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13th Five-Year Plan on STI International Cooperation Promulgated

Summary

Since April 2017, the Ministry of Science and Technology has promulgated a series of important documents on science, technology and innovation (STI) to deliver *the Plan for Implementing the National Strategy of Innovation-Driven Development*, and the STI section in the 13th *Five-Year Plan* among others. The scope of planning covers material, modern service industry, advanced manufacturing technology, national projects on technological innovation, public security, high-tech zones, biological technology, and international cooperation, etc. The Newsletter will update a series of reports on these important documents.

The Ministry of Science and Technology (MOST) of China has recently formulated and promulgated *the Plan on International Cooperation in Science, Technology and Innovation in the 13th Five Years* (hereinafter referred to as "the Plan") The aim is to plan and promote innovation with a global vision, elevate international cooperation in STI, engage in the global innovation system, establish mechanisms for open innovation at a higher level and promote international cooperation and exchanges during the span of the *13th Five-Year Plan.*

The overall idea is to fulfill the development concepts of "innovation, coordination, greenness, openness and sharing" and establish an open system of STI cooperation based on mechanisms of international cooperation, further engage in the global innovation network, nurture new strengths through international competition and cooperation, boost industrial restructuring and upgrade, and contribute to meeting the objective of turning China into a moderately prosperous society in an all-round way.

To achieve the above-mentioned goals, the Plan has set 9 key tasks.

1. Deepen international cooperation in science and technology (S&T), and help to build new international relations centering on win-win cooperation. Further enrich international cooperation in science and technology, improve inter-governmental S&T cooperation with developed countries, emerging economies and other developing countries, innovate in cooperation mechanisms, and promote high-end cooperation.

2. Advance the Belt and Road Initiative, and promote connectivity in STI with countries along the Belt and Road. Fully leverage the guiding role of STI cooperation in joint initiatives under the Belt and Road, and build a community of shared innovation with common development concepts, unimpeded flows of elements, interconnected S&T facilities and innovation chains and smooth personnel mobility.

3. Further open to the outside world, and establish a system of global STI cooperation. National S&T programs (including special projects and fund) should be more open to the outside world. Support foreign experts to lead or engage in the strategic study, formulation of guidelines, project implementation and evaluation, as well as acceptance check. Encourage foreign R&D centers in China to participate in projects funded by national programs. Establish differentiated R&D cooperation mechanisms for developed countries, emerging economies and developing countries.

4. Engage in and play a leadership role in the organization of international mega-science projects, and boost the international influence of China's S&T advance. Adopt a principle of "clear positioning based on real situation and make steady progress step by step", formulate development strategies and plans based on China's own situation, steadily promote China's engagement and leadership role in international mega-science projects.

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5. Enrich the contents and improve the approaches of technical assistance, and raise the technical level of such assistance. Carry out cooperation with developing countries, take S&T partnership programs as the media, and help assistance recipient countries to improve people's livelihood, enhance homegrown abilities on the basis of respecting the needs of different countries (regions), and effectively leverage the role of S&T in supporting local socio-economic development.

6. Accelerate the nurturing of talent forces for STI that can meet the needs under new circumstances, and raise the level of talent internationalization. Plan for the overall recruitment of S&T talent, expand recruitment channels, innovative recruitment models, continue to leverage the policy for attracting all sorts of innovative talent, introduce high-end overseas talent to meet urgent demands in China, and attract international students, outstanding Chinese scientists and foreign scientists to come and work in China.

7. Develop a network of platforms for international STI cooperation that covers the whole innovation chain, and promote sustainable R&D collaboration. In line with specific purposes and focuses, make arrangements to optimize the global layout of platforms for international STI cooperation in the fields of basic research, cutting-edge technology, and pre-competition technology. Support the establishment of international joint research centers and overseas research bases, and establish international alliances of business-academia-research collaboration with professional expertise and capabilities to serve regional cooperation.

8. Leverage regional strengths, and develop highly integrated regional communities of STI collaboration for mutual benefits. In the light of geographical advantages, fully tap location-specific STI resources in key regions, and support major regional communities of international STI collaboration for mutual benefits.

