

# CHINA SCIENCE AND TECHNOLOGY NEWSLETTER

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## **Special Issue: Review of China's R&D Statistics and Scientific Performance in 2014**

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## **China's R&D Intensity Hits a Record 2 percent**

On October 22<sup>nd</sup>, 2014, the National Bureau of Statistics (NBS), the Ministry of Science and Technology (MOST) and the Ministry of Finance (MOF) jointly released a government report on science and technology spending (S&T) for the year 2013 (hereinafter referred to as "the report"). Statistics from the report showed that research and development (R&D) input of the whole

nation kept growing in 2013, and R&D intensity (R&D expenditure as a percentage of GDP) exceeded 2 percent for the first time.

According to the introduction from a senior statistician and in NBS, the data of the report reflected government efforts in guiding and promoting home-grown innovation and the increased role of the industry community as a

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major player in R&D investment. By analyzing the data of patent filings and new products nationwide, the report also indicated that a good performance was achieved in the output of the increased R&D.

### **R&D intensity reaches record high**

According to the statistics in the report, the R&D input of the nation was 1,184.6 billion yuan, an increase of 154.82 billion yuan, up by 15 percent. R&D intensity exceeded 2 percent for the first time, reaching 2.08 percent, 0.1 of a percentage point higher than the previous year's 1.98 percent.

Following that the national R&D input hit the trillion yuan threshold in 2012, China's R&D intensity, which is the most significant indicator measuring a country's investment in science and technology, surpassed 2 percent in 2013. This demonstrated an increased S&T strength of China, and a narrowed gap between China and some industrialized countries like the US and Japan.

The overall expenditure can be classified by three types of R&D activities. For basic research, 55.5 billion yuan of the overall spending were arranged, up by 11.3 percent over the previous year. 126.91 billion yuan was committed to applied research, up by 9.2 percent, and the funding for experimental development reached 1,002.25 billion, up by 16 percent. The share of basic researches, applied researches and experimental development respectively accounted for 4.7 percent, 10.7 percent and 84.6 percent of the total R&D spending.

From the perspective of the entities who are carrying out R&D activities, enterprises, government-affiliated research institutes and higher education institutions shared respectively 76.6 percent, 15 percent and 7.2 percent of the total spending.

From the perspective of industrial sectors, there were seven sectors whose R&D input exceeded 50 billion yuan, and the R&D spending of the above-scale industrial enterprises in the seven sectors accounted for 61.3 percent of the total R&D input respectively.

According to a distribution of R&D input in regions, the top six investing provinces in terms of the share of the total were Jiangsu (12.6 percent), Guangdong (12.2 percent), Beijing (10 percent), Shandong (9.9 percent), Zhejiang (6.9 percent) and Shanghai (6.6 percent). Provinces with a higher-than-average R&D intensity were Beijing, Shanghai, Tianjin, Jiangsu, Guangdong, Zhejiang, Shandong and Shaanxi.

### **The leading role of the government in innovation is enhanced**

As it is shown in the report and the statistics, the state public spending in S&T in 2013 stood at 618.49 billion yuan, a year-on-year increase of 10.4 percent or 58.48 billion yuan. The share of S&T expenditure to the total public expenditure was 4.41 percent. The number was slightly lower than the previous year's 4.45 percent, but was still 0.6 of a percentage point higher than the average 3.81 percent during the 10th Five-Year Plan period and 0.1 of a percentage point higher than the average 4.32 percent during the 11th Five-Year Plan period.

Keeping the public spending in S&T increased enabled the government to effectively play a major role in guiding and planning actions for scientific and technological innovation. In R&D spending nationwide, the financial support from the government was greater than before, which was 250.06 billion yuan, up by 12.6 percent, accounting for 21.1 percent of the total spending.

### **Corporate R&D spending accounts for 76.6 percent of the national total**

The R&D expenditure from enterprises kept growing. According to the report and relevant statistics, the R&D spending of enterprises of all kinds reached 907.58 billion yuan, up by 15.7 percent over the previous year. Corporate spending accounted for 76.6 percent of the national total, 0.4 percent higher than the previous year.

