

中国科技通讯

CHINA SCIENCE & TECHNOLOGY NEWSLETTER

Facts and figures: Innovation in China

- Statistical Analysis of R&D Activities of Major Industrial Enterprises in China

Top Scientists: Dong Yang and Li Xuebin

In 2020, the 169 high-tech industrial development zones in the country registered a business revenue of 41.8 trillion yuan, an increase of 8.4% from 2019.

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Facts and figures: Innovation in China

-- Statistical Analysis of R&D Activities of Major Industrial Enterprises in China

In 2019, there were 129,000 or 34.2% of major industrial enterprises conducting R&D activities in China. A total of 85,000, or 22.5% of the major industrial enterprises had their own R&D institutions. A total of 4.441 million R&D personnel were employed by major industrial enterprises, 180,000 more than the previous year; the full-time equivalent of R&D personnel was 3.152 million, 171,000 million more than the previous year. The R&D spending of major industrial enterprises reached 1.4 trillion yuan, an increase of 7.8% over the previous year; and the R&D intensity reached 1.32%, up by 0.09 percentage points over the previous year. There were 25 sectors in which the R&D spending of major industrial enterprises exceeded 10 billion yuan. The number of invention patents filed by major industrial enterprises reached 398,000, an increase of 7.3% over the previous year; and the number of invention patents held by major industrial enterprises totaled 1.218 million, up by 11.3% over the previous year.

✧ I. Distribution of enterprises carrying out R&D activities

In 2019, there were 129,000 or 34.2% of major industrial enterprises (hereinafter referred to as enterprises) carrying out R&D activities in China, up by 6.2 percentage points over the previous year; there were 85,000 or 22.5% of enterprises with R&D institutions, up by 3.3 percentage points over the previous year.

In 2019, of all the enterprises carrying out R&D activities, 114,000 or 87.9% were enterprises invested by the Chinese mainland; 7,418 or 5.7% were invested by Hong Kong, Macao and Taiwan; and 8,232 or 6.4% were foreign-invested enterprises.

◇ II. R&D personnel and spending

In 2019, there were 4.441 million R&D personnel employed by enterprises in China, accounting for 62.3% of China's total; among them, 972,000 were female, accounting for 21.9% of all R&D personnel in enterprises. The full-time equivalent of R&D personnel was 3.152 million. Researchers in R&D stood at 971,000, accounting for 30.8% of all R&D personnel in enterprises.

In 2019, the R&D spending of Chinese enterprises totaled 1.4 trillion yuan, an increase of 7.8% over the previous year; the R&D intensity of enterprises (the ratio of R&D spending to main business revenue) reached 1.31%, up by 0.08 percentage points over the previous year.

Enterprises invested by the Chinese Mainland played a dominant role in business R&D activities. In 2019, enterprises invested by the Chinese Mainland spent 1.1 trillion yuan on R&D, accounting for 80.3% of all enterprises; Hong Kong, Macao and Taiwan-invested enterprises spent 113.84 billion yuan on R&D, accounting for 8.1%; foreign-invested enterprises spent 161.38 billion yuan on R&D, accounting for 11.6%.

Industry-wise, in 2019, 25 sectors saw over 10 billion yuan of business R&D spending, with basically the same ranking as in the previous year. The computer, communications and other electronic equipment manufacturing sector had the highest

R&D spending, or 244.81 billion yuan, making up 17.5% of the total business R&D spending. The sectors with over 100 billion yuan of R&D spending also included the electrical machinery and equipment manufacturing sector and the automotive manufacturing sector, which respectively totaled 140.62 billion yuan and 128.96 billion yuan. The sectors with R&D spending ranging from 50 billion yuan to 100 billion yuan included the chemical materials and chemical products manufacturing, ferrous metal smelting and rolling processing, general equipment manufacturing, special equipment manufacturing, pharmaceutical manufacturing, and non-metallic mineral products. Nine industries saw over 50 billion yuan worth of R&D spending, which accounted for 69.3% of the total of all major industrial enterprises.

