Chapter 2
Connotations and Prospects of the New-Type Manufacturing Sector

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In the 21st century, China is being confronted with not only various urgent challenges (including industrialization, urbanization, modernization, and informatization), but also various pressures (including energy/resource shortages and environmental pollution). In this context, it is imperative for China to carry out new-type industrialization characterized by high technological content, high economic benefits, low resource consumption, minimal environmental pollution, and full utilization of human resources. This study sets forth connotations for new-type manufacturing sector from four aspects: economic resourcefulness, technological innovation capability, energy conservation capability, environmental protection capability. Then, this study forecasts the impacts of the new-type manufacturing sector on social and economic development. Finally, this study proposes an evaluation index system for the new-type manufacturing sector, which comprises four indexes and 31 subindexes.

2.1 Connotations of the New-Type Manufacturing Sector

Research on the connotations and evaluation of the new-type manufacturing sector mainly has been conducted in China. Li and Du (2004) were the first to define the connotations of the "new-type manufacturing sector," pointing out that the new-type manufacturing sector was capable of improving technological innovations, reducing energy consumption and environmental pollution, increasing employment, improving economic benefits, strengthening competitiveness, and achieving sustainable development. The evaluation index system for the new-type manufacturing sector covered three major indexes, namely, economic resource-

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L. Li and Z. Du (eds.), *A Research Report on the Development of China's Manufacturing Sector (2016)*, Current Chinese Economic Report Series,
DOI 10.1007/978-981-10-4445-8_2

fulness, technological competitiveness, and resource and environment protection capability, as well as 20 subindexes. Using the abovementioned evaluation index system, Li and Zhou (2005) used the principal component analysis method to conduct comparative analysis and clustering analysis for the degree of newness of manufacturing industries in China's 30 regions, and summarized the development characteristics of manufacturing industries in these regions. Based on the abovementioned philosophy of a new-type manufacturing sector, Li and Zang (2008) used a three-dimensional time-series method to conduct comparative research on the manufacturing industries of China and main developed countries from three aspects, namely, economic resourcefulness, technological innovations, and resource and environment protection. The research results were as follows: (1) China was far below the US and Japan in the output value of its manufacturing sector, and lagged far below developed countries in technological innovation inputs and outputs; (2) China's manufacturing sector was notably characterized by high energy consumption and high pollution, but insufficient inputs in pollution abatement; (3) China's manufacturing sector had a certain comparative advantage in growth rate, product yield, employment, and labor costs. From the perspective of environmental protection, Xu (2010) established an index evaluation system for the new-type manufacturing sector based on three yardsticks, that is, low energy consumption, low pollution, and low emissions, and accordingly analyzed the degree of newness of Jiangsu province's manufacturing sector. Using specific industries as research samples, some scholars built an evaluation index system for the new-type manufacturing sector, and analyzed the newness of specific industries accordingly. Liu (2006) put forward the concept of the new-type equipment manufacturing industry, and built a competitiveness evaluation system for this new-type equipment manufacturing industry; using this competitiveness evaluation system, Liu (2006) used a mathematical statistics method to quantitatively analyze the competitiveness of Liaoning province's new-type equipment manufacturing industry based on four yardsticks, namely, industrial technological competitiveness, economic benefit competitiveness, human resource competitiveness, and regional technological competitiveness. Lv (2014) built an evaluation system for Liaoning province's new-type equipment manufacturing sector, which comprised seven major indexes, namely, informatization, resource utilization, technological content, economic benefit, environmental protection, human resource utilization, and openness and 20 subindexes; using the analytic hierarchy process, Lv (2014) built a comprehensive evaluation model for the new-type equipment manufacturing industry. Wang (2007) conducted systematic evaluation for the evolutionary level of the equipment manufacturing industry by using three yardsticks, including economic benefits, technological potential, and environmental harmony; specifically, economic indexes were used to measure the current contributions made by the equipment manufacturing industry to the national economy, technological indexes were used to measure the future competitiveness of the equipment manufacturing industry, and environmental indexes were used to measure the development sustainability and long-term benefits of the equipment manufacturing industry. Zhang (2009) studied how to evaluate the technological innovation

