

## China

Following three decades of an unprecedented high rate of economic growth, the People's Republic of China has entered into the so called "New Normal" phase of growth, which highlights key transitions and shifts in policy focuses from fast growth to sustainable growth, from rural to urban, from public sector to private sector, from investment to consumption and from manufacturing to services.

Succeeding in the transition to a new growth trajectory will require an unwavering commitment not only to structural reforms but also to making science, technology and innovation (STI) a key engine for growth. China has steadily increased STI investment for decades, with its GERD reaching 2.05% of GDP in 2014, surpassing the intensity of the EU28 (and EU15) as a whole.

Since it launched reform and began opening up to the outside world, China has set up numerous science and technology (S&T) programmes and foundations, which have played a significant role in enhancing the country's scientific and technological strength, improving its competitiveness, and supporting economic and social development.

However, recognising that there is significant duplication, dispersion and inefficiency in these programmes, as well as fragmentation of S&T resource allocation, China initiated a new round of reform of its S&T system under the National Innovation-Driven Development Strategy first proposed in 2012 and then comprehensively revised in May 2016. The 13th Five-Year Plan, launched in March 2016, and the following 13th Five-Year Plan on Scientific and Technological Innovation, released in August 2016, have established a set of targets and policies for S&T development for 2016-20 (e.g. R&D intensity to reach 2.5% of GDP by 2020). Consequently, public budgets are forecasted to increase in the coming years, but at a lower pace than in previous years.

### **Hot Issues: Fostering sustainable/green growth**

The main priority is to enhance the contribution of STI to China's transition to an ecologically sustainable mode of development. China's green productivity, at USD 1.6 (GDP per unit of CO<sub>2</sub> emitted, 2013), was much lower than the EU28 level of USD 4. However, over 2009-13 it grew at a rate of 4.3%, exceeding the OECD median of 1.1%. China's RTA in green technologies has slipped over the past decade, however. The government's 12th Five-Year Plan (2011-15) set the target for green productivity growth at 17% over the five-year period, thereby focusing considerable attention on energy and climate change and triggering a new wave of industrial policies in support of clean energy industries and related low-carbon technologies. In the government's 13th Five-Year Plan (2016-20), environment and ecological improvement are listed among the nation's major tasks. By 2020, energy consumption per unit of GDP is to be reduced by 15% from the 2015 level and CO<sub>2</sub> emissions by 18%.

### **Addressing societal challenges (including inclusiveness)**

China faces serious societal challenges in terms of food security, public health and ageing, all of which will require contributions from STI. The National S&T Major Projects focus strongly on public health, ageing, food and drug safety, and disaster prevention, while the National S&T Plan has been adjusted to sharpen the focus on agriculture, energy resources, ecological environment and health. The energy and health areas are also among the four sectoral focuses of the Innovation 2020 Programme of the Chinese Academy of Sciences (CAS). China has been promoting "inclusive innovation", i.e. innovation by and for low-income people. Existing initiatives include the Spark Programme, which promotes agricultural and rural development by facilitating peasants' access to relevant technologies and related training, as well as the S&T Programme for Public Well-being, which supports the commercialisation of technologies that can benefit social development; both programmes are implemented under the Ministry of S&T.

### **Strengthening public R&D capacity and infrastructures**

Although many PRIs became corporate entities as part of the reform of the S&T system in the early 2000s, PRIs still dominate China's public research and are strongly oriented towards applied and experimental R&D. The government released the Implementation Plan on Deepening the Reform of the Scientific and Technological System in September 2015 to speed up the building of a national system of innovation, including reporting instruments and an advanced management system for research achievements. The latest round of PRI reforms aims to clarify the roles of the three types of PRI (commercial innovation, social welfare and basic research) and to establish appropriate governance, management and funding mechanisms to help them fulfil their missions. The Medium- and Long-Term Plan for Key National Technology Infrastructure Construction (2012-30) aims to develop research infrastructure in the life sciences, environmental science, materials science, space science and other fields.