Enterprise-sponsored research institutions grew stronger. In 2013, above-scale industrial enterprises had

52,000 research institutions, 6000 more than that of the previous year. The institutions employed a total of 2.388 million people, an increase of 120,000 over the previous year, and their expenditure on R&D were 594.15 billion yuan, an increase of 70.82 billion yuan compared with the previous year.

#### **Patent quality and new products develop better**

As China keeps increasing its R&D input in both academia and industrial sectors, industrial entities with above-scale industrial enterprises as major force yield fruitful results.

In 2013, a total of 219,000 applications of invention patent from above-scale enterprises were accepted, up by 24.2 percent over the previous year. For every one hundred enterprises, average 59.2 applications for invention patent were accepted, a year-on-year increase of 8 pieces. The share of applications for invention patent in total patent applications in 2013 was 37.8 percent, 1.8

percent higher than that of the previous year. In 2013, in terms of R&D input in above-scale industrial enterprises, every 100 million yuan generated 26.3 accepted applications of invention patent, 1.8 pieces more than that in the previous year.

In 2013, sales revenue from new products in above-scale industrial enterprises reached 12,846.07 billion yuan, up by 16.2 percent over the previous year, of which, new products' export accounted for 2,285.35 billion yuan, up by 4.4 percent. The sales rate of new products (sales revenue of new products as a percentage of the total revenue of the main business operation) was 12.4 percent, 0.5 of a percentage point higher than that of the previous year. In 2013, among above-scale industrial enterprises, the ratio of sales revenue of new products to R&D input was 15.4:1, improved a little better than the previous year.

(Source: Ministry of Science and Technology, October 23, 2014)

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## **China Ranks 4<sup>th</sup> in Science Paper Citation**

The Institute of Scientific and Technical Information of China (ISTIC) published its statistics for the country's science papers on September 26<sup>th</sup> 2014. According to relevant data, 1,369,800 science papers from China have been published by international publications, over the period from 2004 to September, 2014, ranking the second in the world. These papers are cited for reference 10.3701 million times, ranking the fourth in the world. Chinese papers were cited for reference 7.57 times on average, slightly higher than 6.92 in the previous year, however, lagging below the world average of 11.05 times.

In terms of the disciplines of cited papers, China ranks the second in chemistry, computer science, engineering

technologies, material science and mathematics, and the third in agricultural science and physics. These are the fields in which China has its strength. China is also among the top five in areas such as environment and ecology, geoscience, pharmacy and toxicology.

By the statistics of Science Citation Index (SCI), 204,100 papers were published internationally with Chinese researchers as the first author, and the papers with times of citation higher than the world average numbered 69,064, accounting for 33.8 percent of the total and 7.4 percentage point higher than the previous year.

In the period from 2004 to 2014, papers on various

fields in the top percentile measured by times of citation in China numbered 12,279, accounting for 10.4 percent of the world's total, up by 28.9 percent, ranking China the fourth after the US, the UK and Germany. The ranking has not been changed, but the share of China was improved by 1.8 percent.

A hot paper is one frequently cited within two years after publishing. By September 2014, China produced 384 hot papers, accounting for 15.7 percent of the world's total and 1.4 percentage point higher over the previous year, putting China the fourth in the world.

An academic journal with the best impact factor in its

field is seen as the world's most influential journal. In 2013, there were 153 most influential journals in 176 research fields. Papers published in these journals totaled 57,113 in 2013, among which 5,119 articles were written by Chinese scientists, accounting for 8.9 percent of the world's total, making China second only to the US.

These statistics show that either by times of citation, the number of SCI papers or the number of world's frequently cited papers, China is a solid fourth in the world, and the momentum of growth is stably gathering.

(Source: Science and Technology Daily, September 27  
2014)

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## **Nature Index Released: China has the Second Largest S&T Output**

According to the Nature Index released in November 2013 by Nature Publishing Group, China has joined the rank of leading nations in terms of S&T output, with its output only second to the US. Chinese research institutes such as the Chinese Academy of Sciences has contributed increasingly to science and drawn the attention of the public worldwide.

