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Is China's Textile Industry Still a Labour-Intensive Industry?

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Abstract

Is China's textile industry (CTI) still a labor-intensive one? To answer this question, this study measures the capital-labour intensity and technology intensity of CTI and its sub-sectors during 2006-2018, then applies factor intensity classification and cluster analysis to identify their industrial attributes. The results show that CTI and its sub-sectors are still the labour- and non-technology-intensive. All the indexes of capital-labour intensity and technology intensity of CTI and its sub-sectors are below 100, lower than the average of industry sectors, indicating that they are not separate from the category of labour-intensive industry and still heavily dependent on labour. And cluster analysis verifies the industrial classification results. So CTI still needs to keep on increasing its capital intensity and technology intensity to achieve the goal of industrial transformation and upgrading in the future.

Key words: textile industry, labor-intensive industry, factor intensity classification, capital-labour intensity, technology intensity.

Introduction

All along the textile industry has been regarded as a typical labour-intensive industry. As it absorbs a large amount of the labor force, the textile industry has also become a traditional pillar industry of China's economy. Nowadays, the intelligent manufacturing level of China's textile industry (CTI for short, hereafter) has been continuously improving with the introduction of new equipment, technologies and materials. Its production mode is gradually changing from extensive production to intensive production, from factor-driven production to efficiency-driven production, which not only effectively alleviates the operation pressure brought about by the rising production cost and environmental protection but also promotes industrial transformation and upgrading. More importantly, it exerts a subtle influence on people's view on the attribute of CTI as a labor-intensive industry.

For example, the number of workers used per 10,000 spindles in a cotton mill has decreased from about 300 in the 1990s to less than 100 now. Several mills have even reached the minimum of 17 [1]. The spinning workshop and printing & dyeing workshop of Lutai Textile, one of the listed CTI companies, has dramatically reduced workers and greatly improved production efficiency through importing the most advanced production equipment [2]. With the upgrading of equipment and the improvement of production efficiency in the textile industry, now most indicators point to CTI shifting from a labor-intensive industry to a technology-intensive industry. There are also

some views that CTI [3] part of textile sub-sectors [2, 4] in some regions have taken off the "hats" of "labor-intensive industry" and become technology-intensive instead.

As discussed above, different views and thoughts regarding CTI attributes have been fostered and developed in academia. So what are the industrial attributes of today's CTI? Is it still a labour-intensive industry? What level of factor intensity has it reached? Faced with these questions, this paper firstly measures the factor intensity of CTI and its sub-sectors during 2006-2018, then applies factor intensity classification and cluster analysis to identify their industrial attributes in order to answer whether CTI is still a labor-intensive industry or not. Lastly, some policy suggestions are recommended for the transformation and upgrading of CTI.

Methods & data sources

Factor intensity classification

The industrial classification schemes commonly used include two major categories of classification, three industry classifications, factor intensity classification, Standard Industry Classifications (SIC), the North America Industrial Classification System (NAICS), the Global Industry Classification Standard (GICS), Hoffman classification, Chenery-Taylor classification and so on [5-6]. Factor intensity classification divides industry sectors into labor-intensive industry, capital-intensive industry and technology-intensive industry based on the input factor intensity in the produc-

tion process, in which labor, capital and technology account for the largest proportion, respectively and show its comparative advantage. Literature on industrial classification by factor intensity is little and scattered. The capital-labour ratio and technology ratio are commonly used to classify an industry [7-10], but no literature has been retrieved that studies the factor intensity of CTI. Referring to the index system and statistical method designed by Liu Renyi [7], this study chooses two sets of indicators to measure the factor intensity of CTI.

The first set of indicators includes the capital-labor ratio, capital-output ratio and output-labor ratio, which are used to measure the capital-labor intensity of CTI and to determine whether the textile industry is a labor-intensive or capital-intensive industry. The capital-labour ratio is the most widely used and most important indicator. It refers to the ratio of fixed capital to labour input in the production process of an industry. The capital-output ratio refers to the ratio of fixed capital used per output, and the output-labour ratio is the labour productivity, where larger indicators mean higher CTI capital intensity, while lower indicators mean higher labour intensity.

The second set of indicators includes the R&D expenditure-sale ratio, R&D personnel-employee ratio and R&D expenditure-R&D personnel ratio, which are used to measure the technology intensity of CTI from the perspective of R&D expenditure input, R&D personnel input and input intensity, respectively, and then judging whether it belongs to the technology-intensive industries or not. Larg-

Table 1. Capital-labour intensity of China's textile industry (2006-2018).

