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Special Issue of S&T Statistics

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2012 Statistical Abstract on Science and Technology

The 2012 Statistical Abstract on Science and Technology, released by the Ministry of Science and Technology of China, provided an overall picture of science and technology (S&T) performance of the country from the following aspects, namely research and development (R&D) expenditure, human resources in science and technology (HRST) and R&D personnel, research achievements, patent applications and grants,

technology market and transactions, development of research, industry and trade in hi-tech parks, and science popularization.

I. R&D Expenditure

China's general R&D expenditure (GERD) in 2011 exceeded 868.7 billion yuan (USD134.4 billion), among which 73.9% or 642.06 billion yuan came from

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the enterprises, 21.7% or 188.3 billion yuan from the government and 4.4% or 38.34 billion yuan from the international and other sources.

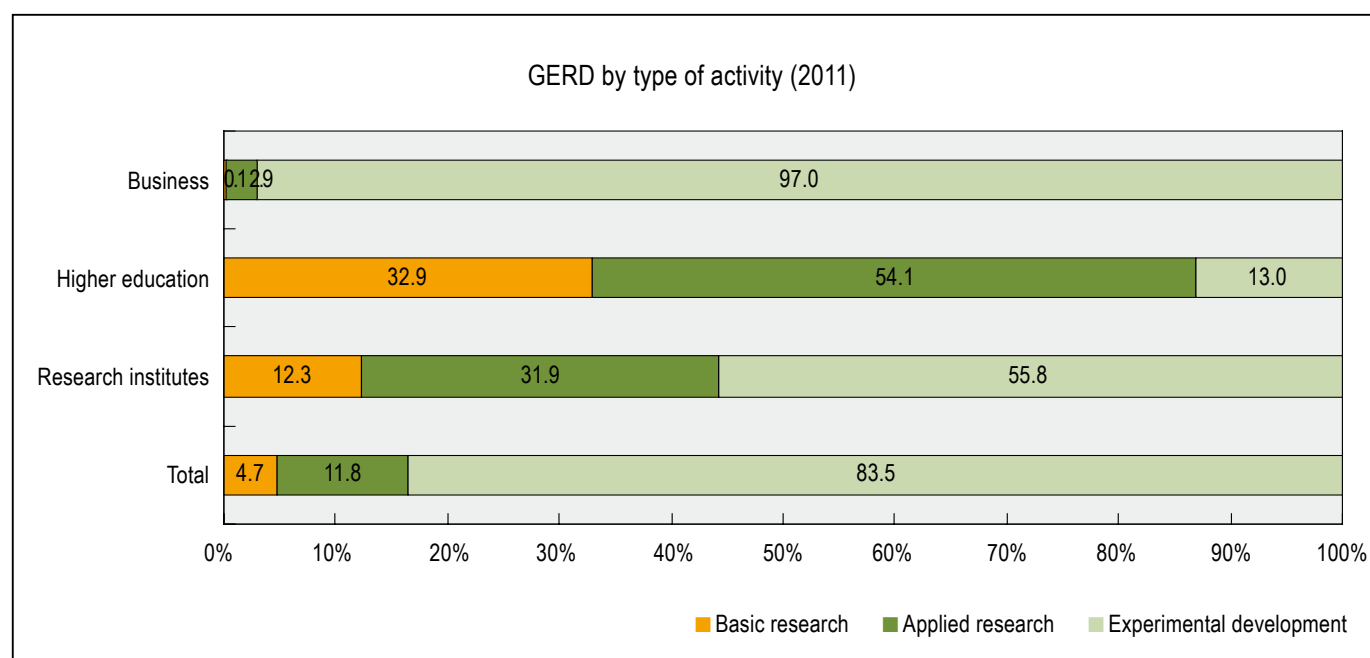
In 2011, the ratio of GERD to GDP reached 1.84%, 0.53 of a percentage point higher than in 2005. The annual ratio over the period from 2006 to 2011 was 1.39%, 1.40%, 1.47%, 1.70%, 1.76% and 1.84% respectively.

