapid expansion in doctoral, master's, and bachelor's degree positions at universities. These developments have unfolded at a pace unmatched anywhere else in the world.

Every five years, China releases a plan outlining goals for STI talent development. The 14th Five-Year Plan mentions the development and attraction of high-level talents and the necessary initiatives and reforms to nurture large numbers of young STI talents. There is continuing focus on developing and securing world-class STI talents by improving the level and quality of human resources, building on the vast pool of human resources already secured.

In implementing specific projects, local governments have prepared numerous funding projects and talent development plans, comparable with those of the central government, and are steadily nurturing and maintaining STI talents. The fact that numerous long-term projects have continued since the 1980s and 1990s is proof that China has a stable system and sufficient know-how in human resource development.

As trade friction between the United States and China intensifies, the Chinese state is aggressively attracting foreign human resources, as it has done since the days of the Thousand Talents Plan, to attract high-level personnel who can solve bottlenecks in the field of advanced technology. China's policy for attracting talent is characterized most of all by unparalleled levels of support, unmatchable by other countries. In the past, China's approach was dubbed the "sea turtle policy." It focused on repatriating overseas Chinese research and entrepreneurial talent. Today, however, China is working to reform its human resources and funding projects to[118] actively attract talents to the country, regardless of their nationality.

However, despite these programs for fostering and supporting STI talents in China, numerous challenges persist. In recent years, the serious unemployment rate among young people has emerged as an urgent problem. The declining employment rate among young people, including educated college graduates, is unlikely to be solely attributed to the decline in the growth rate over the past few years. This trend will certainly impact China's future policies and domestic talent development strategies. Even when fully considering the context of the COVID-19 pandemic, the underlying causes are the intense competition for academic supremacy in China and the country's failure to address unemployment.

In addition to a persistently high unemployment rate, the country is experiencing a serious brain drain. China has become the world's fourth-largest source of emigrants, with an increasing number of excellent human resources moving abroad. Furthermore, despite significant annual investment in research and development, China has produced

[118] This is evidenced by the growing number of new funding projects for foreign researchers and high-level foreign talent attraction projects being developed in various regions, as outlined in this report's discussion of projects to attract foreign talents.

few Nobel laureates. This is largely due to structural issues within its political and education systems.

However, we predict that China's future human resource projects will be responsive to the emerging issues, aligning with the needs of the nation and its scientific and technological development. This is supported by China's major strengths in highly flexible policymaking and human resource planning. The Science and Technology Talent Development Report, published biannually by the Ministry of Science and Technology, highlights issues such as the shortage of high-level talent and the mismatch between the supply and demand for human resources. The Ministry has expressed its commitment to proactively addressing these challenges moving forward. Reforms have already been initiated to grant researchers greater autonomy, more time for research, and minimize administrative and political intervention in academia[119]. Therefore, developments and changes in China's human resources projects warrant continuous and close attention.

Finally, we hope that the efforts to nurture and support STI talents in China, as discussed in this report, will contribute to Japan's future projects aimed at fostering STI talent. Additionally, we anticipate that this report will serve as foundational data for promoting international cooperation between Japan and China and provide valuable insights into China's science and technology projects.

[119] Ministry of Science and Technology, "Opinions on Expanding the Autonomy of Universities and Research Institutions," https://www.gov.cn/xinwen/2019-08/22/content_5423254.htm; State Council, "Measures on Improving Scientific Research Management and Raising Performance," https://www. Related content available at gov.cn/zhengce/content/2018-07/24/content_5308787.htm, etc.

Author and Research Project

Yuna Matsuda (Fellow, Asia and Pacific Research Center, JST)

Research Report APRC-FY2023-RR-03

Strategies for Nurturing and Supporting STI Talents in China

Published January 2025
ISBN 978-4-88890-953-2

For any inquiries regarding this report, please contact:
Asia and Pacific Research Center, Japan Science and Technology Agency
Science Plaza, 5-3, Yonbancho, Chiyoda-ku, Tokyo 102-8666, Japan
Tel: 03-5214-7556 E-Mail: aprc@jst.go.jp
https://www.jst.go.jp/aprc/