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Land Use in Ma'anshan Economic and Technological Development Zone: Based on the Land Survey of Typical Enterprises

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Abstract This article analyzes the typical enterprise's land use structure, land use efficiency, land use intensity and industrial structure in Ma'anshan Economic and Technological Development Zone. Based on the survey results about the typical enterprises, this article put forth the following recommendations: promoting the economical and intensive land use in the development zone by tapping connotation; enhancing the smart land use in the development zone through optimization of function layout; promoting the industrial chain linkage in the development zone through the establishment of industrial land exit mechanism.

Key words Ma'anshan City, Economic and Technological Development Zone, Land use, Typical enterprises

With the advance of new urbanization, a large agricultural population transferred to the city will become the core of synchronized "four modernizations". Since the founding of new China, China's urbanization has taken a road of "supporting the urban development by rural areas", promoting the rapid development of urban areas^[1].

As of 2013, China's urbanization rate reached 53.73%^[2], but the proportion of urban household population was less than 35%, indicating that there was 250 million of urban population still drifting between urban and rural areas. These people are just migrant workers in China, and only 1% of them have their own homes in the city.

So, the new urbanization should pay attention to improving the quality of urban development and making the farmers in the city enjoy the same national treatment as the current urban residents. Based on this, urbanization must be supported by industrialization. China is a country with very scarce land resources, so the industrial development must reflect the strategy of economical and intensive land use.

Ma'anshan Economic and Technological Development Zone, as a typical example of city – industry integration, has made great contribution to the socio-economic development in Ma'anshan City. However, there are still some elements incompatible with the development of new urbanization in the land use process, such as some enterprises' extensive land use.

On the basis of typical enterprise survey, this article studies the present situation and trend of the land use, and proposes the ways and means to promote the economical and intensive land use of the development zone, in order to provide a reference for breaking the bottleneck of land during the process of promoting the new urbanization.

1 Overview of Ma'anshan Economic and Technological Development Zone

1.1 Geographical location Ma'anshan, also written as Maanshan, is a prefecture-level city in the eastern part of Anhui province in Eastern China. An industrial city stretching across the Yangtze River, Ma'anshan borders Hefei to the west, Wuhu to the southwest, and Nanjing to the east^[2].

It is a core city of the Nanjing Metropolitan Circle. Surrounded by low hills (The name of the city means "horse saddle mountain"), it is not as polluted as other major Chinese steelmaking cities, thanks to the environmental policies taken by the local government that granted the city the recognition as one of the "Ten Green Cities of China".

Its climate is similar to other cities in the Yangtze River Delta, with lower humidity that makes its summers and winters less extreme. There are frequent showers during July and August. Ma'anshan city has an annual manufacture investment ranking No. 1 in Anhui Province and her GDP ranks No. 4 in Anhui Province after Hefei, Anqing and Wuhu. Ma'anshan's population ranks No. 16 in the province and has a GDP per capita of US \$ 7118 which is No. 1 in Anhui Province and near the average of Yangtze River Delta.

Ma'anshan Economic and Technological Development Zone is located in the south of Ma'anshan City, adjacent to Meishan Park in the east, the famous national scenic resort Caishi Park in the west, stretching south to Ma'anshan Yangtze River Bridge which is being built, and north to the main city of Ma'anshan.

The development zone consists of five relatively concentrated but separate areas, spanning about three kilometers from east to west and four kilometers from south to north.

1.2 Present situation of development Ma'anshan Economic and Technological Development Zone was approved by Anhui Provincial People's Government as a provincial development zone in October 1995, and upgraded to the national economic and technolo-

logical development zone by the State Council in March 2010. In January 2012, Zhengpugang New Zone Construction Headquarter of Ma'anshan Economic and Technological Development Zone was officially established. The new zone is located in the west bank of Yangtze River, with a total area of 225 square kilometers^[3].

