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Research on Industrial Aggregation and Spatial Development: Jingzhou High-tech Zone as Example

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Abstract: Jingzhou High-tech Zone is an industrial industry agglomeration in Jingzhou. The overall level of high-tech industry development in Jingzhou is not high. After experiencing high growth in recent years, it gradually enters a difficult period of industrial development due to the macroeconomic environment and lacks a large contiguous land, adjustment of new city planning, and generalization of policies, compared to similar development zones. We selected 24 representative indicators for the industrial and spatial development of the Jingzhou industry and High-tech Zone to construct an evaluation system for industrial development in Jingzhou. SPSS principal component analysis method was used for validating the system. We analyzed several factors affecting the industrial clustering of enterprises in the Jingzhou high-tech zone by referring to the existing analysis method of industrial spatial aggregation to construct a calculation model for the industrial spatial aggregation of the Jingzhou high-tech zone. The industrial spatial aggregation of 49 enterprises in the Jingzhou high-tech zone was calculated, too. The results of principal component analysis and the calculation results of the industrial aggregation degree of 49 enterprises showed that the industrial development of Jingzhou was positive in time and space, and six items, such as industrial turnover of movable assets, industrial debt rate, industrial loss rate, industrial secondary industry fixed investment, industrial employment population, and sewage treatment rate affected the zone's industrial development.

1. Introduction

There are 12 national high-tech zones and 20 provincial high-tech zones in Hubei Province 1, of which the Donghu High-tech Zone is the first-class and the first designated one in Hubei Province. It is mainly based on the "5+2" industrial system. The second one is the Xiangyang Hi-tech Zone 2 which has an industrial structure of "one pillar and six clusters". The specific industrial clusters in Hubei Province have experienced enterprise development mainly concentrated on R&D and innovation, human capital, financial development, and industrial clustering 3.

Research on the Hubei industry has been carried out for exploring the integrated development of large and medium-sized enterprises in industrial clusters 4, while research on the Jingzhou industry has been on industrial heritage protection, industrial regions, and agricultural and mechanical industries. Less industrial development has been performed in the last 20 years in Jingzhou, probably because the research was focused on the Yangtze industry. However, there are not many research articles on the Jingzhou high-tech zone. The research was mainly conducted for the incubation of the science and technology industry 5 and the development principles and planning layout 6 of the agricultural high-tech zone. There is no research on the gathering of enterprises in the Jingzhou high-tech zone yet 6.

The "industrial development planning of Chengnan Economic Development Zone (2016−2020)" presented that the status quo of Chengnan High-tech Zone initially formed the pillar industries of petroleum machinery, textile and garment, paper and packaging, agricultural and food processing, and new building materials. Since the industrial income of the city's economic development zone is not high enough to contribute to the economy of the Jingzhou District, the current industrial layout, planning land, leading industries, industrial chains, growth points, and other aspects are facing more serious problems. The main deficiency is the industrial layout and multi-industry development, which leads to confusion in the introduction of industries in the spatial layout. The area of the high-tech zone land is limited with less available land. However, several industries require large areas, resulting in inefficient land use. The characteristics of the leading industries are not clear, too. The original plan envisaged the development of six industries, but no industrial clusters and special industries were formed in the implementation process 7, resulting in stagnant development and missed industrial chains. The 14th Five-Year Plan proposed to build five industrial innovation chains, while the original plan did

not involve the extension of industrial chains. New growth plans were not considered though the original plan focused on six industries, some of which were inefficient. The introduction of electronic information 8 and other university industries was not considered, too, leading to the unbalanced development of six industries.

Generally speaking, the degree of industrial aggregation in the high-tech zone and the development model of industrial clusters differs and shows different characteristics by region. Industrial clusters are grouped according to the formation of the early stage, the growth period, and the cluster industry upgrading period. The degree of industrial aggregation directly affects the development of industrial clusters and the correlation of the related industries where the enterprises affect the industrial correlation effect. Industrial agglomeration and industrial aggregation are accompanied by the whole process of industrial cluster growth.