The Nature Index tracks the affiliations of about 60,000 high quality science papers, covering more than 20,000 research institutes. Articles included in the Nature Index come from 68 journals of natural sciences which

are deemed by the research community as the journals to publish their best output.

According to the latest Nature Index, among the 15 East Asian and Southeast Asian countries, China, Japan and Korea are the top three in terms of scientific output. Meanwhile, China dwarfs any other country in the Asia-Pacific region in terms of the R&D input and the growth rate of scientific output.

(Source: Science and Technology Daily, November 24  
2014)

## USTC Continues to Head Chinese Universities in NPI Ranking

The University of Science and Technology of China (USTC) has topped the Nature Publishing Index (NPI) ranking of Chinese universities for three consecutive years, according to the *NPI 2013 Asia-Pacific* published by Nature Publishing Group in March 2014. USTC ranked only second to the Chinese Academy of Sciences (CAS) among domestic institutions, the 9th in Asia-Pacific area and the 57<sup>th</sup> in the global ranking (16 ranking places higher than the previous year).

It is reported that 37 academic papers from USTC were published in *Nature* in 2013, and the NPI was 15.11, with physics and chemistry holding significant edges.

According to the NPI ranking, the top 10 Chinese research institutes are CAS, USTC, Tsinghua University, Peking University BGI, Nanjing University, Fudan University, Zhejiang University, Shanghai Jiao Tong University and the University of Hong Kong. The editor predicts that China is "on pace to take over as the top Asia-Pacific contributor to the NPI in the next two or three years", as CAS has replaced the University of Tokyo as the head of the Asia-Pacific NPI ranking for the first time.

(Source: Science and Technology Daily, March 28, 2014)

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## 134 Chinese Researchers Honored as 2014 Highly Cited Scientists

According to the list of highly cited scientists released by Thomson Reuters in August 2014, 134 Chinese researchers including those from Hong Kong and Macao were given the honor of highly cited scientists, ranking the 4<sup>th</sup> in the world, next to the US (1702), the UK (304) and Germany (163). 46 researchers were from the Chinese Academy of Sciences, the largest contributor of exceptional researchers among Chinese research institutions and universities. Five of the highly cited Chinese scientists earned the honor for their output in two fields.

Thomson Reuters generated an annual list of highly cited scientists based on the analysis and evaluation of the SCI papers in broad 21 fields of natural sciences and social sciences from 2002 to 2012. The researchers

earned the distinction by writing the greatest number of papers - ranking among the top 1% most cited for their subject fields. The researchers on the list were given high recognition for their exceptional contribution to their fields.

CAS contributes over 50 percent of the Chinese highly cited scientists in fields such as physics, material science, geo-science, environmental science and ecology, phytology and zoology, pharmacology and toxicology, and agricultural science. CAS has the lion share of the scientific output for material sciences, with CAS researchers as 11 percent of the global highly cited scientists in this field.

(Source: Science and Technology Daily, September 1, 2014)

## China Needs to Improve Science Papers' Quality

The Institute of Scientific and Technical Information of China (ISTIC) released 2013 statistics of China's science papers early in October, 2014. According to the statistics, China produced 231,400 SCI papers in 2013, ranking the 2<sup>nd</sup> in the world. As for the citation index, a measurement of the impact of science papers, China was in the 4<sup>th</sup> place.

It is also shown that the average citation of science papers produced in China was 7.57, lagging behind the world average of 11.05.

To call for the attention of researchers to quality and impact of science papers, ISTIC adopted, in 2009, a new indicator — outstanding papers, referring to papers with citation higher than the world average. In 2013, only 33.8 percent of SCI papers first authored by Chinese researchers are outstanding papers, reaching the world average level.

The fundamental solution to enhance the impacts of China's science papers is innovative research. In 2008, Chinese scientists first discovered iron-based superconducting in the world. The research team led by Professor Chen Xianhui of USTC broke the limit of the McMillan's equation and the T<sub>c</sub> of superconductors, proving that iron-based conductor is an alternative to copper oxide as an unconventional high-temperature superconductor. This discovery has been published in Nature, cited more than 900 times.

