Research on Development Strategy of Manufacturing Industry in Pearl River Delta Based on SWOT-AHP Model

Dan Bai [a], and Pengbo Liu[b,*]

School of Liaoning, Dalian University, Dalian 116622, China

[a]Baidan@dlu.edu.cn, [b] 714775303@qq.com

*The corresponding author

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Abstract: The manufacturing industry is the pillar industry of the national economy, and the Pearl River Delta region, as an important manufacturing base of China, promotes the sustainable development of the local economy. However, in recent years, the Pearl River Delta manufacturing industry has encountered great difficulties. Based on the analysis of the Pearl River Delta manufacturing industry and its environmental development status, the SWOT-AHP model is used to study the development strategy of the Pearl River Delta manufacturing industry by combining qualitative analysis and quantitative analysis. It is found that the most important factors affecting the development of the manufacturing industry in the Pearl River Delta are the Guangdong-Hong Kong-Macao Greater Bay Area， he superior geographical environment and the international environmental impact; the lack of independent innovation capacity, the rising labor force and other factors have a relatively small impact on the development of the Pearl River Delta manufacturing industry. Using the strategic quadrilateral to judge the analysis results, it is found that adopting the SO strategy is more conducive to the development of the manufacturing industry in the Pearl River Delta.

1. Summary of Research

1.1 Summary of SWOT-AHP Model.

The SWOT analysis was proposed by Professor Andrews of Harvard University in the early 1980s. It enumerates the main internal advantages, disadvantages, external opportunities and threats closely related to the research object, and arranges them according to the matrix form. Then, using the ideas of system analysis, the various factors are matched and analyzed to obtain one. The corresponding conclusions of the series. However, in practical applications, SWOT analysis also has problems such as lack of quantitative analysis and lack of emphasis. Many scholars have also proposed improvements. KURRTILAA M et al. have combined AHP and SWOT [1]. J, xu combines TOPSIS and AHP into SWOT model, and proposes a quantitative SWOT analysis framework. [2]. Saurabh Pandya conceptualized the Lisa framework to improve understanding of SWOT analysis to improve its learning potential and effectiveness [3]. Mohamed Abdel Basset incorporates AHP into the SWOT model to help analyze the Starbucks Strategic Plan [4]. Marilyn M. Helms and Judy Nixon's application of SWOT analysis in the academic period from 1998 to 2008, found that SWOT analysis has been extended to countries and industries outside the company, but still need to link SWOT analysis with other strategic tools and methods for quantification Research [5].

AHP, the Analytic Hierarchy Process, was introduced in 1980 by Professor Sati of the University of Pittsburgh as a management tool for dealing with multi-objective problems [6]. He combines qualitative and quantitative methods and is an effective method for quantitative analysis of non-quantitative events. The analytic hierarchy process is mainly to decompose the total target layer to be evaluated into multiple indicators, and determine the weight of comparison between each layer of indicators by means of expert assessment and questionnaires. Consistency testing of the judgment matrix reduces the subjective interference factor and improves the accuracy, so it is widely applied to systemic problems that are not quantified and have complex objectives.

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In order to improve the accuracy and reliability of strategic choices, it is necessary to quantify the traditional analysis methods. The common and effective method is to use AHP to improve the SWOT analysis method.

1.2 Summary of Manufacturing Research in Pearl River Delta.

Manufacturing has played an important role in the development of the national economy, but academic research on its development strategy is less. Ilhan Dalci explored the impact of financial leverage on the profitability of China's 1,503 listed manufacturing companies and found that the impact of leverage on profitability is reversed in the U shape [7]. S.F. Lin, S.C. Cai and J. Sun analyzed the driving force of manufacturing transformation and upgrading by constructing PLS-SEM model and tested its impact path and effect [8]. B. Yu, C.L. Fan has used SWOT and PEST methods to construct a strategic analysis framework for China's advanced manufacturing development, and analyzed the evolution of four development strategies [9]. G.M. Xue analyzed the development strategy of Guangzhou's advanced manufacturing industry from the macro background and gave corresponding suggestions [10]. Z.M. Deng discussed the relationship between the high-skilled talents in the Pearl River Delta manufacturing industry and the manufacturing strong areas, and gave suggestions on the shortage of high-skilled talents [11]. W.S. Li used the marginal and elastic theory to analyze the synergy between regional economy and regional logistics in the Pearl River Delta region [12]. W.J. Yun, Y. Zhang and D.W. Wang in-depth analysis of the development status of manufacturing synergies in the 9 cities of the Pearl River Delta [13]. Looking at the research situation of the manufacturing industry in the Pearl River Delta, there is a lack of strategic research on the manufacturing industry in the Pearl River Delta. With the development of China's economy, the pace of transformation and upgrading of the manufacturing industry has been accelerating. As an important manufacturing base in China, the Pearl River Delta will face enormous opportunities and challenges. Therefore, it is very necessary to study the development strategy of the Pearl River Delta manufacturing industry.

