Comparative Research on Control Index of Urban Industrial Lands

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Abstract. Because of the shortage of industrial lands, the control index of industrial lands is being worked out all over China. Three main compiling methods: statistical analysis method, techno-economic analysis method and analogy analysis method, were discussed. The Z-value method was used to compare four key indicators from the technical standards of industrial lands in six cities of China, as plot ratio, investment intensity of fixed assets, land output rate and land tax output rate. It shows the relationship between control index and industrial characteristics, and providing basis for formulation of industrial lands control index.

1. Preface
In order to economically and intensively utilize land resources and optimizing industrial structures, the Ministry of Natural Resources of China issued technical standards of industrial lands in 2008 (so called 2008 standard), which including five basic indicators such as volume ratio, investment intensity, building coefficient, proportion of service facilities, green space ratio. Based on that, more elaborate indicators are worked out, such as economic output of lands, industrial energy efficiency, industrial waste emissions, contribution rate of science and technology, etc. However, the seemingly perfect system of control indicators have not only caused the contradiction in the approval and management of industrial lands, but also made more difficult to compile control indicators. More data from different departments needs to be collected and processed. Some provinces and cities in the Chinese Midwest have not the ability to formulate local technical specification, replacing it with national general technical specifications. It is difficult to guide effectively industrial lands use and development. In general, it is not enough in the management and control of industrial lands in China.

2. The method of formulating control index of industrial lands
There are mainly three methods of formulating the control index of industrial lands, as statistical analysis, techno-economic analysis and analogy analysis.

2.1. Statistical analysis
The statistical analysis is a traditional method, basing on collecting data of different industries and projects, combining with the DELPH method, making out the average value and a certain threshold value. Such as 50%, 90% and 120% of the mean value can be used as the recommended threshold value for high, medium and low schemes. It is relatively simple in processing data, but very difficult in massive data collection. Limited by the sample numbers of enterprises and the accuracy of statistical data, it can only obtain the average value of the development status of a certain industry in the region, which is difficult to reflect scientifically the development trend of the industry and the guidance to the industrial planning.
According to the Industrial classification for national economic activities (GB/T 4754—2017), there are 20 categories, 97 major categories, 473 medium categories and 1380 subcategories in China's industry classification, among which traditional industries (including manufacturing and power energy enterprises) have 34 major categories, 188 medium categories and 626 subcategories. The type of industry is divided into four levels by output value: large, medium, small and micro. At least 6 samples are required for each levels of enterprises, and 15024 enterprise data are required to collect in all. In many cities, there are only a few thousand enterprises at most, which results in insufficient samples. For example, in 2013, there were only 1642 enterprises of the certain scale above in Wuhan. There are even one or two samples of enterprises can be counted in some industries, as Figure 1 below. Because of the insufficient number of samples, the control standards of a number of industries cannot be formulated through statistical analysis.

2.2. Techno-economic analysis method

Techno-economic analysis method on the basis of the statistical analysis method, adjust each control indicators by studies production technology and workshop design specifications of the specific industry. Some cities such as Guangzhou and Jiangsu have compiled quota (m2 / 10000 ton) of Industrial lands according to the relationship between product output and land area. The method is more accurate, professional, but the data analysis is more complex and difficult. The diversity of both land use and output standards is very big. For example, in 2013, the data of 34 types of traditional industrial industries in Wuhan show the index is very different in the three indicators as fixed asset investment, main business income, total tax revenue, especially for non-ferrous metal smelting and rolling processing (Industry code 32), electricity and heat supply (Industry code 44), as Figures 2, Figures 3, Figures 4.

2.3. Analogy analysis method

The two methods above belong to big data processing methods, which are highly required in the economic and data technical conditions of the local government.
The number and precision of samples directly affect the scientifcity of the index. In many cases, the data of subclass and subsubclass industries should be required to collect. If lacking of enterprise-level data samples, some indicators can only make an analogy with other urban. Meanwhile, in order to achieve layout aim, the indicator value will eventually use the method of subjective valuation directly or indirectly, which will requires an object of analogy. In many studies, analogical analysis is a low-cost and effective method. For example, the Guide for Industrial Lands Use of Shanghai(2004), \cite{4} refers to the industrial lands index of Japan and other industrialized countries. The analogy method can get reference value by comparison with advanced cities around the region, then set the adjustment value by valuation of Delphi method, which has certain advantages in the guidance of industry planning.

3. Comparative study on the indicators of industrial lands
In order to investigate the differences of industrial lands control indicators in different regions, we compare the technical specifications of industrial lands in Shanghai, Zhejiang, Guangzhou, Shenzhen, Jiangxi and Wuhan. \cite{5-10} Each technical index adopts the average value of major class industries. The category of industry is from code 13 to 46, \cite{2} including traditional manufacturing industry and energy supply industry. Volume ratio, investment intensity of fixed assets, lands output rate, lands tax output rate, four indicators in total, are selected as research objects. The z-value method is used to compare indicators in different regions. The index of Wuhan is used as the observed value. The three parameters of deviation, range and standardized value are compared. The deviation is the difference between the observed value and the average value of the six regions. The range is the difference between the maximum value and the minimum value of six regions.

