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Cluster's Competitiveness of Photoelectron Industry of Optics Valley of Wuhan Based on the GEM Model

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Abstract: Wuhan East Lake High-tech Zone was called Optics Valley of Wuhan ratified by the Ministry of Science and Technology of China in 2001, which became a national photoelectron industry base now. As time goes by, Optics Valley of Wuhan photoelectron industry cluster become more and more powerful, and it has become a major form of regional economy in gaining competitive advantages. This paper establishes a GEM model of optics Valley photoelectron industry Cluster, and creates its competitiveness evaluation system. At the same time, not only do we measure the cluster's competitiveness by distributing questionnaires, but also preliminary analyze and evaluate the measurement results.

Keywords: Cluster's Competitiveness; Photoelectron Industry; the GEM Model; Optics Valley of Wuhan

1. INTRODUCTION

Photoelectron refers to the frequency ranges from 3×1011Hz to 1016Hz or wavelengths between 1mm to 10nm's electromagnetic spectrum, including infrared, visible light, ultraviolet radiation and soft X-ray. Photonics industry is a general term of researching, developing, producing and selling various type optoelectronics products' supply- demand and economic benefit behavior by using principles and techniques of optoelectronics, With the rapid development of photonics technology, the concept of photonics industry has continuously been enriching. In the aspect of extension, this entire industry covers information photoelectron, energy photoelectron, consumer photoelectron, military photoelectron, software and network etc's application fields.

Optics Valley of Wuhan, which was called Silicon Valley of China, is the first national optoelectronic industry base in china and the most densely areas of China's production of optoelectronic products, especially in optical fiber and cable, optoelectronic devices, laser equipment, software, etc aspects. For example, there are over 12,000 enterprises have Settled and about 8,000 enterprises are active: such as FiberHome, Yangtze Optical Fibre and Cable Company Ltd.(YOFC), Huagong laser engineering, Chutian Industrial Laser Equipment Co. Ltd, etc 21 listed companies which listed on the domestic and international capital markets; Tencent Wi-Fi, Lenovo and other famous companies also create a new site in Optics Valley, and will be put into use quickly. Now about 50% domestic market are controlled by Optics Valley optical fiber and cable's production scales; moreover, laser products own 40% domestic market shares.

Through forming a GEM model, researching and analyzing the pros and cons of photoelectron industry cluster environment factors, this thesis provides some advices aiming at these disadvantages, hoping to give some references for government to optimize environment of Wuhan photoelectron industry cluster.

2. RESEARCH METHODS BASED ON THE GEM MODEL

2.1 questionnaire of photoelectron industry cluster of Optics Valley

This paper combines theoretical study (that is to evaluate Photoelectron Industry cluster environment

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according to the perspective of GEM model) with empirical research (we issued nearly 400 copies of questionnaires to survey) to analyze Wuhan Photoelectron industrial cluster's competitiveness.

First of all, according to GEM model's six factors we made a photoelectron industry cluster's questionnaire; then we relatively randomly survey all levels of people in cluster's enterprises. After perfecting the structures of questionnaire items, and clearing some manifest errors or question items which are difficult to understand, we put the final questionnaire as the formal one into official investigation; finally, by using Analytic Hierarchy Process (APH) to cope with questionnaires we got, we could judge matrix and do a consistency test calculation to get every layer's index weights, then when we put the result into GEM model's formula, the cluster linear score will be got. After that, we analyze various factors to ensure the main factors and secondary factors of influencing of cluster's competitiveness, which could help us to offer some relevant recommendations.

2.2 GEM model of Optics Valley

The Canadian scholar Tim Padmore and Hervey Gibson (1998) improved Michael Porter's "diamond model", and set up an industry cluster's competitiveness evaluation model-groundings-enterprises-markets (GEM model). GEM model involves three pairs, six determinants. (Figure 1.):

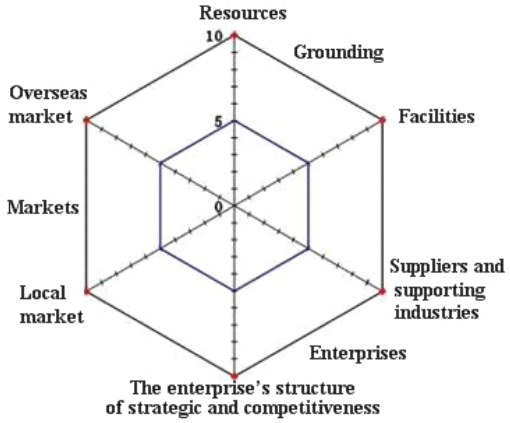

Figure 1. the GEM model's Cobweb Model.

