

Chapter 7

Mid-to-Long-Term Structural Adjustments of Manufacturing and Cultivation of New Competitive Advantages



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The year of 2020 is the last year of China's "13th Five-Year Plan" period, in which we will achieve the strategic goals of basically realizing industrialization and building a moderately prosperous society in all respects. For a long period of time in the future, China's industry will face opportunities such as upgrading domestic demand, expanding markets in developing countries, and the rise of a new industrial revolution. At the same time, it will also face various challenges such as the impact of the "backlash against globalization" and "double-end squeeze", as well as the interference of uncertain factors such as the COVID-19 pandemic. During the 14th Five-Year Plan period, China's industry will be well oriented to cultivate new advantages and take new measures to pace up the move from a large country to a strong country in industry.

7.1 Development Status and Main Problems of China's Manufacturing

7.1.1 *The Growth Rate Declined and Stabilized, and the Development of Industry Differentiated*

Affected by changes in domestic and international market environment, the growth rate of China's manufacturing industry has gradually slowed down since the 12th Five-Year Plan. After its contribution to national economic growth lagged behind that of service industry, the growth rate has continued to decline and is lower than the average growth rate of various sectors of the national economy. In nominal terms,

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the compound annual growth rate of manufacturing added value was 16.7% during the 11th Five-Year Plan period, decreased to 9.2% during the 12th Five-Year Plan period, and further decreased to 5.5% in the first three years of the 13th Five-Year Plan period. In 2018, the added value of manufacturing industry grew 6.2%. With the slowdown of growth rate, the proportion of manufacturing industry in the national economy has declined. The proportion of manufacturing added value in GDP has dropped by 0.7% point during the 11th Five-Year Plan period and 2.4% points during the 12th Five-Year Plan period (see Fig. 7.1). However, since the 13th Five-Year Plan, the development of industries has been differentiated, with the growth rate of food industry, textile and garment, rubber and plastics industries declining most while the proportion of equipment manufacturing and electronic information manufacturing industries increased in the same period (see Fig. 7.2). In the first two years of the 13th Five-Year Plan period, the proportion of main business income of electronic information manufacturing industry increased by 1.2% points—the largest growth. In 2019, with the overall growth rate of manufacturing industry declining, the added value of high-tech manufacturing industry with large scale and strategic emerging industries increased by 8.8 and 8.4% points respectively over the previous year, and the growth rates were 2.8 and 2.4% points faster than those of manufacturing industry with large scale respectively. High-tech industries and emerging industries accelerated their development; the operating conditions of manufacturing enterprises improved significantly; the ability of innovation-driven development increased; and the downward trend of manufacturing growth slowed down. In 2019, the growth rate of added value of manufacturing enterprises with large scale was 6.0%, and it decreased by merely 0.1% point in the first three years of the 13th Five-Year Plan. In 2019, the added value of manufacturing industry accounted for 27.2% of GDP.

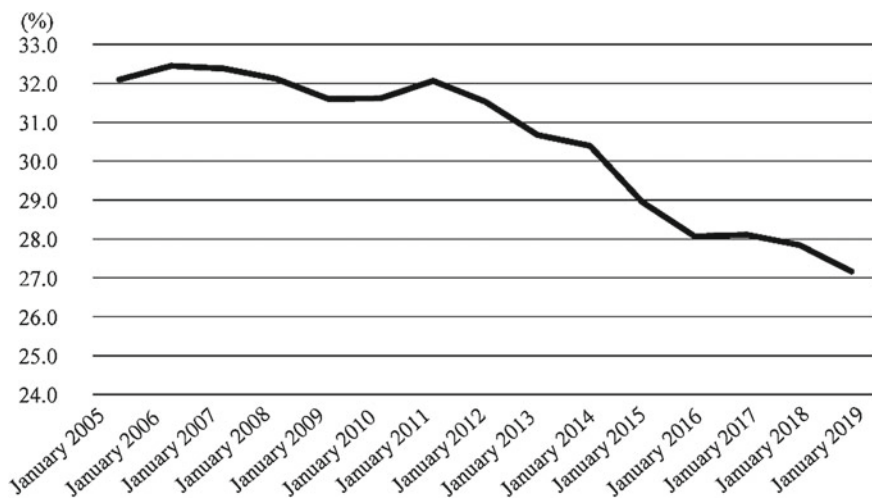


Fig. 7.1 Changes in the proportion of manufacturing added value to GDP. *Source* National Bureau of Statistics

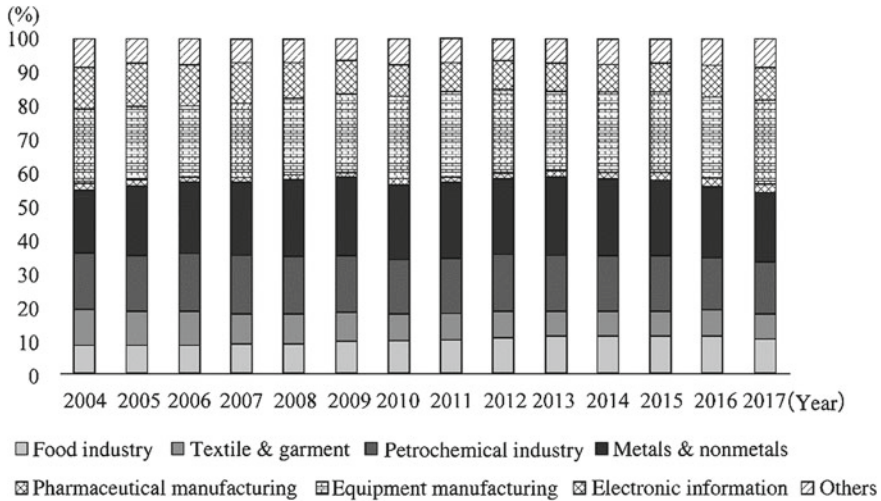


Fig. 7.2 Changes in the proportion of manufacturing output above designated size (calculated by main business income). *Source* Calculated according to the data of the National Bureau of Statistics

7.1.2 Formation of New Development Momentum and Effect of Weak Demand on Industry Benefits

The innovation drive of manufacturing industry has achieved remarkable results in recent years under the policy incentives of optimizing resource allocation, promoting transformation and upgrading, strengthening innovation drive and eliminating backward production capacity. The proportion of research and experimental development activities of industrial enterprises above designated size increased from 19.2% in 2015 to 28.0% in 2018, and the proportion of research and experimental development expenditure in main business income increased from 0.9% in 2015 to 1.3% in 2018. In 2017, the main business income of high-tech industries reached 15.9 trillion yuan, and the proportion of all manufacturing industries above designated size increased from 14.8% in 2015 to 16.7%. With the deepening of supply-side structural reform, the reduction of excess capacity in traditional industries such as steel, coal, petrochemical and building materials has been continuously promoted. While the development of strategic emerging industries has paced up, new products conforming to structural upgrading and consumer demand have emerged constantly, and economic and environmental benefits have improved significantly. In 2017, the total energy consumption of manufacturing industry was 245,000 tons of standard coal, and the energy consumption per 10,000 yuan of added value was 1.0 tons of standard coal, down 16.7% from 2015, which accounted for 54.7% of the total energy consumption, down 2.3% points from 2015. However, affected by the relationship between supply and demand on both domestic and international markets, some industries saw overcapacity, and the ex-factory price index of industrial producers



Fig. 7.3 Trends of ex-factory price and purchase price of industrial producers. *Source* National Bureau of Statistics

continued to fall, leading to the rise of inventories. Especially in the manufacturing industry downstream of the industrial production process, the growth rate of purchase price was higher than that of ex-factory price, and the profit growth rate of industrial enterprises dived (see Figs. 7.3 and 7.4).