3.1. The comparison of volume ratio
Among 34 types of industries, volume ratio of industrial lands is the highest in Shenzhen. All industries are greater than 1.0, and even than 2.0 in central area, which shows it is a high degree on conservation and intensive utilization in Shenzhen's industrial lands; while all types of industrial lands volume ratio in Wuhan is basically the lowest among the six regions, even lower than the provincial indexes of Zhejiang and Jiangxi, reflecting that The construction intensity and management degree of industrial lands in Wuhan are relatively backward. View of specific statistical indicators, the deviation of volume ratio is almost negative, and most of the standardized values are less than -0.3, which reflects that the volume ratio of industrial lands in Wuhan is far lower than the average level, and the degree of saving and intensive use of industrial lands is also relatively low. The Range value is greater than 1.0, which reflects the imbalance of lands development, greatly influenced by the level of urban development. As Figure 5.

3.2. The comparison of investment intensity of fixed assets
The investment intensity of industrial lands in Shanghai is the highest among the 34 industries in six regions, especially the tobacco industry (industry code 16) is 3-6 times higher than other provinces and cities, which reflecting the high economic input threshold of industrial lands in Shanghai. The investment intensity of fixed assets in Zhejiang is similar to that in Shanghai, and the investment intensity index of the whole industries is more than 2 million / mu. Wuhan has the lowest investment intensity index, and the value less than 2 million / mu in a half of industries, which shows low the industrial management level in Wuhan, should be adjusted according to other cities. The deviation of the investment intensity of fixed assets is almost negative, except for the electrical machinery and equipment manufacturing industry (industry code 38). The standardization value of most industries is about -0.6, reflecting the economic scale of unit lands in other industries is very small. The range value of most fixed asset investment intensity is more than 1 million yuan/mu, which reflects the
imbalance of industrial economic development in six provinces and cities. The urban economy in the Yangtze River Delta is better than that in the Pearl River Delta, and both of them are far more than that in the central cities. As Figure 6.

3.3. The comparison of lands output of unit industrial lands

View of lands output of unit land, most industrial lands output in Shanghai far exceeds that of other cities, and the input-output ratio is about 4.0, reflecting industrial management and development in Shanghai are far higher than other cities. It is second in Zhejiang, then is Shenzhen and Guangzhou, which are between 1.0-3.0, while Wuhan's industrial lands input-output rate is the lowest about 2.0 (except for the tap water supply industry) in all regions. The average value of lands output value is 4 million yuan / mu, and the deviation is about 100, the standardized range is -0.3, which reflects the imbalance of industrial development, but 300-500 is a reference value. The tobacco industry (industry code 16) even reaches 100.99 million yuan / mu, which reflects the extremely a high requirement in economic output of Shanghai's tobacco industry. As figure 7.

3.4 The comparison of lands tax output of unit industrial lands
There are no indicators to control the land tax output value in Jiangxi and Wuhan of central cities. The index of industrial lands tax output is more important than lands output, which can reflect the efficiency of industrial lands more scientifically. It is difficult to accurately obtain and count the tax data of enterprises. Many provinces and cities cannot formulated this indicator. The average value of lands tax per unit industrial land is close to 50 ten thousand yuan/mu, which is about one tenth of the land output benefit. There are higher tax rate in some industries. For example, the tax rate of tobacco industry has reached 0.7 in Shanghai, which reflects a restriction on the development of tobacco industry. Shenzhen has also imposed high tax rates on some industries, such as paper industry, printing industry, metallurgy industry, etc., especially for the metal products industry (industry code 33), the tax rate is close to 0.5, which is the guidance in the industry by the tax. As figure 8.

Figure 7. Lands output - Industry code (Ten thousand/mu) (except tobacco industry)

Figure 8. Lands tax output- Industry code (Ten thousand/mu) (except tobacco industry)

4. Conclusions
By comparing the deviation, range and standard value normalization of indicators in different cities, we can quantify the dispersion degree of observed indexes, to find the industrial development level and industrial land management level of different industries. The economy is more developed, the difference of industrial land control indicators is the greater among different industries. The control index of developed areas is much higher than that of underdeveloped areas, which has certain guidance to underdeveloped areas. The control index of industrial land is close in the same area. But if the industrial planning is different, it is difficult to learn from each other.

Compared with the southeast coastal cities in China, the industrial project management is relatively extensive in the central cities, where the index value and the threshold of industrial lands approval are both obviously low. It also shows there is no reasonable method to make out the control standard of industrial lands in these regions.

So, in regard to the methods of formulation control indicators for industrial lands, first of all, statistical analysis method is used to investigate the local data of resource endowment, economic characteristics and production technology in a large scale, to make out the basic standards. Secondly, on the micro level, threshold values at all levels is raised through compared with advanced cities, and the control indexes of different industries can be adjusted by analogy method. Thirdly, special technical research should be carried out according to the characteristics of each park, so as to ensure to manage appropriately and scientifically on industrial lands.

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