

Sphere: health services and guarantees Indicator: premature death rate from serious chronic disease (%)  
2015: 19.1 (2013)  
2020: lower by 10 percent comparing with 2015  
2030: lower by 30 percent comparing with 2015

Sphere: health services and guarantees Indicator: number of practicing (assistant) physicians per 1,000 permanent residents  
2015: 2.2  
2020: 2.5  
2030: 3.0

Sphere: health services and guarantees Indicator: proportion of personal expenditure in China's total expenditure on health (%)  
2015: 29.3  
2020: around 28  
2030: around 25

Sphere: healthy environment Indicator: proportion of days per year meeting good or excellent air quality index standard in cities at prefectural level and above (%)  
2015: 76.7  
2020: >80  
2030: keep improving

Sphere: healthy environment Indicator: proportion of water bodies of Grade III and better quality in all surface water bodies (%)  
2015: 66  
2020: >70  
2030: keep improving

Sphere: health industry Indicator: monetary value of health service industry (RMB trillion)  
2015: ---  
2020: >8  
2030: 16<sup>1426</sup>

### 8.7.10 Machine tools

**Machine Tools or Advanced computer numerical control machine tools (CNCs)**  
**Chapter 22 “Develop China into a Manufacturing Powerhouse” in the Part V “An Optimized Modern Industrial System” of the 13<sup>th</sup> Five-Year Plan for Economic and Social Development of The People’s Republic of China (2016–2020) mentions:**

“We will implement the Made in China 2025 action plan. With an emphasis on strengthening the innovative capacity and basic capabilities of manufacturing, we will work to deepen the integration of information technology and manufacturing technology

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<sup>1426</sup> Excerpts of The State Council Information Office of the People’s Republic of China White Paper “Development of China’s Public Health as an Essential Element of Human Rights” published in September 2017 [http://english.www.gov.cn/archive/white\\_paper/2017/09/29/content\\_281475894089810.htm](http://english.www.gov.cn/archive/white_paper/2017/09/29/content_281475894089810.htm)

and promote the development of high-end, smart, green, and service orientated manufacturing so as to foster a new competitive edge in manufacturing.”<sup>1427</sup>

**Box: High-End Equipment Innovation and Development:**

<b>Box</b> <b>High-End Equipment Innovation and Development</b>
<b>1. Aerospace equipment</b> <ul style="list-style-type: none"><li>• Make breakthroughs in core aircraft engine and gas turbine technologies;</li><li>• Accelerate the development of large aircraft;</li><li>• Promote the industrialized development of trunk and feeder route aircraft, helicopters, general-purpose aircraft, and unmanned aerial vehicles;</li><li>• Develop advanced airborne equipment and systems;</li><li>• Strengthen supporting systems for civil aircraft;</li><li>• Develop next generation and heavy-lift launch vehicles, new types of satellites, and other space platforms and payloads;</li><li>• Make breakthroughs in core technologies for key aerospace components and put them into use.</li></ul>
<b>2. Marine engineering and high-tech vessels</b> <ul style="list-style-type: none"><li>• <b>Develop equipment and systems for deep-water exploration, ocean drilling, seafloor resources exploration and development, and marine operations support;</b></li><li>• Promote the development and engineering of deep-sea stations and large floating structures and launch projects in this regard;</li><li>• Focus on breakthroughs in core technologies for cruise ships and other high- tech vessels, as well as for the integrated, intelligent, and modular design and manufacturing of key accessory equipment for such vessels.</li></ul>
<b>3. Advanced rail transit equipment</b> <ul style="list-style-type: none"><li>• Develop advanced and reliable rail transit products and light, modular, and serial rail products;</li><li>• Develop next generation high-speed and heavy-load rail transit equipment and systems;</li><li>• Become better able to provide users with lifecycle rail transit system solutions;</li><li>• Set up a national high-speed train technological innovation center.</li></ul>
<b>4. High-grade CNC machine tools</b> <ul style="list-style-type: none"><li>• Develop fast, flexible, and high-precision CNC machine tools, basic manufacturing equipment, and integrated manufacturing systems;</li><li>• Develop high-grade digitally controlled systems, bearings, gratings, sensors, and other major components as well as key application software, with a focus on improving reliability and retention of precision.</li></ul>
<b>5. Robotics</b> <ul style="list-style-type: none"><li>• Develop industrial, service, surgical, and military robots;</li><li>• Promote independence in the design and production of high-precision retarders, high-speed high-performance controllers, high-performance servo motors and drives, and other key parts and components;</li></ul>