Universities contribute the lion share of China's SCI papers, 82.77 percent in 2013. Therefore, the quality of science papers produced in universities should be given full attention to.

(Source: Science and Technology Daily, October 8, 2014)

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## China Releases IP Index Report

*The 2014 China Intellectual Property (IP) Index Report* was released in October 2014, the sixth such report since 2009.

The report describes IP development in various localities. Beijing, Jiangsu, Shanghai, Guangdong and Zhejiang are the top 5 in terms of comprehensive IP development, followed by Tianjin, Shandong, Liaoning, Fujian and Chongqing. Beijing has topped the ranking for several years.

According to historical statistics, the IP index is positively correlated to GDP. The areas with high IP index often have high GDP, showing activities are more

active in the fast economic growth regions.

There is a regional imbalance in China's IP development, strong in the east and weak in the west. As the most urbanized area in China, East China has the highest IP index, 0.378 percentage point higher than the national average. In the ranking of IP index, five of the Top 10 provinces are located in East China, including Jiangsu, Shanghai, Zhejiang, Shandong and Fujian.

To encourage IP development, the research team adopts a more visual method. An IP early warning mechanism is introduced based on the ranking of IP index. The top 10 provinces are marked by green color,

the middle 10 by yellow and the last 10 by red.

In the 2014 report, the green zone includes Beijing, Shanghai, Guangdong, Jiangsu, Zhejiang, Shandong, Tianjin, Liaoning, Fujian, and Chongqing. The yellow zone consists of Hunan, Hubei, Anhui, Sichuan, Shaanxi, Henan, Hebei, Jilin, Shanxi, Heilongjiang, and Hainan. The red zone includes Inner Mongolia, Jiangxi, Guangxi, Guizhou, Yunnan, Gansu, Ningxia, Xinjiang, Qinghai, and Tibet.

The research team is comprised of eminent economists and legal experts. They try to discover the relation between IP and economic development with quantitative IP indicators. The report is highly recognized for its authoritative data and complete index system. WIPO has already included the report into its publication system to honor the contribution of Chinese experts to IP development.

(Source: Science and Technology Daily, October 15, 2014)

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## China International Patent Fair Rounded off in Dalian

The three-day International Patent Fair was closed at Dalian of Liaoning province on September 14, 2014, and there were a number of contracts signed up for over 800 projects with a transaction turnover of 3.38 billion yuan.

The fair witnessed a great number of patent transactions and close exchanges in IP. Over 1,700 enterprises from 17 countries and regions as well as 21 province and over 100 cities presented over 6,000 patented technologies during the event.

With exhibition of high-level technologies and organization of diverse activities, the fair reaped fruitful results in promoting professional and pragmatic cooperation.

17 countries and regions around the world were well represented in the fair, including the Czech Republic, Hungary, Poland and Pakistan, which sent delegations to the event for the first time.

The fair set aside a special area for the Chinese Academy of Sciences (CAS) for the first time, showcasing over 170 projects from 23 research institutes. There was also an exhibition area for national awarded patent projects.

In the area for Dalian Innovation Alliance, high-level projects were presented.

During the event, projects were promoted and signed, making a record high of contract value. A number of activities were held on the sideline of the fair, including finance matchmaking, entrepreneurship tutoring and roadshows, as well as IP services.

At the high-level forums on “IP Application and Urban Innovation Development” and “Robots and Intelligent Manufacturing”, senior experts and business elites had discussion on frontier technologies like big data and intelligent manufacturing, and the application of IP in promoting urban development.

The fair also promoted the ties between national research institutes and local industries. Quite a number of CAS patented technologies were showcased at the fair. A cooperation agreement was signed between CAS Shenyang Institute and Dalian Municipal Bureau of Science and Technology, launching a new chapter for cooperation.

(Source: Science and Technology Daily, September 15, 2014)