With the data of Jingzhou for the past 20 years and principal component analysis 10, we analyzed the 24 selected indicators of the Jingzhou industry and the industrial accumulation degree of 49 enterprises [10,12] by using the industrial aggregation degree method. The concept of the industrial and spatial development of the Jingzhou high-tech zone was proposed based on the result. By exploring Jingzhou's late development, the demands of enterprises and the benign mutual promotion of industrial development and urban construction for industrial development were investigated to accelerate the development, achieve the fast development of Jingzhou, remove the unfavorable situation of slow development, and improve economic efficiency.

2. Current Situation and Data Collection

2.1. Current Situation in Study Area

Jingzhou is located in the Jianghan Plain with advantages in transportation, resource, and location. It has the basic conditions to develop the city's economy continuously. The existence of the two cities is a characteristic feature of Jingzhou and Shashi. During the Western Han Dynasty, Jingzhou was one of the ten major commercial ports in China. However, with the southward movement of the Yangtze River, Jingzhou gradually lost good conditions for external transportation and its economic functions, while the economic functions of Shashi became more prominent. During the late Qing Dynasty, Shashi was a semi-colonial and semi-feudal port of commerce with the rise of industry and commercial prosperity. In 1994, Jing Sha was merged into Jing Sha City, and in 1996 Jing Sha City was renamed Jingzhou City. With the demand for urban development, Jingzhou has gradually expanded to the north and formed a twin city. However, Jingzhou's industrial development has not reached an outstanding level. At present, Jingzhou's development potential lies in the industry, and the industrial operation in 2021 showed a stable and improving trend, however, compared with neighboring cities, Jingzhou still lacks large industries and modernized industrial chains, industrial systems and industrial foundation capabilities.

The planned area of the Jingzhou High-tech Zone is 592.6 ha including Xingang Avenue (west), South Taihu Harbor Road (north), and West Ring Road (east). Most of the area is occupied by industrial land with limited green land on the west side of Jingjiang Avenue and wetland in the middle. The area of residential land is 67.8 ha, accounting for 11.4% of the total area. The area of industrial land is 300 ha, accounting for 50.63%. Supporting service facilities and infrastructure account for a relatively low proportion, and the urban land structure is yet to be adjusted.

2.2. Data Source

Data was collected from "Jingzhou District Yuan-December National Economic Operation Overview" and " Jingzhou Statistical Yearbook" for the past 20 years from 2001 to 2021. Missing data were averaged according to the data of close years. The output of enterprises was calculated from the total output value by December every year, and planning scope and land use were collected from the satellite and CAD land planning map.

3. Methods

3.1. Principal Component Analysis

Based on the principal component analysis with SPSS 25.0 software, 24 indicators were selected for the Jingzhou data for the period of 2020–2021. After the results of the analysis, a few important indicators were selected for the industrial analysis of Jingzhou.

The data were first processed initially by using the descriptive statistics of SPSS software as follows.

$$\mu_i = \frac{1}{n}\sum_{j=1}^{n} x_{ji} \tag{1}$$

$$\sigma_i^2 = \frac{1}{n-1}\sum_{j=1}^{n}(X_{ji} - \mu_i)^2 \tag{2}$$

where μ_i is the mean of the indicator, the σ_i^2 is the variance of the indicator, and n is the total number of years for the indicator ($n = 20$ in this analysis).

The data were then standardized with Eq. (3).

$$z_{ji} = \frac{x_{ji} - \mu_i}{\sigma_i} \tag{3}$$

where z_{ji} is the standardized value of the index, and x_{ji} is the original value of the index.

In principal component analysis, the correlation coefficient matrix was obtained (Eq. (4)).

$$r_{ij} = \frac{\sum_{k=1}^{n} z_{ki} * z_{kj}}{n-1}, (i, j = 1, 2, \cdots, m) \tag{4}$$

where r_{ij} is the indicator coefficient, and m is the number of indicators ($m = 24$ in this analysis).