In view of GERD distribution in three types of

R&D activities, about 4.7% of the total went to basic research, 11.8% to applied research and the other 83.5% to experimental development. In view of GERD in the public research institutes, 12.3% of the total was used for basic research and 31.9% for applied research, while the figures in universities 32.9% for basic research and 54.1% for applied research respectively. The enterprises spent 97% of their research funding on experimental development.

Gross Domestic Expenditure on R&D

	2006	2007	2008	2009	2010	2011
GERD (billion yuan)	300.31	371.02	461.60	580.21	706.26	868.70
GERD/GDP (%)	1.39	1.40	1.47	1.70	1.76	1.84



II. HRST and R&D Personnel

1. Human Resources in Science and Technology (HRST)

China's total HRST reached about 63 million people in 2011, an increase of 10.5% over the previous year. Among them, 27.4 million people held bachelor or higher degrees. In China, around 4,018 thousand

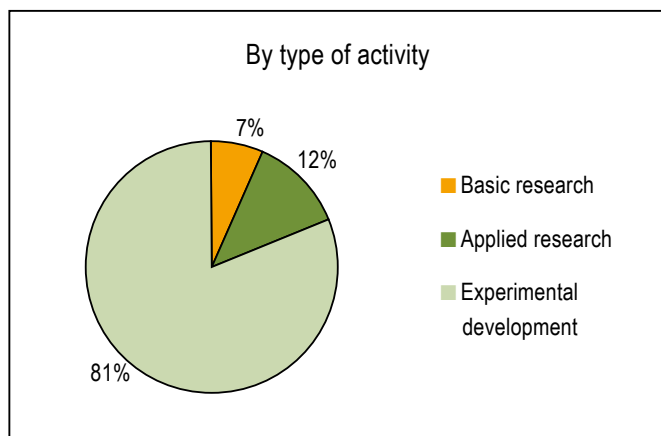
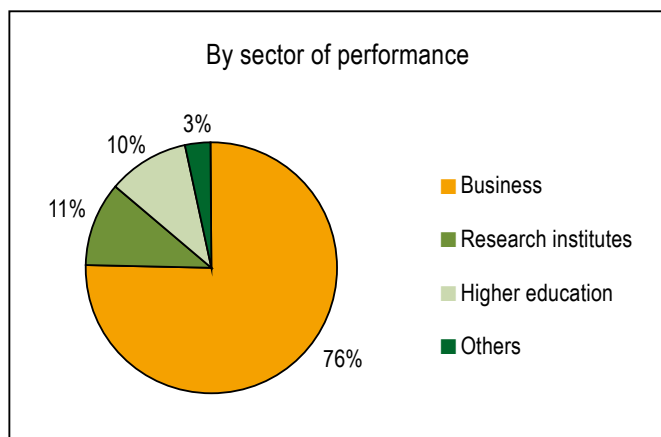
people were engaged in R&D activities in 2011, among them 252 thousand held PhD degrees, 566 thousand with master degrees and 1,279 thousand with bachelor degrees, and more than one million were women.

2. R&D Personnel

Based on the data comparable internationally, the

R&D personnel full-time equivalent in China reached 2,883 thousand person-years in 2011, an increase of 12.9% or 329 thousand person-years compared with the previous year. Among them, 81.1% or 2,337 thousand person-years were engaged in experimental development, 12.2% or 363 thousand person-years in applied research, and only 6.7% or 193 thousand person-years in basic research. Since 2000, there have been a continuous increase of researchers in experimental development, while the proportion of researchers in basic and applied research have been dropping. Among the full-time researchers, 75.2% or 2,168 thousand person-years were from the enterprises, 10.4% or 299 thousand person-years from universities, and 11% or 316 thousand person-years from research institutes.

R&D personnel by sector of performance and by type of activity(2011)



3. International Comparison

Despite the large number of HRST, the intensity of R&D personnel in China is still quite low compared to that in developed countries. In 2011, the R&D personnel per 10,000 labor forces was only 37 person-years in China, while the figure was 136 person-years in the US, 145 person-years in Japan, 138 person-years in South Korea and 119 person-years in Russia. In view of education level of personnel, the number of personnel with higher education per 100 labor forces in China was 11, and it was 61 in the US, 54 in Russia, 41 in Japan and 35 in South Korea.