❖ **III. Patent output**

In 2019, Chinese enterprises filed 1.06 million patents, including 399,000 invention patents, an increase of 10.7% and 7.3% respectively over the previous year. Invention patents accounted for 37.6% of all patent applications filed by enterprises.

In 2019, Chinese enterprises held 1.218 million invention patents, an increase of 11.3% over the previous year. Among them, enterprises invested by the Chinese Mainland made up the lion's share of invention patent ownership (84.4%), while Hong Kong, Macao and Taiwan-invested enterprises and foreign-invested enterprises accounted for 7.7% and 7.9% respectively. Industry-wise, the computer, communication and other electronic equipment manufacturing sector held the largest number of invention patents (340,000), followed by the electrical machinery and

equipment manufacturing sector (143,000). Together they accounted for 39.7% of all valid invention patents held by enterprises. Region-wise, the number of invention patents held by enterprises in the eastern, central, western and northeastern regions were 881,000, 185,000, 119,000 and 34,000 respectively, accounting for 72.3%, 15.2%, 9.7% and 2.8% respectively. In terms of geographic distribution, enterprises in Guangdong and Jiangsu had the largest number of invention patents, accounting for 30.8% and 14.9% respectively.

Top scientists

✧ **Dong Yang: Exploring biological treasures with genomics research**

Dong Yang, a young scientist born in the 1980s, is a professor at Yunnan Agricultural University. He is leading a team, aged 26 on average, to uncover the mechanisms behind the genetic diversity and domestication of grapes. A total of 26 countries have joined the research project. With a daily processing volume of 40 Tb of data, it is one of the world's largest research projects on plant genetic resources.

In sequencing the goat genome, Dong Yang and his team, with the next-generation sequencing technology and the latest DNA single-molecule optical mapping technology, have overcome the limitations of short read scaffold in sequencing and developed a super scaffold. Having assembled a genome close to the chromosome level, the project has produced the first large genome that does not depend on genetic mapping. At the same time, using the microRNA transcriptome technology, the research team has for the first time revealed all the differences of goat

fleece and hair follicles at the transcriptional level, and identified more than 50 genes closely associated with the formation of goat fleece.

In addition, with their technological advantage, Dong Yang and his team successfully reduced the time required in genetic mapping from 10-15 years to half a year, and the related results were published in Nature Biotechnology. On the basis of the research, Dong Yang also worked with relevant Chinese universities and institutes to breed cashmere goats, giving a strong boost to the yield and quality of cashmere.



✧ **Li Xuebin: Guardian of the “high-speed railway lifeline”**

As the pioneer in the research of homegrown catenary lines for high-speed trains, Li Xuebin and his team successfully developed the "ultra-fine crystal reinforced copper-magnesium alloy" contact wire in 2009, which is a major achievement in China's high-speed rail electrification. In 10 years' time, it has reduced the cost of high-speed rail construction by nearly 10 billion yuan.

For more than ten years, Li Xuebin has maintained his passion for innovation in the field of high-speed railway contact wires. In 2013, his team developed a new contact wire for Xinjiang's "100-mile wind area", which was applied on a large scale in the electrification of Lanzhou-Xinjiang Railway and the construction of Lanzhou-Xinjiang High-speed Railway. Even with the train passing through the fierce wind zone at a speed of 250 km per hour, the performance of the contact wires remains stable. In 2014, the team successfully developed the contact wire for high-speed trains running at a speed of 400 km per hour, with the tensile strength increasing by 8% and the conductivity by 13%. The new wire was successfully applied to the high-speed railways in western ROK. In 2015, the team developed a new type of contact wire material, which was successfully piloted in the test section of the Datong-Xian High-speed Railway. The strength of the contract wire reached 580 MPa, and the conductivity of the load-bearing cable reached 80%. In 2016, the team successfully developed a new type of suspension wire technology, increasing the wire fatigue life by 3 times.

Up to now, Li Xuebin's team has been granted more than 80 patents, including 10 invention patents and 42 utility models. His team has also participated in the revision of 2 industry standards, 2 local standards and 2 international IEC standards.

(Source: Ministry of Science and Technology of China)