The contribution and cumulative variance explaining each component was calculated with the following equation.

$$b_i = \frac{\lambda_j}{\sum_{k=1}^{n} \lambda_k}, (j = 1, 2, \cdots, n) \tag{5}$$

$$\alpha_p = \frac{\sum_{k=1}^{p} \lambda_k}{\sum_{k=1}^{n} \lambda_k}, (p \leq n) \tag{6}$$

where b_i is the indicator contribution rate, and α_p is the cumulative contribution of the indicator.

Finally, the composite score for each principal component was obtained.

3.2. Industrial spatial agglomeration model

Based on existing research methods, the spatial aggregation of industries was calculated as follows.

$$\eta = \frac{1}{2} \cdot \frac{c}{s} \cdot \frac{100}{Emax} + \frac{1}{2} \cdot \frac{O}{s} \cdot \frac{100}{Gmax} \tag{7}$$

where η is the spatial aggregation of industry, c is the total number of enterprises of a certain industry in the high-tech zone, s is the area of the enterprises of the industry in the high-tech zone), o is the output income of enterprises of a certain industry in the high-tech zone, $Emax = max$ (49 enterprises of a certain industry/area of the high-tech zone), and $Gmax = max$ (49 enterprises of a certain industry/area of the high-tech zone).

Through the above industrial spatial aggregation calculation model, the output income of the industry, the area of the high-tech zone of 49 enterprises, and the spatial aggregation of the high-tech zone were calculated. The industrial spatial aggregation degree was expressed in percentage.

4. Results and Analysis

4.1. Result of Principal Component Analysis

The 24 indicators were standardized as shown in Table 1 for principal component analysis. The indicators that did not have a significant role or linear correlation were deleted to determine the final evaluation of the indicators, and the four main factors were obtained (Table 2). The contribution of the first four principal components were 68.5, 10.0, 7.5, and 5.7%. The four principal components contained most of the information of the data with a high degree of confidence, being used as factors for calculating loading values (Table 3). The weight of each factor was calculated, too. Principal component 1 pertained to per disposable income per urban resident, GDP per capita, wastewater treatment rate, and investment in fixed assets. Jingzhou's GDP per capita and per capita income of urban residents were high, and industrial development was good. Fixed investment also increased with industrial investment, making industrial development continue. The industrial wastewater treatment rate became higher, indicating that the development of science and technology reduced the pollution for better development.

Principal component 2 accounted for the turnover rate of movable assets, total population, gearing ratio, primary industry and output value. Industrial dynamic asset turnover rate and gearing ratio play a role in industrial development. At the same time, the large population contributed to urban development and increased employment. Primary industry output was mainly agricultural, which also affected industrial development. Principal component 3 pertained to enterprise loss, gearing ratio, the turnover rate of movable assets, and per capita consumption of urban residents. Enterprise loss and gearing ratio influenced industrial development, and the turnover rate of movable assets was related to the turnover of total assets of industrial enterprises, the industrial sales capacity, and the efficiency of asset utilization. As production determines consumption, the higher urban consumption indicates that industry

is developing. Principal component 4 was for total assets contribution, total population, the turnover rate of movable assets, and enterprise loss surface. Increased population allowed industrial development.

Table 1. Standardized data on raw indicators for the Jingzhou sample 2001–2020.