2. Present Situation of Manufacturing Industry in the Pearl River Delta

In the 1990s, the Guangdong Provincial Government proposed the concept of the "Pearl River Delta Economic Zone." The Pearl River Delta region is located in the south-central part of Guangdong Province, bordering the South China Sea and adjacent to Hong Kong and Macao. The Pearl River Delta includes Guangzhou, Shenzhen, Foshan, Dongguan, Huizhou, Zhongshan, Zhuhai, Jiangmen and Zhaoqing. The land area is 4.17 square kilometers, accounting for 23.2% of the province.

The development of manufacturing in the Pearl River Delta region can be divided into four stages from the reform and opening up. The first stage was the initial development stage from 1978 to 1990. The Pearl River Delta region initially formed the daily consumer goods industry represented by light industrial products and the household appliances industry represented by refrigerators, color TVs and air conditioners. The second stage was the rapid development stage from 1991 to 1997, during which the industry led by electronic information and electrical machinery was developed. The third phase is the adjustment and development phase of 1998-2007. Affected by the Asian financial crisis, the Pearl River Delta began to develop heavy industries represented by equipment, petrochemicals and energy. The fourth stage is the transitional development stage from 2008 to the present. The occurrence of the international financial crisis has led to industrial transformation oriented to endogenous development.

At present, China's manufacturing industry ranks first in the world, and the rapid development of the manufacturing industry has supported Guangdong's economic scale to rank first in the country for many years [14]. Among them, the scale of the manufacturing industry in the Pearl River Delta is in a leading position in the country. The bottleneck in China's manufacturing industry is a consensus. In the Pearl River Delta region, these areas with strong traditional manufacturing strength have encountered great difficulties in recent years. In the past, industrial accumulation was realized at a low cost. Now, the outward transfer of manufacturing factories and the relocation to the interior have become the norm. The advantages of the elements of land, labor, and raw materials are gradually

disappearing. Second, there is also an imbalance in the development of the Pearl River Delta region. The investment stamina is still relatively backward, and increasing industrial investment is also an urgent problem to be solved in the Pearl River Delta region. In addition, the downward pressure on the economy has forced the industry to upgrade from the low end to the high end. The difficulties in production and operation of enterprises have gradually emerged, and efforts must be made in terms of product quality and economic benefits. In recent years, the proportion of manufacturing in the Pearl River Delta region has also declined, and the level of specialization is also lower than that in the Yangtze River Delta region [15]. It must be clearly recognized that the internal and external environment facing the Pearl River Delta region will help achieve better development of the manufacturing industry in the Pearl River Delta region.

3. SWOT Finalization Analysis of Manufacturing Industry in Pearl River Delta

3.1 Advantage Analysis.

Superior geographical position: Adjacent to Hong Kong, Macao and Taiwan, radiating Southeast Asia. The Pearl River Delta region is home to ports such as Shenzhen and Guangzhou, and the neighboring Hong Kong port makes the port throughput of the Pearl River Delta region among the highest in the world.

The Unique Advantage of Attracting Foreign Investment: The Pearl River Delta region is China's famous hometown of overseas Chinese and has a natural advantage in attracting foreign investment from Southeast Asia, Hong Kong, Macao and Taiwan. In the first half of 2017, 4,932 new foreign direct investment projects were established in the Pearl River Delta region, a year-on-year increase of 41.7%; the actual use of foreign investment was US$11.867 billion, an increase of 5.8%. The number of new projects in the Pearl River Delta region and the actual utilization of foreign investment in the province accounted for 94.1% and 96.4% of the province [16].