III. Research Achievements

Scientific paper is one form of the output of S&T activities, which reflects major research progress and represents the scale, level and quality of research in a country.

Chinese S&T papers indexed by SCI, EI and CPCI-S(2006-2011) 10,000 papers

	2006	2007	2008	2009	2010	2011
SCI	7.1	8.9	9.6	10.9	12.2	14.4
EI	6.5	7.6	8.9	9.3	11.2	12.4
CPCI-S	3.6	4.3	6.5	5.2	3.8	5.2

Based on the data from 1998 kinds of scientific journals collected by the Chinese Science and Technology Paper Citation Database (CSTPCD), the number of papers with Chinese researchers as the first author was 530 thousand in 2011, a slight drop from 2010. About 67.2% of CSTPCD papers came from the top ten disciplines which are clinical medicine, computer technology, electronics, communications and automatic control, traditional Chinese medicine, agriculture, preventive medicine and hygienics, basic medicine, biology, chemical engineering and civil engineering, each with over 10,000 papers collected by

the database.

According to the statistics, Science Citation Index (SCI) collected 1,516 thousand papers worldwide in 2011, an increase of 6.7% over 2010, among which 144 thousand papers were published in mainland China, increased by 18.2% over the previous year. In the same year, China ranked the second in terms of SCI papers after the US, followed by the UK, Germany and Japan.

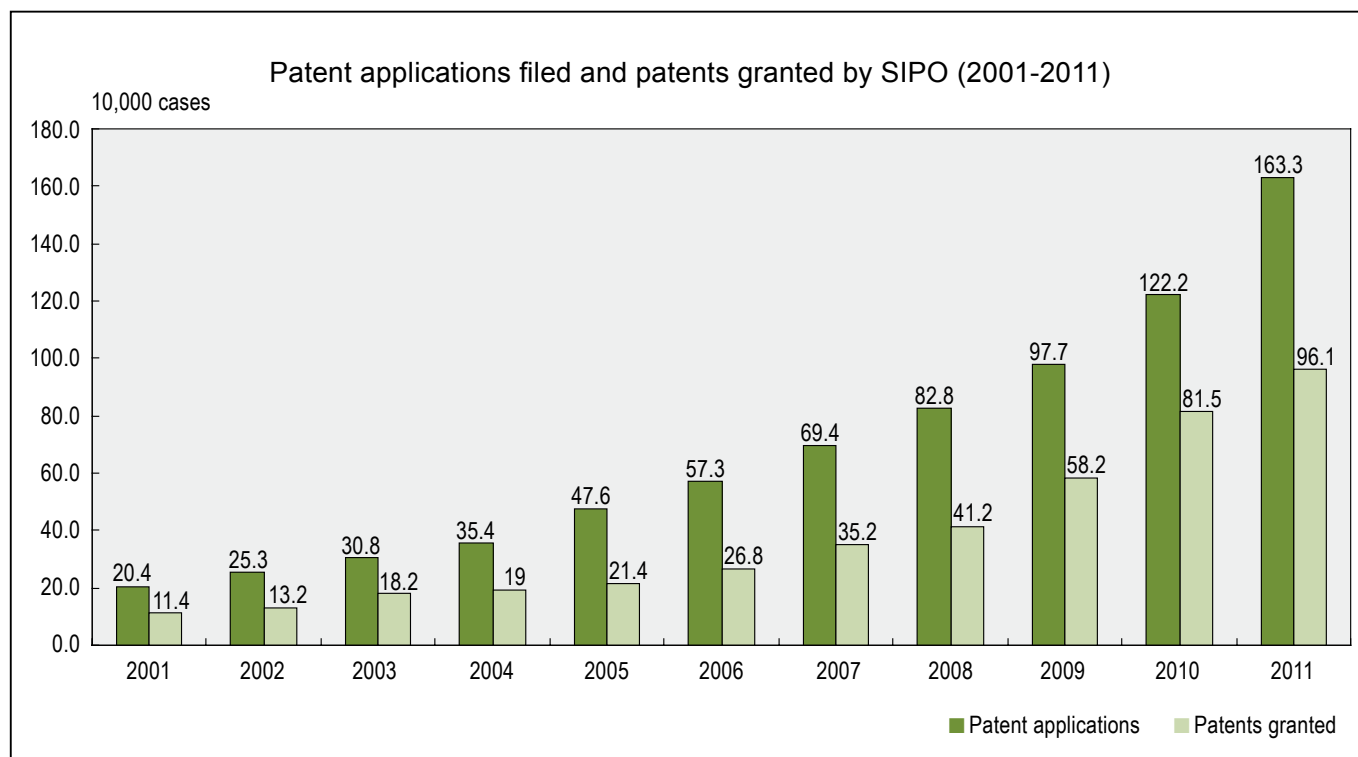
In view of the citation to SCI articles, China's average citation frequency per article is 6.51 times, higher than that in the previous year, but lower than the world average times of 10.60. Among the 17 countries, each of them accumulated over 200 thousand SCI papers during 2002-2012, China ranked 14th in terms of SCI citations. Based on the figures of China's SCI citations during the same period (before Nov.1, 2012), there were