Year	Capital-labour ratio (thousand CNY per person)		Capital-output ratio (thousand CNY per thousand CNY)		Output-labor ratio (thousand CNY per person)		Mean Index
	Amount	Index	Amount	Index	Amount	Index	
2006	93.53	43	0.38	76	243.17	57	59
2007	112.65	45	0.39	78	290.05	57	60
2008	127.10	46	0.40	81	317.86	56	61
2009	140.41	45	0.39	75	364.17	59	60
2010	153.95	44	0.35	74	434.25	59	59
2011	186.03	44	0.34	74	548.35	60	59
2013	192.09	44	0.27	64	700.84	69	59
2014	234.77	46	0.30	65	781.20	70	60
2015	256.42	45	0.30	60	860.95	76	60
2016	279.19	45	0.30	59	936.32	77	60
2017	284.53	43	0.31	59	923.26	73	59
2018	301.60	41	0.36	65	839.76	64	57

Table 2. Technology intensity of China's textile industry (2006-2018).

Year	R&D expenditure-sale ratio (thousand CNY per billion CNY)		R&D personnel-employee ratio (persons per thousand persons)		R&D expenditure-R&D personnel ratio (thousand CNY per person)		Mean Index
	Amount	Index	Amount	Index	Amount	Index	
2006	2291.01	44	3.20	34	173.83	74	51
2007	2386.59	45	3.26	30	212.42	86	54
2008	2573.48	48	4.12	36	198.64	75	53
2009	3078.66	52	5.48	37	204.50	83	57
2010	3011.02	52	5.15	36	253.66	87	58
2011	4212.74	59	8.64	41	267.43	87	62
2013	4281.14	54	10.33	42	297.41	89	62
2014	4640.27	56	11.60	44	312.53	89	63
2015	5193.32	58	13.30	49	336.26	89	65
2016	5384.75	57	14.59	51	345.62	85	65
2017	6456.68	61	16.61	54	358.99	82	66
2018	9167.61	74	22.41	60	343.58	79	71

er indicators mean that CTI's technology intensity is higher and its dependence on technology input is also greater.

Because the units are different for the indicators of each set, they need to be indexed for the following study. The specific method is to take the average factor intensity of every indicator of industry sectors as 100 and divide it by the corresponding indicator of the industry, thus the indicator is indexed.

This study also calculates the arithmetic average value of the three indexed indicators of each set in order to avoid error caused by comparing a single index, then these two mean indexes are used to classify CTI. If the mean index of the first set is greater than 100, CTI is considered a capital-intensive industry, not a labour-intensive industry. Similarly, if the mean index of the second set is greater than 100, CTI is considered a technology-intensive industry.

Cluster analysis

In order to check the result reliability of factor intensity classification for CTI and reduce the error caused by the single classification method, referring to the classification method of China's manufacturing industry designed by Zhang Li [11], this study applies Q-cluster analysis to re-identify the industrial attributes of CTI with the calculation results of factor intensity above. The cluster samples are all industry sectors in China, with the cluster indexes being the two sets of indicators above. The capital-labour ratio, capital-output ratio and output-labor ratio are used to judge whether CTI is a labour-intensive industry or a capital-intensive industry. The R&D expenditure-sale ratio, R&D personnel-employee ratio and R&D expenditure-R&D personnel ratio are also used to judge whether CTI is a technology-intensive industry or not.

Due to the availability of data, the time period used in this paper is 2006-2018,

and all data are obtained from the China Statistical Yearbook and China Industry Statistical Yearbook. Fixed capital is represented by the total fixed assets of CTI, and labour is the number of employees, represented by the total workers in CTI. Since the China Statistical Yearbook no longer counts the gross industrial output value after 2012 and the revenue of the principal business is close to the gross industrial output value, the output and sales are represented by the revenue of principal business of CTI. R&D expenditure and R&D personnel are represented by the R&D expenditure and R&D personnel of CTI, respectively.

Results of factor intensity classification

Factor intensity of China's textile industry

This study calculates the values and indexes of capital-labour intensity indicators (*Table 1*) and technology intensity indicators (*Table 2*) of CTI during 2006-2018. Since the China Statistical Yearbook does not count the number of CTI employees in 2012, *Table 1* and *2* do not include the results for 2012.

