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China's Innovation Driven Development Strategy

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Summary

Innovation has been placed at the centre of China's overall development strategy and regarded as the primary driver for growth. It will be implemented as the enabler for the key social and economic priorities set out in the 13th Five Year Plan. The strategy has a clear focus on improving the economic competitiveness of China, and meeting the urgent needs of the sustainable development and the major challenges of the national security.

Background

In October 2015 China's 18th Party Congress convened to decide the country's 13th Five Year Plan (2016-2020). It placed technological innovation as a strategic priority in supporting the country's efforts to enhance economic productivity and national strength. In May 2016 the State Council (Cabinet Office) published the **Innovation Driven Development Strategy**, setting out the blueprint for a development model based on economic, social and environmental sustainability. This also extends China's latest long term scientific development plan to cover the period from 2030 up to 2050.

Objectives

1. By 2020, to join the world's top 15 most innovative nations.

A national innovation system with Chinese characteristics will be in shape, supporting the goal of establishing a "moderately prosperous society":

- The innovative economy to be shaped, priority industries[1] to reach the medium or high level of the global value chain, fostering a cohort of innovative enterprises and industry clusters achieving international competitiveness.
- In 2020 scientific progress is to contribute to over 60% of the national economic growth with knowledge-based services to account for 20% of GDP, of which 2.5% to be spent on R&D[2].
- Significant improvement in indigenous innovation capacity, with breakthroughs in the major bottlenecks and core technologies that threaten national security and development.
- A coordinated and effective innovation system that supports dynamic innovators and better synergy between science and economy.

[1] China's priority industries include: manufacturing, IT, logistics, shipping, automobile, petrochemical, textile, non-ferrous metal, etc.

[2] China spent 2.1% of its GDP on R&D in 2015, i.e. RMB 1.422 trillion (approx. £150 billion). 2.5% of China's GDP in 2020 means RMB 2.32 ~2.37 trillion if the GDP grows at the rate of 6.5% ~ 7% according to the current estimate, which is 63% ~67% increase against 2015.

- An optimized innovation eco-system with better policy and regulation, stronger intellectual property protection and a culture that encourages entrepreneurship and innovation.

2. By 2030, to become a leading country in innovation.

A fundamental shift to innovation driven economy achieving significant improvements in international competitiveness and overall development.

- Major industries to position themselves higher in the global value chain with new technologies and products, new models and types of business, new demand and market to achieve more sustainable development, better quality employment, higher income and better life:
- 2.8% GDP will be spent on R&D, in an effort to lead in many strategic areas, forming a Chinese thought leadership; original innovation to deliver important global impacts.
- Better innovation system with enhanced synergy between science and economy.
- An innovation culture with strong governance of laws and morale for innovation.

3. By 2050, to become a strong global leader and international hub of science and innovation

Providing strong support to the Chinese dream for rejuvenation and a prosperous, democratic and harmonious modern nation.

- Science, technology and human capital to become the most important strategic resources in creating a stronger economy, and innovation the key factor for policy making and institutional arrangements.
- Productivity improvement mainly comes from scientific progress and comprehensive innovation, with a view to high quality economic growth with low resources consumption.
- World class science and technology for national defence.
- To become an important hub of innovation and entrepreneurship for global high end talents, with a cohort of the world first class research institutes, universities and innovative enterprises cultivating significant original innovations and world leading scientists.
- The institution, market and culture for innovation further improved. Respect for knowledge, inspiration for innovation, intellectual property protection, inclusiveness and diversity become the mainstream values.

Strategy (1-2-6)

1. A national innovation system: an eco-system that enables the innovation stakeholders to coordinate and synergize effectively. Enterprises, research institutes, universities and social organizations will have their clearly defined functions in the system. Government and market have clear demarcations. Civilian and military innovations will have one platform. Legal system to protect innovation will be improved.

2. Two-wheel driven: means coordination of technological and institutional innovations.

3. Six shifts:

- Change economic growth model to quality and efficiency focused sustainable growth;
- A move from traditional development to innovation driven;
- Transform industry from medium-low value chain to medium-high;

- Move innovation capacity from mainly to follow to mainly to lead;
- Shift the focus of resource allocation away from R&D to industry, innovation and finance chains;
- Main innovation players from researchers to an interactive pool of researchers and wider population.