The economic benefits of China’s manufacturing enterprises have been continuously depressed due to impact of the COVID-19 pandemic. Since 2018, the cumulative year-on-year growth rates of manufacturing operating income and total manufacturing profit have been declining continuously, down to -1.1 and -42.7% respectively in February 2020. Although it has improved since then, the values of these two indicators remained negative in May, i.e. -7.5 and -16.6% respectively. In the meantime, the year-on-year growth rate of the number of manufacturing loss-making enterprises and the cumulative year-on-year growth rate of the total losses of manufacturing loss-making enterprises tended to rise. The two figures reached 44.1 and 46.9% respectively in February. By May, 27.2% of manufacturing enterprises still suffered losses, and the cumulative year-on-year growth rate of total losses reached 38.9% , both of which were much higher than the same period in 2018 and 2019. Among them, it is particularly noteworthy that, as the COVID-19’s impact on enterprises was directly related to their ability to resume work and resist capital risks, small and medium-sized enterprises saw poor production conditions and capital conditions, and their ability to resist capital chain and supply chain risks also became weaker under greatest impact. According to the data released by the National Bureau

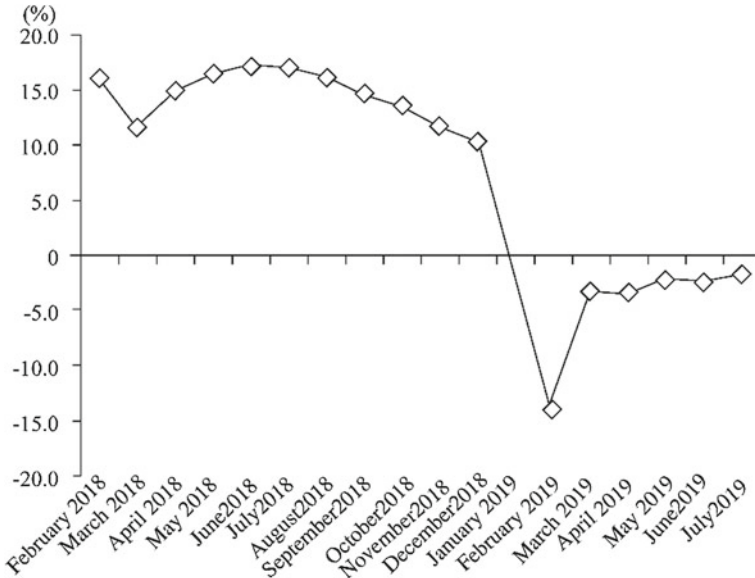


Fig. 7.4 Trends of profit growth rates of industrial enterprises. Source National Bureau of Statistics

of Statistics, the number of loss-making enterprises in private industrial enterprises with dense small and medium-sized enterprises increased by 31.1% year on year in May, while the number of loss-making enterprises in state-owned and state-controlled industrial enterprises with large scale increased by 12.2% year on year.

7.1.3 The Industrial Production System is Complete and the Scale Advantage is Outstanding

China has built an industrial production system with 41 major categories, 207 middle categories and 666 minor categories in the world. China’s industrial products and investment have spread over more than 230 countries (regions) and 190 countries (regions) respectively, providing domestic and foreign consumers with various industrial products of complete styles, which occupy an important position in the global industrial chain. Since 2010, the United States has taken measures to promote the comeback of manufacturing industry, and its manufacturing growth rate has slightly recovered to 1.0%, but China maintained a growth rate of 7.5% in the same period. In 2018, China’s manufacturing added value accounted for more than 28% of the world’s total, 1.7 times that of the United States, 3.9 times that of Japan and 4.8 times that of Germany.

In 2013, China surpassed the United States to become the world’s largest trading country in goods, and the growth of import and export of manufactured goods played

a decisive role. According to the World Bank, the added value of China's manufacturing industry surpassed that of the United States in 2010 and became the largest manufacturing country in the world. According to the data of the United Nations Industrial Development Organization (UNIDO), industrialized countries accounted for 55.3%, and newly industrialized countries accounted for 16.3%. It reached 24.8% in China in 2017. Compared with 2005, China's share of global manufacturing value added increased by 13.2% points, more than doubling (see Table 7.1). In recent years, China's imports and exports have further expanded, with the total import and export volume rising from US \$2974.00 billion in 2010 to US \$4576.13 billion in 2019, and its international trade ranking has jumped continuously. Among them, the total export volume increased from US \$1577.75 billion in 2010 to US \$2499.03 billion in 2019, and the export of manufactured goods in 2019 was US \$2365.09 billion, accounting for 94.6% of the total export volume of all goods, which was the most important industrial sector to create foreign economic and trade surplus (see Table 7.2).

Table 7.1 Distribution trends of global manufacturing value added (*Unit %*)

	2005	2010	2015	2017	Average annual growth rates from 2005 to 2010	Average annual growth rates from 2010 to 2017
Industrialized countries	69.6	61.8	56.8	55.3	-0.3	1.3
Newly industrialized countries	16.0	16.6	16.5	16.3	3.5	2.7
Other developing countries	2.3	2.5	2.7	2.8	4.5	5.2
Least-developed countries	0.5	0.6	0.7	0.8	9.1	6.7
China	11.6	18.5	23.3	24.8	13.1	7.5
United States	20.2	17.3	15.6	15.1	-0.4	1.1

Source Calculated according to UNIDO database data

Table 7.2 China's trade in goods in recent years (*unit* 100 million US dollars)

Years	2010	2012	2014	2016	2018	2019
Total import–export volume	29,740.0	36,418.6	43,015.3	36,855.6	46,224.1	45,761.3
Total export	15,777.5	18,983.8	23,422.9	20,976.3	24,866.8	24,990.3
Total import	13,962.5	17,434.8	19,592.4	15,879.3	21,357.3	20,771.0
Balance between import and export	1815.0	1549.0	3830.5	5097.0	3509.5	4219.3

Source National Bureau of Statistics

7.2 Stability of Employment and Investment and Non-optimistic Market Environment

The manufacturing industry is the most important pillar industry to promote steady transformation of China's economy, and plays an important role in all aspects. In terms of added value, the added value of China's manufacturing industry reached 26.5 trillion yuan in 2018, 1.3 times that at the end of the 12th Five-Year Plan and 2.0 times that at the end of the 11th Five-Year Plan. In terms of employment, by the end of 2018, there were 41.783 million employed people in non-private entities in manufacturing cities and towns, accounting for 24.2% of the total employed population in non-private entities in all cities and towns. In terms of investment, the growth rate of manufacturing investment has declined in recent years. The growth rate of manufacturing fixed assets investment in 2018 was still 3.6% points higher than the national total. In 2017, the manufacturing fixed assets investment reached 19.4 trillion yuan, accounting for 30.7% of all urban fixed assets investment. In terms of tax payment, the tax payment of manufacturing industry in 2018 was 5.5 trillion yuan, accounting for 32.2% of the total tax revenue. In terms of foreign investment, the actual use of foreign capital in manufacturing industry in 2018 was US \$41.17 billion, accounting for 30.5% of the total actual use of foreign capital. In terms of outbound investment, as of 2018, the stock of manufacturing foreign investment was US \$182.23 billion, accounting for 9.2% of the total stock of foreign investment, an increase of 2% points over 2015. While China's manufacturing industry made great contributions to economic and social development, the development environment needs to be improved. The manufacturing development environment in China is obviously poorer than developed countries (see Fig. 7.5). According to the results of comprehensive development environment assessment of major manufacturing countries in the world in 2018 released by Brookings Institution, Britain, Switzerland and the United States ranked among the top three, while China ranked 13th in the world with a score of 61 points.

7.3 New Trends and Challenges of Global Manufacturing Development and New Demand of China's Manufacturing

7.3.1 Trends of "New Four Modernizations" of Manufacturing Industry and Its Impact on Competitive Advantages

In recent years, a new round of scientific and technological revolution and industrial transformation, featuring explosion of science and technology in the fields of new generation information technology, new materials, new energy and life sciences, has

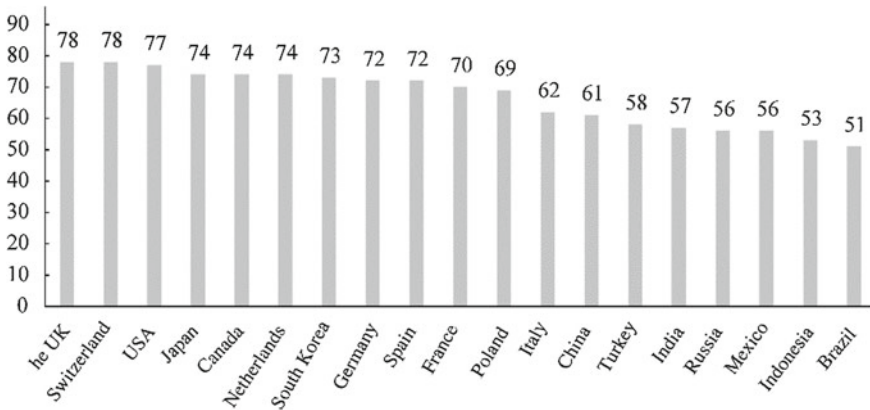


Fig. 7.5 Rankings of comprehensive manufacturing environment by countries in 2018. *Source* Brookings Institution: *global manufacturing scorecard: a comparative study of the United States and 18 countries*, July 2018

emerged all over the world. The development of manufacturing industry will show a trend of green, intelligent, service and customization.