capability of China's manufacture of computers, communication, and other electronic equipment; specifically, the technological innovation capability for this industry was broken down into four primary indexes, that is, innovation environment, potential innovation resources, innovation inputs, and innovation outputs, and 15 secondary indexes. From the perspective of industrial security, Zheng (2010) built an evaluation index system for China's manufacture of medicines, which comprised five indexes, namely, self-dependent innovation capability, development environment, international competitiveness, industrial controlling power, and external dependence.

Regarding the connotations and evaluation of the new-type manufacturing sector, abundant research findings have been attained. Such findings are of high theoretical and practical significance. The evaluation index system mainly focuses on economic resourcefulness, technological innovation capability, and resource and environment protection capability, but gives very little consideration to social contribution capability, including employment and taxes. While the mass of people pay more attention to enterprises' social responsibilities (e.g., employment and taxes), it is necessary to redefine the concept of the new-type manufacturing sector.

This research study considers that the connotations of the new-type manufacturing sector should include not only economic resourcefulness, technological innovation capability, energy conservation capability, and environmental protection capability, but also social contribution capability. Therefore, the new-type manufacturing sector can be redefined as the manufacturing sector that is capable of improving technological innovation capability, reducing energy consumption and environmental pollution, improving economic benefits, increasing employment opportunities and tax contributions, and attaining sustainable development.

1. Economic resourcefulness

Economic resourcefulness is an important part of the new-type manufacturing sector, and is an important yardstick for the degree of newness of the manufacturing sector. Economic resourcefulness is particularly important for a country that is in the process of industrialization. Only by creating great economic benefits, can China's manufacturing sector obtain the impetus for sustainable development and provide material support for developing science and technologies, improving economic efficiency, increasing employment opportunities, enhancing the taxpaying capability, and protecting the environment.

2. Technological innovation capability

Technological innovation capability is an important part of the new-type manufacturing sector. In the process of transforming from extensive traditional manufacturing sector to the intensive new-type manufacturing sector, science and technologies are of vital importance. Only by making the best of modern science and technologies, conducting technological innovations, and taking full advantage of China's human resources can China's manufacturing sector improve efficiency

and benefits, reduce environmental pollution, develop hi-tech industries, and be transformed from the "Made in China" mode to the "Created in China" mode.

3. Energy conservation capability

Nowadays, China's traditional manufacturing sector adopts an extensive production mode characterized by low benefits, high consumption, and high pollution. This has aggravated China's resource shortages and ecological deterioration. The resources herein mainly refer to natural resources that are closely linked to the development of China's manufacturing sector and other biological resources used as industrial raw materials. These resources provide the material basis for the production activities of China's manufacturing sector, and many of them are non-renewable. Unreasonable utilization of resources will lead to resources waste and environmental deterioration. Reasonable and efficient utilization of resources is increasingly important for the sustainable development of the social economy.

4. Environmental protection capability

Environmental protection capability refers to the comprehensive capability to solve real or potential pollution problems encountered in the production activities; coordinate the relationship between economic activities and environmental protection; and ensure sustainable development of the social economy. Environmental harmony and ecological protection are prerequisites for sustainable social and economic development. Environmental protection attained by technological progress is increasingly important for the sustainable development of China's manufacturing sector.

