CHINA SCIENCE AND TECHNOLOGY NEWSLETTER

Department of International Cooperation *No. 24*
Ministry of Science and Technology(MOST), P.R.China *December 30 2016*

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China's Research and Innovation Performance

40 Chinese R&D Institutions Make to World's Top 100

According to the "Nature Index 2016 Rising Stars" published on 28 July 2016, a supplement to Nature, 40 of the world's top 100 R&D institutions in R&D output increment come from China. 24 of them have increased their R&D output by over 50% since 2012. As the largest contributor of high-quality scientific research papers, the US ranks the second on the list, with 11 institutions entering the top 100.

The top 9 names on the "Nature Index 2016 Rising Stars" list are all Chinese R&D institutions. The Chinese

Monthly-Editorial Board:54,Sanlihe Road Beijing 10045,china
Contact: Liu Bin E-mail:liub@cstec.org.cn nis@cstec.org.cn http://www.cistc.gov.cn

Academy of Sciences ranks the first, and the other eight Chinese institutions are: Peking University, Nanjing University, University of Science and Technology of China, Nankai University, Zhejiang University, Fudan University, Tsinghua University and Suzhou University.

David Swinbanks, founder of Nature Index, said that China has achieved significant growth in high-quality R&D output, and stayed on a stable growth trajectory.

The Nature Index report shows that in the last four years, China has registered the most significant growth in R&D output among all countries included in the Nature Index. The same trend can be seen in both overall performance and in the four disciplines tracked by Nature Index, i.e. physics, chemistry, life sciences, and earth and environmental science.

(Source: Science and Technology Daily, 29 July 2016)

China Steadily Improves Performance of Science and Technology

On 1 August, 2016, the result of the fifth national technology forecast, was released, forecasting and evaluating the goals, priorities and benefits of China's science and technology development in the coming decade, and selecting100 core technologies and 280 key sectoral (industrial) technologies. It was a research task assigned by the Ministry of Science and Technology to the Chinese Academy of Science and Technology for Development.

Through the commonly used methods of technology forecast, the research conducts quantitative evaluation of China's gap with international standards in 1,346 technologies. The conclusion shows that the gap between China and advanced international standards is markedly narrowed. China used to be trailing behind in all technologies, but now, "trailing behind" is only half of the technologies. And in the other half, China is already "on a par with" or even "running ahead of" world leaders. Compared to the countries in the lead, China now stands at a medium-to-high level of technological development.

Based on the fourth national technology forecast, the forecast this time has included four new areas, i.e. transportation, earth observation and navigation, ocean, and urbanization and urban development, basically covering all the main areas of scientific and technological innovation in China.

The result of the research has provided important scientific evidence and support for the formulation of Plan for Implementing the National Strategy of Innovation-driven Development and the national, ministerial and local innovation plans for the 13th Five-Year period.

(Source: Science and Technology Daily, 2 August 2016)

China Ranks Top 25 in Global Innovation Index

On 15 August 2016, World Intellectual Property Office (WIPO), Cornell University and INSEAD released the Global Innovation Index 2016. The report for the first time puts China in the top 25 list of the world's most innovative economies.

China's top 25 ranking makes it the first middle-income country to match highly advanced economies in innovation capability. Since the launch of the Global Innovation Index in 2007, the top 25 positions have never been held by countries other than highly advanced economies.

The report highlights the progress China has made in the key indicators of innovation index over recent years, including gross expenditure on R&D, ICT services imports, patents by origin, citable documents H index and innovation human capital.

It is reported that China ranks the first place in ten of the 82 indicators for evaluation, including share of high-

tech exports, knowledge workers, competence (reading, mathematics and science) evaluation of 15-year-old teenagers and corporate training. It also holds visible advantages in such fields as R&D expenditure of global corporations, knowledge and technology output, and intangible assets.

The report points out that at the national level, innovation policies should be more conducive to international cooperation and the cross-border communication of knowledge, and that the new international governance structure should be more conducive to the dissemination of technology to and between developing countries.

The report stresses that as the share of innovation activities rises in the global innovation network, global innovation returns are shared more extensively through the cross-border movement of knowledge and talent.

Switzerland, Sweden, the UK, the US and Finland are the top five performers in the Global Innovation Index 2016. China's rankings from 2011 to 2015 were respectively 29th, 34th, 35th, 29th and 29th.

(Source: Science and Technology Daily, 17 August 2016)

WIPO Senior Leader on China's Innovation Capability

The "Global Innovation Index" co-published by WIPO and other institutions on 15 August 2016 places China in the top 25 list of most innovative economies for the first time.