First, green development, the green development of manufacturing industry refers to the transformation of manufacturing industry to energy and resource conservation, environmental friendliness and low greenhouse gas emission. On the one hand, the trend of green development stems from the changes in production methods and business models caused by technological innovation. Not only is it limited to the improvement of energy conversion efficiency and resource utilization efficiency in resource-based industries with high energy consumption, high pollution, but greener production equipment, production technology and development mode will be generally adopted in every manufacturing sector and every link of the whole life cycle of the manufacturing industry chain. On the other hand, countries all over the world have raised higher environmental standards for raw materials, production processes, final products, environmental impacts, recycling, etc. Green development has thus increasingly become a consensus. On the one hand, the trend of green development promotes the energy-saving and environmental protection industry to become the leading industry. On the other hand, the environmental cost of manufacturing industry will increase. For those enterprises lacking green manufacturing technology, the increase of environmental costs may offset the existing cost advantages.

Second, intelligent development with the development of new generation information technology, the manufacturing industry is developing along an intelligent direction that is data-driven, real-time online and intelligence-led. With the empowerment of artificial intelligence technology, production equipment and products will have the capabilities of self-perception, self-learning, self-decision-making, self-execution and self-adaptation. Smart manufacturing will reconstruct the production mode and value process of the manufacturing industry, improve the efficiency of

R&D and production, strengthen market response, and improve user service. Smartness will also bring about fundamental changes in the manufacturing structure, thus forming a number of strategic emerging industries with software and digital transmission and integrated analysis, while some traditional industries will be rejuvenated by digital empowerment. Therefore, the competitive advantage of manufacturing industry has changed towards intensive human capital and knowledge. For example, “labor-intensive” industries such as food manufacturing, printing and reproduction of recording media, furniture manufacturing, textile and clothing, shoes and hats manufacturing are evolving into “capital-intensive” industries with low dependence on labor under the highly automated production paradigm.

Third, provide services, service-based development information network technology has created conditions for manufacturing enterprises to extend to clients on the basis of production division. The manufacturing industry has changed from product-centered to customer-centered, from processing and assembly-oriented to product service outsourcing integration, from one-time trading products to long-term service provision, and from product-based value source to “product + service” combination as value source. Integrated and customized services based on products are increasingly becoming an important source of competitiveness for manufacturing enterprises.

Forth, customized products, customization and mass production are the main way to improve the efficiency of traditional industrialization. The new round of industrial revolution has provided enterprises with low-cost, large-scale and extremely personalized customized manufacturing. Providing highly customized products to specific customers can accurately enable manufacturers to expand personalized market demand, obtain more orders and improve efficiency. Personalized customization market is a like gold mine for manufacturing industry to expand its market scale and form new competitive advantages after the traditional consumption demand.

7.3.2 Impact of New Challenges of the International Environment on China’s Traditional Competitive Advantage

New challenges of the international environment mainly originate from the destruction of the global industrial division of labor caused by unilateralism and trade protectionism in some developed countries, and from the changes of competitors that Chinese manufacturing faces when it approaches the center of the world stage.

First, the global industrial value chain is retracting. Driven by the new round of industrial revolution, the popularization of industrial Internet, artificial intelligence, cloud computing, big data and other technologies in major developed countries has promoted the improvement of local labor productivity, while the advantage of low labor cost of developing countries has been continuously weakened. After the international financial crisis, in order to solve the problems of industrial hollowing out and

employment, the manufacturing industry chain of developed countries has returned to their own countries. The increasing protectionist measures introduced by major developed economies in the world have seriously threatened the integration of global economy and reduced opportunities for developing countries to promote industrialization by integrating into the global industrial chain. For China with a relatively complete manufacturing system, it will lose the opportunity to climb to the high end of the industrial chain, which may affect China's competitive advantage formed on the basis of the existing global industrial division of labor.

Second, the supply of cutting-edge technology is restricted. With the development of China's manufacturing industry and with the adjustment of policies of developed countries, the relationship between China and developed countries has gradually changed from a cooperative relationship of upstream and downstream division of labor to a competitive relationship in the same industrial chain. Developed countries have changed from technology supply demonstration to technology blockade and suppression. The fundamental purpose of the United States to provoke trade friction is to block the development of China's cutting-edge technology. Although China and the United States formally signed the first-phase economic and trade agreement in January 2020, and the "hot trade war" eased, the "cold war of science and technology" between China and the United States in key industries will not stop. In the second stage of trade friction and future competition, the U.S. government will be characterized by non-tariff barriers such as import and export control and investment restriction, using various measures to restrict China's access to American technology, imposing special export restrictions on certain specific sectors, and examining Chinese companies' investment in the United States and their technology acquisition channels. Therefore, China should promote diversification of the supply chain, strengthen control over the key links of the value chain, and lay a solid foundation for modernization of the industrial chain, so as to reduce the risk of "seized us by the throat".

Third, newly industrialized countries are catching up with China's development. The transformation and upgrading of China's manufacturing industry increased the competition with developed countries in the field of high-end manufacturing. On the other hand, due to the rising labor cost and environmental cost, the competitive advantage of China's manufacturing industry in labor-intensive industries and low-end production links has been challenged by newly industrialized countries. China has a vast territory, but its development level of productive forces is unbalanced. In some areas, the demand for industrial development and economic development is very urgent. The competition between newly industrialized countries and China in labor-intensive industries has affected the economic development of underdeveloped areas in China to some extent, and brought down the development speed of manufacturing industry to a certain extent. However, as the development of manufacturing industry needs industrial supporting system, the competition from developed or developing countries will not have a fundamental impact on the development of China's manufacturing industry. The fundamental factor affecting the development of China's manufacturing industry is the internal driving force brought by the improvement of economic development level.

7.3.3 The Global Spread of the COVID-19 Pandemic Threatens the Stability of China's Industrial and Supply Chains

China is the largest manufacturing country and exporter of manufactured goods in the world. Its manufacturing industry is deeply integrated into the global production network and is the most important manufacturing base in the world. On the one hand, a large number of high-tech intermediate products represented by high-end equipment, core components and scientific instruments have been imported. On the other hand, the advantages of low cost of comprehensive factors and large production scale have been brought into play. After the outbreak of COVID-19, China adopted a series of measures to restrict population mobility, such as extending holidays and delaying the resumption of work, and temporarily suspended the production in enterprises. With the relief of the pandemic and the normalization of epidemic prevention and control in China, the process of resuming production in China has been accelerated, and the manufacturing industry has basically recovered to the pre-epidemic level. However, the overseas epidemic situation was not effectively controlled, affecting the consumer market, with overseas orders of Chinese enterprises canceled one after another, and some export-oriented SMEs have been greatly impacted.

After the international financial crisis in 2008, the United States proposed “re-industrialization” to promote the comeback of manufacturing industry. After the outbreak of COVID-19 in Europe and America, politicians and media in some countries such as the United States and the European Union wantonly hyped the anxiety about the shortage of masks, ventilators and medicines, and took the opportunity to promote the comeback of the manufacturers. On March 27, 2020, after the U.S. federal government urgently launched the *National Defense Production Act* to ensure localization of strategic materials production. White House trade consultant Navarro and Republican Senator Rubio actively promoted the *Buy American* bill and required federal agencies to purchase American-made medicines and medical equipment to reduce dependence on China's manufacturing supply chain. On April 9, 2020, US Presidential Economic Adviser Kudlow announced that he would promote the comeback of manufacturing to the United States by implementing measures such as full pre-tax credit for relocation costs. Subsequently, the US State Department, the Department of Commerce and other federal agencies began to jointly promote the construction of an “Economic Prosperity Network” with “reliable partners” such as Australia, India, Japan, New Zealand, South Korea and Vietnam, with the aim to reduce the dependence of the United States on Chinese manufacturing and to weaken China's central position in the global manufacturing supply chain. The EU's discussion on reducing dependence on external supply chains has expanded from promoting self-built industrial chains to produce necessary protective products against the COVID-19 to promoting the comeback of key industries or diversifying their supply chains. On March 9, 2020, French Finance Minister Lemerre publicly stated that France must reduce its dependence on China's supply chain and strengthen

its own control in strategic value chains such as automobiles, aerospace and pharmaceuticals. From April to May, EU officials continuously put forward in public the idea of achieving self-sufficiency in health and safety products and ensuring EU autonomy in strategic industries.

