Research on Industrial Park Planning for Intelligent Manufacturing: A Case Study of Dongguan Beizha Industrial Park

Hao Cai[1], Yanguang Cai[2,3], Le Cao[4], Jiqianzhi Xu[5], Peiqin Xu[6], Si Gao[7]

1 Department of Investment and Development, Dongguan Industrial Investment Holding Group Co., Ltd., Dongguan, Guangdong Province, China
2 School of Intelligent Manufacturing and Electrical Engineering, Guangzhou Institute of Science and Technology Guangzhou, Guangdong Province, China
3 School of Automation, Guangdong University of Technology, Guangzhou, Guangdong Province, China
4 Guangdong Dongshao Industrial Investment Development Co., Ltd., Dongguan, Guangdong Province, China
5 Department of Strategic Consulting, Jones Lang LaSalle (Shenzhen)Business Consulting Co., Ltd., Shenzhen, Guangdong Province, China
6 School of Economics and Management, South China Normal University, Guangzhou, Guangdong Province, China
7 School of Electrical Engineering, Xinjiang University, Urumqi, Xinjiang 830046, China

Abstract: The Chinese economy is growing rapidly with at least 5% per year in terms of GDP. Its industrial system is shifting from "made in China" to "innovate in China". However, the current architectural and logistics design of new industrial park project is always unable to meet the requirement of promising industries. The aim of this research is to identify potential matching industries, and investigate the initial architectural and logistics demands from manufactures before developing a new industrial park project at Beizha Community, Dongguan, China. The whole research is inspired by Yin. 61 interviews, literature, and field studies are conducted. It is concluded that there is still a lack of understanding on the demands of different stakeholders in this industrial park development process. Further study will aim to develop a rigorous and rigid methodological framework to have an in-depth understanding of different industrial park cases.

Keywords: China; industrial park project; real estate development; architectural design; logistics design

1. Introduction

China is shifting its position in global trade from "made in China" to "innovate in China" [1]. This implicates not just changes on people's minds and thoughts, but also on aspects of regional development and urban planning [2,3]. The agglomeration of industries becomes evident especially in the Yangtze River Delta and Pearl River Delta [4]. Furthermore, different types of manufactures have significant differences on design of industrial parks. For instance, the architectural and logistics design of existing industrial park is unable to meet the requirement of newly emerging manufactures

[5,6]. This is particular of importance in the coastal area of China when attracting new industries, as it is the symbol of what makes China as a "world factory" [7].

One of the examples is industrial park project of Beizha community at Donguan city, China. This particular community is situated in the southwest of Dongguan, Guangdong province, China. The whole population is 80,000 within 5.88 square kilometers. 90% of the inhabitants are immigrant workers with their descendants from in-land China. The Beijing-Hongkong & Macao Expressway is passing through the community with multiple connecting entrances. It is also a cross road connecting Guangzhou, Shenzhen, and Hongkong metropolis, three of the five most important cities in China in terms of every measure. Besides, this cross road also connects the west and east pearl river delta region using Humen bridge nearby. As a matter of fact, this cross road is one of the busiest roads in China with thousands of workshops and factories by its side. In addition, a number of universities are also operated within 30 kilometers. This industrial park project plans to cover an area of 93196 square meters, the plot radio is between 3.0 to 5.0. The building height is controlled within 100 meters. The local government requires to build auxiliary dormitories and develop commercial area for workers. In addition, there are multiple private houses and schools on the north and east side, which needs extra consideration from perspectives of logistics design and acoustic pollution.

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2. Methods

Inspired by Yin, we have applied multiple ways of collecting data including interviews with local government offices, industry associations, manufactures, and literature study [8]. In addition, we have conducted a field study on the competing industrial parks with similar targeting manufactures. This is to better understanding the lessons learned from these previous developed cases, and to better illuminate our research on this industrial park in Beizha community. The selection criteria of cases is these targeting industrial parks should be within 100 kilometers and 2 hours of truck driving.

3. Results and Discussions

61 interviews were conducted, including 4 local government offices, 6 industry associations, and 51 manufactures. The field study was about investigating the local civilian facilities including bus terminal and market to have an in-depth understanding of this community. In addition, 4 competing industrial parks were investigated including Quanzhi technology innovation park, Songshan Lake intelligent valley, Fenggang Tian'an cyber park, and Country Garden Julong intelligent industrial park.