Through ten years of development, the main economic indicators are rapidly growing and the economic aggregate is increasingly expanding. At present, the development zone has formed four characteristic industrial groups (automobile and auto parts industry; green food processing industry; machinery processing and equipment manufacturing industry; optoelectronic and electronic materials and new materials industry), and four professional bases (China's largest special vehicle production base – Anhui Xingma Automobile Co., Ltd.; Asia's largest ice cream production base – Mengniu Dairy Industry (Ma'anshan) Co., Ltd.; China's largest meat processing base – Ma'anshan Yurun Food Co., Ltd.; national 863 new material base^[4]).

2 Typical enterprise survey

2.1 Selection of typical enterprises First, the top 15 enterprises in terms of gross revenue are initially selected, then according to the leading industry in the development zone, 2 to 3 enterprises with the highest total revenue are selected from each industry type, and finally 10 typical enterprises are selected after integrating the above two selection criteria. The total land area for the 10 typical enterprises is 176.3 hm², accounting for 25% of the total area of land for industrial and mining warehouses that have been completed.

The selected typical enterprises have the leading industries in the development zone. 3 automobile and auto parts industry enterprises (Anhui Xingma Automobile Co., Ltd., Anhui Hualing Au-

tomobile Co., Ltd., Anhui Masteel Holly Industrial Co., Ltd.) are selected; 3 food manufacturing enterprises (Ma'anshan Mengniu Dairy Industry Co., Ltd., Ma'anshan Dali Food Group Co., Ltd., Ma'anshan Yurun Food Co., Ltd.) are selected; 3 optoelectronics and new materials enterprises (Sinosteel Anhui Tianyuan Technology Co., Ltd., Keda (MAS) Industrial Co., Ltd., Ma'anshan Kinve Electronic Technology Co., Ltd.) are selected; 1 machining and metal manufacturing enterprise (Anhui Taier Heavy Industry Co., Ltd.) is selected.

2.2 Survey content and results

(i) The basic situation of enterprises. The survey includes name of enterprise, number of employees, and industry type.

(ii) The input of enterprises. The survey is mainly the survey of totaled actual fixed assets investment.

(iii) The output of enterprises. The survey includes enterprises' total revenue, total output value and total amount of tax and profits. This item should collect the corresponding land data for the evaluated enterprises in the development zone.

(vi) The land use of enterprises. The survey includes the total area of land for enterprises, the area of land for the factory building and ancillary facilities, the area of land for administrative offices and living service facilities within the enterprise, the area of land for open yard and open operating field, the area of roads and parking area within the factory, the area of green space, the area of other land use types^[5].

(v) The construction of enterprises. The survey includes total construction area, floor area ratio, the total area of building base, open yard, open operating field, and building coefficient^[6].

The survey results about typical enterprises are summarized in Table 1 and Table 2.

Table 1 Input and output of typical enterprises in the development zone

Name of enterprise	Industry type	Number of employees	Total investment 10 ⁴ yuan	Total revenue 10 ⁴ yuan	Total output value//10 ⁴ yuan	Total profit and tax//10 ⁴ yuan
Anhui Xingma Automobile Co., Ltd.	Transportation equipment manufacturing	1 326	246 480.00	323 380.00	332 141.26	78 209.00
Sinosteel Anhui Tianyuan Technology Co., Ltd.	Communications equipment manufacturing	426	24 894.00	39 567.40	39 582.00	12 561.00
Keda (MAS) Industrial Co., Ltd.	Non-metallic mineral products industry	512	80 072.00	60 274.80	61 859.00	11 500.00
Anhui Hualing Automobile Co., Ltd.	Transportation equipment manufacturing	2 145	306 625.00	478 501.40	460 534.00	145 826.00
Anhui Masteel Holly Industrial Co., Ltd.	Metal products industry	1 385	39 804.00	32 304.00	34 426.00	11 353.00
Mengniu Dairy Industry (Ma'anshan) Co., Ltd.	Food manufacturing	2 825	185 112.00	300 188.00	314 293.00	46 760.00
Anhui Taier Heavy Industry Co., Ltd.	Special equipment manufacturing	420	28 000.00	35 206.40	33 742.00	8 256.00
Ma'anshan Yurun Food Co., Ltd.	Agro – food processing industry	1 742	144 329.00	105 818.00	105 462.00	25 234.00
Ma'anshan Kinve Electronic Technology Co., Ltd.	Chemical fiber manufacturing	628	43 050.00	40 010.30	41 430.00	7 400.00
Ma'anshan Dali Food Group Co., Ltd.	Food manufacturing	2 262	86 500.00	113 580.00	118 482.00	12 351.00