In order to understand an enterprise cluster's competitiveness clearly, the biggest feature of the model is to deal with every factors in GEM model,

The specific process is divided into three steps: factors grade or evaluation, figure out pair scores, and calculate the total score of this industrial cluster's competitiveness.

3. EVALUATION STEPS OF PHOTOELECTRON INDUSTRY CLUSTER

According to the six factors of GEM model, we designed a Photoelectron Industry cluster study questionnaire. The content includes "affecting factors' significance rating", which aims to ensure the weight of what is the main factor that influences cluster's competitiveness, and "all kinds of impact factors' rating", which is to collect experts' evaluation of current status of various factors.

Collecting and counting questionnaires. The first part of statistical data, which mainly came from some professionals who has a deeply understanding for this cluster, could conclude the weight of various factors. The second part of statistical data, which were mainly collected from enterprises in this cluster, could obtain the factors' ratings companies gave. Through making survey and collecting statistics, we based on GEM model's six factors and Photoelectron Industry's characteristics put forward 28 items secondary indicators which strongly related to the cluster. There are specific scores shown in figure below (Figure 2.) Finally, use GEM model to

calculate. Take the data into the following equation (1). The GEM score of Wuhan Photoelectron Industry Cluster's Competitiveness is 412 points.

$$GEM = 2.5(\prod_{i=1,3}(D_{2i-1} + D_{2i}))^{2/3} \quad (1)$$

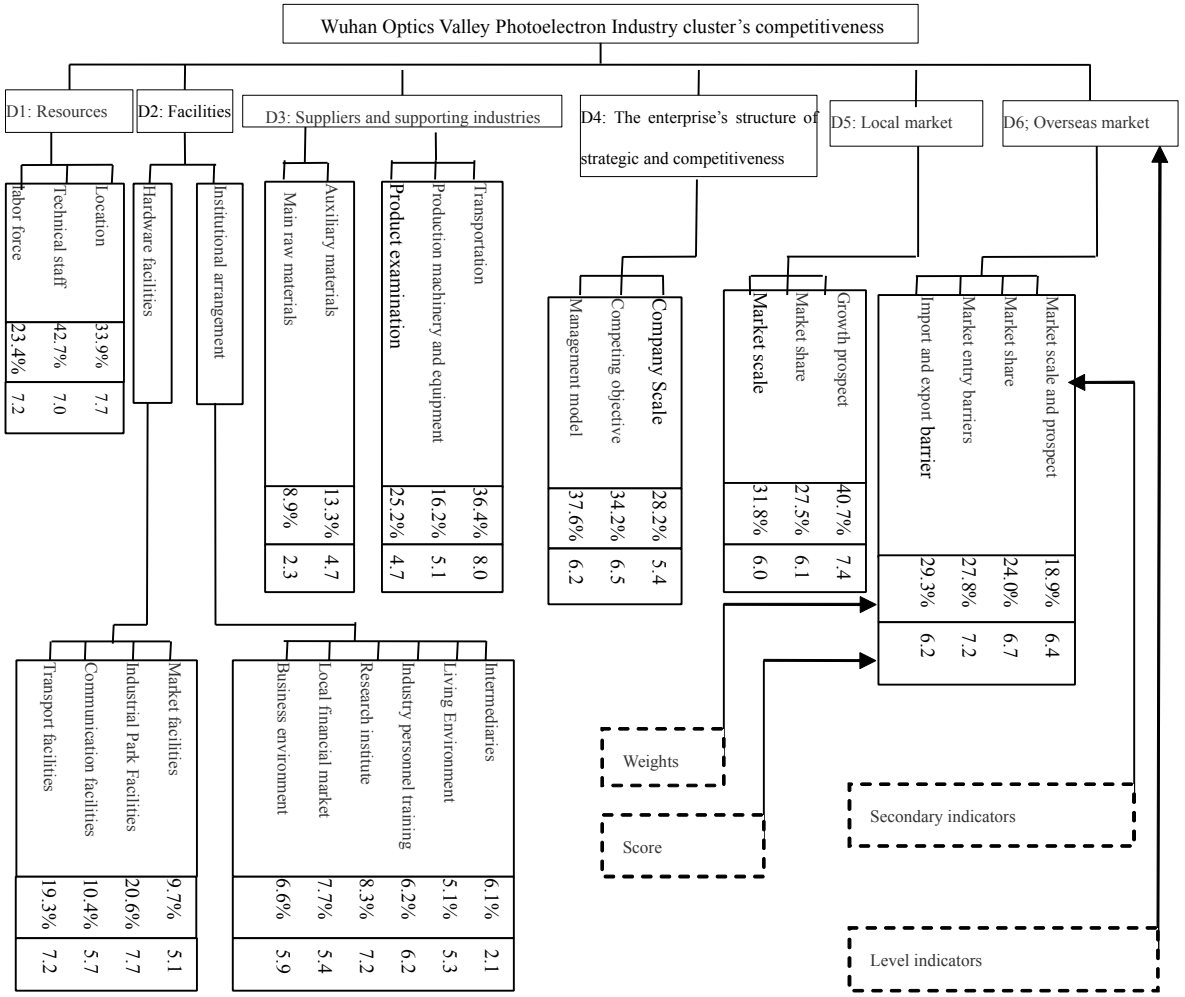

Figure 2. Optics Valley Photoelectron Industry Cluster's competitiveness GEM model's indicators, weights, and scorings

4. Evaluation and Recommendations

In summary, Wuhan photoelectron industry cluster's competitiveness's evaluation and recommendations are as follows:

- Resources: Optics Valley as a concentrated place of universities and high-tech areas is rich in professional and technical personnel. On the other hand, owing to Optical Valley's location, many workers are attracted all over the world, which may offer enough labor resources.
- Facilities: this cluster has a good performance in hardware facilities, for instance, Optics Valley possesses the most advanced domestic optoelectronic market, excellent facilities in Industrial Park, and convenient transportation and communication facilities. However, There is slight deficient in "software facilities" (institutional arrangements), for even though the demand are on the increase, the scarcity of facilities like intermediaries are still existing in Optics Valley. Besides, the local financial market is still in the middle

stage.

- Suppliers and supporting industries: Wuhan became the central city of central region authorized by the State Council in 2010. The word "central" not only means our government starts to concentrate on this city, but also means its geographical location that Wuhan is located in central China. So its transportation facilities are really convenient, so the cluster has strong competitive advantages in raw and auxiliary materials' origin as well as supporting finished goods.