Wang Binying, who has been working in WIPO since 1992, said in a media interview that from 2007 when the first Global Innovation Index was released to last year, China's innovation ranking was staying between 29th and 43rd. The top 25 ranking this year is mainly the result of the commitment of the Chinese government to the building of innovation capability and the growing public awareness of the importance of intellectual property rights.

According to the WIPO materials, there has been a significant increase in the applications for both patents and trademarks in China in recent years. In 2015, China filed over 29,800 international patent applications within the WIPO framework of Patent Cooperation Treaty, up by 16.8% year-on-year, ranking the third, only next to the US and Japan. As for the ranking of applicants, China's Huawei Group ranked on top for the second year in a row, with 3,898 applications, and ZTE came the third with 2,155 applications.

In the first half of 2016, the number of China's international patent applications already surpassed 17,400, up by 36.9% over the same period of last year. This shows the advance of science and technology and expansion of development space for China during the past decade.

Wang Binying also mentioned the key challenges China may face in the future in pursuing innovation, such as how to turn itself from a major country in patent application into a global power of scientific and technological innovation; how to master cutting-edge science and technology with the international patent application system; how to ensure sustainable development in scientific and technological innovation; and how to cope with the ever intense international patent competition. All these are questions that require some serious reflections by visionary people in China.

(Source: Xinhua News Agency, 3 September 2016)

Nature Publishing Group on China's Scientific Research

From 6 to 8 September 2016, the editors-in-chief and senior editors of Nature and its 44 affiliated journals gathered in Shanghai for the first Nature Research Summit held in China together with the Chairman, Chief

Executive Officer, Chief Publishing Officer and other senior executives of the Springer Nature Group.

An editor of Nature told the media that the number of influential thesis published by Chinese scientists on Nature and its affiliated journals has significantly increased. In 1997, only 0.3% of the original research papers published on Nature were from Chinese authors, yet the share soared to 8% in 2015. The number of thesis published by Chinese scientists on Nature's affiliated journals also jumped from 0.3% to 11.9%.

The latest Nature index shows that China's high-quality R&D output has increased by 37% from 2012 to 2014, far outpacing the average speed. Its contribution to global output ranks the second, only next to the US. Of the top ten countries in the Nature index 2016, China is the only country with a double-digit annual growth during the 2012-2015 period.

Stefan von Holtzbrinck, Chairman of the Springer Nature Group, linked China's R&D progress with the commitment and sustained input of the Chinese government in science and technology. China's input in science and technology is already larger than that of the EU and close to the US, which will continue to give strong boost to the R&D programs in China.

"We want to have more cooperation with China. China is a rising global power in R&D and a country with its own distinctive features. In the meantime, we believe supporting China's R&D will also contribute to the global endeavor in this regard," said Stefan von Holtzbrinck.

He also pointed to China's huge room for development in the field of basic research. In 2014, R&D input accounted for 2.1% of China's GDP, which is already close to the level of developed countries like the UK and the US. However, only a small fraction of the input is directed to basic research. Since the R&D outcomes of applied research all originated from basic research, increasing input in this field is a visionary long-term strategy for promoting innovation.

(Source: Science and Technology Daily,
9 September 2016)

China's Overall Performance in Science Papers

On October 12th 2016, the Institute of Scientific and Technical Information of China (ISTIC) released the latest statistical results of China's scientific and technological papers. It shows that although China still ranks the second globally in the number of international papers, the overall quality of the papers is improving. For the first time, China is among the top three of highly cited papers and international hot papers.

In 2015, China published 296,800 international papers (in the SCI database), ranking the second in the world for the seventh consecutive year, and accounting for 16.3% of the world's total, only next to the US. The quality of China's international papers is also constantly improving. The number of citations rose by 15.7% over last year, ranking the fourth in the world, notably faster than other countries.

It is worth noting that for the first time China ranks the third in the world in both highly cited papers and international hot papers. Highly cited papers refer to the top 1% of the most cited ones in a ten-year period. International hot papers refer to those frequently cited in the first two years since publication; and are among the top 0.1% of most cited ones in its academic discipline. According to statistics, China produced 16,900 highly cited papers, accounting for 12.8% of the world's total, and 495 international hot papers, or 18.0% of the total, both moving one position up in the ranking list. This demonstrated the stronger innovation capability of Chinese scientists.

China's international paper citation is relatively higher in eight disciplines including chemistry. Statistics show that China ranks the second in the world in the number of international paper citations in eight fields: chemistry, agricultural science, computer science, engineering technology, material science, mathematics, pharmacy and toxicology, and physics; the third in environmental and ecological science and general science; the fourth in geology, botany and zoology; and fifth in biology and

biochemistry, and microbiology.

