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A LOCATIONAL COMPARATIVE STUDY ON HIGH-TECH INDUSTRIAL ZONES IN CHINA

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ABSTRACT: There are three parts in this paper. Part I is involved in discussion of three essential soft factors acting at development of high-tech industry—location, network and comprehensive factors. It stresses the role of brains and practical capacity in high-tech development, clarifying the same importance of qualified personnel network as information network, elucidating both internal and external impetus. Part II deals with locational comparison among high-tech industrial zones in China, for which an Analysis of Hierarchy Process (AHP) method is used. Upon results, Chinese high-tech industrial zones are divided into four grades. The last part proposes four aspects as implementation measures for high-tech industrial zone in China.

KEY WORDS: high-tech industry, essential soft factor, AHP

Since the establishment of Beijing New-Tech Industrial Experiment Zone in 1988, the State Council ratified 26 other ones in March, 1991. That is an important policy set afoot to ameliorate traditional industry structure, to enhance our national power and to achieve National Second Strategic Goal by 2000. That also helps found technological and economic basis.

High-Tech Industrial Zone (HIZ) has a short history in the world and the development is unbalanced. It is a huge task for such a developing country to set up so many HIZ at the same time. Studies from different fields are indispensable for incorporation of foreign experiences and Chinese characteristics. This paper holds a micro-locational view.

I. ESSENTIAL SOFT FACTORS IN THE FORMING AND DEVELOPMENT OF HIZ

Disagreements exist among experts at home and abroad on the denotation of

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high-tech industry. Ratified by the State Council, the Science and Technology Committee defined it as: microtronics and electronic information technology, space science and aerospace technology, photoelectronics and mechanic and electronic integration technology, biological science and genetic engineering technology, materials science and new-materials technology, energy science and new-energy and energy-saving technology, ecology and environment protection, geoscience and oceanographic engineering, matter science and radiology, medicine and biomedicine engineering, and other new technology. This definition is accordance with current development of science and technology, reflecting both contents and development level of high-tech industry in China. On one hand it is combination of science and technology with their industrialization, on the other hand it stresses application of new crafts and techniques. It is not strange that such defined high-tech industry is certainly born out from particular regions with the best combination of some relevant factors. Below are three main factors which have played an important role in the forming, development and transformation of HIZ.

1. Location Factor

Attention has been paid to brain-concentrated groups when choosing location for HIZ [1] . However, general consideration can not avoid from drawing conclusions for its backing from such statistic data as number of colleges, universities, institutes and scientific and technical personnel, which, generally speaking, can only be regarded as a mark of regional culture quality and a basis of high-tech industrial socialization, most parts of which are not directly involved in high-tech activities. In fact, HIZ has its own inherent laws which always bind itself to the most prestigious technical schools and universities and institutes—cradles of high-tech industry [1] . Even so one should be cautious before considering two points: One is the tradition to translate scholastic attainments into substantial products. The other point is the benefit from achievements of scientific research. If the benefit is much less than that from high-tech industry, they will show little interest in the research, needless to say without assurance of their own development.

When analysing location of HIZ, personnel accustomed to research on application of new crafts and technology should be greatly stressed, because they account for development of HIZ. One example is the HIZ of Seattle in USA, which has chiefly relied on Boeing Airline Company. Another example is Caohejing HIZ of Shanghai in China, which benefits from microtronical and biological research and production basis.

So there are two levels of analysis of locational factor, one is general analysis of regional scientific and technological level and cultural quality, the other is concrete analysis of its backing groups on degree of connection, reality and possibility.

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2. Network Factor

High-tech is the fastest developed production force. Due to its sharply-advanced and internationalistional trend,it is also an adaptable soft system. Thus the first network that a HIZ requires is information network [1] . As it is the fastest means for high-tech researchers to collect information through international retrieve computer network, computer network has become a prerequisite of high-tech industry.

Secondly, a personnel network is required, which should be composed of researchers, organizers, directors, bankers, decision-makers, leaders,economists, jurists, traders,and so on to assure regular circulation of R & D, production, sale and training. In the complex system of high-tech industry, any link may play a leading role. For example, a product developed by Qinghua University, Glass Vacuum Solar Energy Geyser, can provide hot water all year round in sunshine, which has won Gold Prize at Geneva. However, until Beijing Xinghai Huan Ke New Technology Company's promotion, it did not enter even civil market.