Although China is the country with the strongest supporting capacity and the most obvious advantages in the industrial chain in the world as the largest manufacturing country in the world, it maintains a deep interdependence with other countries in the manufacturing supply chain. According to the data of World Integrated Trade Solutions (WITS), in 2018, China's imports of raw materials and intermediate products totaled US \$967.5 billion, accounting for 45.3% of the total imports of goods. In the same year, the imports of raw materials and intermediate products of the United States, Japan and Germany accounted for 25.1, 39.5 and 30.5% of the total imports of goods respectively (see Fig. 7.3). From this point of view, China is the world's major manufacturing country with the deepest dependence on the supply of foreign raw materials and intermediate products. On the other hand, the supply chain resilience of Chinese enterprises is relatively low. According to the 2020 Global Supply Chain Resilience Index released by FM Global, China ranks 45th among 126 countries and regions, while Germany, Japan and the United States rank 9th, 14th and 16th respectively. That is to say, from the perspective of the conditions and capabilities to cope with the impact of supply chain, Chinese enterprises are facing more challenges.

7.4 New Demands Brought About by a Moderately Prosperous Society and the “Belt and Road” Initiative

China will build a moderately prosperous society in all respects in 2020, and the people's living standards will be further improved. At the same time, the “Belt and Road” Initiative has received wide response, and the changes in the domestic and international market environment will make the demand side of China's manufacturing industry show a series of new features in the mid-to-long-term development, which will have a significant impact on the development direction of the manufacturing industry.

First, consumer demand is expanding. The rise of economic growth is usually accompanied by the change of demand structure. From the evolution of demand structure in developed countries, the change path of demand structure in different countries is highly related to the level of economic development, showing remarkable convergence.¹ Looking forward to the medium and long term, and under the condition that there is no major negative impact on employment and inflation, the total consumption demand of Chinese residents will grow steadily, and its proportion in the total social demand will continue to increase. Consumption demand will play a more important role in promoting economic growth. China's consumption scale is expected to surpass that of the United States in recent years, and become the

¹ China Development Research Foundation (2018).

largest consumer market in the world. The continuous expansion of domestic market demand will form a significant local market advantage, which is an important support for the medium and long-term high-quality development of China's manufacturing industry.

Second, the demand for technology investment has increased. International experience shows that under the background of slowing economic growth, the structure of investment demand will undergo great changes. Take Japan as an example. After 1973, Japan's investment demand underwent major structural changes, that is, the growth rate of its total investment gradually slowed down, but the investment in advanced technology and equipment increased rapidly. The penetration rate of industrial robots in Japanese manufacturing industry increased from 0.083 units per 1000 people in 1974 to 0.822 units per 1,000 people in 1979, which increased nearly nine times in five years, with an average annual growth rate of 58%,² while the average annual growth rate of total capital formation in Japan was only 7.5% in the same period. China's manufacturing industry has huge debts in investment in advanced technology and equipment. Under the dual influence of the disappearance of demographic dividend and the arrival of "Smart+" era, digital and intelligent equipment and systems such as robots will become the main force driving the upgrading of investment structure.

Third, new durable consumer goods are emerging. Comparing the per capita consumption expenditure structure of Chinese residents in 2018 with that of Japanese residents during 1973–1979, we can find that there is little difference in the proportion of food expenditure, clothing expenditure, household goods expenditure and medical care expenditure between the two countries, but the proportion of Chinese residents' housing expenditure is 37% higher than that of Japan in the highest year in the sample period (see Table 7.3). If the real estate price and the resulting rent price can remain basically stable, there is still much room for adjustment of Chinese residents' consumption structure in the medium and long term. New durable goods that have relatively low value but can improve the quality of life are an important support for promoting the growth of residents' consumption. The main driving force for the growth of Chinese residents' consumer demand in the medium and long term may be "new household appliances" (such as dishwashers, etc.), which have only appeared in recent years and have relatively low penetration rate at present, as well as new consumer electronic products related to emerging electronic information technologies (such as VR equipment, smart household appliances, etc.).

Fourth, the emerging external demand market is taking its shape. The optimization effect of external demand structure formed by the co-construction of the Belt and Road will become an important factor to promote the upgrading of China's manufacturing industry. Asian, European and African countries participating in the co-construction of the "Belt and Road" Initiative are still the three major sources of China's external demand growth, among which Asian countries are the most important growth points, while African countries are playing an increasingly important role. Using the time-varying stochastic frontier trade gravity model, this paper

² Tani (1989).

Table 7.3 Composition of Japanese residents' consumption (1973–1979) and its comparison with China (2018) (*unit %*)

	Japan							China
	1973	1974	1975	1976	1977	1978	1979	2018
Food	27.6	28.3	28.4	28.1	27.5	26.2	24.8	28.4
Clothing	8.8	8.4	8.1	8.2	7.7	7.7	7.5	6.5
Rent, water, energy	16.1	15.5	15.6	16.1	16.7	17.1	17.1	23.4
Household goods	7.9	7.6	6.3	6.4	6.1	5.8	6.2	6.2
Medical care	7.8	8.4	9.0	9.0	9.2	9.6	9.8	8.5
Transportation and communication	8.6	9.1	9.6	9.6	10.0	10.0	10.2	13.5
Recreational and educational activities	9.2	9.0	8.8	9.0	8.9	8.9	8.8	11.2
Others	14.1	13.9	14.2	13.6	14.0	14.8	15.7	2.4

Source Statistics Bureau of Ministry of Internal Affairs and Communications of Japan, National Bureau of Statistics of China

makes an empirical analysis on the export data of manufactured goods from China to 136 countries that have signed the cooperation documents of the “Belt and Road” Initiative from 2010 to 2018. The results show that: from the perspective of export product types, from 2013 to 2018, among the four categories of manufactured goods exported by China to 136 countries that have signed cooperation documents to jointly build the Belt and Road, the export trade efficiency of resource-based, low-tech, medium-tech and high-tech manufactured goods increased by 8, 5, 17 and 11% respectively (see Table 7.4). In other words, since the “Belt and Road” Initiative was put forward, the medium-tech finished products represented by automobiles, chemicals, machinery and equipment benefit most from the improvement of export trade efficiency, followed by high-tech manufactured goods represented by electronic information products, power equipment, pharmaceuticals, resource-based manufactured goods such as wood, and low-tech manufactured goods such as textiles and clothing benefit relatively little. In the medium and long term, if the export efficiency increase of these four types of manufactured goods is the same as that of 2013–2018, then, according to the conservative estimation of the export value of various manufactured goods in 2018, only by improving the efficiency of export trade, China’s exports of medium-tech, high-tech, low-tech and resource-based manufactured goods to 136 countries participating in the “Belt and Road” Initiative will increase by 25 billion US dollars, 16.2 billion US dollars, 9.9 billion US dollars and 2.4 billion US dollars respectively. The demand for medium-tech manufactured goods in countries participating in the “Belt and Road” Initiative will significantly improve China’s external demand structure. With the improvement of the income level of the countries participating in the “Belt and Road” Initiative, the demand for high-tech manufactured goods will form a strong driving force for the development of China’s corresponding industries, while the new demand for resource-based and low-tech manufactured goods due to the improvement of export trade efficiency is relatively small.