Table 2 The land use and construction of typical enterprises in the development zone

Name of enterprise	The land use of enterprises					
	The area of land for enterprises hm^2	The area of land for the factory building and ancillary facilities $/hm^2$	The area of land for administrative offices and living service facilities within the enterprise hm^2	The area of land for open yard and open operating field $/hm^2$	The area of backup land within the factory $/hm^2$	The area of roads and parking area within the factory $/hm^2$
Anhui Xingma Automobile Co., Ltd.	37.41	19.45	2.24	8.47	1.87	2.62
Sinosteel Anhui Tianyuan Technology Co., Ltd.	3.72	2.16	0.24	0.56	0.00	0.30
Keda (MAS) Industrial Co., Ltd.	14.99	8.24	0.82	1.82	1.27	1.27
Anhui Hualing Automobile Co., Ltd.	41.68	25.46	2.52	6.27	1.50	3.13
Anhui Masteel Holly Industrial Co., Ltd.	6.03	4.13	0.36	0.83	0.00	0.37
Mengniu Dairy Industry (Ma'anshan) Co., Ltd.	24.58	15.50	1.23	1.47	1.26	1.72
Anhui Taier Heavy Industry Co., Ltd.	4.35	2.52	0.30	0.48	0.00	0.35
Ma'anshan Yurun Food Co., Ltd.	26.03	15.22	1.82	1.82	2.31	1.82
Ma'anshan Kinve Electronic Technology Co., Ltd.	6.03	3.48	0.42	0.81	0.52	0.56
Ma'anshan Dali Food Group Co., Ltd.	11.48	7.43	0.83	0.69	0.00	0.92

Name of enterprise	The construction of enterprises					
	The area of green space hm^2	The area of other land use types hm^2	Total construction area $/10^4 m^2$	Floor area ratio	The total area of building base, open yard, open operating field $/10^4 m^2$	Building coefficient // %
Anhui Xingma Automobile Co., Ltd.	2.75	0.00	36.53	0.98	16.23	43.38
Sinosteel Anhui Tianyuan Technology Co., Ltd.	0.47	0.00	4.09	1.10	2.12	56.94
Keda (MAS) Industrial Co., Ltd.	1.57	0.00	16.85	1.12	8.25	55.04
Anhui Hualing Automobile Co., Ltd.	2.80	0.00	41.46	0.99	19.18	46.02
Anhui Masteel Holly Industrial Co., Ltd.	0.35	0.00	6.85	1.14	3.82	63.38
Mengniu Dairy Industry (Ma'anshan) Co., Ltd.	3.39	0.00	25.88	1.05	12.29	50.01
Anhui Taier Heavy Industry Co., Ltd.	0.70	0.00	4.25	0.98	2.50	57.44
Ma'anshan Yurun Food Co., Ltd.	3.03	0.00	28.60	1.10	12.29	47.22
Ma'anshan Kinve Electronic Technology Co., Ltd.	0.23	0.00	6.88	1.14	3.14	52.09
Ma'anshan Dali Food Group Co., Ltd.	1.61	0.00	13.99	1.22	6.12	53.30

2.3 Result analysis

2.3.1 Analysis of land use structure. Based on the survey results about the land use of typical enterprises, we carry out the statistical analysis of the related data on the land use structure of enterprises (Table 3).

Table 3 shows that from the overall land use structure of the 10 typical enterprises, the proportion of land for the factory building and ancillary facilities is the highest, 59% of the total area of land for enterprises, followed by the proportion of land for open yard and open operating field (13%); the proportion of the area of land for green space is 10%; the proportion of roads and parking area within the factory is 7%; the proportion of land for administrative offices and living service facilities within the enterprise is 6%; the proportion of backup land within the factory is 5%; there are basically no other land use types.