It is found that manufactures from electronic information manufacturing, textile and clothing, and packaging industry have shown clear interests on renting or buying properties in this industrial park project. This is due to a majority of manufactures in Beizha community are from these three industries. What is more, these manufactures have a very strong business tie to the city of Shenzhen as suppliers. Companies like Huawei has shown a clear demand for the designated design of its unmanned factory and big data application facilities. In addition, all the collaborating vendors and major traders are located within 2 hours of driving by expressways, which has ensured consistent provision of raw materials for productions and sales, as well as skilled engineers and workers. What

has limited their development is the outdated architectural design of current space, for instance, the floor height, load bearing, and inside column span. Several studies indicate similar findings [9,10]. Furthermore, the electric capacity and seismic resistance are also two concerns of the expecting manufactures. Most of manufactures demand for back-up power for at least half day production. The study in Guangzhou, China has shown similar findings [11]. It is also found that warehouse, exhibition space for sales purpose, living facilities including condos with independent bathrooms, canteens, and basketball fields are expected by the owners of manufactures as well. They told the authors that millennials and generation Z working in factories have a much higher living standard than their last generations. They just do not want to make money in factories but also enjoy their lives with better quality of food, living standard, and respect from owners. It is argued that there are significant differences on architectural demand from manufactures, which takes an extra consideration in this industrial park project design [12,13,14,15].

Logistics efficiency as well is a primary concern for the manufactures. This not only includes vertical transportation inside buildings, demanding for sufficient number of freight and passenger elevators, but also connection with entrances of expressway. Eventually efficiency of transportation is a key which in return will affect on production. As one of the interviewees suggests that the height limit of nearby expressway bridge has to be increased to allow heavier load of trucks to pass by. We have also found the similar statements from other interviewees. Several studies indicate concerns on logistic efficiency [16,17]. The developers of 4 competing industrial parks have also show extra considerations on the logistics design, implicating similar concern. It is argued that this is very much relevant to choice of geographical location of individual industrial park case. Hereby it requires extra attention in the design process.

It is also found that there are multiple organizational and individual demands from the interviewees, especially from the owners of manufactures. This includes governmental financial support, public services in finance and taxation, supply chain management support, law support platform, conference holding, free market campaign and exhibition supported from governmental side, on-time and fast-track inspection and certification from local professional institutions, more comprehensive industrial consultation service, and most importantly guarantee of owners' and workers' children mandatory elementary, junior, and high school education. However, it is argued that these demands are in a long run. In some literature we have found similar findings [18,19,20,21,22,23]. In addition, it is suggested that auxiliary schools on all levels should be carefully considered and built in the future planning of industrial park. One significant difference we found during the study is that cites as Dongguan and Shenzhen tend to foster skilled technicians from manufacturing side. On the other hand, Guangzhou and Foshan focus on the side of research, which would be of interest to find out this difference in the coming studies. It might need extra interviews with local government officers and abundant literature studies.

It is found that there is a different demand on types of matching industries at different levels of government offices. For the county level, the officers have shown a clear demand and request on electronic information industry. At next lower level which is community level, the employees there tend to favor on textile and clothing, and packaging industry. It is argued that this is due to rent level on different industries. Electronic information industry, at its early stages, either is unable to suffer with rent, or there are multiple subsidies from local government, which is very much relevant to local financial status. This difference of choices requires the developers of this industrial park to better understanding the need of different stakeholders in this process. One concern has shown during the

interviews with manufactures is that all the lands in this project is owned by the local community, the owners of manufactures suggest that if new factory space can be sold in separate floors to them. This is to ensure the consistency of production, as well as state of art technology can be applied in this project. In addition, different manufactures have diversified demand on the size of space, this is actually to ensure the flexibility of production. On the contrary, the local community tends to hold the ownership of these lands. The local government office has shown similar concern as the community. They would prefer to keep the lands rather than selling it, hence to ensure a consistent money flow annually. Hence it requires much deeper considerations on this divergence, could be an interesting topic for the future studies.