### **Supporting R&D and innovation in firms**

BERD as a share of GERD has risen to the top level of OECD countries, with firm self-funded R&D reaching 94% of BERD in 2012. The review of the implementation of the Medium- and Long-Term National Plan for S&T Development (2006-20), carried out in 2010, noted that there was a need for greater vitality and drive with respect to business participation in technological innovation. There is recognition that close collaboration among enterprises, universities and research institutes is needed, that high-level innovative talents in S&T are relatively lacking, that the allocation of S&T resources needs to be more efficient, and that the implementation of the indigenous innovation policy should be enhanced. The Chinese government regards the enterprise sector as the main body for innovation, and has steadily increased direct and indirect support for business innovation, although equity funding still remains the most relevant instrument in the policy mix. Several funding schemes have been restructured in order to set up a national SME development fund with USD 17 billion PPP (60 billion yuan renminbi, CNY). The fund focuses on support for the development of seed, start-up and growth-oriented SMEs. In April 2015, China launched a national strategy for mass entrepreneurship and innovation, which aims to enable more people to start their own business and become involved in innovation.

### **Improving the attractiveness of scientific and research careers**

Although China has the world's largest pool of human resources for S&T, the tertiary-qualified share of the population is still extremely low. Furthermore, China lacks world-class researchers. Both the Thousand Talents Programme and the CAS 100 Talents programme aim to attract and retain top-tier academics, including from overseas. The National Plan for S&T Talent Development (2010-20) addresses the business sector's need for innovative personnel by supporting mobility of the highly skilled and by investing in innovation platforms and national key labs to cultivate talented, leading R&D personnel. Living allowances and funding for postdoctoral research in enterprises are provided as well.

### **Selected Highlights: New sources of growth**

China's competitive advantage as a global manufacturer is faced with a challenge, as Chinese labour costs have increased, and multinationals, including Chinese ones, are increasingly relocating their manufacturing activities to countries with lower labour costs. In addition, China's RTA in some key technologies such as biotechnology has declined significantly since the early 2000s. To address these challenges and to seize the opportunity of the "next production revolution", China launched "Made in China 2025" in 2015, as part of a 30 year strategy to strengthen China as a manufacturing country. This is the first in a series of national ten year plans, and it focuses on enhancing innovation, product quality and environmental sustainability, optimising industrial structure and developing human resources in Chinese manufacturing. Ten key sectors were targeted for support, including ICT, robotics, agriculture, aerospace, marine, railway equipment, clean energy, new materials, biological medicine and medical devices. The core goal of "Made in China 2025" is upgrading industry through the greater use of digital technology. As a first step, 46 demonstration projects for so called "intelligent manufacturing" have been initiated by the Ministry of Industry and

Information Technology. In parallel, the “Internet Plus” initiative was launched in 2015 with a view to digitalising major sectors of the economy and building a service-oriented interconnected intelligent industrial ecosystem by 2025, thus making digitalisation an important driver of growth. The “Internet Plus” initiative aims to develop intelligent factories, improve synchronization over production chains, better customize manufacturing and promote manufacturing as a service. Combined with other policies, this initiative is intended to bring about a “new industrial revolution”.

### **STI policy governance**

In 2014, two significant policies were announced, i.e. the Opinions on Improving and Strengthening the Management of National Government-Funded Projects and Funds and the Scheme of Deepening Management Reform of National Science and Technology Programmes (Special Projects and Foundations, etc.). According to the latter, about 100 national S&T programmes will be classified into five categories and will no longer be directly managed by departments and ministries. An open and unified national S&T management platform will be established, which consists of a new unified evaluation and inspection mechanism. A programme to evaluate National Engineering Technology Centres has been designed using a new set of indicators. China has also started making use of the results of STI evaluation exercises to improve S&T management and enhance the national innovation policy design at the level of programmes, institutions and the system. For example, the Mid-Term Review of the Mid- and Long-Term S&T Development Plan (2006-20), carried out in 2014, supported the development of the 13th Five-Year Plan (2016-20). However, most of the evaluation reports are for internal use only and are not publicly published. In 2014, the China Publishing and Distribution Trading Cloud Platform was established, serving the publishing industry chain, based on cloud computing technology. The Ministry of Science and Technology (MOST) also established the National S&T Information System, a public information service platform to access reports and information, including on resources and data about publicly financed R&D projects. Those undertaking S&T projects receiving public funding are requested to submit relevant S&T reports, a summary of their S&T achievements and relevant IP information to the National S&T Information System in a timely manner.