2.2 Motivating Force and Prospects of the New-Type Manufacturing Sector

The 16th National Congress of the CPC put forth the concept of "new-type industrialization," and creatively resolved that China should follow a new-type industrialization path characterized by high technological content, high economic benefits, low resource consumption, minimal environmental pollution, and full utilization of human resources. In 2015, China adopted the *Made in China 2025* development program. New-type industrialization is mainly embodied in innovations in China's manufacturing sector, and the enhancement of overall national strength largely relies on the development of the manufacturing sector. In addition, the manufacturing sector is the foundation and pillar of a country's production capacity and national economy. This has been proved by the practices of developed countries. It should be noted that China's manufacturing sector is faced with various bottlenecks (e.g., environmental, resource, and population bottlenecks). Thus, China's manufacturing sector should take a new-type industrialization path, and China should actively develop the new-type manufacturing sector by seizing the

development opportunity created by the knowledge economy era and global economic integration. As a representative force of industrial progress, the new-type manufacturing sector is gradually taking shape and the theoretical system for it has been improved continuously. The new-type manufacturing sector adheres to the philosophy of "human-oriented, self-independent innovation that is environmentally friendly and future oriented." In light of this philosophy and the related findings in *A Research Report on the Development of China's Manufacturing Sector* (2004–2014), this study further examines the motivating forces and prospects for the new-type manufacturing sector.

Economic motivation: The core of traditional industrialization is to develop a large-scale and high-efficiency manufacturing sector, and thereby drive the development of agriculture and service sectors, with a view to providing abundant material products to the society. The production process largely relies on the massive consumption of capital, labor, and energy, thereby causing a variety of severe problems, including environmental pollution, resource shortages, and a significant wealth gap. As a type of industrialization driven by informatization, new-type industrialization emphasizes the role of knowledge and technologies in production activities, and has changed the constitution of conventional production factors and the relative importance of different production factors. The new-type manufacturing sector is a prerequisite and foundation for new-type industrialization. The new-type manufacturing sector will drive China's new-type industrialization, or more specifically, the new-type manufacturing sector is an inevitable requirement for accelerating the adjustment of economic structure and promoting the transformation and upgrade of industrial structure. The development of the new-type manufacturing sector provides a guarantee for the enhancement of international competitiveness of the traditional manufacturing sector. The new-type manufacturing sector can transform the traditional manufacturing sector through various modern technologies (especially information technologies). The new-type manufacturing sector serves to change the extensive growth mode and attain sustainable economic development. Characterized by high added value, high growth, high efficiency, low energy consumption, and low pollution, the new-type manufacturing sector is an inevitable choice for new-type industrialization and sustainable development. In addition, enterprise development is mainly measured by economic performance, enterprise survival entails low transaction costs, and profit seeking is a natural instinct of entrepreneurs. Therefore, economic performance directly determines the result of enterprise development. As an important part of China's market economy system, manufacturing enterprises play an important role in attaining harmonious and coordinated development of the society, promoting economic development, creating employment opportunities, facilitating technological progress and innovations, and invigorating the market economy. The rapid growth of manufacturing enterprises will directly promote industrial upgrade and industrial structure optimization, and will provide a basic impetus for the development of the new-type manufacturing sector.

Technology motivation: With the global integration of the manufacturing sector and advent of the knowledge economy, the level of technological development has gradually become the decisive factor in increasingly fierce global economic competition. Since the 1990s, several developed countries have successively transferred their low-end technologies and low-tech industries to other countries, encouraged their transnational companies to invest across the world, and attempted to reach the commanding heights of global economic competition through various means (e.g., capital, financial, public opinion, and military resources). As a result, developed countries with strong technological innovation capabilities have gradually dominated the global production system and profit distribution system. Seemingly, the financial crisis in Southeast Asia and the economic crisis in Latin America were caused by these regions' economic systems and management systems. However, at a more in-depth level, such crises can be ascribed to excessive reliance on foreign technologies, markets, and capital; put another way, their innovation capability was not sufficient. The *11th Five-year Plan on National Economic and Social Development* formulated by the Central Committee of the CPC pointed out that in order to carry out a complete scientific outlook on development, China must improve its self-dependent innovation capability. China's long-term and sustained development should rely on technological progress and improvement of labor competences. More specifically, China should ensure deep implementation of strategies; take enhanced self-dependent innovation capability as the cornerstone for scientific and technological development and as a central task for adjusting industrial structure and transforming the economic growth pattern; and actively improve its original innovation capability, integrated innovation capability, and its introduction, digestion, absorption, and re-innovation capabilities. The technological concept of the manufacturing sector lies in a variety of technological innovations, which include not only original innovations (represented by self-dependent innovations), integrated innovations, and re-innovations based on introduction, digestion, and absorption, but also application innovations (represented by knowledge innovations) and sustained innovations. Therefore, technology motivation is manifested as a balance of innovations and utilizations.