3.2 Disadvantage Analysis.

Labor shortage: According to statistics, in 2014, the employment gap in the 9 cities of the Pearl River Delta was as high as 2 million, mainly concentrated in the traditional labor-intensive areas, with a large gap in manufacturing in Guangzhou, Shenzhen, Dongguan and Foshan. The Pearl River Delta region is in a state of oversupply of labor and has a long-term trend.

Rising cost: In recent years, the cost pressure of manufacturing has increased a lot. The previous labor cost advantage has gradually become a disadvantage that hinders its development. The continuous rise in labor costs and land costs, coupled with rising raw material prices, has led to a “hollowing” risk in the Pearl River Delta industry, and some industries have begun to develop outward.

Insufficient Independent Innovation Ability: The capacity for independent development in the Pearl River Delta region is not strong enough and key technologies are missing. The development of equipment manufacturing industry is lagging behind, especially the “working machine” such as general equipment and special equipment is weak.

Financing difficulties: SMEs have difficulty financing, especially in terms of fixed-asset loans, and corporate financing rates and fees are too high.

3.3 Opportunity Analysis.

The Belt and Road: There is still much room for improvement in infrastructure construction in most countries along the Belt and Road. The production, trade and service directions of the Pearl River Delta need to be adjusted to develop in the “One Belt, One Road” emerging countries, which will be very beneficial to the Pearl River Delta region. The manufacturing industry went out [17].

Policy support: The “Government Work Report” issued by the Guangdong Provincial Government in January 2019 emphasizes that the focus of development economics is on the real economy dominated by manufacturing, and efforts are made to “consolidate, enhance, enhance, and smooth” and accelerate improvement. Supply, promote industrial transformation and upgrading [18].

In order to promote the development of the manufacturing industry, the governments of the cities in the Pearl River Delta have introduced many policies. For example, Guangzhou City issued the “Guangzhou Development Zone in Guangzhou Huangpu District to promote the development of advanced manufacturing methods”. The project settlement award, enterprise contribution award, senior management talent award, transformation and upgrading award, industrial linkage development award, capital support and key project support were clarified. In 2017, the Dongguan Municipal People's Government issued the “Opinions of the Dongguan Municipal People's Government on Implementing the Scale and Benefit Multiplication Plan for Key Enterprises – Comprehensively Enhancing the Level of Industrial Intensive Development”, and at least doubled the income of the main business of pilot enterprises within the agreed period of time.

GBA: In February 2019, the " The development plan for Guangdong-Hong Kong-Macao Greater Bay Area" was issued. Comprehensive planning has been made on the strategic positioning, development goals and spatial layout of Guangdong, Hong Kong and Macau. The "Outline" pointed out that the key point is to accelerate the development of advanced manufacturing industries and improve the ecological system for innovation and development of the manufacturing industry in the Pearl River Delta. We will build an advanced manufacturing industry in the west bank of the Pearl River with Zhuhai and Foshan as the core, and a world-class advanced manufacturing industry cluster such as the East Bank electronic information of Shenzhen and Dongguan. It has the advantages of strong innovation and R&D capabilities in Hong Kong, Macao, Guangzhou and Shenzhen, dense operation headquarters and complete industrial chain in Zhuhai, Foshan Huizhou, Dongguan, Zhongshan, Jiangmen and Zhaoqing. Accelerate the structural adjustment of the manufacturing industry, promote the green transformation and upgrading of the manufacturing industry, focus on promoting the green transformation of traditional manufacturing, create a green supply chain, and vigorously develop the remanufacturing industry [19].

3.4 Threat Analysis.

International Environmental Impact: The occurrence of the US financial crisis has increased the uncertainty of world economic development and increased the risk of manufacturing enterprises. The appreciation of the renminbi has led to a local manufacturing industry, especially an export-oriented manufacturing industry, where costs continue to increase and profits continue to decrease. Manufacturing investment has changed, with about one-third of manufacturers planning to shift production capacity to Southeast Asia, where labor costs are lower.

Weak economic radiation capacity: Unlike the Yangtze River golden waterway in the Yangtze River Delta region, the Pearl River Delta region is weakened by the north ridge and has weak radiation capability to neighboring regions.