9. Facilitate the efforts of enterprises to go global through STI, and promote mass entrepreneurship and innovation. Attract enterprises to participate in inter-governmental STI cooperation mechanisms, encourage inter-government dialogues and B2B partnerships, and raise the level of cooperation.

The Plan also calls for efforts in the following aspects: to provide strong support for international STI cooperation during the *13th Five-Year Plan,* efforts should be made to further strengthen mechanisms for inter-ministerial and provincial-ministerial coordination, coordinate and improve incentives such as talent attraction and other supporting policies to boost mobility of innovation elements, continue to increase fiscal funding of international STI cooperation, guide the development of diversified investment sources, coordinate and improve regulations on the management and use of research grants involving foreign parties, as well as improve and strengthen consultation in decision-making and subsequent monitoring and evaluation.

13th Five-Year Plan on Innovation in Material Science Promulgated

The Ministry of Science and Technology has recently released *the 13th Five-Year Plan on Scientific and Technological Innovation in Material Science* (hereinafter referred to as “the Plan”), specifying the guiding ideas, objectives, tasks and key directions.

The basic principle of the Plan is: the strategic task is to meet major national needs; the fundamental purpose is to deliver benefits to people’s livelihood through S&T progress; a powerful driving force for development is further reform; a basic requirement for expanding the material industry is to enable talent to provide growth momentum; and to adopt a global vision is an important guide for the development of material science and technology.

The goals and indicator system put forward in the Plan are as follows.

Start to establish China's own systems of basic and new materials, develop high-performance composites, special functional and intelligent materials, strategic advanced electronic materials, and nanomaterial serial products and application technologies for various kinds of industrial applications in the country, and become self-sufficient in over 80% of key materials; nurture 8 to 10 growth sources of strategic emerging industries; develop simulation algorithms and calculation software of high-throughput materials; establish computing, experimental and database platforms for material engineering; and develop a serials of new methods and equipment for the synthesis and characterization of high-throughput materials.

Raise the average percentage of high-end products in key basic materials in China by 15% to 20%, and reduce carbon emissions by 500 million tons per year; be self-sufficient in meeting over 80% of domestic demands for typical iron and steel varieties and high-end nonferrous metal materials; raise the overall energy efficiency of steel, iron and non-ferrous metal production by 10%; and enable the share of new chemical materials and fine chemicals to reach 60% of the overall output; become self-sufficient in producing 50% of special engineering plastics and other high-end products from the current level of 30% within 5 years; raise the percentage of domestically produced key materials in light industries from 15% to 40%; raise the differentiation rate of chemical fibers from 56% to 65%; increase the processing volume of industrial textile fiber from 23% to over 30%; and bring the output percentage of emerging building materials to around 16% of the overall building material production.

Develop 3,000 patents, formulate 500 standards and specifications, complete 500 demonstration lines of commercialization, and train 15 to 20 joint taskforces for key technology R&D in major fields; engage 10 to 15 robust young teams in forward-looking technological innovation, and form talent tiers for research and innovation. Nurture 1,000 leaders of innovation and entrepreneurship.

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The Plan has specified 7 key fields.

1 Technological improvement and industrial upgrade of key basic materials including technologies related to iron and steel materials, non-ferrous metal materials, textile materials, oil and chemical materials, materials for light industries, and building materials.

2 Strategic advanced electronic materials, including third-generation semiconductor materials and semiconductor lighting technologies, new display technologies, high power laser materials and laser devices, high-end optoelectronic and microelectronic materials, as well as frontier and multidisciplinary electronic materials.

3 Key engineering technologies and support platforms, including building computing platforms for high-throughput materials, platforms for the synthesis and characterization of high-throughput materials and platforms of special databases; the R&D of multi-scale integrated, high-throughput concurrent computing methods and software, technologies for the synthesis and characterization of high-throughput materials, evaluation of service behavior, and Big Data technologies for material engineering.

4 Nanomaterials and devices, including technologies for graphene and carbon materials; technologies for nanomaterials in information and electronic industries; technologies for nanomaterials in energy conversion and storage; technologies for biomedical nanomaterials; technologies for nanomaterials in traditional industry improvement, energy conservation and emissions reduction; and nanomaterial processing, preparation, characterization, safety evaluation, standardized technologies and equipment.