Resource motivation: China has an abundant variety of natural resources, and is blessed with both conventional and scarce resources. In addition, China ranks at the top globally in reserves of main industrial raw materials (e.g., petroleum, iron ores, and copper ores). This provides the natural resource conditions required for development of the new-type manufacturing sector. Meanwhile, such ideas as ecological civilization, resource conservation, and environmental protection have been deeply rooted in the hearts of people. Overall, China has made great progress in environmental protection inputs, efficient resource utilization, energy conservation and emissions reduction, and resource exploitation. Moreover, information technologies are profoundly affecting the IT application competence of China's labor forces, and for new employees, it has become a necessary skill to handle their daily work using modern information technologies. This provides powerful human resource support for enhancing the level of informatization in the new-type manufacturing sector and for increasing the added value in the IT sector.

2.3 Four-Yardstick Evaluation Index System for China's Manufacturing Sector

Based on the abovementioned analyses of the new-type manufacturing sector, this annual research report proposes a four-yardstick evaluation index system for the new-type manufacturing sector.

2.3.1 Design Principles for the Evaluation Index System

The connotations of the new-type manufacturing sector provide the guidelines for its evaluation index system. Such connotations cover four main aspects, that is, economic resourcefulness, technological innovation capability, energy conservation capability, and environmental protection capability, each of which covers diverse points. In order to measure the degree of newness of the manufacturing sector systematically and accurately, a reasonable evaluation index system should be built based on appropriate principles. In this research study, we consider that the evaluation index system for the new-type manufacturing sector should follow the principles of scientificity, systematicness, comparability, and operability.

1. Scientificity

Can the new-type manufacturing sector be evaluated accurately and reasonably? This largely depends on whether the evaluation indexes, evaluation criteria, and evaluation methods are selected scientifically. In evaluating the new-type manufacturing sector, the scientificity principle for the evaluation index system mainly covers accuracy and completeness. Accuracy has the following requirements: (1) the evaluation indexes should be defined accurately and clearly, so as to avoid subjective assumptions or misconceptions; (2) the evaluation index system should be structured and hierarchized reasonably, and the different indexes should be well coordinated to serve the entire evaluation index system. In addition, the completeness of the evaluation indexes places the following requirements: (1) the evaluation index system should reflect the evaluation objects completely around the evaluation purpose; (2) the evaluation index system should highlight the key points and take account of all aspects without omitting any essential aspect.

2. Systematicness

The new-type manufacturing sector involves diverse aspects, each of which is denoted by appropriate indexes. The selected indexes should cover as many aspects as possible, have a certain representativeness, indicate the main connotations, characteristics, current status, and evolutionary process of the new-type manufacturing sector, reflect the inherent connections between different aspects of the connotations, and be hierarchized clearly. Systematicness requires that the evaluation index system is not a simple pile-up of indexes, but an organic whole.

3. Comparability

Statistical indexes may vary among different manufacturing industries. The selection of evaluation indexes should take full account of the differences in statistical indexes between different manufacturing industries, and ensure consistency in meaning, statistical caliber, and statistical range, so as to ensure the comparability of the evaluation indexes. The selection of evaluation indexes should take account of the differences in statistical standards and statistical calibers between different provinces. In selecting evaluation indexes, the statistical indexes and statistical calibers should be consistent between different manufacturing sectors and between different manufacturing regions, so that the evaluation index system and evaluation criteria have definite comparability among different sectors and regions.