According to the calculation results of the capital-labour intensity indicator, CTI is still a labor-intensive industry. From 2006 to 2018, the capital-labour ratio index, capital-output ratio index and output-labor ratio index of CTI are all less than 100, and the mean index is stable at around 60. The data reveals that CTI has not stayed outside of the category of labour-intensive industry, and that the capital intensity of CTI is increasing. Its capital-labour ratio takes on a tendency to continuously go up, from 93.53 thousand CNY per person in 2006 to 301.60 thousand in 2018, suggesting that its reliance on capital is deepening. But the capital-labour ratio index is only about 41, far below the average. By contrast, the capital-output ratio shows a fluctuant downward trend on the whole, from 0.38 thousand CNY in 2006 to 0.36 thousand in 2018, and the capital-output ratio index also drops from 76 to 65. The output-labor ratio shares the same trend with the capital-labor ratio, increasing from 243.17 thousand CNY per person in 2006 to 839.76 thousand in 2018. Its index also keeps on increasing, but is lower than the average of industry sectors.

The technology intensity indicators listed in **Table 2** show explicitly that CTI is not a technology-intensive industry. The R&D expenditure-sale ratio, R&D personnel-employee ratio and R&D expenditure-R&D personnel ratio of CTI increase by 300%, 599% and 97%, respectively, from 2006 to 2018, and their indexes are also on the rise. Therefore, it means that the technology intensity of CTI has been improving and that CTI is increasingly dependent on technology input. However, all these indexes are less than 100 in 2006-2018, and the mean index is only 71 in 2018. Thus, it can be concluded that although CTI continues to expand R&D investment to improve technology intensity, it has not yet crossed the threshold of being a technology-intensive industry. On the other hand, it should also be noted that the R&D intensity (R&D expenditure-R&D personnel ratio) of CTI has become closer to the average of industry sectors, 345.62 thousand in 2016, with its index reaching 89 in 2013-2015, the highest among all the indicators. It clearly illustrates that the textile industry attaches great importance to technology innovation.

Factor intensity of CTI sub-sectors

This section analyses the factor intensity of CTI sub-sectors and classifies them. As the China Industry Statistics Yearbook began to count the data of sub-sectors in 2012 and lacks data of employees for that year, the time period used in this section is from 2013 to 2018. After calculating, this study obtains the values and indexes of capital-labour intensity indicators (**Table 3**) and technology intensity indicators (**Table 4**) of CTI sub-sectors. Due to the large number of data and the limited space of this paper, this section only lists the mean value and mean index of relevant indicators.

Capital-labour intensity indexes clearly demonstrate that all the CTI sub-sectors are still labour-intensive industries, although their capital intensity increases in 2013-2018. The indexes and mean index of the capital-labour intensity of CTI sub-sectors are all less than 100, remaining within the range of 45-60. It reveals that all the sub-sectors have not yet achieved the transformation from a labor-intensive industry to a capital-intensive industry. Their production processes are still most dependent on labour. The capital intensity of cotton textile is the highest of all, followed by

Table 3. Mean capital-labour intensity of China's textile industry sub-sectors in 2013-2018.

Sub-sector	Capital-labour ratio (thousand CNY per person)		Capital-output ratio (thousand CNY per thousand CNY)		Output-labor ratio (thousand CNY per person)		Mean index
	Amount	Index	Amount	Index	Amount	Index	
Cotton textile	199.78	45	0.23	61	864.98	73	60
Wool textile	175.42	40	0.19	52	903.68	77	56
Hemp textile	149.16	33	0.26	70	562.60	47	50
Silk textile	124.84	28	0.17	46	719.05	61	45
Chemical fibre weaving industry	187.76	43	0.28	76	666.70	56	58
Knitted textile	173.30	40	0.22	60	784.85	66	55
Household textile	129.05	29	0.18	47	730.33	62	46
Manufactured textile	186.26	43	0.22	59	844.30	72	58

Table 4. Mean technology intensity of China's textile industry sub-sectors in 2013-2018.