Table 7.4 Efficiency of China's export trade to 136 countries participating in the "Belt and Road" Initiative

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Africa (44 countries)	0.35	0.35	0.34	0.36	0.37	0.39	0.42	0.45	0.48
Asia (37 countries)	0.78	0.77	0.81	0.80	0.83	0.85	0.85	0.86	0.86
Europe (27 countries)	0.62	0.61	0.60	0.62	0.64	0.65	0.65	0.67	0.68
Oceania (9 countries)	0.55	0.53	0.53	0.54	0.56	0.57	0.57	0.59	0.59
South America (8 countries)	0.58	0.54	0.57	0.57	0.58	0.57	0.60	0.61	0.63
North America (11 countries)	0.49	0.52	0.51	0.51	0.53	0.55	0.58	0.59	0.58
Resource-based finished products	0.62	0.61	0.61	0.62	0.64	0.65	0.63	0.65	0.67
Low-tech manufactured goods	0.76	0.77	0.76	0.75	0.76	0.77	0.78	0.77	0.79
Medium-tech manufactured goods	0.57	0.56	0.56	0.58	0.59	0.61	0.63	0.65	0.68
High-tech manufactured goods	0.46	0.46	0.46	0.47	0.46	0.48	0.51	0.50	0.52

Source Estimated by the research group

7.5 Development Orientation and Key Areas of China's Mid-to-Long-Term Manufacturing Industry

7.5.1 Positioning of Manufacturing Industry in the National Economy

During the 12th Five-Year Plan period, the development speed of China's manufacturing industry began to slow down, and the industry's position in the national economy was retreated from the largest industrial sector to lagging behind the service industry. In recent years, the development speed has further declined due to the impact of increasing tariffs and trade protection in the United States. From the international experience, the decline in the proportion of manufacturing industry is a feature of economic development entering a high-income stage. For example, before 1968, the proportion of manufacturing industry in the United States was above 25%, while the per capita GDP reached 23,000 US dollars (constant price in 2010). When Japan's per capita GDP was US \$18,700 (constant price in 2010), there emerged an inflection point of continuous decline in manufacturing industry. Compared with the United States and Japan, the proportion of manufacturing industry in China has declined too early and too fast. Although the proportion of manufacturing industry of China is close to that of developed countries, the economic development is still outside the threshold of high-income countries.³ This change in industrial structure is called premature industrial structure. All countries caught in the "middle income trap", such

³ According to the standards of the World Bank in fiscal year 2020 and the Atlas method of the World Bank, a country with its per capita GNI (Gross National Income) in 2018 exceeding 12,376 US dollars will be seen as a high-income country. In 2018, China's per capita GDP was 9,771 US dollars (current price), and the per capita CNI (Atlas method) was 9460 US dollars (current

as Brazil and Argentina, witnessed precocious industrial structure. The rapid decline in the proportion of manufacturing in these countries was almost synchronized with the economic stagnation. In addition, from the lessons of developed countries deeply impacted by the international financial crisis, manufacturing is not only a key pedal for middle-income countries to move towards high-income countries, but also an important guarantee for maintaining national economic strength. In the medium and long term, although the contribution of China's manufacturing industry to economic growth will still be lower than that of service industry, its role in national economic development is mainly manifested in five irreplaceable aspects.

First, the basic role of industry in building a strong socialist modern country is irreplaceable. Industry is the most important material production sector to provide material products that can't be replaced by any other sectors for residents' lives and economic activities of various industries. Without modern industry, if economic activities lack material basis for operation, China's economy will have to rely on other countries in international competition, which will not meet the people's needs for material products in pursuit of a better life, nor will it effectively respond to major emergencies such as natural disasters and infectious diseases. In addition, this will safeguard national security and ensure the people to live and work in peace and contentment. From the lessons of developed countries deeply impacted by the international financial crisis, industry is not only a key pedal from middle-income countries to high-income countries, but also an important guarantee to maintain national economic strength. The proportion of China's industry dropped from the highest point of 42.0% in 2006 to 32.8% in 2018, and the proportion of service industry reached 53.3%. However, industry will still play a fundamental supporting role in the development of national economy, building a moderately prosperous society in all respects and building a modern country.

Second, the supporting role of industry in crossing the "middle income trap" and "high income wall" is irreplaceable. From the history of global economic development, we can see that some countries were stagnant when their per capita GDP was only 4000–5000 international dollars, far from the threshold of high-income countries. Some other countries were difficult to further grow after their per capita GDP reached about 10,000 international dollars. These two situations were called "middle income trap" and "high income wall" by economists respectively. The cause of "middle income trap" and "high income wall" is that after the advantages of primary production factors are lost, advanced production factors such as knowledge and technology have not become sources of industrial competitive advantage and economic growth, which is essentially a "technology stagnation trap". Industry is an industrial sector that has the largest investment in R&D, the most active technological innovation and the strongest radiation driving force. It plays an irreplaceable role in promoting other industries to break the "technology stagnation trap". From the perspective of industrial structure, if the proportion of manufacturing industry declines too early and too fast, there will appear the problem of "premature industrial

price). In 2019, the per capita GDP reached US \$10,276, but it still did not cross the threshold of high-income countries.

structure". The economic stagnation in Brazil, Argentina and other countries caught in the "middle income trap" was almost synchronized with the rapid decline of the proportion of manufacturing industry.

Third, the leading role of industry in promoting China's industrial division of labor is irreplaceable. Manufacturing is the main force of China's foreign trade. Although China's service export is growing rapidly, the export scale of manufactured goods in 2018 was still about 10 times that of service industries. The trade surplus of manufactured goods was as high as 917.70 billion US dollars, while the trade in services saw a deficit of 258.20 billion US dollars. Manufacturing is also the main field of utilizing foreign capital and foreign investment. In 2018, China's manufacturing industry actually utilized foreign capital of 41.17 billion US dollars, accounting for 30.5% of the total actual utilization of foreign capital. By 2018, China's manufacturing foreign investment stock amounted to US \$182.23 billion, the proportion of total foreign direct investment stock increased from 5.6% in 2010 to 9.5%. In 2019, 129 enterprises in China (including Hong Kong, Macao and Taiwan) entered the ranks of Top 500 in the world, and a quarter of the main business was manufacturing. From the industry point of view, the manufacturing industry in China's large enterprises was more internationalized.

Fourth, industry's role in promoting technological innovation and technological diffusion is irreplaceable. Many talents, funds and hardware facilities of innovation activities depend on industry. At the same time, the establishment of the physical system of innovative activities depends on industry. It is the verification place for the industrialization and commercialization of innovative achievements and the "mother" of technological innovation. Even in the United States, where the proportion of manufacturing is very low, about 70% of innovation activities depend directly on manufacturing or receive financial support from manufacturing.

Fifth, the leading role of industry in driving economic development in backward areas is irreplaceable. Industry is an important industrial sector for rapid economic development because of its long industrial chain, wide driving force, strong employment absorption and technology diffusion. It is a successful experience to get rid of backwardness and accelerate economic development in many areas of China to choose and develop industries and manufacturing industries suitable for local needs according to local conditions. For example, the prosperity of Northeast China is due to the prosperity of manufacturing industry, while its decline is due to the decline of manufacturing industry. At present, China's per capita GDP level has just exceeded 10,000 US dollars, and some impoverished areas have just lifted out of poverty. Therefore, the task of economic development is very arduous, and it is urgent to rely on the development of industry to drive the economy to take off.

7.5.2 Favorable Conditions for Cultivating New Competitive Advantages of China's Manufacturing Industry

The changes of domestic resource endowment, industrial base and development stage, as well as the international technological, economic and political environment have required China's manufacturing industry to shape new competitive advantages. Although China's manufacturing industry is squeezed by both developed countries and emerging developing countries, China's manufacturing industry still has development potential and favorable conditions to reproduce new competitive advantages.

First, the comprehensive cost is low. Driven by factors such as the improvement of economic development level, the disappearance of demographic dividend and the increase of living cost, China's wage level is rising continuously and rapidly, and the prices of production factors such as land and energy are relatively high, which has a certain impact on the traditional low price advantage of China's manufacturing industry. However, the cost and price advantage of manufacturing industry depends not only on the wage level, but also on the joint action of many factors such as labor quality, equipment level, infrastructure and industrial supporting conditions. Compared with developing countries, although their wage level is obviously lower than that of China, and their wage level and unit labor cost of labor productivity also have advantages, the backward infrastructure and industrial facilities restrict their low-cost manufacturing advantages. Compared with developed countries, China's wage level still has obvious advantages, moreover, China's cost advantage is reflected in the processing and manufacturing links at the low end of the global value chain. With the improvement of national education level, more and more high-quality laborers will enter the national economy. The change of China's labor dividend from quantity dividend to quality dividend or "engineer dividend" will make China's manufacturing industry have lower costs in R&D, design, products and services, thus forming the cost advantage of China's manufacturing industry compared with developed countries in the whole life cycle.