Conspicuously, the overall land use structure of the selected 10 typical enterprises is reasonable. However, due to the difference in the industry nature and development plans between enterprises, there are also differences in the land use structure between enterprises.

Under normal circumstances, among the enterprises that have been built, the food, beverages, electronic technology and other types of light industry use a relatively high proportion of land for

the factory building and ancillary facilities; open yard and open operating field use a relatively low proportion of land; the land use structure of metal processing and machinery manufacturing enterprises is the other way around.

The newly built enterprises usually have some internal backup land. With the development of enterprises, the internal backup land will gradually be completed.

2.3.2 Analysis of land use efficiency. Based on the survey results about the land use of typical enterprises, we carry out the statistical analysis of the related data on the land use efficiency of enterprises (Table 4).

Table 4 shows that the average fixed asset investment intensity of the 10 typical enterprises is 67.21 million yuan/ hm^2 , 1.43 times of the average investment intensity of industrial land in the development zone (47 million yuan/ hm^2). However, in terms of each typical enterprise, there are great differences in the level of fixed assets investment between enterprises.

The top three enterprises in terms of level of investment are Ma'anshan Dali Food Group Co., Ltd., Mengniu Dairy Industry (Ma'anshan) Co., Ltd., and Anhui Hualing Automobile Co., Ltd. The level of their fixed assets investment is 1.6 times, 1.6 times and 1.56 times of the average level of investment of industrial land in the development zone, respectively.

Table 3 The land use structure of typical enterprises in the department zone

Name of enterprise	The total area of land for enterprises hm^2	The proportion of land for the factory building and ancillary facilities // %	The proportion of land for administrative offices and living service facilities within the enterprise %	The proportion of land for open yard and open operating field // %	The proportion of backup land within the factory %	The proportion of roads and parking area within the factory // %	The proportion of land for green space // %
Anhui Xingma Automobile Co., Ltd.	37.41	52	6	23	5	7	7
Sinosteel Anhui Tianyuan Technology Co., Ltd.	3.72	58	6	15	0	8	13
Keda (MAS) Industrial Co., Ltd.	14.99	55	5	12	8	8	10
Anhui Hualing Automobile Co., Ltd.	41.68	61	6	15	4	8	7
Anhui Masteel Holly Industrial Co., Ltd.	6.03	68	6	14	0	6	6
Mengniu Dairy Industry (Ma'anshan) Co., Ltd.	24.58	63	5	6	5	7	14
Anhui Taier Heavy Industry Co., Ltd.	4.35	58	7	11	0	8	16
Ma'anshan Yurun Food Co., Ltd.	26.03	58	7	7	9	7	12
Ma'anshan Kinve Electronic Technology Co., Ltd.	6.03	58	7	13	9	9	4
Ma'anshan Dali Food Group Co., Ltd.	11.48	65	7	6	0	8	14

Table 4 The land use efficiency of typical enterprises in the development zone

The basic situation of enterprises		The input of enterprises		The output of enterprises	
Name of enterprise	Land area // hm^2	Fixed asset investment intensity 10^4 yuan/ hm^2	The ratio of fixed asset investment intensity to the average investment intensity of industrial land in the development zone	Output intensity 10^4 yuan/ hm^2	The ratio of output intensity to the average output intensity of industrial land in the development zone
Anhui Xingma Automobile Co., Ltd.	37.41	6 589	1.40	8 644	1.60
Sinosteel Anhui Tianyuan Technology Co., Ltd.	3.72	6 686	1.42	10 626	1.96
Keda (MAS) Industrial Co., Ltd.	14.99	5 342	1.13	4 021	0.74
Anhui Hualing Automobile Co., Ltd.	41.68	7 357	1.56	11 480	2.12
Anhui Masteel Holly Industrial Co., Ltd.	6.03	6 604	1.40	5 360	0.99
Mengniu Dairy Industry (Ma'anshan) Co., Ltd.	24.58	7 532	1.60	12 214	2.26
Anhui Taier Heavy Industry Co., Ltd.	4.35	6 433	1.37	8 089	1.49
Ma'anshan Yurun Food Co., Ltd.	26.03	5546	1.18	4 066	0.75
Ma'anshan Kinve Electronic Technology Co., Ltd.	6.03	7 142	1.52	6 638	1.23
Ma'anshan Dali Food Group Co., Ltd.	11.48	7 533	1.60	9 891	1.83

In terms of the ratio of level of investment to the investment intensity controlled by the state, the top three are Keda (MAS) Industrial Co., Ltd., Mengniu Dairy Industry (Ma'anshan) Co., Ltd. and Anhui Taier Heavy Industry Co., Ltd., 4.84 times, 4.84 times and 4.29 times of the investment intensity controlled by

the industry, respectively.