4. Operability

In addition to scientificity, systematicness and comparability, the evaluation index system for the new-type manufacturing sector should follow the operability principle; specifically, the required data for the evaluation index system should be easy to acquire, process, and operate, and the evaluation results should be easy to utilize, for example, guiding the development practice of the manufacturing sector.

2.3.2 Evaluation Index System for the New-Type Manufacturing Sector

Based on the abovementioned connotations, the evaluation index system for the new-type manufacturing sector mainly comprises four major indexes, namely, economic resourcefulness, technological innovation capability, energy conservation capability, and environmental protection capability. Economic indexes are used to measure the contributions made by the manufacturing sector to the national economy, technological indexes are used to measure the future competitiveness of the manufacturing sector, energy indexes are used to measure the degree to which the development of the manufacturing sector relies on energy consumption, and environmental indexes are employed to measure the degree to which the manufacturing sector affects and damages the environment. Accordingly, this research study proposes an evaluation index system for the new-type manufacturing sector, which comprises four major indexes and 31 subindexes (as described in Table 2.1).

1. Economic indexes

Economic resourcefulness is mainly measured in terms of output value, profits, efficiency, market performance, employment, and tax. In Table 2.1, A1 and A2 are output value subindexes, which are used to reflect the output capacity of the manufacturing sector and its contributions to the national economy. A3 and A4 are profit subindexes, which are used to reflect the total profit and per-capita profit in the manufacturing sector. A5 is an efficiency subindex, which is used to reflect the

Table 2.1 Evaluation index system for the new-type manufacturing sector

General index	No.	Major index	No.	Subindex	
Evaluation index system for the new-type manufacturing sector	A	Economic index	A1	Output value	Total output value of the manufacturing sector (unit: 100 million yuan)
			A2		Ratio of total output value of the manufacturing sector to total industrial output value (%)
			A3	Profit	Total profit of manufacturing enterprises (unit: 100 million yuan)
			A4		Per-capita profit in the manufacturing sector (unit: yuan per capita)
			A5	Efficiency	Labor productivity of the manufacturing sector (unit: 10,000 yuan per capita)
			A6	Market	Product sales rate of the manufacturing sector (%)
			A7	Employment	Employed population in the manufacturing sector (unit: 10,000)
			A8		Ratio of employed population in the manufacturing sector to total employed population (%)
			A9	Tax	Total taxes of manufacturing enterprises (unit: 100 million yuan)
			A10		Per-capita tax in the manufacturing sector (unit: 10,000 yuan per capita)
	B	Technological index	B1	R&D	R&D expenditure in the manufacturing sector (unit: 10,000 yuan)
			B2		Full-time equivalent of R&D personnel in the manufacturing sector (unit: person-year)
			B3		R&D expenditure intensity in the manufacturing sector (%)
			B4		Ratio of R&D personnel to total employed population in the manufacturing sector (%)
			B5	Product development	Quantity of new product development projects in the manufacturing sector
			B6		New product development expenditures in the manufacturing sector (unit: 10,000 yuan)
			B7	Patent	Quantity of patent applications in the manufacturing sector
			B8		Quantity of patent grants in the manufacturing sector

(continued)

Table 2.1 (continued)

General index	No.	Major index	No.	Subindex	
			B9	Technological achievement transformation	Output value of new products in the manufacturing sector (unit: 10,000 yuan)
			B10		Rate of output value of new products in the manufacturing sector (%)
			B11		Input–output coefficient of technological innovations in the manufacturing sector
	C	Energy index	C1	Gross consumption	Energy consumption in the manufacturing sector (unit: 10,000 tons of standard coal)
			C2		Energy consumption per unit output value in the manufacturing sector (unit: 10,000 tons of standard coal per 100 million yuan)
			C3	Electric power consumption	Electric power consumption in the manufacturing sector (unit: 100 million kWh)
	D	Environmental index	D1	Wastewater	Discharge amount of wastewater in the manufacturing sector (unit: 10,000 tons)
			D2		Discharge amount of wastewater per unit output value in the manufacturing sector (unit: 10,000 tons per 100 million yuan)
			D3	Waste gas	Discharge amount of waste gas in the manufacturing sector (unit: 100 million standard cubic meters)
			D4		Discharge amount of waste gas per unit output value in the manufacturing sector (unit: 100 million standard cubic meters per 100 million yuan)
			D5	Waste residue	Discharge amount of waste residue in the manufacturing sector (unit: ton)
			D6		Discharge amount of waste residue per unit output value in the manufacturing sector (unit: tons per 100 million yuan)
			D7	Comprehensive utilization	Output value by comprehensive utilization of three types of industrial waste (unit: 10,000 yuan)