### **ICT and Internet infrastructures**

China has significantly improved its RTA in ICT in past years. Patent data also show that China is a top world player in new technologies related to the Internet of Things and Big Data, and that it holds the third-largest portfolio – after Japan and the United States – of patents in bursting technologies for wireless communication monitoring. According to the Ministry of Industry and Information Technology, the total sales revenue of China’s ICT industry increased 10.4% in year 2015, to USD 4.3 trillion PPP (CNY 15.4 trillion), with an annual increase of 17.3% in domestic sales being the key driver. The Internet Plus initiative addresses the integration of ICT technologies with China’s industry. It also aims to make China a leading player in certain technology areas, such as 5G internet and integrated circuits. However, the relatively higher price and lower speed of China’s Internet have been openly criticized and still have room to improve, as does its network readiness. New infrastructure, such as the Internet of Things, mobile Internet, industry cloud and big data, is also considered necessary and yet to be fully developed.

### **Technology transfers and commercialisation**

While a significant share of China’s public research is funded by industry, signalling the existence of sound industry-science co operation, China’s universities and PRIs are not very engaged in patenting activities. The government encourages enterprises to entrust universities and PRIs with research; up to 50% of the expenditure can be deducted before income tax. In order to foster collaboration between academia and industry, the government supports the China Industry Technology Innovation Strategic Alliance by financing research- and IP-pool. Under the Law on the Promotion and Transformation of Scientific and Technological Achievements (revised in 2015), the government encourages R&D institutions and higher education institutions to transfer S&T achievements to enterprises or other organisations by assignment, license, investment as a trade-in, and other means. Public funding agencies are required to specify the obligations of project undertakers in transforming their S&T achievements, strengthening IPR management, and creating and utilising IPR as a basis for project initiation and acceptance. In December 2015, China’s State Council published

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an opinion on the acceleration of the development of an IPR system by 2020.

### Clusters and regional policies

In 2011, a programme for the construction of innovative industry clusters was launched in order to coordinate the development of science and technology enterprises with the local economy, on the one hand, and with the national strategic orientation, on the other hand. The programme aims to foster the technological upgrading of the traditional economy and the growth of regional industries, and to accelerate regional economic development. The programme also supported the development of both SMEs and large firms in local industrial fields, as well as the development of new skills.

### Globalisation

China's science and innovation systems are weakly linked to global networks, as is reflected in a level international of co authorship and co invention that is below the OECD median (3q,r). The government is trying to make the STI system more open through continued government co operation on S&T and through diversification of the ways in which Chinese enterprises and PRIs interact with their foreign counterparts. In recent years, China has also strengthened its participation in large-scale international collaborative projects, such as the EU 7th Framework Programme, and has engaged in annual bilateral dialogues on STI co-operation with key partner countries, such as the United States and Germany. For example, financial support continues to be made available under the Sino-EU Science and Technology Cooperation Programme, which aims to promote and support both China and EU S&T innovation and industrial cooperation. China plans to support the programme with USD 56 million PPP (CNY 0.2 billion) in 2016.

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[8] [http://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-innovation-outlook-2016/sti-country-profiles-reader-s-guide\\_sti\\_in\\_outlook-2016-44-en](http://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-innovation-outlook-2016/sti-country-profiles-reader-s-guide_sti_in_outlook-2016-44-en)



- [9] [http://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-innovation-outlook-2016/methodological-annex-to-the-2016-oecd-sti-outlook-country-profiles\\_sti\\_in\\_outlook-2016-95-en](http://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-innovation-outlook-2016/methodological-annex-to-the-2016-oecd-sti-outlook-country-profiles_sti_in_outlook-2016-95-en)
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