To establish a high-tech industry firm should rely on venture investment. In the United States, the number of venture investment firms in Silicon Valley is about one-third of nation's total [2] . Around Beijing New-Tech Development Experiment Zone, there are China Science and Technology Trust Company, Beijing Fiscal Company, Pioneering Company, etc. That has started combination of capital with knowledge, promoted industrialization of scholastic attainments, and provided commercialization with venture investment. With comprehensive personnel network, new-technology has formed a marking industry, stimulating economic boom.

3. Comprehensive Factors

The impetus to develop high-tech industry is driven by comprehensive factors. There are two impetus types: internal type and external type. With the constraint of social economic conditions and ecoenvironment, some regions may have difficulties to continue to develop either capital-intensive industries or labour-intensive industries. High-tech industry seems more likely to help solve the problem, providing competitive industries, forming technical and economic basis, ameliorating traditional industrial structure, and impelling regional economic growth. That is called internal type. External type means that guided by other HIZ and scientific and technological zones, one region, making full use of favorable location and policy, introduces foreign capital to establish HIZ in order to develop economy. Both types are toward the same goal. However, the former is internal structural evolu-

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tion and the latter is outside stimulus.

Song Jian, director of China Science and Technology Council, proposed at National Conference of HIZ that to develop high-tech industry is to set up a large number of high-tech enterprises and groups to open to the outside world. Though basic activities in HIZ are R & D, only industrialization, especially industry consolidation and internationalization, bring about real economic growth. From this point of view, a region's general social and economic conditions become a comprehensive factor of great importance, which affects scale industrialization, conditions of complete set, position and strength in competition and also development speed. We can conclude from foreign experiences that it is more likely to succeed to establish HIZ in comprehensive metropolis which has: 1) more prestigious brain concentrated areas as backing; 2) better complete set such as raw materials, elementary parts and equipments; 3) collectivization of economic activities good for large-scale or large group; 4)better infrastructure. In China there have been Tangshan Neutral Salt Chemical Plant of Nanjing University, Lishui Neutral Salt Plant of Nanjing Institute of Glass and Fibre, and ten more experimental service centres in Beijing HIZ as examples.

II. LOCATION COMPARISON OF HIZ IN CHINA

1. Distribution of HIZ

The distribution of twenty seven HIZ qualified by the State Council varies distinctly concerning location, scale and open degree of their backing cities. First, they tend to be located in east coast belt of China. In the belt, where every coastal province or district has at least one HIZ, there are eighteen HIZ, accounting for 63% of national's total. By contrast, there are only six and three in middle belt and west belt respectively. Second, they tend to occur in metropolises. Nineteen of them (70.3%) are in megalopolises, while two in metropolises, five in medium-sized cities, and one in little city. Third, they tend to be located in regions more open. Three of five special zones, Xiamen,Shenzhen and Haikou have HIZ. And five of fourteen coastal open cities have HIZ.

2. Micro-Location Condition Analysis

2.1 Index system

In order to evaluate micro-location conditions of HIZ, a method of AHP has been used. Here micro-location conditions mean those high-tech interrelated conditions of backing cities. Index system is composed of two different classes of indexes. The first class

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includes six indexes— policy, brains, natural conditions, industry, social conditions and infrastructure; while the second class includes twenty-two indexes. When choosing these indexes, following aspects are considered: 1) the essence of high-tech development, that is, brains is chosen as a first-class index and both the number of colleges and universities and the number of doctorate stations of natural science and engineering as well as ratio of number of scientific and technic workers to that of total population are chosen as second-class indexes; 2) the influence of regional industrial policies by which four open degrees are formulated, namely special economic zone, economic and development zone, open city and common city; 3) comprehensive factors of which only in the first-class indexes, four are chosen—natural conditions,industry, social conditions and infrastructure. As a method of combination of qualitative and quantitative analysis, AHP hardly avoids subjectivity of expert's evaluation. However, we try to use as many statistical data as possible to lessen the influence of such subjectivity to a reasonable degree so as to make the result more practical.