Second, China has a sound industrial chain. China has the most complete industrial categories in the world, and the detailed industrial division of labor has formed perfect industrial supporting facilities and rapid supply chain response capability. China's manufacturing industry as a whole is in the processing and assembly link with low added value in the global value chain, and many high-tech intermediate products depend on imports, but this situation is changing. More and more intermediate products can already be produced in China, and the global value chain is becoming shorter. With continuous improvement of China's manufacturing innovation capability, the industrial supporting capability will be further enhanced. In contrast, the supporting capacity of upstream capital and technology-intensive industries in developing countries is weak. However, in developed countries, the lack of processing and manufacturing capacity restricts innovation and engineering and large-scale production of new technologies.

Third, the ability to make innovations has been enhanced. After more than 40 years of development since the reform and opening-up, the innovation capability of China's manufacturing industry has been significantly improved and continues to increase, which has promoted the expansion of production capacity of raw materials, industries such as steel, cement and textiles, as well as industries such as clothing and electronic assembly, and made the technical level of these industries or industrial chain links among the world-class. This has also solved problems of advanced materials, core components and major equipment from scratch, and continuously improved the technical level in these fields. Major technological breakthroughs have been achieved in strategic emerging industries and cutting-edge technologies, which has strongly supported the development of China's strategic emerging industries.

Fourth, China's digital economy leads the world. Information technology is promoting the manufacturing industry towards digital, networked, intelligent, service-based and green development, and plays an important role in helping manufacturing industry improve supply quality and production efficiency, make quick response to market, and expand value-added space. The future manufacturing industry will be an industry with deep integration of digital technology and industrial technology, advanced manufacturing industry and modern service industry, and will also become a typical feature of the future manufacturing power. China's digital economy ranks second in the world, with a number of world-class digital economy enterprises, and cutting-edge digital technologies such as artificial intelligence are in the forefront of the world. Adoption of digital technologies such as robots and artificial intelligence will not only reduce the number and cost of labor, but also offset the pressure of rising costs to a certain extent. It can also improve the flexibility of manufacturing industry, help provide products to meet market changes and user needs, and develop high value-added services based on existing products.

Fifth, the size of China's economy is expanding. China is one of the countries with the largest population and economy in the world. It boasts super-large-scale economy, super-large-scale population, land space, economic volume and unified market. These four factors are superimposed and coupled to form five characteristics: super-large scale economy effect, scope economy effect, spatial agglomeration effect, innovation learning effect and development spillover effect.⁴ China's domestic market is large in scale and good in growth. The continuous expansion and upgrading of the market scale of residents and industries, consumer goods and investment products has raised more demands for products of more advanced technology, higher quality and stronger performance, which provides huge domestic market support for the manufacturing industry to climb to the middle and high end.

⁴ Research Group of Development Research Center of the State Council (2020).

7.5.3 *Favorable Conditions for Promoting the Development of Manufacturing Industry*

In the medium and long term, the development of China's manufacturing industry needs to adapt to the changes in domestic and international demand, and seize the opportunities brought about by the new round of industrial revolution, so as to promote the transformation and upgrading of traditional industries, and cultivate and expand strategic emerging industries. Emerging industries specifically include:

First, strategic emerging industries driven by new technologies. In traditional industries, the competitive position between countries (regions) and enterprises is relatively solidified, and latecomers need to spend huge time and cost in catching up with leaders. However, in the field of emerging industries, developed countries and developing countries are at a similar starting line, and there is no ready-made technological development direction for them to imitate. Therefore, every scientific and technological revolution and industrial transformation has become a historical opportunity for late-developing countries to catch up. At present, the new round of scientific and technological revolution and industrial transformation is also an opportunity for China's manufacturing industry to overtake other developed economies. President Xi Jinping emphasized that we should "clarify the main direction and breakthrough of China's scientific and technological innovation according to the principle of active follow-up, careful selection and doing a better job in something while abandoning something else. When the right direction is determined, we should work out plans, increase investment in human resources, focus on overcoming a number of key core technologies, and accelerate catch-up and even take the lead."⁵ The engineering transformation and large-scale production of advanced and cutting-edge technologies will be accelerated to produce a batch of irreplaceable "trump card" products in China's manufacturing industry in emerging industries so as to overcome restrictions of western developed countries on China's key core technologies.

Second, the intelligent manufacturing industry utilizing digital technology. Intelligent manufacturing industry utilizing digital technology is the core content of the new round of industrial revolution. Under the background that the low-cost advantage of China's manufacturing industry is gradually weakening, efforts must be made to improve product quality and production management efficiency, and reshape competitive advantage. The intelligent manufacturing industry utilizing digital technology is an important way to enhance the competitiveness of manufacturing industry. At present, as far as the actual situation in China is concerned, the degree of automation and IT application in automobile, household appliances and other industries has been relatively high, while other industries such as 3C, food and beverage and chemicals are accelerating the process of automation and IT applications. Intelligent manufacturing is the key support direction in policy making at the government level, but transformation and upgrading at the enterprise level and technological breakthrough at the research level, the practical application of intelligent manufacturing

⁵ "Accelerating the Implementation of Innovation-driven Development Strategy and the Transformation of Economic Development Mode", *People's Daily*, August 19, 2014.

in China remains in its infancy. One of the important reasons for late arrival of the intelligent manufacturing era is the lack of specialized providers for intelligent manufacturing solution. Manufacturing enterprises have an urgent need to break the bottleneck of development through intelligent manufacturing, but the shortage of specialized providers for intelligent manufacturing solution has become the main obstacle hindering the development of China's intelligent manufacturing industry and market. Conformance to the development trend of digital economy and solving difficult problems in the process of digital transformation of intelligent manufacturing industry has become top priority to effectively promote the high-quality development of manufacturing industry.

Third, green manufacturing industry that promotes ecological civilization. Green manufacturing refers to a modern manufacturing mode that comprehensively considers environmental impact and resource efficiency on the premise of ensuring the function, quality and cost of products. Over years, China's economic growth and industrialization have relied largely on resource-based growth, and the industrial development is dominated by the growth model characterized by "high input, high consumption, high pollution, low quality, low benefit and low output" and "pollution precedes environmental protection". At present, China is in the middle stage of industrialization, an important stage of upgrading consumption structure. On the one hand, as the main body of China's economy, industry has a broad market space. On the other hand, heavy chemical industry has strong expansion power, while problems such as waste of resources, environmental degradation and structural imbalance in the industrial field are still very prominent, restricting the sustainable development of China's industry. In recent years, developed countries have advocated the concept of "low-carbon development" and made great efforts to promote green economy and "Green New Deal". Faced with the changes of international environment and domestic situation, China finds it is of great strategic significance to accelerate the transformation of China's industrial development mode, realize green manufacturing and shape sustainable competitiveness. This is not only conducive to maintaining the autonomy of energy conservation, emission reduction and industrial restructuring, but also can produce more remarkable effects and extensive influences, and create new industrial sectors due to the great potential of industrial energy conservation and emission reduction and relatively good technical and market conditions.

Fourth, labor-intensive industries with high employment. At present, the international economic situation is complex and changeable, and there emerges some deep-seated contradictions that have accumulated for a long time in China. The new normal of economic development and supply-side structural reform put forward new requirements for promoting employment. The inherent requirements for realizing a moderately prosperous society in all respects and promoting high-quality economic development involve developing labor-intensive industries that efficiently drive employment, comprehensively improving workers' employment and entrepreneurship ability, and achieving relatively full and high-quality employment. On the one hand, we will accelerate the development of labor-intensive manufacturing industries such as light industry, 3C processing and assembly with obvious international competitive advantages and large rigid demand for people's livelihood. On the other

hand, we will promote the transformation and upgrading of difficult industries with limited market demand and weak competitiveness, and stabilize the existing employment demand. The supply-side structural reform of labor-intensive industries will be further promoted by eliminating excess and backward production capacity, reducing the social burden of state-owned enterprises, and implementing tax reduction and fee reduction policies. We will also step up efforts to achieve deep integration of the new generation of information technology and manufacturing industry, improve the scientific and technological content and added value of products, and promote the transformation of traditional manufacturing industry from production to production service, so as to extend the industrial chain and increase jobs. Along this direction, we will promote adjustments of industrial structure and transformation of workers' skills, and enhance the ability to absorb employment during transformation and development.