14 disciplines ranked top ten in the world, of which the citations in the fields of chemistry, material science, engineering and mathematics ranked world 2nd and the citations in computer science, physics and earth science ranked 5th in the world.

IV. Patent Applications and Grants

1. Applications and Grants

In 2011, the number of patent applications in China reached 1,633 thousand, a growth of 33.6% year-on-year. Of which 32.2% or 526 thousand pieces were invention patents, increased by 34.6% over the previous year; 35.8% or 585 thousand pieces were utility model patents, and 31.9% or 521 thousand pieces were design patents.



In the same year, the number of patent grants had an increase of 17.9% to reach 960 thousand. Among which, the number of invention patent grants, utility model patent grants and design patent grants

were 172 thousand, 408 thousand and 380 thousand respectively and the annual growth rate of the three types of patent grants were 27.4%, 18.5% and 13.4% respectively.

According to the statistics, most of the invention patents came from the enterprises, contributing 55.7% or 231 thousand pieces of invention patent applications, an increase of 49.8% over 2010, while the number of invention patent grants to enterprises was 58,000 or 51.9% of the national total, a growth of 45.7% over 2010.

Among the top ten companies in term of submitting most domestic invention patent applications in 2011, seven are home-grown and the other three are foreign invested. Of which, the chinese company ZET ranked No.1 with 4,685 applications, followed by Huawei with 3,617 applications.

By the end of 2011, the number of valid patents in China stood at 2.74 million, among which 84.1% or 2,303 thousand were domestic valid patents and the other 15.9% or 437 thousand were foreign valid patents. Of all the valid patents registered in China, 351 thousand pieces or 15.3% were invention patents.

2. International Comparison

The past few years had witnessed a rapid development of patents in both applications and grants held by Chinese nationals. China's international ranking of the invention patent applications increased from the world No.4 in 2006 to No.1 in 2010 and the ranking of the invention patent grants was the world No.2 in 2011.

China's international patent filing under PCT reached 16,000 pieces in 2011, an increase of 33.4% year-on-year, and maintained the fourth position in the world. In PCT patent filing with 2,826 applications, ZTE corporation outscored Panasonic to become world No.1, and Huawei Technology Co.Ltd ranked No.3 with 1,831 applications in 2011.

In addition, based on OECD statistics on 41

countries (regions) with Tripartite patents, China took the lead among the developing countries to climb from the world No. 11 to No. 8 in 2010 with 875 Tripartite patents, a growth of 23.4% over 2009.

V. Technology Market and Transactions

Technology market in China is a trading place of the science and technology (S&T) achievements. The number of contract and the transaction volume in technology market reflect the scale and dynamic of the activities in transfer of S&T achievements. Technology trading has facilitated the transfer of S&T achievements and accelerated technology commercialization and industrialization.