4. Establishment and Analysis of SWOT-AHP Model

4.1 Establishing Strategic Hierarchical Structure Model of Manufacturing Industry Development in Pearl River Delta.

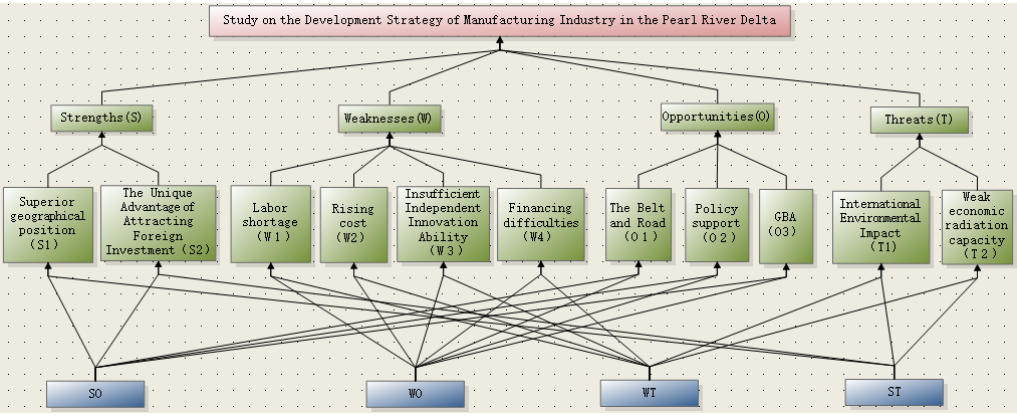

Figure. 1 Hierarchical Structure Model of Manufacturing Development Strategy in Pearl River Delta

Using the SWOT analysis of the results of the manufacturing industry in the Pearl River Delta region, the hierarchical structure of Fig. 1 is constructed and divided into the target layer, the criterion layer and the program layer[20].

4.2 Applying AHP Method to Determine the Weight of SWOT Analysis Factor of Manufacturing Industry in Pearl River Delta.

Based on the results of the above analysis, a panel of 6 experts is selected and assigned according to the 1-9 scale method of the Analytic Hierarchy Process and a judgment matrix is established. Using Yaahp analytic hierarchy software, the weights of various factors were calculated and the consistency test was performed. Among them, the test coefficient CR = CI / RI, when CR < 0.1, the consistency test passed. When CR ≥ 0.1, the consistency test does not pass. Among them, CI = (λ max-n) / (n-1), the calculation results are shown in the following table 1[21].

Table 1 Value assignment and consistency test results of each judgment matrix

	S	W	O	T	weight
S	1	3	0.3333	2	0.2262
W	0.3333	1	0.2000	0.3333	0.0734
O	3	5	1	5	0.5597
T	0.5000	3	0.2000	1	0.1407
Consistency test CR=0.0490<0.1					
S	S1	S2			weight
S1	1	3			0.7500
S2	0.3333	1			0.2500
Consistency test CR=0.0000<0.1					
W	W1	W2	W3	W4	weight
W1	1	0.3333	0.3333	0.1429	0.0647
W2	3	1	0.5000	0.2000	0.1349
W3	3	2	1	0.3333	0.2168
W4	7	5	3	1	0.5836
Consistency test CR=0.0273<0.1					
O	O1	O2	O3		weight
O1	1	3	4		0.6144
O2	0.3333	1	3		0.2684
O3	0.2500	0.3333	1		0.1172
Consistency test CR=0.0707<0.1					
T	T1	T2			weight
T1	1	4			0.8000
T2	0.2500	1			0.2000
Consistency test CR=0.0000<0.1					

From the above test results, it can be seen that all the judgment matrices have passed the consistency test, which proves that the calculation results are reliable.

Hierarchical Total Sorting. Table 2 General ranking of factors influencing the development of manufacturing industry in the Pearl River Delta

Table 2 General ranking of factors influencing the development of manufacturing industry in the Pearl River Delta

	First level index	Relative weight	Two level index	Relative weight	Comprehens-ive weight	Ranking
Development Strategy of Manufacturin-g Industry in Pearl River Delta	Strength	0.2262	S1	0.7500	0.1697	2
			S2	0.2500	0.0566	6
	Weaknesses	0.0734	W1	0.0647	0.0047	11
			W2	0.1349	0.0099	10
			W3	0.2168	0.0159	9
			W4	0.5836	0.0428	7
	Opportunities	0.5597	O1	0.1025	0.0574	5
			O2	0.2158	0.1208	3
			O3	0.6817	0.3815	1
	Threats	0.1407	T1	0.8000	0.1126	4
			T2	0.2000	0.0281	8

According to Table 2, the main advantages and disadvantages of the Pearl River Delta manufacturing development and the main opportunities and threats are S1(0.1697),W4(0.0428),O3(0.3815)and T1(0.1126).The quadrilateral of the Pearl River Delta manufacturing development strategy is thus constructed as shown in Fig. 2 below.