5 Advanced structures and composites, including high-performance fibers and composites, high temperature alloys, special alloys for high-end equipment, key structural materials for marine engineering, lightweight & high-strength materials, high-performance materials of polymer structures, surface engineering technologies, 3D printing materials & advanced powder metallurgy technologies, and metal and ceramic composites.

6

New functional and intelligent materials, including new functional materials of rare earth, advanced energy materials, high-performance separation membranes, intelligent and biomimetic materials and metamaterials, new-generation biomedical materials, ecological environmental materials, and special functional materials for major equipment and engineering projects.

7

Talent team building, including to continuously expand the talent pool, balance the development of all kinds of professionals, significantly improve the caliber of corporate personnel, gradually develop new mechanisms of personnel training, employment and management tailored to the development in the fields of materials, and promote related bases and alliances.

(Source: Ministry of Science and Technology, April 25, 2017)

13th Five-Year Plan on STI in Modern Service Industry Promulgated

In an effort to speed up innovation and development of the modern service industry, the Ministry of Science and Technology has recently released the *13th Five-Year Plan on STI in the Modern Service Industry* (hereinafter referred to as "the Plan"), specifying the goals, tasks and directions of STI in the modern service industry.

In the 13th Five Years, as the service industry is growing its share in the Chinese economy, the industry is confronted with a more arduous tasks of maintaining economic growth and promoting industrial restructuring and upgrade. It is essential to adhere to innovation-driven development, promote producer service industries to become more specialized and move towards the higher end of the value chain, enable consumer service industries to provide refined and high quality services, fully leverage the strengths of the service industry for efficient development and continue to unleash new momentum for economic growth.

The overall goal of the Plan is to establish a system of modern service science by 2020, substantially raise the level of theoretical research and technological development and bring China to the forefront of the world in terms of research and practical capabilities of producer service industries, emerging service industries, the integration of culture, science & technology, and the R&D service industry. Work on the R&D of key core technologies in major fields; develop a number of international and national standards and industrial solutions; support the establishment of 10 to 20 state-level engineering and technological research centers, state key laboratories and enterprise technology centers for modern service industry; significantly raise the contribution of science and technology to the growth of added value of modern service industry, and comprehensively enhance the scale, quality, efficiency and quality of the modern service industry.

The Plan calls for strengthening theoretical research and R&D of common key technologies in the modern service industry, including establishing a theoretical system for modern service industry and tackling major issues in the R&D of common key technologies.

In promoting producer service industries to move towards the higher end of the value chain, the Plan designates e-commerce, modern logistics and modern finance as key directions.

For emerging service industries, digital life, healthcare and old-age caring, digital education and smart transport are named the key directions in the Plan.

For the in-depth integration between culture and science & technology, the Plan sets the key directions of cultural resources service for ethnicity and folklore, services for cultural and artistic exhibition and performance, services for contents and knowledge, services for film and television media, services for cultural tourism, and services for cultural and creative design.

To make the S&T service industry bigger and stronger, the Plan designates the following as key directions: technology transfer services, business incubation services, intellectual property right services, S&T consulting services, financial services for technology, services for inspection, testing and certification, and general S&T services.

In improving the STI system for the modern service industry, the key directions set forth in the Plan are to establish new think tanks, build major innovation bases, enhance enterprises' innovation ability and build innovation networks.

For strengthening the support system of modern service industry, the Plan identifies key directions of improving mechanisms of diversified investment, enhancing the training of innovation talent and establishing a policy system for innovation.

(Source: Ministry of Science and Technology, April 26, 2017)