Part 1										
Year (years)	−1.60579	−1.43676	−1.26773	−1.09870	−0.92967	−0.76064	−0.59161	−0.42258	−0.25355	−0.08452
Total population (10,000)	−0.17236	0.03512	0.06624	−1.09563	−0.92135	−0.73359	−0.50847	−0.14850	0.01644	1.75406
GDP per capita (yuan)	−1.00215	−1.03511	−0.99212	−0.93714	−0.99025	−0.92923	−0.81829	−0.67884	−0.56568	−0.41747
Primary industry output (billion yuan)	−1.30408	−1.23788	−1.20637	−1.14056	−1.07800	−1.00039	−0.78262	−0.51568	−0.36276	−0.17390
Secondary industry output value (billion yuan)	−1.06579	−1.01755	−0.96494	−0.90101	−1.09907	−1.04046	−0.93132	−0.80696	−0.67084	−0.42226
Tertiary industry output value (billion yuan)	−0.97658	−0.93993	−0.90423	−0.86391	−0.81988	−0.76319	−0.69445	−0.58787	−0.51150	−0.41129
Fiscal revenue (billion yuan)	−0.89939	−0.93420	−0.92183	−0.91826	−0.94762	−0.93063	−0.88073	−0.80797	−0.73143	−0.62156
Retail sales of social consumer goods (billionyuan)	−1.05904	−1.02133	−1.00246	−0.95441	−0.98558	−0.91969	−0.82733	−0.66175	−0.53142	−0.40983
Disposable income per urban resident (yuan)	−1.04399	−1.01762	−0.99125	−0.98650	−0.99705	−0.82552	−0.79714	−0.57825	−0.53721	−0.38910
Per capita consumption expenditure of urban residents (yuan)	−0.94440	−0.90897	−0.87354	−0.78851	−0.71850	−0.63006	−0.75294	−0.68023	−0.56459	−0.36576
Investment in fixed assets (billion yuan)	−0.96647	−0.95797	−0.94324	−0.93243	−0.92447	−0.89402	−0.83756	−0.76278	−0.62978	−0.47643
Number of people in employment (10,000)	1.00450	0.29774	0.43113	0.68397	0.78351	−0.22388	−1.59560	−1.96391	−1.79270	−1.38855
Wastewater treatment rate (%)	−1.17862	−1.05525	−0.93187	−0.93187	−0.80849	−0.80849	−0.80849	−0.80849	−0.68511	−0.56174
Rate of days with good air quality(%)	−0.90803	−0.83804	−0.76805	−0.69806	−0.62807	−0.55807	−0.55807	−0.41809	−0.55807	−0.55807
Development of high technology industries (billion yuan)	−0.74381	−0.73336	−0.72291	−0.71245	−0.70200	−0.69155	−0.42963	−0.69155	−0.69155	−0.61640
Statutory high−tech enterprises (billion yuan)	−0.68308	−0.67316	−0.66325	−0.65333	−0.64342	−0.63350	−0.38503	−0.63350	−0.63350	−0.68367
Corporate loss surface	−0.76321	−0.72647	−0.68974	−0.65300	−0.61626	−0.57952	−0.39584	−0.39584	2.80027	−0.39584
Total asset contribution margin (%)	−0.39186	−0.38222	−0.37258	−0.36294	−0.35331	−0.34367	−0.33403	−0.32439	−0.31475	−0.30511
Gearing ratio (%)	−0.10113	−0.08994	−0.07876	−0.06757	−0.05638	−0.04520	−0.03401	−0.02282	−0.01163	−0.00045
Turnover rate of movable assets (times/year)	−0.64213	−0.51769	−0.39324	−0.26880	−0.14436	−0.01991	0.10453	0.22898	0.35342	0.47787
