CHINESE GEOGRAPHICAL SCIENCE
Volume 6, Number 2, pp. 104—111, 1996
Science Press, Beijing, China

FACTORS AFFECTING FORMATION AND DEVELOPMENT OF THE URBAN INDUSTRIAL DISTRICT IN CHINA——A Case Study on Caohejing Hi-Tech Park in Shanghai

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(Manuscript was received in May 1995)

ABSTRACT: In China, the urban industrial district is usually an organic concentrated district including many factories that are in big, middle or small size, and are coordinated in the process of production, or use infrastructure in common. The formation and development of the urban industrial district in China are affected by not only general factors such as natural factor, transportation factor, labour factor, ecologic factor, but also special factors such as agglomeration factor, technologic factor and social factor. To the district's formation, both the social factors and natural factors are important, especially the attitude the government have towards the district and the regional natural condition. But the agglomeration, market and transportation costs here are not as important as those in the traditional Industrial Location Theory. Now we must pay great attention to these three factors owing to the new economic conditions in China. In the development of the district, the main factors are technology and agglomeration. This indicates that the technologic factor is gradually the essential condition in the development of the district. Besides, we must also know the affection of the eclologic factor in the development of the district. According to the reality of Caohejing district, this paper gives every factor mark in the Analytic Hierarchy Process (AHP). With the result of the AHP, some suggestions have been put forward to Caohejing Hi-Tech Park and other urban industrial districts as well.
KEY WORDS: urban industrial district, Caohejing Hi-Tech Park, urban development

I. DEFINITION AND CHARACTERISTICS OF THE URBAN INDUSTRIAL DISTRICT IN CHINA

An important feature of the modern industrial society is that economic activities, especially the industrial production are gradually concentrated into cities. In China, the urban industrial district is usually an important concentrated district including many factories that are in big, middle or small size, and are coordinated in the process of production, or use infrastructure in common[1]. It is also in a certain range of a city.

In recent years in China, the urban industrial districts have developed rapidly. For example, the original Caohejing Industrial District now becomes Caohejing Hi-Tech Park, its area has enlarged from 1.7 to 5.98 km^2, its character has changed from simply researching microelectronics to researching medium-trial, development and production of microelectronics, information technology, optical fiber, digital communication technology and biotechnology[2].

The urban industrial districts in China have some characters as follows. First, the districts often have good economic geographic location. They are located in the inner-city or the borders of the city, and have transport facilities connecting with the city's center. Second, the district is usually a concentration of many processing factories and is characterized by specialized production, it is an important component of a city. Third, the urban industrial district is really a branch district or satellite town of a city because the district was constructed with the requests of the development of the city and the industry[3]. For example, Jinshan Industrial District is a satellite town but Caohejing is a branch-district.

II. FACTORS AFFECTING FORMATION AND DEVELOPMENT OF THE URBAN INDUSTRIAL DISTRICT

In China, the formation and development of the urban industrial district are affected by not only general factors such as nature, transportation, labor and ecology but also special factors such as agglomeration, technology and social factors.

At first we discuss these general factors. The natural factors include natural condition and natural resources. Generally, the local natural condition will lay a natural base for the industrial district and the natural resources will affect the features of the district. As for Caohejing Hi-Tech Park, the geo-

graphic location and environment suitable for working and living are very important. Caohejing Hi-Tech Park is located in southwest Shanghai, with the border line from Guilin Road to Xinjing Gang to Puhui River to Caobao Road, about 5.98 km^2. Here one can expect pleasant climate most time of the year round in Shanghai which has typical seasonal alternations and sub-tropical monsoon. The park is bordered the suburbs and has not factories with much pollution, so it's a rare area of "non-industrial pollution" in Shanghai with suitable natural conditions and pleasant living conditions. Besides, there is smooth terrain and three rivers.

The transportation factor is one of the three most important factors in the Industrial Location Theory. This factor also influences the urban industrial district in China. But the degree of the influence is not measured by freight, it is greatly related to transport facilities of the district. Caohejing Hi-Tech Park is only about 7 km away from Hongqiao International Airport, 1.5 km away from subway station, 11 km away from the city center. The development of the city's communication and transportation has brought about a great advance in the hi-tech park. The inner and outer ring highway links up the park with city's center and suburbs. We can say that the park has good transport facilities not only at the beginning of the industrial district but also at present. This is also an important reason for choosing it as a hi-tech park.