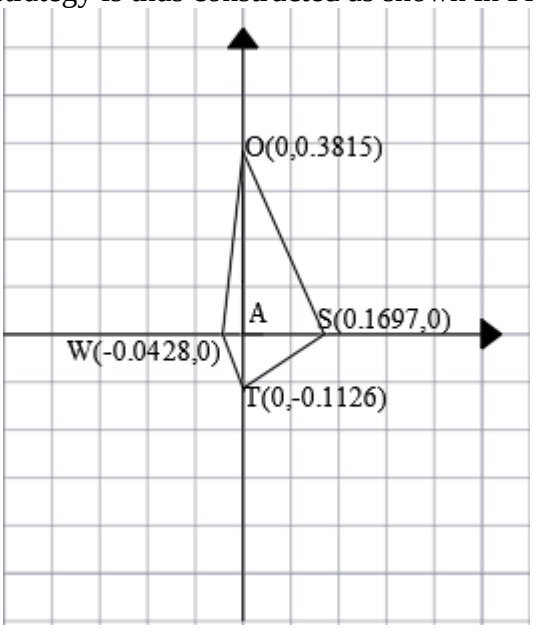

Figure. 2 Strategic Type Map

Calculate the triangle area of each quadrant according to Figure 2: S△SAO=0.0323,S△WAO=0.0082,S△WAT=0.0024,S△SAT=0.0096.

The size of the above triangle area is as follows: S△SAO > S△SAT > S△WAO > S△WAT. Therefore, the order of strategic choices is SO strategy, ST strategy, WO strategy, and WT strategy. The manufacturing industry in the Pearl River Delta should focus on the SO strategy. Give full play to its own advantages and external opportunities to achieve better development of the manufacturing industry in the Pearl River Delta region.

5. Conclusion

Through the SWOT-AHP analysis of the manufacturing industry in the Pearl River Delta region, the strategic focus of the manufacturing industry in the Pearl River Delta was discovered. That is to say, in the process of developing the manufacturing industry, the SO strategy is mainly adopted, and at the same time, the ST-type strategy should be emphasized. Seize the opportunities provided by the external environment and combine its own advantages to face the threats. This paper mainly proposes the development of manufacturing industry in the Pearl River Delta around SO strategy and ST strategy.

(1) Grasp the opportunities for government policy support and accelerate the development of advanced manufacturing.

We will conscientiously implement the "Made in China 2025" and "The development plan for Guangdong-Hong Kong-Macao Greater Bay Area" to build an advanced manufacturing base. Promote the transformation and upgrading of traditional manufacturing industries and vigorously develop the remanufacturing industry.

(2) Give full play to geographical advantages and further improve infrastructure construction.

The Pearl River Delta region has a good geographical advantage, but its infrastructure needs to be improved. Accelerate infrastructure construction, enhance the international competitiveness of the Pearl River Delta port group, unblock the external comprehensive transportation corridor, build a world-class airport group, and build a rapid transportation network.

(3) Give play to comparative advantages and emphasize development priorities.

Accelerate the rapid development of a new generation of information technology, biotechnology,

high-end equipment manufacturing, new materials and other fields, create a group of emerging industrial clusters with international competitive competitiveness, and enhance the vitality of economic development.

(4) Implement brand strategy based on its own advantages.

The brand building of the manufacturing industry in the Pearl River Delta region can not keep up with the development speed of enterprises, which seriously restricts the further development of enterprises [8]. Only by scientifically planning the brand strategy and improving the brand competitiveness can we achieve better economic benefits.

(5) Building a highland of talents and fully stimulating the vitality of talents.

Learn from the experience of attracting high-end international talents to create a more attractive introduction environment. Improve the cultivation of talents and strengthen the international exchange and cooperation of talents. Promote cooperation among universities and jointly build distinctive disciplines and research and development centers.

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