Cost margin (%)	−0.83355	−0.83355	−0.83355	−0.83355	−0.83355	−0.83355	−0.75106	−0.66857	−0.58608	−0.50359
Part 2										
Year (years)	0.08452	0.25355	0.42258	0.59161	0.76064	0.92967	1.09870	1.26773	1.43676	1.60579
Total population (10,000)	1.61609	1.67003	1.43662	1.17105	−0.41200	−0.08418	−0.53441	−0.61014	−1.03754	−1.50747
GDP per capita (yuan)	−0.13911	0.06456	0.25667	0.46000	0.65930	0.83580	1.12222	1.34686	1.97094	1.78905
Primary industry output (billion yuan)	0.09598	0.31494	0.52313	0.74415	0.79174	1.02701	1.08244	1.20146	1.43769	1.58371
Secondary industry output value (billion yuan)	−0.00626	0.24202	0.49014	0.70363	0.82334	0.96235	1.33813	1.54199	1.62721	1.19764
Tertiary industry output value (billion yuan)	−0.25786	−0.09461	0.02880	0.20069	0.41753	0.62427	0.86775	1.13524	2.33624	2.21476
Fiscal revenue (billion yuan)	−0.27075	−0.01011	0.30841	0.64852	0.97941	1.22055	1.36838	1.61602	1.72317	1.01002
Retail sales of social consumer goods (billionyuan)	−0.22656	−0.03846	0.31153	0.50815	0.74810	1.01721	1.30567	1.61960	1.95642	1.17118
Disposable income per urban resident (yuan)	−0.19869	−0.14626	0.03265	0.49913	0.73691	0.97785	1.22122	1.49729	1.84752	1.69603
Per capita consumption expenditure of urban residents (yuan)	−0.20859	−0.05567	0.12729	0.14287	0.35730	0.56520	0.79875	1.08163	1.37243	3.04629
Investment in fixed assets (billion yuan)	−0.31649	−0.06736	0.22206	0.49604	0.77384	1.09899	1.34412	1.60556	1.91422	1.25414
Number of people in employment (10,000)	−0.61210	−0.17609	0.81736	1.15382	1.05627	0.98260	0.69592	0.04689	0.05286	−0.25374
Wastewater treatment rate (%)	−0.31498	−0.05712	0.53262	0.72139	0.83243	0.98048	1.14087	1.56035	1.59736	1.58503
Rate of days with good air quality(%)	−0.48808	−0.48808	−0.55807	−0.37120	0.49179	0.83475	1.58365	1.67464	1.63965	2.17158
Development of high technology industries (billion yuan)	−0.49746	−0.30609	−0.21474	−0.03696	0.45480	0.53914	0.83482	1.18987	2.42213	2.34970
Statutory high−tech enterprises (billion yuan)	−0.47645	−0.43520	−0.34349	−0.26893	0.44823	0.53281	0.81320	1.14972	2.61774	2.24781
Corporate loss surface	−0.39584	−0.34073	−0.02847	−0.02847	−0.02847	0.33890	0.33890	−0.57952	0.52258	2.61659
Total asset contribution margin (%)	−0.21547	−0.14125	−0.42174	−0.14222	−0.42656	2.91131	−0.42174	−0.14222	−0.42656	2.91131
Gearing ratio (%)	1.27153	0.96277	0.39558	0.27699	0.17855	−3.95175	0.39558	0.27699	0.17855	0.52311
Turnover rate of movable assets (times/year)	0.47787	3.83786	0.15431	−0.48035	−0.50524	−0.91591	0.15431	−0.48035	−0.50524	−0.91591
Cost margin (%)	−0.33037	−0.04166	0.09857	2.31752	0.68424	0.84097	0.09857	2.31752	0.68424	0.84097