labor productivity of manufacturing enterprises. A6 is a market subindex, which is used to reflect the product sales performance of the manufacturing sector, as well as the degree to which the manufactured products cater to social needs. A7 is an aggregate employment subindex, which is used to reflect the capacity of the manufacturing sector to provide employment opportunities. A8 is a relative subindex about employment, which is used to reflect the proportion of employed population in the manufacturing sector to the total employed population. A9 and A10 are tax subindexes, which are used to reflect the tax contributions made by manufacturing enterprises. The following section describes the calculation methods for the abovementioned subindexes.

(1) Total output value of the manufacturing sector is equal to $\sum_{j=1}^{30} \mathrm{TVP_j}$, where $\mathrm{TVP_j}$ indicates the total industrial output value of the j-th manufacturing industry, and $j = 1, 2, \ldots, 30$. For details on the manufacturing industries, refer to *Classification and Code Standard of National Economy Industry* (GB/T4754-2002).

(2) Ratio of total output value of the manufacturing sector to total industrial output value is equal to $\frac{\sum_{j=1}^{30} \mathrm{TVP_j}}{\mathrm{TP}} \times 100\%$, where, $\sum_{\mathrm{j}=1}^{30} \mathrm{TVP_j}$ indicates the total output value of the manufacturing sector, and TP indicates the total industrial output value.

(3) Total profit of manufacturing enterprises (denoted by S) equals the sum of the profits earned by all manufacturing enterprises, and is determined by adding the profits earned by 30 manufacturing sectors at the two-digit SIC level.

(4) Per-capita profit in the manufacturing sector equals $\frac{\mathrm{S} \times 10{,}000}{\mathrm{L}}$, where S indicates the total profit of manufacturing enterprises (unit: 100 million yuan), and *L* indicates the total employed population of manufacturing enterprises (unit: 100,000).

(5) Labor productivity of the manufacturing sector equals $\frac{\sum_{\mathrm{j}=1}^{30} \mathrm{TVP_j}}{\mathrm{L}} \times 100\%$.

(6) Product sales rate of the manufacturing sector equals $\frac{\sum_{\mathrm{k}=1}^{30} \mathrm{SR_k}}{\sum_{\mathrm{j}=1}^{30} \mathrm{TVP_j}} \times 100\%$, where $\mathrm{SP_k}$ indicates the product sales income of the k-th manufacturing industry, $\mathrm{k} = 1, 2, \ldots, 30$, $\mathrm{TVP_j}$ indicates the total industrial output value of the j-th manufacturing industry, and $\mathrm{j} = 1, 2, \ldots, 30$.

(7) Employed population in the manufacturing sector is denoted by L.

(8) The ratio of employed population in the manufacturing sector to total employed population equals $\frac{\mathrm{L}}{\mathrm{L_q}} \times 100\%$, where, L indicates the employed population in manufacturing enterprises, and $\mathrm{L_q}$ indicates the regional employed population.

(9) Total tax of manufacturing enterprises is denoted by T.

(10) Per-capita profit in the manufacturing sector equals $\frac{\mathrm{T}\times 10{,}000}{\mathrm{L}}$, where, T indicates the total profit of manufacturing enterprises (unit: 100 million yuan), and L indicates the total employed population of manufacturing enterprises (unit: 100,000).