From the overall situation of land use efficiency, the average output intensity of the 10 typical enterprises is 86.72 million yuan/ hm^2 , 1.6 times of the average output intensity of industrial land in the development zone. However, in terms of each typi-

cal enterprise, there are also great differences in the level of output between enterprises.

The top three enterprises in terms of output level are Mengniu Dairy Industry (Ma'anshan) Co., Ltd., Anhui Hualing Automobile Co., Ltd. and Sinosteel Anhui Tianyuan Technology Co., Ltd., 2.26 times, 2.12 times and 1.96 times of the average out-

put level of industrial land in the development zone, respectively.

2.3.3 Analysis of land use intensity. Based on the survey results about the land use of typical enterprises, we carry out the statistical analysis of the related data on the land use intensity of enterprises (Table 5).

Table 5 The land use intensity of typical enterprises in the development zone

Name of enterprise	The area of land approved hm^2	Floor area ratio	The ratio of floor area ratio of typical enterprises to the comprehensive floor area ratio of the industry in the development zone	Building coefficient	The building coefficient of typical enterprises to the average building density of industrial land in the development zone
Anhui Xingma Automobile Co., Ltd.	37.41	0.98	0.98	43%	0.80
Sinosteel Anhui Tianyuan Technology Co., Ltd.	3.72	1.10	1.10	57%	1.05
Keda (MAS) Industrial Co., Ltd.	14.99	1.12	1.12	55%	1.02
Anhui Hualing Automobile Co., Ltd.	41.68	0.99	0.99	46%	0.85
Anhui Masteel Holly Industrial Co., Ltd.	6.03	1.14	1.14	63%	1.17
Mengniu Dairy Industry (Ma'anshan) Co., Ltd.	24.58	1.05	1.05	50%	0.92
Anhui Taier Heavy Industry Co., Ltd.	4.35	0.98	0.98	57%	1.06
Ma'anshan Yurun Food Co., Ltd.	26.03	1.10	1.10	47%	0.87
Ma'anshan Kinve Electronic Technology Co., Ltd.	6.03	1.14	1.14	52%	0.96
Ma'anshan Dali Food Group Co., Ltd.	11.48	1.22	1.22	53%	0.99

Table 5 shows that the average floor area ratio of the 10 typical enterprises is 1.08, higher than the average floor area ratio of industrial land in the development zone (1). However, in terms of each typical enterprise, there are also great differences in the level of floor area ratio between enterprises.

The top three enterprises in terms of floor area ratio are Anhui Masteel Holly Industrial Co., Ltd., Ma'anshan Dali Food Group Co., Ltd. and Ma'anshan Kinve Electronic Technology Co., Ltd., 1.14 times, 1.22 times and 1.14 times of the average level of floor area ratio of industrial land in the development zone, respectively. The 10 typical enterprises all reach the level of floor area ratio controlled by the state, and the floor area ratio is generally high for the 10 typical enterprises.

2.3.4 Analysis of the industrial structure. From the industrial structure types of the 10 enterprises selected, they are the leading industries in the development zone. There are a total of four industries, namely, automobile and auto parts industry, food manufacturing industry, optoelectronics and new materials industry and machining and metal manufacturing industry.