Table 2. Indicator characteristics and contribution rates.

Ingredients	Initial Eigenvalue			Extraction of sum of squares of loads		
	Total	Percentage variance	Cumulative %	Total	Percentage variance	Cumulative %
1	14.373	68.445	68.445	14.373	68.445	68.445
2	2.103	10.013	78.458	2.103	10.013	78.458
3	1.578	7.516	85.974	1.578	7.516	85.974
4	1.201	5.721	91.695	1.201	5.721	91.695
5	0.52	2.474	94.169			
6	0.512	2.44	96.609			
7	0.313	1.489	98.098			
8	0.231	1.099	99.197			
9	0.102	0.485	99.682			
10	0.041	0.194	99.876			
11	0.012	0.059	99.935			
12	0.006	0.029	99.964			
13	0.003	0.015	99.979			
14	0.002	0.011	99.99			
15	0.001	0.004	99.994			
16	0.001	0.003	99.997			
17	0	0.002	99.999			
18	0	0.001	100			
19	0.0000484	0	100			
20	−9.86E−18	−4.69E−17	100			
21	−2.74E−16	−1.31E−15	100			

Table 3. Loadings of the factors on the original indicators.

Factors	Principal Components			
	1	2	3	4
Disposable income per urban resident (yuan)	0.995	0.053	−0.015	−0.007
GDP per capita (yuan)	0.993	0.095	0.001	−0.014
Wastewater treatment rate （%）	0.986	0.084	−0.111	0.008
Investment in fixed assets (billion yuan)	0.983	0.072	−0.121	−0.017
Retail sales of consumer goods (billion yuan)	0.979	0.116	−0.1	−0.011
Tertiary industry output value (billion yuan)	0.977	0.004	0.128	−0.083
Secondary industry output value (billion yuan)	0.966	0.193	−0.146	0.031
Fiscal revenue (billion yuan)	0.965	0.089	−0.208	0.005
Primary industry output (billion yuan)	0.961	0.212	−0.004	0.144
Year (years)	0.953	0.21	0.064	0.124
Development of high technology industries (billion yuan)	0.952	−0.112	0.129	−0.178
Rate of good air quality days (%)	0.944	−0.15	0.12	−0.137
Per capita consumption expenditure of urban residents (yuan)	0.942	−0.049	0.2	−0.01
Statutory high−tech enterprises (billion yuan)	0.928	−0.154	0.149	−0.219
Cost margin (%)	0.795	0.158	−0.324	0.096
Turnover rate of movable assets (times/year)	−0.224	0.763	0.203	0.213
Total population (10,000)	−0.245	0.74	−0.201	0.492
Gearing ratio (%)	−0.091	0.642	0.285	−0.601
Number of people in employment (10,000)	0.234	−0.211	−0.795	−0.12
Enterprise loss surface (%)	0.483	−0.148	0.661	0.229
Total assets contribution (%)	0.515	−0.487	0.161	0.577

The composite score of the principal components of the evaluation system of the Jingzhou industrial development was calculated and ranked (Table 4). The development of the Jingzhou industry continued by year. The turnover rate of the Jingzhou industry's movable assets accounted for the impact of the three main components. In Jingzhou, industrial development strengthened industrial assets, reduced the industrial debt and loss rate, and further adjusted the development pattern of the Jingzhou industry.

4.2. Spatial Aggregation of Industries

The overall evaluation of the industrial spatial aggregation degree of the 49 industrial enterprises in the Jingzhou High-tech Zone in 2020 was conducted by using Eq. (7). In using the equation, η was the industrial spatial aggregation degree, c was the

number of enterprises of a certain industry, s was the actual area of the industry, O is the total output value of a certain industry, Emax=max (the number of 49 regulated enterprises/total actual area of the high-tech zone), Gmax=max (total output value of 49 regulated enterprises/total actual area of the high-tech zone), and the total area of the high-tech zone = total actual area of 49 enterprises in the Jianzhou High-techzone..

Table 4. Jingzhou industrial development evaluation principal component scores and ranking.

Year	Y1	Y2	Y3	Y4	Overall score Y	Ranking
2020	46.69	18.29	2.73	1.21	34.06	1
2019	43.57	17.09	0.4	−0.94	31.51	2
2018	35.9	13.48	−0.98	1.03	25.91	3
2017	31.61	10.25	−0.27	−0.67	22.6	4
2016	28.99	9.68	−1.52	4.19	20.94	5
2015	22.62	6.26	−1.08	−0.14	16.02	6
2014	20.47	4.28	−1.91	2.33	14.43	7
2013	13.65	1	−1	0.46	9.39	8
2012	7.22	−1.28	0.35	1.01	4.9	9
2011	1.19	−3.03	0.26	−0.09	0.53	10
2010	−6.44	−5.12	0.54	0.56	−4.85	11
2009	−11.15	−4.95	2.79	0.59	−7.88	12
2008	−15.7	−6.73	1.28	−0.49	−11.35	13
2007	−22.61	−7.28	1.16	−0.92	−16.17	14
2006	−28.31	−7.89	0.21	−1.27	−20.23	15
2005	−30.41	−8.22	−0.46	−1.51	−21.76	16
2004	−31.98	−8.29	−0.46	−1.63	−22.85	17
2003	−33.89	−8.87	−0.55	−1.13	−24.19	18
2002	−34.86	−9.25	−0.51	−1.18	−24.89	19
2001	−36.57	−9.41	−0.98	−1.41	−26.12	20

Table 5. Evaluation results of the overall spatial aggregation of 49 industrial enterprises on the gauge in Jingzhou High-tech Zone in 2020.