In 2011, a total of 256 thousand technology contracts of all kinds have been signed in China's technology market, an increase of 11.7% over the previous year, and the turnover has reached 476.36 billion yuan, an increase of 21.9%. The total transaction turnover in the technology market has exceeded 1% of China's GDP, while the average turnover of each technology contract has reached 1.86 million yuan. According to the data on the turnover of the contract in 2011, 86.5% of the sellers are enterprises and 5.5% are research institutions.

In the context of industrial restructuring, technology transaction in the domestic market has witnessed a rapid development in strategic and emerging industries such as electronic information, bio-medicine, new energy, new material, energy conservation and environmental protection. Among above-mentioned fields, the turnover in electronic information technology has exceeded 120 billion yuan, accounting for 25.7% of the total turnover; the turnover in advanced manufacturing technology has reached 71.6 billion yuan, accounting for 15%; the turnover in new energy and energy efficiency technology

has reached 61.1 billion yuan, accounting for 12.9% of the total.

VI. Development of Research, Industry and Trade in Hi-tech Parks

Building high and new-technology industrial development zone or park (hereinafter referred to as hi-tech parks) nationwide is an important component of the state policy concerning S&T development and innovation. In 2011, the State Council approved the establishment of 5 more hi-tech parks, so there are altogether 88 hi-tech parks at national level in China.

1. Pooled Scientific Talents and High Density of R&D Personnel

By the end of 2011, enterprises in hi-tech parks have employed 10.736 million employees, among them 5.48 million have bachelor or higher degrees, accounting for 51%, and 1,371 thousand have senior and intermediate professional titles, accounting for 12.8% of the total. In 2011, the number of employees in enterprises in 83 hi-tech parks has increased by over 10% compared with last year.

In 2011, there were nationwide 1,744 thousand scientific personnel working in hi-tech parks, accounting for 16.2% of the total and among them 914 thousand (879 thousand full-time equivalent) were R&D personnel.

2. Sustained Increase of S&T Funds

In 2011, the S&T fund of enterprises in hi-tech parks reached 405.2 billion yuan. In the same year, the government has allocated altogether 19.84 billion yuan for S&T development in enterprises in hi-tech parks.

In 2011, the R&D expenditure of 57,033 enterprises in hi-tech parks stood at 226.9 billion yuan, accounting for 2.1% of the total sales revenue and 34.7% of the

total R&D expenditure of enterprises in China. The figures show that China's hi-tech parks are also the places featuring dynamic R&D activities. Moreover, with support of the regional funds for hi-tech parks all across China, 5.95 billion yuan were used for innovation in small and medium-sized and S&T-based enterprises, 15.02 billion yuan for supporting startup services investment, and 14.74 billion yuan for supporting guarantee agencies there.

3. Fruitful S&T Innovation Activities

In 2011, the number of patent applications in China's hi-tech parks has reached 169,161 pieces. Among the 88,238 patents that have been authorized, 29,438 were invention patent grants, accounting for 50.7% of the total invention patent grants of China's enterprises. Enterprises in hi-tech parks possessed 305,223 valid patents, among which 104,436 were valid invention patents, accounting for 15% of the nation's valid invention patents. The valid invention patents per 10,000 people in hi-tech parks are 97 pieces, which is 10.7 times of the nation's average level.

In 2011, the enterprises in 88 hi-tech parks have altogether registered 21,785 trademarks and acquired 21,478 software copyrights, 386 layout designs of integrated circuit and 66 new plant varieties. In 2011, the sales revenue of new products developed by 57,033 enterprises in hi-tech parks has reached 3458.15 billion yuan, and the export volume of the enterprises has reached 95.72 billion dollars. The sales volume of the new products developed in hi-tech parks accounted for 32.7% of the total product sales revenue there.

4. Industrial Output and Trade Volume

In 2011, China's hi-tech industry continued to expand, and its total output has reached 8843.4 billion yuan. Statistics has shown that joint ventures remained

to be the main contributors of the industrial output of hi-tech parks in different localities. During the 12th Five-year Plan Period, the proportion of the industrial output of domestic enterprises in hi-tech parks tended to increase. In 2011, the afore-mentioned proportion stood at 37.1% of the total, while the proportion of joint ventures stood at 62.9%. At present, the provinces and municipalities where the joint ventures' contributions to the local hi-tech industrial output exceeds 80% include Shanghai, Fujian and Tianjin, and those where the afore-mentioned proportion exceeds 70% are Jiangsu, Beijing and Guangdong.