2.2 Result analysis

Upon the feedback questionnaires from experts of related fields and calculations of computer, several conclusions have been achieved. In the first-class indexes, brains factor appears the most important of all six, reflecting the characteristics of high-tech industry, while policy and industrial basis weigh the second followed by the other three. In the twenty-two second-class indexes, eight factors ahead in an order of weights from large to small are number of colleges and universities of science and engineering, open degree, doctorate station number of science and engineering, economic benefit, ratio of number of scientific and technic workers to that of total population, industry structure, attractability to foreign capital, and geographical location. Although natural and social conditions weighs less than brains, policy and industry in first-class indexes, some of their second-class indexes such as attractability to foreign capital and geographical location weigh much heavily, which can not be neglected in the development of HIZ. Besides all these indexes' weight value, we have processed 27×22 data, obtained either from statistic data [3] or from experts' evaluations, which are for twenty-two second-class indexes of twenty-seven HIZ. Based on those calculations, we can figure out weight-value of twenty-seven HIZ in China. According to their weight value they can be classified into four grades:

First Grade with excellent conditions. It includes six cities—Beijing, Shanghai, Wuhan, Nanjing, Guangzhou, and Tianjin, most of which are along either coast or river with both well developed economy and scientific and technic strength, and all of which have a population over 2,000,000. In 1990, the export of each HIZ in Beijing, Shanghai and Wuhan has been above 10,000,000 yuan (RMB). The will-be export of HIZ either in Guangzhou or in Tianjin is 10,000,000 yuan.

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Second Grade with better conditions. It includes Changchun, Shenyang, Dalian, Xi'an, Harbin, Changsha, Xiamen, Hangzhou, Chengdu and Shenzhen. Five of them are megalopolises in middle and west belt, and capital cities of provinces, with better brains and industry basis, reflecting that there are good locations for HIZ in middle and west belt of China. Among rest cities, Xiamen and Shenzhen are both medium-sized cities, however, they enjoy preferential policies for development of HIZ.

Third Grade with above-middle conditions. It includes Jinan, Chongqing, Zhengzhou, Hefei, Fuzhou, Haikou, Shijiazhuang and Lanzhou. All of them are provincial capitals, and most of them ar metropolises even megalopolises which can be better backing of HIZ.

Fourth Grade with medium conditions. Only Zhongshan, Weihai and Guilin are in this grade. They are medium-sized cities, lack of backing brains-concentrated groups.

III. IMPLEMENTATION MEASURES FOR DEVELOPMENT OF HIZ

1. Government's Fostering Policy Plays a Key Role in the Development of HIZ

Most foreign HIZ has benefited from government's fostering policy, which has three types: 1) science town invested only by government such as in Japan, German and the former Soviet Union; 2)joint venture such as in German and governmental loan such as in the United States; 3) preferential tax legislature, common to most countries [2].

In the midst of sustainable development, it is impossible for our country to set aside a large amount of funds for HIZ. Therefore, it is wise to introduce appropriate preferential policies such as reduction on property tax, preferential tariff, capital loan, etc. In the meantime local governments should also enact some preferential policies suitable for themselves in order to achieve the threshold.

2. Proper Management System Ensures Development of HIZ

There is no fixed managing system fitted to any HIZ, so every HIZ should build up its own system according to its local conditions and situations. For example, in HIZ of Shenzhen, considering lack of strength, a managing council has been organized cooperatively by Shenzhen Municipality,Chinese Academy of Sciences and Guangdong International Investment Trust Company, under which Shenzhen Science and Technology Industry Zone General Company is responsible for real estate planning and development.

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3. Planning is Prerequisite for Development of HIZ

The development of HIZ in China should avoid rushing headlong which will cause unnecessary waste. Therefore planning is needed, which should consider: 1) demands from world market; 2)backing of resources, technology,personnel and equipment; 3) technological innovation of traditional industries. Planning is also made to give a clear-out goal for development and some focal points of investment, guiding to form a reasonable high-tech industrial structure.

4. Organization Adjustment is an Important Measures for Development of HIZ

At present organization adjustment includes the following aspects: 1) combination and cooperation among HIZ; 2) collectivization of high-tech industry; 3) establishment of development centre to foster middle-and small-sized enterprises; 4) diffusion of high-tech and its productions.

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