Sub-sector	R&D expenditure-sale ratio (thousand CNY per billion CNY)		R&D personnel-employee ratio (persons per thousand persons)		R&D expenditure-R&D personnel ratio (thousand CNY per person)		Mean index
	Amount	Index	Amount	Index	Amount	Index	
Cotton textile	4939.06	52	14.06	48	302.36	78	60
Wool textile	6329.62	66	14.87	51	382.15	98	72
Hemp textile	5277.66	56	9.05	31	331.51	86	57
Silk textile	4959.90	52	11.70	40	304.80	79	57
Chemical fibre weaving industry	6936.40	74	10.94	37	431.90	113	75
Knitted textile	5603.85	60	12.71	43	355.84	93	65
Household textile	4681.40	49	11.61	40	295.92	77	55
Manufactured textile	5014.15	53	13.29	46	319.21	83	60

manufactured textile, woven chemical fibre, wool textile, knitted textile, hemp textile, household textile and silk textile. The mean capital-labour ratio of cotton textile is 199.78 thousand CNY per person, and its mean index is only 60, about 60% of the average of industry sectors. This shows that even cotton textile, the most dependent on fixed capital of all, still has the greatest demand for labor in its production process and remains within the scope of a labour-intensive industry, as with other sub-sectors.

Technology intensity indicators reveal that all the CTI sub-sectors are still not those of a technology-intensive industry. The indexes and mean index of the technology intensity of CTI sub-sectors are in the range of 55-75, indicating that all sub-sectors have not yet crossed the threshold of being a technology-intensive industry. The R&D intensity of sub-sectors are getting closer to the average of industry sectors. The chemical fibre weaving industry exceeds the average, and wool textile and knitted textile are close to being thus. This clearly illustrates these sub-sectors attach great im-

portance to R&D investment. The mean index of the cotton textile industry, with the highest capital intensity, is only 60 and ranks fourth of all sub-sectors. It shows that the cotton textile industry does not feature technology-intensity and is still a typically labour-intensive & non-technology-intensive industry, as in the case of manufactured textile. It can be seen that although all CTI sub-sectors continue to increase R&D investment, there is still a long way to realise technology-intensive development.

Results of cluster analysis

This study applies Q-cluster analysis to classify the industrial attributes of all China's CTI industry sectors during 2006-2018 with SPSS19.0. Due to the limited space of this paper, this study only analyses the cluster results of CTI and its sub-sectors to re-identify their industrial attributes. The cluster results of capital-labour intensity indicators show that CTI and its sub-sectors have been a labour-intensive industry. The cluster results of technology intensity indicators show that CTI and its sub-sectors have

not been a technology-intensive industry. Thus, it can be concluded that the results of the Q-cluster analysis and factor intensity classification are the same for CTI and its sub-sectors. They still represent a labor-intensive and non-technology-intensive industry. CTI has not realised the transformation from a labor-intensive industry to a capital-intensive and technology-intensive industry yet.

Conclusions & policy suggestions

This study firstly measures the factor intensity of CTI and its sub-sectors during 2006-2018, then applies factor intensity classification and cluster analysis to identify the industrial attributes of CTI and its sub-sectors in order to answer whether CTI is still a labor-intensive industry or not. The conclusions are as follows:

CTI and its sub-sectors are still a labour-intensive and non-technology-intensive industry. Although the capital intensity and technology intensity of CTI are increasing, its mean index of capital-labour intensity indicators is about 60 and that of technology intensity indicators about 65, both lower than the average of industry sectors. The mean indexes of capital-labour intensity of CTI sub-sectors remain in the range of 45-60, revealing that they all remain within the scope of labour-intensive industry and that they are still the most dependent on labour. Their mean indexes of technology intensity are in the range of 55-75, indicating that all sub-sectors have not yet crossed the threshold of being a technology-intensive industry. As the most cap-

ital-intensive sub-sector, the mean index of cotton textile is only 60, and therefore it is still a labor-intensive industry, as are the other sub-sectors.

Therefore, it should be clearly acknowledged that CTI still falls into the category of a labor-intensive industry. Thus, CTI should be encouraged to actively improve the intelligent manufacturing level by strengthening technology input, eliminating backward production capacity, introducing and updating automated production equipment and so on, in order to enhance capital intensity and technology intensity. It would help CTI achieve industrial transformation and upgrading in the future.

Limitations and extensions

This paper focuses on the industrial attributes of China's textile industry and its sub-sectors during 2006-2018. The analysis of clothing industry is not included in this paper. More information may be revealed about the textile industry after the industrial attributes of the clothing industry are analysed, which will be done in the future.

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