The automobile and auto parts manufacturers are Anhui Xingma Automobile Co., Ltd., Anhui Masteel Holly Industrial Co., Ltd., and Anhui Hualing Automobile Co., Ltd.; the food manufacturers are Mengniu Dairy Industry (Ma'anshan) Co., Ltd., Ma'anshan Dali Food Group Co., Ltd., and Ma'anshan Yurun Food Co., Ltd.; the optoelectronics and new materials enterprises are Sinosteel Anhui Tianyuan Technology Co., Ltd., Ma'anshan Kinve Electronic Technology Co., Ltd., and Keda (MAS) Industrial Co., Ltd.; the machining and metal manufacturing enterprise is Anhui Taier Heavy Industry Co., Ltd.

3 Recommendations

3.1 Promoting the economical and intensive land use in the development zone by tapping connotation The new urbanization regards the urbanization of agricultural population as the core, and its fundamental purpose is to solve the problem of surplus labor in rural areas. Therefore, the development of new urbanization must be supported by industries, and take the road of city-industry integration.

However, China is a populous country, and food security is the overriding political task, that is, the development of new urbanization must strictly determine the boundary between various development zones, and take the road of connotation tapping. From the survey results about the typical enterprises in Ma'anshan Economic and Technological Development Zone, the internal land still has large potential to tap.

Table 4 shows that the output per unit of land of Keda (MAS) Industrial Co., Ltd. and Ma'anshan Yurun Food Co., Ltd. is 40.21 million yuan/ hm^2 and 40.66 million yuan/ hm^2 , respectively, indicating that the land use efficiency of enterprises is not high, so it is necessary to increase the investment intensity and improve the level of intensive land use.

Table 5 shows that the building coefficient of Anhui Xingma Automobile Co., Ltd. is only 43%, and the ratio of it to the average building density of industrial land in the development zone is 0.8, indicating that there is room for horizontal expansion of land; the floor area ratio for some enterprises has not yet reached 1, such as Anhui Hualing Automobile Co., Ltd., indicating that there is room for longitudinal potential tapping.

3.2 Enhancing the smart land use in the development zone through optimization of function layout Innovating upon the

drivers is to abandon the previous unsustainable development behaviors. From the perspective of land allocation, the land should be allocated to the high-tech and high-yield low-carbon industries and environment-friendly industries.

For the existing enterprises with high energy consumption and high pollution, even if the level of intensive land utilization is high, it is also necessary to promote the smart land use pattern.

For example, Anhui Taier Heavy Industry Co., Ltd. in Ma'anshan Economic Development Zone can consider the introduction of high-tech drive and implement the restructuring jointly with the two automotive industries, to achieve the purpose of smart land use.

3.3 Promoting the industrial chain linkage in the development zone through the establishment of industrial land exit mechanism China's industrial land takes the supply way of "bid, auction and listing", and the land usage term is 50 years. However, the life cycle of many enterprises is less than 10 years, resulting in inefficient industrial land, and even providing the soil for "land speculation".

Therefore, the establishment of industrial land exit mechanism is a major measure to destroy sunset industries and promote the development of sunrise industries. Based on the analysis of the land use structure of enterprises in Ma'anshan Economic and Technological Development Zone, it is found that the two automobile industries lack the momentum for linkage, and many enterprises only pursue the immediate investment performance but lack long-term planning.

Therefore, the development zone should not only make the land use planning, but also make the industrial development planning, to achieve linkage and sustainable development.

4 Conclusions

The focus of new urbanization is to solve issues concerning agriculture, countryside and farmers, and solve the housing and employment problems for the urbanized farmers. Therefore, the promotion of new urbanization must be synchronized with the advance of industrialization.

In order to improve the efficiency of industrial land, promote industrial chain linkage and reduce pollution, it is necessary to take the road of "making industry concentrate in industrial park". Ma'anshan Economic and Technological Development Zone has set a benchmark for the development of city - industry integration, and has taken a substantial step in economical, intensive and smart land use and industrial chain linkage.

But research shows that either the breadth or depth of land use, Ma'anshan Economic and Technological Development Zone still has much room for development.

Therefore, in order to ensure food security and adhere to 1.8 billion mu of arable land red line, all types of development zones must determine the scale boundary and prohibit the random expansion.

The enterprises within the development zone should regularly assess the land use, and implement the smart land use strategy for those inefficient and high pollution enterprises, to ensure the sustainable use of land use in the development zone.

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