Fifth, new consumer goods industry for the people's better life. The upgrading of domestic residents' consumption has created favorable conditions for the structural adjustment and transformation of manufacturing industry and even the whole national economy, which is the greatest potential of China's domestic demand. We will make full use of domestic demand and develop a new consumer goods industry to meet the needs of a better life. This will help reduce the dependence of national economy on exports and investment and making contribute to growth, and will also help adapt to the wave of scientific and technological innovation under the background of the new round of industrial revolution, and provide good conditions for China to occupy an active position in the new round of scientific and technological competition. To provide new consumer goods with strong consumer demand and closely related to people's daily life, we will focus on the development of new information products such as next-generation mobile communication terminals, ultra-high definition video terminals, wearable devices, smart homes and consumer drones, as well as cutting-edge information consumption products such as virtual reality, augmented reality, intelligent service robots and unmanned driving. For these new consumer goods, we will provide support for enterprises to find users' needs and strengthen innovation in product development, design, packaging scheme and marketing, so as to actively carry out personalized customization and flexible production, enrich and refine consumer goods types, and promote the transformation from "Made in China" to "Created in China".

7.6 Strategic Measures to Foster New Competitive Advantages

In the medium and long term, if China's manufacturing industry intends to take a solid step towards fostering new competitive advantages, it is necessary to formulate strong measures. We hereby propose implementing the following seven major projects.

7.6.1 Industrial Basic Capacity Building Project

First, we will pull together various resources to develop core technical parts (components) with high performance, high reliability and intelligence necessary for intelligent manufacturing equipment such as integrated circuits, high-end sensors and reducers. We will also improve the performance, quality stability and self-sufficiency of key basic materials, such as special metal functional materials, high-end technical structural materials, advanced polymer materials, new inorganic nonmetallic materials and information functional materials, with focus on research, development, popularization and application of new advanced basic technologies, such as digitization, networking, intelligence and greening, and strive to solve the key bottlenecks restricting the upgrading of the industrial chain.

Second, we will uphold innovation-driven development and strengthen R&D innovation and industrialization in basic fields. Innovative resources will be optimized and integrated to guide enterprises, research institutes, universities and downstream users to jointly establish technological innovation organizations, such as R&D institutions and industrial technology alliances. We will further increase investment in basic research and common technology research, strengthen research on common technologies, high-end technologies and forward-looking technologies in basic fields. We will make efforts to solve the key common technologies that affect the performance and stability of core basic components (components), so as to improve the technical level of key manufacturing processes such as digital design, advanced molding and processing, enhance the supply of source technology, and break through technical bottlenecks of industrial chain upgrading.

Third, we will strengthen cooperation on industrial chain, promote coordinated development of leading enterprises, supporting enterprises and downstream user enterprises, and improve the overall synergy of upgrading the industrial chain level. The “one-stop” application plans for key technology research and development, product design, special material development, advanced technology development and application, public test platform construction, mass production and demonstration promotion of key basic products and processes will be formulated to promote the interactive development of the whole machine (system) and basic technology. We will jointly develop measurement standards, establish a new integrated organization model of integration, symbiosis, division of labor and benefit sharing in the upper, middle and lower reaches. The industrial chain cooperation will be enhanced to integrate and form a benign interaction between upstream and downstream of the industrial chain, so as to achieve an upgrading mechanism, and enhance the high-end, intelligent and green level of the whole industrial chain.

7.6.2 Industrial Ecosystem Upgrading Project

First, the competitive market environment will be further improved to attract more foreign innovative elements and innovative enterprises to join the innovation and development of China's manufacturing industry with the international-flow business environment. We will strengthen the basic position of competitive policies, promote the transformation of manufacturing industrial policies from selective and differentiated to functional and inclusive manufacturing, and continuously improve the competitive market environment. The access management system of service links related to advanced manufacturing industries will be improved to promote the negative list management system related to service links in integrated circuits and other industrial fields, and drive product and process innovation with service innovation. With focus on intellectual property protection, we will further optimize the business environment, and create favorable conditions for the high-quality development of intellectual property-intensive manufacturing industries. A comprehensive service platform for intellectual property operation will be built to provide patent analysis and risk prevention services for small and medium-sized innovative manufacturing enterprises, so as to promote domestic enterprises to build comprehensive competitive advantages based on patent intellectual property rights.

Second, we will improve the system and mechanism to promote industrial innovation. For this end, we will build a world-leading industry-university-research consortium and provide a solid knowledge base and cutting-edge industrial common technologies for product and process innovation in domestic high-end manufacturing industries. We will promote technical cooperation among domestic enterprises in emerging industries. For technologies in the exploratory stage that see a large technological gap, we will jointly tackle key problems. For fields that already have technical foundation, we will seize opportunities and accelerate engineering and industrialization.

Third, the public service platform of industrial technology foundation will be optimized and upgraded to improve the industrial technology foundation system, and promote the upgrading of industrial chain. Full use will be made of existing backbone enterprises, research institutes, universities, users and third-party institutions to improve the service level of industrial technology basic public service platform, test and detection public service platform and industrial big data public platform, and strengthen the supply of industrial common technologies, research and development and transformation of key technologies, so as to enhance the technical basic support capabilities such as test verification, inspection and certification, intellectual property rights and standards.

7.6.3 Core Technologies in High-End Manufacturing Field

First, we will make a good strategic layout of core technologies. Centering on the national strategic needs and the development trend of manufacturing industry, we will examine the technical level of high-end manufacturing industry in the medium and long term, analyze the gap with foreign advanced level, and study possible technological breakthroughs, so as to identify key development areas, core technologies, and technologies that give priority to development. We will also establish the technological development path, and enhance the engineering and technical capability and level of high-end manufacturing industry. In the meantime, we will strengthen coordination with industrial basic capacity building project to provide strategic support for breakthroughs in core technologies in high-end manufacturing industry.

Second, we will increase support for special projects. Because of the complexity of products and processes, long R&D cycle and high cost risk of core technologies, we will intensify scientific research at the national level, formulate major special R&D plans, and set up special research funds so as to carry out research on common problems, and strengthen the organic connection between basic research, applied research and achievement transformation. We will speed up the R&D process of core technologies to prevent and resolve major risks in high-end manufacturing and engineering science and technology. By summarizing the implementation experience of “special project for core electronic devices, high-end central chips and basic software products” and “special project for manufacturing equipment and complete processes of very large scale integration”, we will focus on future industrial competition, and coordinate efforts of all parties in production, education and research, so as to make breakthroughs in core technologies in key links of high-end manufacturing. We will strive to achieve technological leadership in some important areas, and gain equal opportunities to participate in the global manufacturing division of labor system by improving our self-sustaining ability in extreme environment and leading advantage in competitive environment.

Third, we will promote the establishment of substantive industrial alliances. The core technologies of high-end manufacturing industry involve information, machinery, electronics, chemistry and materials, so they can hardly be overcome by only a few enterprises or organizations. It is thus necessary for government agencies to take the lead in establishing a scientific research and production system with leading enterprises at the core and scientific research institutes, universities and supporting enterprises working together. Exchanges and cooperation between institutions in different disciplines will be enhanced to promote cooperation between businesses, universities and research institutes, speed up the R&D process and reduce R&D risks.

7.6.4 Independent Brand Creation Project

First, we will pool resources to build independent brands. Standing on a strategic height, we will study and establish institutions and mechanisms at the national level, integrate governments, industries, enterprises and social organizations, pool resources and form a national brand promotion system, so as to promote Chinese quality brands overseas, eliminate the stereotype of “Made in China” by overseas consumers, and establish a brand-new independent brand image of “high quality, green and safety”. We aim to realize the mutual promotion of national image, independent brand image and Chinese-made product image.

Second, we will improve collaborative and effective proprietary brand promotion mechanism. A market mechanism for development of quality brands will be established, with focus on solving the problem of asymmetric quality information in the market, give play to the effect of “voting by feet” by consumer groups, and guide production factors to gather around high-efficiency industries and high-quality independent brands. A public service platform of quality brand will be established to strengthen the building of social intermediary organizations of quality brand service, promote market-based platform operation of quality brand service, and provide professional independent brand promotion services for enterprises.

Third, we will optimize the development environment of independent brands. We will improve the quality supervision and inspection mechanism, and establish a supervision and publicity mechanism for independent brand protection, so as to improve, implement laws and regulations on brand protection, and crack down on intellectual property infringement, counterfeiting and unfair competition according to law. We will step up efforts to improve the national brand value evaluation mechanism, and formulate international standards for brand value, with focus on improving the standards of safety, environmental protection and hygiene of Chinese products. Independent brand enterprises will be encouraged to adopt international standards and higher industry standards in terms of product quality and safety.