<sup>1427</sup> THE 13TH FIVE-YEAR PLAN FOR ECONOMIC AND SOCIAL DEVELOPMENT OF THE PEOPLE’S REPUBLIC OF CHINA (2016–2020), Pg 60, available online at URL:  
[https://en.ndrc.gov.cn/policyrelease\\_8233/201612/P020191101482242850325.pdf](https://en.ndrc.gov.cn/policyrelease_8233/201612/P020191101482242850325.pdf)

- Facilitate the commercial application of artificial intelligence technologies in all sectors

## **6. Modern agricultural machinery and equipment**

- Develop advanced agricultural machinery suitable for all cultivation conditions, with a focus on high horsepower tractors and compound operations machinery, large and efficient combine harvesters, precision seeders, and other food crop equipment, as well as machinery for seeding, farmland management, and harvesting of cotton, sugar cane, and other cash crops.

## **7. High-performance medical equipment**

- Focus efforts on the research and development of diagnostic and treatment equipment such as nuclear medicine imaging equipment, superconducting magnetic resonance imaging systems, and non-invasive ventilators as well as in vitro diagnostic equipment such as fully automatic biochemistry analyzers and high-throughput genomic sequencers;
- Develop and put into use medical accelerators and other treatment equipment as well as implantable and insertable medical devices, such as artificial heart valves and pacemakers, stents, and artificial joints;
- Develop and put into use medical devices that utilize the distinctive strengths of traditional Chinese medicine.

## **8. A complete set of advanced chemical machinery**

- With the support of projects demonstrating upgrades to the modern coal-to-chemical industry, work toward the independent design and production of a complete set of advanced chemical machinery, focusing on coal classification, coal gasification, syngas purification, energy utilization, wastewater treatment, and other key areas;
- Accelerate research and development on key equipment for the integration of the oil refining and chemical industries as well as for the intensive processing of downstream petrochemical products, and help enhance complimentary support capabilities.

### High-grade CNC machine tools

- Develop fast, flexible, and high-precision CNC machine tools, basic manufacturing equipment, and integrated manufacturing systems;
- Develop high-grade digitally controlled systems, bearings, gratings, sensors, and other major components as well as key application software, with a focus on improving reliability and retention of precision.<sup>1428</sup>

According to a news item captioned “Advanced computer-directed machine tools are taking charge” by Ren Xiaojin, published (June 27, 2017) in China Daily: Advanced computer numerical control machine tools, or CNCs, have boosted China's key manufacturing sectors and added over 70.6 billion Yuan (\$10.3 billion) to industrial output over the past eight years, a senior government official told a media briefing on June 26, 2017. CNC machining is the automated process in the manufacturing sector,

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<sup>1428</sup> The 13th Five-Year Plan for Economic and Social Development Of The People's Republic Of China (2016–2020), Pg 63, available online at URL: [https://en.ndrc.gov.cn/policyrelease\\_8233/201612/P020191101482242850325.pdf](https://en.ndrc.gov.cn/policyrelease_8233/201612/P020191101482242850325.pdf)

where computers are used to control machine tools such as lathes, mills and grinders. They produce precise parts and increase productivity. China has invested 9.1 billion Yuan in R&D since CNCs were listed as one of 16 national science and technology major projects in 2009, and their utilization has made smooth progress, said Luo Junjie, a senior official from the Ministry of Industry and Information Technology.

"CNC machine tools are vital for the country's major manufacturing areas such as the auto, nuclear power, aeronautics and astronautics sectors," said Luo. "It was behind the success of some keynote projects as the launch of Long March-5 heavy lift carrier rocket and the Tianzhou 1 cargo spacecraft," Luo added. Lu Bingheng, chief engineer of the National Additive Manufacturing Innovation Center, said that in 2016 the Chinese-proposed testing standards for five-axis CNC machines gained international approval. "It is the first standard China has set for high-tier CNC machine tools", Lu said. The rapidly progressing local CNC technology is also breaking into a market dominated by foreign technology. According to Lu, domestic high-tier CNC technology has caught up with international standards and its market share of the Chinese market has expanded from 1 percent to 5 percent. It has been applied in massive production in important sectors such as aeronautics, astronautics and military. Medium-end CNCs have also secured a quarter of domestic market in 2016, a jump from the previous 10 percent in 2009, with total sales now at around 4 billion Yuan in the past eight years. The ministry's Luo said Chinese-made punch press production lines for automobile parts had taken 30 percent of the global market. "We have exported our production lines abroad to, among others, Ford Motor Co in the United States," Luo said.