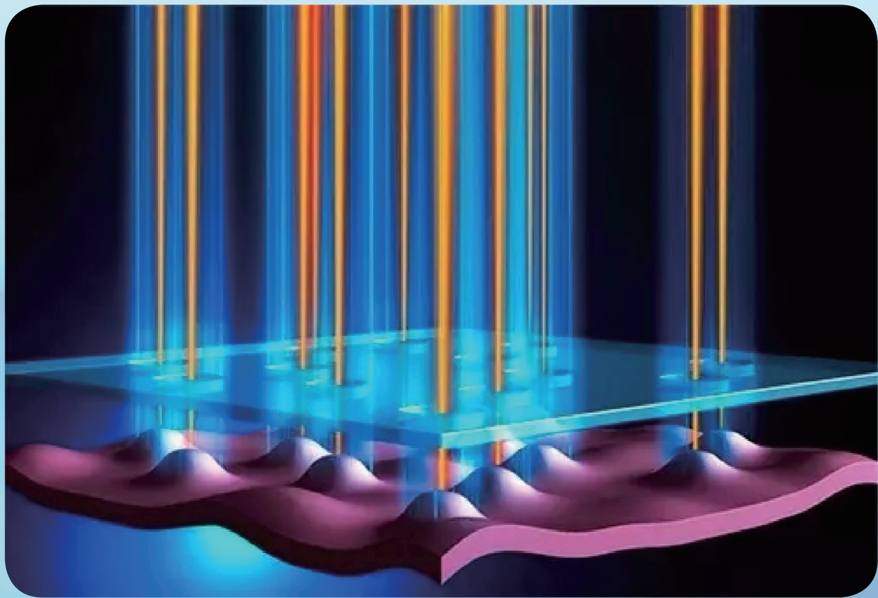
World's 1st Photon Quantum Computer Born in China

The Chinese Academy of Sciences held on May 3, 2107 a press conference in Shanghai, announcing the birth of the world's first photon quantum computer that outperforms classical computers. In collaboration with a research team led by Professor Wang Haohua of the Zhejiang University, Professor Pan Jianwei, member of the Chinese Academy of Sciences and his colleagues Lu Chaoyang and Zhu Xiaobo from the University of Science and Technology of China, have recently made a series of breakthroughs in the study of photons and superconducting system-based quantum computing. As for the optical system, the research team achieved the first ten-photon entanglement manipulation in 2016. Building on this success, the team has used a highly efficient single-photon source based on a quantum dot to build the world's first photon quantum computer that outperforms early classical computers.

As for the superconducting system, the research team has achieved entanglement of ten superconducting quantum bits, which marks the largest number of entangled quantum bits at present, and developed a quantum algorithm for quickly solving linear equation sets on a superconducting quantum processor. The related findings have been published in the international academic journals *Nature Photonics and Physical Review Letters.*

For the photon system, Pan Jianwei's team created the record of ten-photon entanglement at the end of 2016. Experimental tests show that the "boson sampling" of the prototype is at least 24,000 times faster than the speed of similar experiments conducted by international peers. This is the first photo quantum simulator in history, laying a solid foundation for eventually enabling quantum computing to outperform classical computing.

(Source: Chinese Academy of Sciences, May 3, 2017)



Single-photon source of the highest quality and efficiency in the world

China Builds World's Largest Kinase-based Whole-cell Screening Library

Starting from scratch, a pharmacology team led by Liu Qingsong at the High Magnetic Field Laboratory of the Hefei Institutes of Physical Science of the Chinese Academy of Sciences has established a large-scale cancer kinase cell bank that relies solely on target gene growth. Over a period of more than 4 years, the team has done genetic engineering and worked on a mouse prototype cell line to develop the bank for cancer-related kinase targets common in the clinical stage. Currently, the cell bank includes nearly 70 major kinase targets associated with tumor progression and development, covering most clinical treatment, drug resistance and prognosis-related mutations that are found in clinical tumor patients. With over 150 cell types, the bank is now the world's largest kinase target-based whole cell screening library, filling a gap in the testing systems for new drug development in China.

(Source: Chinese Academy of Sciences, April 19, 2017)

China Develops 1st International Specification of Concrete Durability

In March this year, the International Union of Laboratories and Experts in Construction Materials, Systems and Structures (RILEM) officially released the *Test Methods to Determine Durability of Concrete under Combined Environmental Actions and Mechanical Load* to the world. This is the world's first recommended specification on concrete durability that comes from China. The service behavior and life of engineering structures are directly related to the durability performance of concrete. However, methods of concrete durability and service life evaluation have long been a major difficulty for the engineering community. After 15 years of efforts, Yao Yan, President of China Building Materials Academy, and her research team have conducted key research on multi-factor coupling and finally developed a set of methods which have become the first internationally recommended specification of concrete durability.

(Source: Science and Technology Daily, April 14, 2017)