In 2011, the import and export volume of China's hi-tech products totaled 1021.1 billion dollars, an increase of 11.8% compared with last year, among which the export volume was 548.8 billion dollars, an increase of 11.5% and the import volume was 463.2 billion dollars, an increase of 12.2%. The trade surplus in 2011 has hit a record high of 85.6 billion dollars.

In China, there are two main trade methods of exporting hi-tech products: processing trade (processing with imported material and processing with supplied material) and general trade. Figures from 2002 to 2011 have shown that the share of processing trade value was 76.9%, indicating its dominant role in trade. General trade value accounted for a smaller share but it demonstrated an upward trend, increasing from 3.1% in 2002 to 16.4% in 2011.

In 2011, the top three regions in terms of the trade volume of hi-tech products remained to be Guangdong, Jiangsu and Shanghai. The export value of hi-tech products in the three regions accounted for 78.7% of the national total, while the import value accounted for 73.2%.

VII. Science Popularization

Science popularization in China has seen a sustained development: the investment in relevant events and the

number of staff devoted to science popularization have both increased; a large number of facilities for science popularization have been built nationwide; media for science popularization are featured by various forms; local-level science popularization activities have become more dynamic.

1. Personnel and Funds

In 2011, the number of personnel devoted to science popularization stood at 1942.8 thousand, an increase of 11% compared with 2010, among which the number of full-time staff reached 224.2 thousand and that of part-time personnel reached 1718.6 thousand, accounting for 11.54% and 88.46% respectively in the total number of personnel for science popularization (PSP). At present, there are 14 PSP in every 10,000 people in China.

Science popularization in China is conducted based on the regional and local networks. Nowadays, the number of county-level science popularization staff has reached 1513.7 thousand, accounting for 78% of the total PSP in China. The number of PSP in rural areas stood at 711.2 thousand accounting for 36.61% of the total, which means the number of PSP per 10,000 people was 10 in rural areas. To a large extent, the science popularization activities in rural areas have facilitated the spread of scientific knowledge and the application of agricultural technologies there.

In 2011, funds for science popularization from all social sectors stood at 10.53 billion yuan, an increase of 5.81% compared with 2010, among which government funding at all levels has reached 7,259 million yuan, about 69% of the total fund. Funds for science popularization in China mainly come from the government, local organizations and social contributions. In 2011, the funds from the government and local organizations have both sustained their growth.

2. Facilities and Activities

By the end of 2011, the number of facilities for science popularization with its construction area exceeds 500 square meters reached 1,681 nationwide, which added 170 more to the total in 2010, an increase of 11.25%. Among these facilities, there were 357 S&T venues, 619 S&T museums and 705 stations for S&T activities for young people, increasing 22, 64 and 84 respectively compared with 2010. In 2011, the total expenditure on the building science popularization facilities was 2.197 billion yuan, which was about 12% less than that in 2010.

In 2011, 830 thousand lectures regarding S&T and science popularization were held in China, with 179 million audience, a slight increase compared with 2010; 130 thousand exhibitions on S&T and science popularization were held, with over 224 million visitors, an increase of 11.66% compared with 2010; more than 50 thousand competitions for S&T and science

popularization were held, with about 140 million participants, an increase of 158% compared with 2010. In 2011, over 30 thousand large-scale science popularization activities, each with over 1000 participants, were held all across China.

Science and Technology Week is a large-scale public activity for science popularization in China. In 2011, the total financial input for the S&T Week reached 436 million yuan, an increase of about 19% compared with 2010, among which government funding stood at 311 million yuan and enterprise financial support was 43 million yuan. During the S&T Week, over 110 thousand special events on science popularization were organized, attracting about 110 million participants and increasing 3% compared with the year 2010. It is estimated that by the end of 2013, there have been over 700 million people participated in the activities of S&T Week.

(Source: Department of Development Planning, MOST, June 2013)