Shenyang Machine Tool Group, one of the leading companies in independent CNC R&D, said it had developed a number of intelligent and online customized machine tool manufacturing modes. "We used to supply products to customers, but now we provide a set of solutions" said Guan Xiyou, chairman of the group. "It is a transformation from being a manufacturer into becoming a product services provider".

In the 13th Five-Year Plan (2016-20), the goal of the CNC project was to improve domestic R&D capabilities and catch up with advanced countries. Ministry official Luo said that by 2020, the domestic CNC sector should be able to meet 80 percent of manufacturing demand from key areas like aviation, aerospace and automobiles.<sup>1429</sup>

According to sub heading Machine Tools of a report "**China - Machinery**" of Ministry of Commerce, USA, last published on July 30, 2019:

The majority of domestic machine tool companies have upgraded their product structure and used more innovative technology. The import market is still focusing on high-precision, intelligent high-end Computer Numerical Control (CNC) machine tool and accessories.

As the world's largest machine tool market, the main business revenue of machine tools reached about \$106 billion in 2018, with a year-on-year growth of 8.3% from the previous year. According to data from China Customs, imports valued \$16.5 billion, up 8.5%, and exports valued \$13.6 billion, up 16.8% from 2017. More than half of all high-

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<sup>1429</sup> China Daily News Item dated June 27, 2017 titled "Advanced computer-directed machine tools are taking charge" written by Ren Xiaojin, available online at URL:  
[https://www.chinadaily.com.cn/business/2017-06/27/content\\_29898086.htm](https://www.chinadaily.com.cn/business/2017-06/27/content_29898086.htm)

end CNC machine tools and accessories were imported from Japan and Germany; fewer than 20 Chinese companies can provide medium and high-end CNC machine tools. Local industry experts expect that the demand for metal cutting, forming machine tools, and accessories will face challenges of continued growth in 2019.<sup>1430</sup>

### **8.7.11 Military technology**

#### **8.7.11.1 Developments and Trends in China's Defense Industry**

China's defense-industrial complex continues to adapt and reorganize to improve weapon system research, development, acquisition, test, evaluation, and production.

China has realigned its S&T decision making apparatus by establishing two advisory groups that promote a strategic approach to military modernization and enhance collaboration.

**Defense Sector Reform:** China's defense industrial complex continues to adapt and reorganize to improve weapon system research, development, acquisition, test, evaluation, and production (RDATE&P). Inherent to this effort is a realignment of China's S&T decision making apparatus and the establishment of two advisory groups at the highest levels of government. One group is focused on promoting a strategic approach to military modernization, and the other encourages innovation through a doctrine of increased collaboration between China's military- and state-owned (defense) industrial sector and its private and commercial industrial enterprises. During the past four years, the CMC and the State Council implemented organizational and policy changes to advance the PLA's defense research and increase its capacity for innovation through market sector cooperation.

One of the most influential reforms to help improve RDATE&P occurred in 2015 with the establishment of the Strategic Committee of Science, Technology, and Industry Development for National Defense, a high-level advisory group chaired by the State Administration for Science, Technology, and Industry for National Defense. The committee, comprising military and civilian industrial, government, and technical leaders and experts, advises China's military and defense-industrial leaders on military modernization issues and on opportunities to develop emerging technologies.

The CMC, in 2016, established the S&T Commission, a high-level defense research body, as an independent organization under the high command. It also emphasized Civil-Military Integration (CMI), a phrase used in part to refer to the defense and commercial industrial sectors sharing or combining resources to develop dual-use technologies, policies, and organizations for mutual benefit but with a particular emphasis on assimilating private sector innovation into the defense industrial base. The 2017 establishment of a Central Commission for Integrated Military and Civilian Development, responsible for overseeing CMI efforts, underscores the importance China assigns to this initiative.

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<sup>1430</sup> Excerpts from a report "China - Machinery" of Ministry of Commerce, USA, last published on July 30, 2019, available online at URL: <https://www.export.gov/apex/article2?id=China-Machinery>