2. Technological indexes

Technological innovation capability is mainly measured in terms of R&D expenditures, product development, patents, and technological achievement transformation. In Table 2.1, B1, B2, B3, and B4 are R&D subindexes of the manufacturing sector, which reflect the total R&D expenditure and R&D expenditure intensity of manufacturing enterprises. B5 and B6 are product development subindexes, which can objectively reflect the expenditures and expenditure intensity of manufacturing enterprises on new product development. B7 and B8 are patent subindexes, which reflect the input–output performance of technological innovations made by manufacturing enterprises. B9, B10, and B11 are subindexes on technological achievement transformation, which reflect the capability of manufacturing enterprises to transform and apply technological achievements. These 11 subindexes reflect the technological innovation capability of the manufacturing sector from the perspective of R&D inputs, new product development, technological outputs, and technological achievement transformation and application. The following section describes the calculation methods for these subindexes.

(1) R&D expenditure in the manufacturing sector refers to the sum of R&D expenditures inputted by all manufacturing enterprises.
(2) Full-time equivalent of R&D personnel in the manufacturing sector refers to the sum of full-time R&D personnel in all manufacturing enterprises.
(3) R&D expenditure intensity in the manufacturing sector equals $\frac{R\&D}{GDP}\times 100\%$, where R&D indicates the R&D expenditures of the manufacturing sector, and GDP indicates the gross domestic product.
(4) Ratio of R&D personnel to total employed population in the manufacturing sector equals $\frac{L}{L'}\times 100\%$, where L' indicates the R&D personnel in the manufacturing sector, and L indicates the total employed population in the manufacturing sector.
(5) Quantity of new product development projects in the manufacturing sector refers to the total quantity of new product development projects carried out by all manufacturing enterprises.
(6) New product development expenditures in the manufacturing sector refer to the total expenditures of new product development inputted by all manufacturing enterprises.
(7) Quantity of patent applications in the manufacturing sector refers to the total quantity of patent applications submitted by all manufacturing enterprises.
(8) Quantity of patent grants in the manufacturing sector refers to the total quantity of patent grants owned by all manufacturing enterprises.

(9) Output value of new products in the manufacturing sector refers to the total output value of new products created by all manufacturing enterprises.
(10) Rate of output value of new products in the manufacturing sector equals $\frac{NPV}{\sum_{j=1}^{30} TVP_j} \times 100\%$, where NPV indicates the output value of new products in the manufacturing sector (unit: 100 million yuan), TVP_j indicates the total industrial output value of the j-th manufacturing industry (unit: 100 million yuan), and $j = 1, 2, \ldots, 30$.
(11) Input–output coefficient of technological innovations in the manufacturing sector equals $= \frac{\text{NPV}}{NPR} \times 10,000$, where NPV indicates the output value of new products in the manufacturing sector (unit: 100 million yuan), and NPR indicates the expenditures on new product development (unit: 10,000 yuan).

3. Energy indexes

Energy conservation capability is mainly measured in terms of total energy consumption and electricity consumption. In Table 2.1, C1 and C2 are subindexes on total energy consumption, which reflect the total energy consumption and energy intensity, respectively, in the manufacturing sector. C3 is an electricity consumption subindex, which reflects the degree to which the manufacturing sector relies on electricity. The three subindexes jointly reflect the dependency relationship between the development of the manufacturing sector and energy consumption, and comprehensively embody the energy conservation capability of the manufacturing sector. The following describes the calculation methods for these subindexes.

(1) Energy consumption in the manufacturing sector (denoted by CC) refers to the total amount of energy consumed by all manufacturing enterprises.
(2) Energy consumption per unit of output value in the manufacturing sector equals $\text{CC}/\sum_{\text{j=1}}^{30} \text{TVP}_\text{j}$, where CC again indicates the energy consumption of the manufacturing sector.
(3) Electricity consumption in the manufacturing sector (unit: 100,000,000 kWh).