We have found that 75% building space for manufacturing, office management, and warehouse, 15% for living facilities, 10% for commercial and exhibition space are the objective architectural demand for potential matching industries in the case of this industrial park project. It is also suggested that the commercial and exhibition space should be facing the residential area of this whole community, with extra consideration of transportation connection, population density, and sunlight duration. This was under the cautious discussions among the authors as well as feedback from interviews, literature study, and field study. We have actually provided detailed architectural design in the research with the inspiration from Singapore and discretion conversation with potential buyers of this project. It is estimated that after the completion of this industrial project, 6 billion CNY in terms of GDP will be generated each year, with about 600 million CNY taxes and 8000 jobs. In addition, to ensure the economic contribution per square kilometers, it is suggested that a combination of residence, research, and manufacturing can be considered in one building. However, under the current laws and regulations of Chinese urban planning, it is still required for more thorough discussions and effort to achieve this breakthrough. It is argued that by using this type of architectural design, the production can be more effective and residential friendly to the workers. For office management space, comparing to previous industrial parks in this area, this space is often transformed from warehouse, which makes working space not very much user-friendly. In detail, this could be lack of lavatory facilities, no grocery stores, or no shared office area where staff can meet and exchange new ideas. In this project, a mix function of apartment, joint office, and public conference room is proposed. Fire control is given extra consideration from the aspect of architectural design as well. We have also considered the demand of start-up companies, in which many public facilities are designed aiming to foster the efficiency of communication and decrease the cost of maintenance by sharing them. This is also to create a good innovative and competitive atmosphere in which new ideas can have a platform to present with potential investors. Which in return, will become a positive circle to attract more talented technicians and scientists to settle down in the development of this industrial park. For warehouse design, we have made it flexible in the design with a height of 12 meters. This is under the consideration that these spaces can not only be operated for storage, but can also be used for manufacturing or office management, sometimes combined. The space for air conditioner is also carefully reserved for different use of production, as well as the electric capacity, eventually this is for the efficiency of whole business circle. The outside elevation is also carefully discussed, with the balance between social appearance and energy saving. All these efforts are of importance for the coming new industrial project.

During our investigation, it is found that attracting investment is very critical on the development of industrial park project. The people with this particular role are not just from government, but from out-sourced sales companies as well. The quality of this job will determine type

of manufactures which actually can move into the project. Furthermore, the feedback from these potential buyers, if under discretion among different interest groups, will have a very positive effect in terms of cost control and usability of the project. It is argued that people who take this responsibility can play a more important role in the design phase. For their feedback is argued to be more realistic and feasible from the aspects of manufactures, and sometimes arguably able to control the cost. We have already found this trend is that people who is responsible for attracting investment are arranged to join the project in the early phase from other 4 competing industrial parks. It is argued that this is vital in the development of the industrial park project.

It is found that there are many champion firms in their respective field. This is because industries in the city of Dongguan define themselves as members of supply chains for Guangzhou or Shenzhen. This particular scenario has made the local manufacturers been lack of systematic understanding of production and trade. In addition, these manufacturers actually hold a significant quantity of funds, as well as local industrial park developer. However, these funds have flooded into the real estate market of the Guangdong-Hongkong-Macao Greater Bay Area. The annual return of interest on the local real estate market is actually higher than the trade and production. Hence, many owners of the local manufacturers are reluctantly enlarging the productions. In addition, the transition of legacy between generations has escalated this trend. Most of the next generations of these manufacturing owners are unwilling to continue the same career like their parents do, as they tend to focus on investment, commercial or finance industries. Some of the local manufacturers are lack of understanding on international trade, this is due to some of the businesses are outsourced to the trade company. It is argued that one possibility for these manufacturers could be to build a whole chain of sales and production. Furthermore, this will be very competent when facing the opponents in the international trade, especially in Africa, South America, and South Asia.

Finally, we have found that not in this industrial park project, but in other similar projects, the local government tends to provides commercial and residential projects for developers to balance investments. However, this is not always a thorough solution, as it is also affected by the local real estate market. It also requires developers having ability to construct and operate commercial and residential projects at the same time, which is argued that not many industrial park developers are capable of fulfilling such goal. In addition, whether developers tend to make money flow or sell projects at time can also affect the choice of operation strategy, even in many cases, the architectural design as well [24,25]. In addition, professional level of developers and seasonal macro economy will also affect the development. What we see in the other 4 competing cases, some developers have required affiliated commercial and residential projects but not develop as expected, even they have carefully built the professional teams and managed all the possibilities ahead of time. It is argued that a more rigid and rigorous theoretical framework and methodology on industrial park project investment is of necessity to develop [26]. Surprisingly we have not found significant number of articles on this topic in the academic, however it is argued that this framework is very much crucial. Regional differences should be considered as we have already found similar studies been conducted in other areas [27,28,29]. Furthermore, this research has to be built on a large study with considerations from region to region as well. Cultural diversities and economic development level could be some of the most important factors. However, it requires for more investigations. Furthermore, as China has developed many overseas industrial parks, this could be another interesting topic worth to study as well [30,31,32].

4. Conclusions

In-depth research on industrial park project of Beizha Community in China is conducted. Different demands and barriers from local government offices, industry associations, and manufactures are found during the investigations and literature studies. It is concluded that there is still a lack of understanding on the needs of different stakeholders in this industrial park development process. Further study will aim to develop a rigid and rigorous theoretical and methodological framework to better understanding different industrial park cases. Eventually and hopefully, it will help us to control the cost of investment and facilitate development process of industrial parks in China.

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