The National Natural Science Foundation of China (NSFC) is the main funding institution of basic research. If journals with the highest impact factor in various disciplines are counted as the most influential ones in respective fields, then China published 8,286 papers on these journals in 2015, accounting for 15.2% of the world's total, 2,781 more than in 2014. Statistics show that 54.6% of such papers are funded by the NSFC.

In all the international papers China published in 2015, 75,000 are produced in cooperation with foreign scientists, which accounted for over a quarter of the total for the first time, 15.1% higher than in 2014. The top six partners of Chinese scientists are from the US, Australia, the UK, Canada, Japan and Germany. China-US collaboration alone accounts for 45% of all the joint papers.

Relevant data also suggests that of all the international papers published in 2015, 188 papers are produced by over 1,000 authors in over 150 institutions. 451 papers are produced by over 100 authors in over 50 institutions in such disciplines as high energy physics, astronomy and astrophysics, instrumentation, meteorology and atmospheric science, biology, medicine and health. Among the 36 papers whose primary authors belong to Chinese institutions, 35 are published by the Institute of High Energy Physics of the Chinese Academy of Sciences.

(Source: Science and Technology Daily,
13 October 2016)

China Excels on 30 R&D Frontiers

According to the Research Fronts 2016 published by the Chinese Academy of Sciences on October 31st, 2016, China excels in 30 out of the 180 popular and emerging frontiers of the world, ranking the second among all countries.

The Report was written by the Institute of Science and Development and the National Science Library of the Chinese Academy of Sciences and the Clarivate Analytics (formerly the IP and Science business of Thomson Reuters). The research team picked 100 popular frontiers with the highest rankings in the ten major disciplines of natural and social sciences as well as 80 emerging frontiers that have made rapid headway in the past two years from a total of 12,188 research frontiers cited, classified and analyzed from the literature over the past six years. Through analysis of distribution among countries and institutions, the Report has provided an overview of the global trend of research frontiers. Meanwhile, countries like the US, the UK, Germany, France, Japan and China have also been evaluated in terms of their contribution and potential for development in the 180 frontiers.

According to the Report, China excels in 30 research frontiers, or 1/6 of the total, ranking the second in the world (the US ranks the first with excellent performance in 106 frontiers). China's 30 frontiers covered eight fields, featuring a concentration in chemistry and material science and balanced distribution in other fields like physics, biology, engineering, mathematics and computers. The majority of the research frontiers were generated by critical issues. China's performance is particularly impressive in such frontiers as avian influenza, polymer solar cells, black phosphorus, Weyl semimetal and cloud manufacturing.

The US still leads notably with the presence of corresponding authors in core papers in 152 frontiers, almost accounting for 85% of the total. China has corresponding authors in 68 frontiers, nearly 40% of the total, ranking the third next to the UK which covers 90 frontiers.

According to the Report, research frontiers can be identified by tracking the most important research and academic papers globally, studying and analyzing the model and classification of cited papers. Having picked the 180 popular and emerging frontiers, the Report went on to analyze their distribution among countries and institutions, which provided a basis for revealing a global trend. For instance, there are 20 research frontiers

in physics, which mainly concentrates in high energy physics, condensed matter physics, theoretical physics and optics. Taking high energy physics as an example, neutrino oscillation and gravitational wave observation remain the most popular frontiers of this year, while indirect probes of dark matter also attracted much attention.

(Source: Science and Technology Daily, November 1, 2016)

China's Information Industry Index

On November 18th 2016, the Third World Internet Conference closed in Wuzhen of Zhejiang Province. In a report published that day, China Internet Network Information Center announced that China's global ranking in information industry has jumped to the global 25th, surpassing the average of the G20 countries for the first time.

According to the Report, the US, the UK and Japan are the top three countries. China's ranking among the world's 20 major countries is after Russia and followed by Italy.

The Report notes that by the end of last year, China had 688 million netizens, simply half of its population. And an additional 300-500 million of its population have the potential to become netizens. Beijing, Shanghai and Tianjin lead the country in broadband speed of over 10Mbps while that of world leaders like the ROK and Singapore is 20Mbps.

According to the Wuzhen Report of World Internet Development 2016 released at the closing ceremony, there are 3.5 billion netizens worldwide in 2016, yet over half of the world's population still has no experience with the internet. The penetration of the internet is over 80% in developed countries, but only 23.5% in least developed countries and regions.

It also presented the value of the global retail e-commerce market in 2016 as USD 1.9 trillion, including 0.51 trillion euro in Europe and US$ 0.8 trillion in China.

(Source: Science and Technology Daily, 19 November 2016)