Sector Specific Priorities

The strategy aims to build a modern industry technological system with international competitiveness which is well-structured, practical, open, inclusive and manageable. It prioritizes convergence of industry and information technologies with a technological basis that drives digitization, internet connectivity, 'smart technologies' and sustainability while promoting trans-boundary innovation of emerging technologies. Collective technological breakthroughs are to lead the development of the emerging industry clusters and support the industrial upgrading move.

1. The next generation IT network technologies - ensure successful transformation of the economy and safeguard national cyber security.

- Research for technologies such as quasi-human intelligence, virtual reality, micro-electronics and optoelectronics
- R&D and deployments of broadband mobile network, cloud computing, Internet of Things, big data, hi-performance computing and smart mobile terminals.
- Breakthroughs and deployment of home-grown software and hardware products (eg. Integrated circuits and industrial control) as well as internet security solutions.

2. Green, intelligent manufacturing technologies - move manufacturing up the value chain.

- Restructure the manufacturing technology system to transform this sector into a strong industry.
- Accelerate in-depth use of new technologies such as cloud computing and big data so that the industry can be more automated, intelligent and service-oriented.
- Reform the traditional manufacturing industries to be green and intensified.
- Strengthen the fundamental technology capabilities and trial platforms to enhance the key generic technologies such as the basic materials, components and software.
- To develop high-end equipment and products including large aircraft, aerogenerators, nuclear power, high-speed rail, marine engineering equipment and ultra-high voltage electricity transmission systems.

3. Eco-friendly, safe and effective agricultural technologies - ensure food security and safety, embracing a modern agriculture that produces high output and safe products with low input[3] and environment-friendly approach.

- Strengthen R&D on animal and plant breeding and high-end equipment.
- Roll out technologies to increase yield and retrofit the low and medium yield fields.
- Step up R&D on technologies for water saving[4], circular production, organic farming and bio-fertilizers as well as for large standardized modern livestock farms.

[3] China's arable land accounts for 7% of the world's total, however, the country consumes about 35% of world's fertilizer and pesticide.

[4] China's agriculture accounts for about 2/3 of fresh water consumption.

- Introduce cost-effective technologies and models to reduce agricultural pollution.
- Set up new food safety systems to cover the full life cycle of the food productions.
- Drive agriculture to evolve towards a value-added and brand-oriented industry that integrates with the second and third industries.

4. Secure, clean and efficient energy technologies - revolutionize energy productions and consumption to move towards clean and low carbon energy with the priority on optimal energy mix and improved efficiency.

- Exploration and mining technologies for oil, gas and mineral resources and demonstration projects for shale gas.
- Accelerate development, equipment manufacturing and large scale use of new energies including nuclear energy, solar energy, wind energy and biomass with breakthroughs in optimizing demand and supply, energy storage and grid connections.
- Roll out energy-saving technologies and products, retrofitting high energy-consuming industries such as iron and steel, petrochemical, construction materials and non-ferrous metals.
- Drive R&D and application of new-energy vehicles and smart grids

5. Environmental protection technologies – enable efficient use of resources and build a resource-saving and eco-friendly society.

- Develop technologies and industries for pollution treatment and resources recycling with a holistic approach.
- Build early warning and analysis systems for heavy air pollution events and a modern integrated water utilization system.
- Step up waste management and recycling, environment monitoring and emergency response systems, and increase environmental capacity.

6. Advanced marine and space technologies - cultivate marine and space economies. Implement the National Marine Strategy.

- Technologies for efficient and sustainable use of marine resources.
- Marine engineering equipment for multi-dimension synchronized observation systems.
- Enhance technologies for space exploration and improve space infrastructure while boosting R&D and the industrial chain of satellite technologies including remote sensing, communications, navigation and GPS services.

7. Smart city and digital technologies - drive people-oriented urbanization.

- Modern city development and public services to be supported by new technologies and governance innovations.
- Roll out information technologies for social security.
- City infrastructure such as transport, electricity, telecom and underground pipelines will comply with standards and be more digitalized and ‘smart-ized’.
- Key technologies for green buildings, smart cities and eco-cities.
- Key solutions and breakthroughs for emergency response.

8. Safe and effective health-care technologies - address challenges from major diseases and the aging population.

- Integrating technologies in the areas such as life science, western /traditional Chinese medicine and bio-engineering.