Type of business	Industry Type	Number of companies	Industrial space aggregation degree
Retail	Retail	8	1091.270877
Wholesale industry	Wholesale industry	6	291.1976546
Textile industry	Textile industry	4	1008.792904
Professional Equipment Manufacturing	Professional Equipment Manufacturing	9	1958.949722
General Equipment Manufacturing	General Equipment Manufacturing	8	296.2082179
	Non-metallic minerals manufacturing	1	
	Chemical raw materials and chemical products manufacturing	1	
	Construction Manufacturing	1	
	Metal products industry	1	
	Other Manufacturing	1	
	Automotive Manufacturing	1	
High-tech manufacturing	Research and Experimental Development	1	243.54784441359
	Pharmaceutical Manufacturing	1	
	Non-ferrous metal smelting and rolling processing industry	1	
	Manufacturing	1	
	Ecological protection and environmental management industry	1	
	Road transport industry	1	

According to "Jingzhou District Yuan-December National Economic Operation Overview", the enterprise output value in December and CAD land use planning map were used (Fig. 1). 49 enterprises in the industry of retail, wholesale, textile, professional equipment manufacturing, general e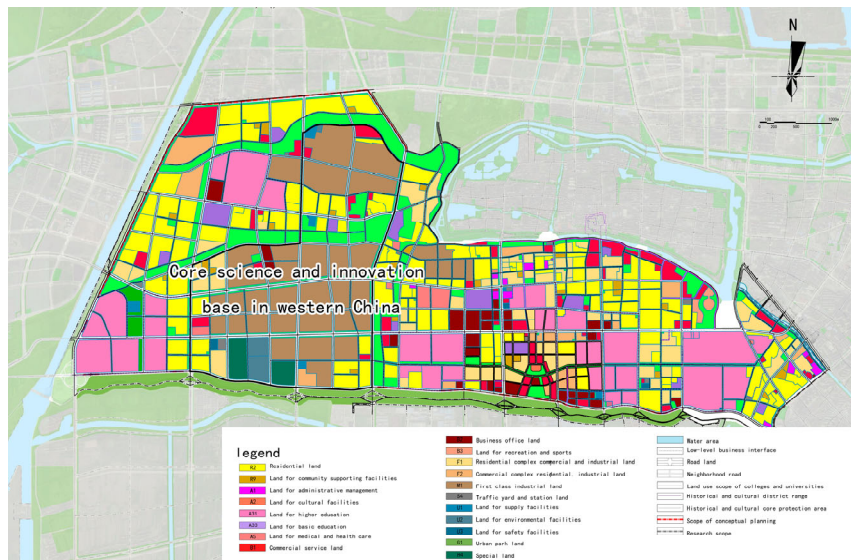quipment manufacturing, and high-tech manufacturing were selected for the classification of the industrial enterprise (Fig. 2). The area and the output income of the industrial enterprises were also obtained. The industrial spatial aggregation degree of the 49 enterprises was calculated according to the proposed model. The evaluation results of the overall spatial aggregation degree are shown in Table 5.

The largest output value of machinery manufacturing in the entire Chengnan High-tech Park industrial was 2,483.39 million yuan in one month, of which the total output value of the sub-town office output value was the highest. In 2020, the Chengnan High-tech Zone showed a total industrial output value of 24.83 billion yuan with an increase of 24.80% in the same month of the previous year. In 2020, Jingzhou City had an industrial added value of 20.733 billion yuan and tax revenue of 11.120 billion yuan. The revenue of the south of the economic development zone increased to 238.97 million yuan. 121.01 million yuan in the south of the high-tech zone accounted for 50.8% with an increase of 43.9% compared to that of the previous year. The contribution to the increase in the city's revenue increased. The industry including retail, wholesale, textile, professional equipment manufacturing, general equipment manufacturing, and high-tech manufacturing reached a mature level.