As for the labor factor, here the location indicator is not the regional surplus labor but the quality of the labor and the living condition of the residential area of the park. It is reported that about half of total 50 thousand staff of the park live in the resident area and nearby. Now the park has built houses about 87,000 m^2, in 1994 added 50,000 m^2. In March 1994, another residential area named Huabao began to be built. Surrounding the hi-tech park, there are more than 20 universities, and 120 research institutes. In the park, more than 35 percent of the total staff are technical personnel, of which about 93.9 percent is middle-aged or young persons. In some enterprises, the technical personnel make up 65 percent of the total staff. So we can agree that abundant intelligent labor resource is ensured for the development of the hi-tech park. Nevertheless there are some problems, for example, now the technical personnel in the park have two peaks of their ages: one is from 46 to 50, the other is from 26 to 30 (in 1989), and the latter is not a very stable group. So that for Caohejing Hi-Tech Park, the perfect excitation mechanisms for free inter-flow of the qualified scientists and technicians must be introduced, and we must prepare suitable conditions for working and living to absorb the qualified personnel and to ensure the development of the park.

As the industrial district is near the city, the ecological factor is impor-

tant. The hi-tech park needs pure and fresh air. At the beginning of development of this industrial district, the environment is considered to be good. But now in the park, there is some ecological problems. For example, the waste gas is drained into the air at the height of less than 30 m, not all the sewage has been disposed when it is drained off. The green plants have only covered less than 10 percent of the total area. In order to develop the park, we must pay great attention to the ecological factor. About 87,000 m^2 of green plants will be grown in the park, including 20,000 m^2 of grass land, a forest belt consisting of 35,000 bay trees and the vertical green plants surrounding the factories and so on, then the green area will reach 420,000 m^2, and the coverage of green plants may reach 30 percent. In the park, cleaned energy such as electricity, petroleum and gas will be used to prevent and reduce the impact of the waste gas on the environment. Besides, a unified heat feed system and a new sewage treatment and draining system will be run to raise the quality of the environment in the park.

To the industrial district, some special factors are more important. One is agglomeration factor. The modern agglomeration process can be divided into two parts, they are function agglomeration and non-function agglomeration[4]. The former is agglomeration for the production, we can think as the formation of the industrial district, the latter is agglomeration for the service such as infrastructure, culture, education, commerce, communication and so on. The two processes exist in the industrial district at the same time. Within a certain extent, the agglomeration factor will promote the development of the district. In Caohejing Hi-Tech Park, the "soft" and "hard" environment for the non-function agglomeration has been constructed. For the convenience of the investors, many new roads corresponding to 6.75 km long is extended, public utilities such as power, water, gas supplies are guaranteed. The total pipelines are as long as 135 km. About 30,000 programs-controlled telephone sets and communication service such as IDD, DDD, FAX are also guaranteed. "Management center" is now well running according to the international standard.

In recent years, the function agglomeration has run well. By the end of March 1994, there had been about 200 enterprises and institutes in the park, among them 122 enterprises were foreign enterprises with foreign capital totaling US $390 million. Among the 122 foreign enterprises, 37.5% was from the United States, 18% from Japan, 32.5% from Hong Kong and 12% from West Europe. In 1993, the park attained the annual output of 6.18 billion yuan (RMB).

The second special factor is technology, here the technology is referred to the technical competence and force in the industrial district or the city. For the

hi-tech park, the precursory technical condition and information network are important. Integrated circuit is one of the precursory technical products and in Shanghai its output was doubled in 1993 than that in 1990. In Caohejing Hi-Tech Park, the Bell Company from Belgium and Phillips from Netherlands are the new strength for development of the integrated circuit with international advanced technology and instruments.

The construction of information network and the dissemination of the information is necessary for the hi-tech park. In 1993, the total output value of the modern information industry in Shanghai was 7 billion yuan. It is a solid foundation for the park. Another achievement is the first undersea cable connecting Shanghai with Kyushu. They are very useful for the development of Caohejing Hi-Tech Park.

The third special factor is the social factor, especially the support of the government to the industrial district. This factor is outside the range of geography and economy, but it affects the industrial location deeply, the support of the government is more important and sometimes critical to the formation of the industrial district. At the beginning of the Caohejing Industrial District in 1984, it was the government not the market that has chosen Caohejing as a new Microelectronics Industrial Zone. Then in September 1986, a loan of 100 million yuan was allotted by the government to open up the construction. After years of development, in 1988, the State Council of China approved the establishment of Shanghai Caohejing Hi-Tech Park on the basis of the original Caohejing Microelectronics Industrial Zone. The hi-tech park has been since then ranked in the list of fourteen coastal economic and technological development zones of China. In March 1991, the State Council approved the park as one of the state-level hi-tech park. In a word the support of the government is very important to the park although other factors such as nature, agglomeration and technology are acting on it.