- Develop innovative medicine, new vaccines, advanced medical equipment and bio-therapies.
- Promote R&D on big data, precision medicine, inheritable genes and predisposing genes for chronic diseases.
- Improve diagnosis and treatment for major health challenges such as cardiovascular diseases, malignant tumors, respiratory problems and diabetes.
- Scale up digitalized, remote, personalized medicine and internet services for disease prevention, treatment, recovery, healthy life style and elderly care. Establish an integrated health-care model.

9. Technologies for modern services - support business innovations and drive advancement of economic formation.

- Build the infrastructure for modern services and expand emerging services in digital consumption, e-commerce, modern logistics, internet finance and remote learning.
- Accelerate integration of industrial design, new cultural concepts and relevant sectors to boost innovative design capability for key industries.

10. Disruptive technologies - revolutionize businesses while nurturing new industries and creating new jobs.

- Deploy cutting edge R&D for emerging industries.
- Develop technologies such as mobile Internet, quantum IT, space, advanced manufacturing, AI robots, driver-less automobiles, new energy (hydrogen, fuel battery, etc) and new materials (nano & graphene).

Overarching Priorities

1. To align innovation needs with national strategic needs

Embed national strategic needs into scientific research objectives with an emphasis on issues concerning national interests and original innovation capacity. Improve national capabilities in scientific discovery, technological invention, and industrial innovation to support industry transformation and safeguard national security. More support will be provided to basic research. A number of infrastructure and platforms will be built to support high end innovations.

2. To Improve regional innovation capabilities and competitiveness

- The East to focus on stronger original and collective innovation capabilities to facilitate industrial clusters and the regional economy with international competitiveness
- The Middle and West to focus on the adoption of advanced technologies; integrate regional innovation resources and build trans-regional innovation network and consortium;
- Beijing and Shanghai to be turned into Science and Innovation Hubs with global impacts.

3. To deepen synergy and interactivity between military and civilian innovations.

Build an effective management system with unified leadership to coordinate guideline, policy and strategy planning for military and civilian research. Increase the adoption of such research findings, sharing resources and achieving balanced and compatible development. Promote the inter-change and mutual transfer of military and civilian technologies.

4. To empower innovation players and become innovation leaders

Cultivate world first class innovative enterprises, universities, research institutes, diversified R&D organizations and business incubators as well as professional technology transfer systems.

5. To implement major national research programs and achieve key breakthroughs
   - By 2020, acquire key technologies such as high-end chips, digitally controlled machinery, integrated circuit equipment, mobile broadband networks, oil and gas fields, nuclear power stations, water contamination control and management, genetically modified products, new medications, and epidemics prevention.
   - By 2030, launch research programs for areo-engines and gas turbines while preparing for research covering quantum communications, information networks, intelligent manufacturing and robots, detection of deep waters and outer space, new materials and new energy sources, brain science, health-care and medical treatment.
6. To accelerate talent training to consolidate foundations for innovation

Accelerate the training for innovation leaders and building high-caliber personnel with special support to young researchers. Leverage the leadership of entrepreneurs and build a large team of professional, market-oriented and innovative managers with international thinking. Drive innovations in education and reform training systems.

7. To promote mass innovation and entrepreneurship.

Develop maker space and nurture innovative SMEs. Encourage everyone to engage in innovations.

Comments

1. The priority technologies China wants to develop are well aligned with the UK's strengths. With billions of pounds of R&D and entrepreneurship funds available and being a large market itself, this provides significant opportunities for the UK research and business communities. However, its openness to international collaborations also means that engagement with China often faces competition with other developed countries.
2. China is catching up with the world in terms of scientific research and graduate talent pool. While this may be perceived as a threat, it provides the UK with the opportunity for high quality partnerships with China that can be beneficial to both economies. Newton Fund, with a plan to fund over £100 million from 2014 to 2019, is well timed to leverage the UK's innovation capacities for such partnerships
3. China is determined to continue its science and technology institutional reform to ensure the innovation strategy will be effectively implemented. It has recently made unprecedented moves to increasing protection for intellectual property, and has adjusted the policy regarding research funding and enterprise innovation. The eco-system for innovation has been improving. This should be welcoming development for the UK stakeholders.

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