Fig. 1. Site Plan.
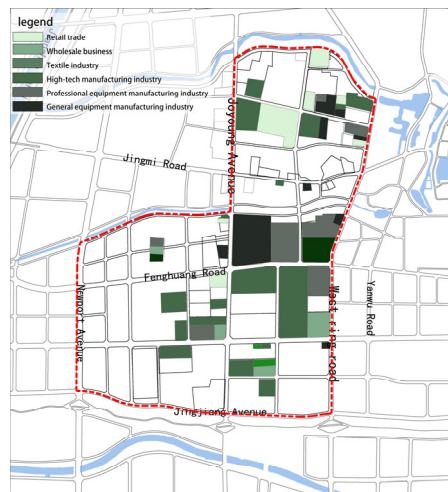
Fig. 2. Industrial Enterprise Type Chart.

The overall spatial aggregation of the 49 enterprises was observed in the high level of the equipment manufacturing industry which gathered in the Jingzhou High-tech Zone. Two main industries of the manufacturing industry included petroleum machinery and construction machinery. These industries need to be transformed to the modernization of machinery manufacturing with high technology. For the 49 enterprises, the highest output in 2020 was created by the petroleum machinery factory with a revenue of 2.3 billion yuan. The second highest output was 2.0 billion yuan of the Hubei Jianghan Construction Engineering Machinery Company. The lower output value was recorded by Jingzhou Shunhui Auto Parts Company Limited as 282.65 million yuan. In terms of enterprise output and industrial space aggregation, Hubei Jianghan Construction Engineering Machinery Co. has the highest value

of 1,420,700 yuan/m². The second highest value was created by the fourth petroleum machinery factory with 463,140 yuan/ m². The machinery industry created high output values so its related industries need to develop at a later stage.

5. Discussion and Conclusions

It was found that the industrial development in Jingzhou continued every year. When Jingzhou developed its industry, the turnover of industrial moving assets increased to alleviate the industrial debt and loss rates. The structure of Jingzhou's three industries was adjusted to change the mode of industrial economic development, further upgrade the industrial structure, and increase fixed investment in the secondary industry and industrial employment. Science and technology strengthened the industry, introduced more high-tech enterprises, and increased the rate of industrial sewage treatment.

In the late industrial development of Chengnan High-tech Zone, the Chengnan Economic Development Zone contained mainly professional equipment manufacturing and general equipment manufacturing.   In addition to technological research, brand creation, marketing services, and other development are required for further aggregation of bigger and stronger machinery manufacturing and integration of the equipment machinery manufacturing industry chain to have the leading industry. Then, the development level and tax benefits of the advantageous industries can be significantly enhanced. Inefficient industries in the north need to be integrated and gradually dismantled. The equipment and machinery manufacturing industry in the lower and middle parts needs to be expanded and strengthened to form an industrial chain. The electronic information industry must be introduced in the middle part for new growth. Combined with the latest 14th Five-Year Plan, new energy and material industry and other high-tech industries must be the focus of national development. Through investment projects, integrated electronic information and other high-tech enterprises need to be introduced into the development zone for enhancing the technical level and competitiveness of the development zone. In addition, the industry needs to be diversified including services, processing trade industry, petroleum machinery, textile and linen, and biomedical industries, and it is necessary to combine the humanistic characteristics of Jingzhou and the advantages of the development of universities for an environment of excellent vitality and creative intelligence area. Finally, the following is suggested to develop the High-tech Zones.

(1) Having an information leading point: industry cluster, the extreme core place of electronic information, the development of the electronic information industry in the north of Xueyuan Road and Xingang Avenue
(2) Equipment machinery venture valley: innovative thinking and research and development to promote the development
(3) Emphasis on green ecology, accumulation of human resources for research and development, and the development of equipment machinery and petroleum machinery industry in the south of South Harbor Road and Newport Avenue related to promoting the process of innovative machinery.
(4) Vigorous creative zone: service development and educating industrial talents

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