Now we have analyzed seven factors, these factors may also include many detailed elements, and affect the formation and development of the industrial district in every sector in varying degrees. Considering that some factors such as agglomeration and social factor and their effect can't be quantitated, we now adopt the Analytic Hierarchy Process according to the reality of Caohejing Hi-Tech Park to analyze the effect of these factors. The analysis structure is as

Fig. 1.

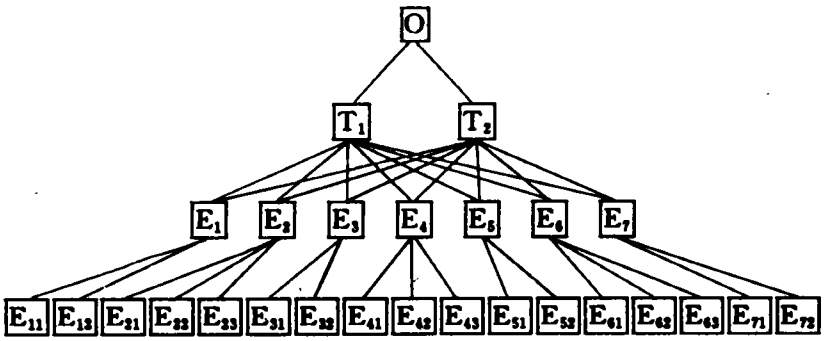

Fig. 1 The analysis structure in Analytic Hierarchy Process

In Fig. 1
O represents general objective, here it is the optimum for the development of the park
T represents times
T_1 represents the formation time of the park
T_2 represents the development time of the park
E represents the factors
E_1 represents nature factor
E_{11} natural condition
E_{12} geographic location
E_2 represents transportation factor
E_{21} railway condition
E_{22} highway condition
E_{23} airline condition
E_3 represents labor factor
E_{31} the convenience for live in the residential area
E_{32} the percentage of the qualified and technical personnel
E_4 represents ecology factor
E_{41} afforestation coverage
E_{42} sewage treatment
E_{43} treatment for waste gas
E_5 represents agglomeration factor
E_{51} agglomeration for the economic results
E_{52} agglomeration for the economic results
E_6 represents technology factor
E_{61} technical competence
E_{62} technical force
E_{63} the precursory technical condition
E_7 represents social factor
E_{71} the government's support
E_{72} political and economic situation

On the basis of the structure, we can make the determining matrix ac-

cording to the reality and calculate the weighted proportion of every element in every hierarchy. After the examination, we can get the result of the Analytic Hierarchy Process.

As to the formation of Caohejing Hi-Tech Park, the social factor, particular the support of the authority is important (the total weighted proportion is 0.2730), then is the nature factor, particularly the geographic location (0.2598), and next the agglomeration factor (0.1433), labor factor (0.1086), technology factor (0.0832), ecology factor (0.0495) and transportation factor (0.0444).

As to the development of Caohejing Hi-Tech Park, the technology factor, particularly the precursory technical condition is important (the total weighted proportion is 0.3037), then is the agglomeration factor (0.1792), the society factor (0.1157), ecology factor (0.1135), transportation factor (0.0876), labor factor (0.0830) and natural factor (0.0740).

III. SOME INSPIRATION AND SUGGESTIONS

From the above-mentioned analysis, we can gain some inspiration as follows:

First, the most important factors affecting the formation of the urban industrial district is the authority's support and the geographic location, while such factors as agglomeration, market and transportation are not as important as they are in the traditional Industry Location Theory. This is the usual phenomenon of the location-decision in the planned economies. Now we are changing to the market economy, we must pay a great attention to the latter factors when we deal with the formation of the industrial district.

Second, the more important factors affecting the development of the urban industrial district is technology and agglomeration. This means that technical condition has somewhat become necessary for the development of the industrial district, especially for the hi-tech park. So we must think highly of the technology and agglomeration factors and promote the investment environment for the industrial district and the hi-tech park.

Third, in the development of the urban industrial district, ecologic factor and qualified personals are not be taken seriously. In fact, these two factors

are somehow the obstacles for the development of the industrial district and the hi-tech park. In order to ensure the further development of the park, we must also reduce the negative effect of these two factors. We may make laws and policies for the environment of the park and make it be the real "non-pollution" area. We may also promote the working and living conditions of the park and absorb the qualified personnel.

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