- Whereas on supporting industries, especially in machinery, the cluster has some obvious defects: facilities' advanced levels rank a little lower in the world, which decrease the productivity.
- The enterprise's structure of strategic and competitiveness: as majority of the cluster enterprises are in smaller size, their competing goals exist consistency, which could lead to fierce competitions between enterprises in cluster. When it comes to management model, these high-tech enterprises have accepted more advanced ideas, especially for some companies formed by college students themselves may have more advantages. At the same time, long-term cooperative relations will be established, if they can enhance the relationship between each other, which could specialize and diversify the source of suppliers, which aims to promote common development of both sides. So that the whole cluster's competitiveness will have an obvious reinforce.
- Local market: for the past few years, domestic market of the photoelectron is expanding. Its market share has increased gradually, even market scale exceeds ten billion Yuan and the potential needs of civilian market are great in the long run. However, some of industries like optoelectronic materials, devices and machine in Optics Valley cluster is worse than other areas', such as Changchun and Guangdong. If Optics Valley cluster could enter an all-round development, it will be better to enhance the competitiveness of this cluster.
- Overseas market: with the moving of the world electronic information products manufacturing to China, the electronic materials market of China has gradually been paid attention to by other countries. Now, Chinese Mainland has become the world's third-largest GaN chip production base and the world's largest producing and exporting countries in full color LED display, the solar energy LED, etc applications. Also more than 95% photovoltaic cells are exported to Europe, America and Japan. Moreover, magnetic materials market owns about 26 billion Yuan. But according to China Electronics Materials Industry Association Copper Clad Laminate Materials Branch's (CCL) statistics, we can know that almost entirely China's slap-up electrolytic copper foil still depended on imports in 2007; and China still had to import about 70% of optical fiber performs mainly from Japan in 2008. In addition, China seldom set up production bases of world's important Electronic Materials enterprises, for domestic electronic materials skill level is relatively lower. That means although China's exports are great, we need to strengthen the independent innovation. We should not have been depending on imports, or the competitiveness of China's optoelectronics industry will no longer improve.

5. CONCLUSIONS

This essay, which theories are on the basis of technical economy, industrial economy, statistics, management science, etc, uses the method of GEM and questionnaire to study Wuhan photoelectron industry cluster's competitiveness. The conclusion we got is that the GEM score of this cluster's competitiveness is 412 points. And there are some advantages of Wuhan, such as the geographical location, Growth prospect. We point out that Wuhan government should take favorable measures in them to provide a better environment for some other related industries so that they could drive the development of whole financial market.

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