4. Environmental indexes

Environmental protection capability is mainly measured in terms of discharge of wastewater, discharge of waste gas, discharge of waste residue, and comprehensive utilization of the three types of industrial waste. D1 and D2 reflect the total discharge amount and discharge intensity of wastewater, respectively, D3 and D4 reflect the total discharge amount and discharge intensity of waste gas, respectively, D5 and D6 reflect the total discharge amount and discharge intensity of waste residue, respectively, and D7 refers to the output value by comprehensive utilization of the three types of industrial waste, and is a specific embodiment of the circular economy in the manufacturing sector. These subindexes reflect the environmental protection capability of the manufacturing sector in different ways. The following describes the calculation methods for these subindexes.

(1) Discharge amount of wastewater in the manufacturing sector refers to the amount of wastewater discharged by all manufacturing enterprises.
(2) Discharge amount of wastewater per unit output value in the manufacturing sector is equal to $\frac{\mathrm{WWD}}{\sum_{j=1}^{30} \mathrm{TVP}_j}$, where WWD indicates the discharge amount of wastewater in the manufacturing sector during the report period.
(3) Discharge amount of waste gas in the manufacturing sector refers to the amount of waste gas discharged by all manufacturing enterprises.
(4) Discharge amount of waste gas per unit of output value in the manufacturing sector is equal to $\frac{\mathrm{WGD}}{\sum_{j=1}^{30} \mathrm{TVP}_j}$, where WGD indicates the discharge amount of waste gas in the manufacturing sector during the report period.
(5) Discharge amount of waste residue in the manufacturing sector refers to the amount of waste residue discharged by all manufacturing enterprises.
(6) Discharge amount of waste residue per unit of output value in the manufacturing sector is equal to $\frac{\mathrm{WSD}}{\sum_{j=1}^{30} \mathrm{TVP}_j}$, where WSD indicates the discharge amount of waste residue in the manufacturing sector during the report period.
(7) Output value by comprehensive utilization of the three types of industrial waste refers to the total output value created by the comprehensive utilization of the three types of waste in all manufacturing industries.

References

Li, L.S., and Z.Y. Du. 2004. *A research report on the development of China's Manufacturing Sector 2004*. Beijing: Science Press.

Li, L.H., and Y. Zhou. 2005. Empirical analysis of the status of the "new industrial model" in China's manufacturing sector–an assessment based on the manufacturing sectors of 30 Chinese regions. *Management World* 6:76–81.

Li, L.S., and Z.P Zang. 2008. The international Comparison of new style manufacturing industry three-dimensional of time series. In *Collection of papers on the Academic Annual Conference of the Fourth Term of the China Science and Technology Policy Studies: II.*

Liu, Z.B. 2006. Developing modern producer service and adjusting and optimizing Structure of manufacturing, *Journal of Nanjing University (Philosophy, Humanities and Social Sciences)* 5:36–44.

Lv, F.B. 2014. Research of industrial development environment and technological innovation problem of the equipment manufacturing industry, illustrated by the case of the technological innovation of technology, bases small and micro enterprises in Liaoning. *Scientific management research*, 32(5):71–73.

Wang, Q. 2007. Public policy choices to TNCs' M&A practices in China's equipment manufacture enterprises. *Journal of Beijing Normal University (Social Sciences)* 1:115121

Xu, X.C. 2010. The new-style of analyses of Jiangsu manufacturing sector based on the visual angle of environment protection, industrial and Science Tribune 9:7.

Zhang, X.G. 2009. On the driving functions of designing and creating industry in China's economic transformation. *Journal of Henan University of Technology (Social Science Edition)* 5(4):43–46,50.

Zheng, R.G. 2010. Evaluation of the Capacity of Industrial Self-Innovation in China's Manufacturing Industry. *Contemporary Finance & Economics*,1:89–95.

http://www.springer.com/978-981-10-4444-1

A Research Report on the Development of China's Manufacturing Sector (2016)

Li, L.; Du, Z. (Eds.)

2017, XII, 384 p. 69 illus., 60 illus. in color., Hardcover
ISBN: 978-981-10-4444-1