7.6.5 Human Resources Quality Improvement Project

Full consideration will be given to factors such as talent training cycle and uncertainty of industrial technology innovation. We will take the building of “emerging engineering education” as the starting point to meet the urgent needs of high-end manufacturing for high-quality talents. We will also increase investment in basic disciplines such as mathematics and physics, and lay a foundation for enhancing the original innovation capability of China’s manufacturing industry.

First, we will make good use of the stock resources of personnel training by reforming the personnel training system of science and engineering technology majors. In the building of “emerging engineering education”, we should coordinate various resources and give full play to the guarantee function of “capital, resources

and information” of government departments in the cultivation of innovative talents. We will also promote high-end manufacturing enterprises and domestic first-class universities to actively explore new mechanism of integration of production and education, school-enterprise joint training, so as to achieve the effective connection between theoretical teaching in colleges and universities and enterprise engineering training, and improve the quality of engineering and technical personnel training. The China Manufacturing Skills Enhancement Fund will be proposed to provide financial support for first-class universities and enterprises to train engineers and industrial skilled workers in cooperation. Universities are encouraged to set up corresponding majors according to the work requirements of team leaders or workshop leaders in intelligent modern factories, and fill in the gap that China’s “low-end vocational education” cannot meet the development requirements of “high-end manufacturing” by training high-skilled industrial talents.

Second, we will improve the level of China-foreign cooperation in running schools for natural science and engineering science majors, drive stock resources with high-quality incremental resources of science and technology education, and form the core nodes of global manufacturing knowledge innovation network in China. With focus on natural science and engineering science majors urgently needed for the development of strategic industries such as integrated circuits, we will enhance cooperation with overseas high-level universities and scientific research institutions in running schools.

Third, while attaching importance to the cultivation and introduction of elite R&D talents, we should give priority to the upgrading of general skills of engineers, high-skilled workers and general industrial workers, and build a lifelong learning system composed of enterprises, technical schools, research universities and reform service institutions. On the basis of deeply implementing a series of preferential policies for the introduction of high-level scientific and technological talents, a market mechanism for the return of overseas high-level management and technical talents will be created by optimizing the entrepreneurial environment. While strengthening the training of engineers and high-skilled industrial workers, we will improve the skill level of industrial workers along with the development of vocational and technical schools. Through implementation of government-funded training programs, we will make efforts in training key process equipment such as machine tool operation and general industrial robot operation, so as to improve the overall labor productivity of China’s manufacturing industry.

7.6.6 “Smart+” Pilot Demonstration Project

First, we will build “smart+” pilot demonstration projects in key manufacturing industrial clusters so as to promote the effective diffusion of common technical knowledge related to “smart+”. In order to change the situation that manufacturing enterprises do not fully understand the power of “smart+”, it is suggested that in areas with high development level of manufacturing industrial clusters, we will build

a number of “smart+” pilot demonstration projects, and encourage entrepreneurs in the manufacturing industry to go beyond the level of “machine replacing people”, so that they can steadily transform into intelligent manufacturing which is all-factor, whole-process and multi-field intelligent collaborative operation, reduce labor costs with “data resource dividends”, and build a new competitive advantage based on industrial big data.

Second, we will make moderate adjustment the integration of IT application and industrialization to lay a solid foundation for the manufacturing industry to move towards the “smart+” era. Due to an obvious gap in IT application among manufacturing enterprises, the enterprises with higher level of IT application have focused on intelligent transformation and upgrading, while enterprises with lower level still lack the foundation and ability to implement intelligent transformation. Therefore, it is suggested that the focus of the integration of IT application and industrialization should be adjusted from “promoting the strong” to “helping the weak”, so as to increase support for enterprises with good product market prospects and advanced production technology but with relatively backward IT application, and guide them to gradually realize IT application in research and development, production control, operation management, guarantee services and market development. This will lay a good foundation for the subsequent transformation to “smart+”.

Third, we will enhance the supporting service capability of the “smart+” transformation of manufacturing industry. On the one hand, we should strengthen training of intelligent manufacturing talents in manufacturing industry, and foster a group of compound talents with both manufacturing industry knowledge and intelligent manufacturing technology, as well as high-quality professional talents who are good at intelligent equipment and system operation. We will provide human resources guarantee for the development of modern productive service industries, such as system integration design, transfer incubation and professional technical consultation for the “smart+” transformation of manufacturing industry. On the other hand, we will consolidate the digital infrastructure and save the cost of comprehensive digital transformation of enterprises. In view of the outstanding problem of data migration bandwidth constraint in the process of enterprise real-time data cloud, we should speed up the building of digital infrastructure, and combine cloud computing and big data technology to formulate scientific development plans, determine the geographical location of cloud computing data centers, and establish a perfect cross-regional information sharing mechanism. Operators will be guided to provide low-latency ubiquitous network services with integrating wired and wireless for traditional manufacturing enterprises at reasonable prices to meet their real-time operation and management needs of big data. The construction of national intelligent manufacturing data centers will be accelerated in manufacturing industries so as to provide basic support for the development and utilization of industrial big data services.

Fourth, we will improve the network security barrier to escort the comprehensive digital transformation of manufacturing enterprises. In the wave of digital transformation, we find it difficult to deal with increasingly diversified and unknown security threats by relying solely on the strength of enterprises. For this end, the government

needs to make overall plans and learn from the idea of building a “digital government” security barrier. The network security barrier of “digital industry” must change from passive threat response and standard compliance planning to capability-oriented systematic synchronous construction. On the one hand, we will move the gateway forward, make plan synchronously with the digital transformation of enterprises, and build a comprehensive defense capability system. On the other hand, the defense systems such as threat intelligence detection and response, safe hunting, alarm analysis, incident response and disposal, which are faced by different industries after comprehensive digital transformation, will be taken as important common technologies in the industry and provided by the government in the form of purchasing services.

7.6.7 Optimizing the Global Layout Project of Manufacturing Industry

First, we will continue to promote the structure of manufacturing investment in countries along the Belt and Road. We will comprehensively promote investment cooperation with 17 countries in ASEAN, South Asia, Central Asia, West Asia and Central and Eastern Europe, and advance the construction of the New Eurasian Continental Bridge, China-Mongolia-Russia, China-Central Asia-West Asia, China-Indochina Peninsula, China-Pakistan and Bangladesh-China-India-Myanmar international economic cooperation corridors. We will strengthen economic and trade negotiations, sign bilateral and multilateral investment agreement, and create a favorable external environment for Chinese manufacturing enterprises to invest in countries along the Belt and Road. We will encourage manufacturers to “go global” by promoting infrastructure connectivity, energy development cooperation, capacity cooperation and equipment cooperation among countries along the route, and accelerate the investment pace of rail transit, information and communication, energy and power industries by building “arterial roads” such as passage, communication, navigation and trade in international major channels. The economic and trade cooperation parks and manufacturing bases will be built to form a network of foreign trade and economic cooperation parks for countries along the route and for the whole world.

Second, efforts will be made to optimize the structure of manufacturing investment in developed countries. We will actively promote the negotiation of bilateral investment agreements (BIT) between China and the United States and between China and Europe, and establish a two-way, reciprocal, open and mutually beneficial investment mechanism so as to create a favorable environment for Chinese manufacturing enterprises to invest and merge in Europe and America. Through direct investment in European and American countries, Chinese manufacturing enterprises will effectively integrate into local production networks of industrial powers, and give full play to the functions of forward and backward connection and division of labor and cooperation of the regional production networks. Meanwhile, through foreign direct

investment, Chinese manufacturing enterprises will directly connect with various entities with high-end manufacturing innovation resources, including SMEs, hi-tech service enterprises and research universities in the local innovation network. By making full use of the factor differences and division advantages of different countries or regions, China's manufacturing industry will promote its position in the global value chain.

Third, we will improve the professional service ability of manufacturing to conduct foreign investment. A comprehensive and one-stop service platform will be built to effectively integrate resources scattered in various sectors and trades, and provide industry guidance, information services, financing services, investment promotion, personnel training, risk prevention and other full-process services for manufacturing enterprises to facilitate foreign investment. A number of institutions engaged in internationally competitive design consulting, asset appraisal, credit rating, legal services and investment banking will be established to enhance the international and professional service capabilities of domestic institutions involved in banking, information, legal, financial and technical services.

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