

Exploration of the Scenario Planning Path of the Airport New Area of Small and Medium-sized Airports: A Case of Jincheng Airport New District

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Abstract: With the development of Chinese science and technology economy, as a new form of spatial economic organization, the planning and construction of the Airport New Area is increasingly becoming a focus of attention. The actual development of the Airport New Area is affected by the development of the city. Therefore, the scenario planning method, as an effective tool to deal with future uncertainties. This article uses scenario planning methods, taking Jincheng Airport New Area as an example, through five steps including background analysis, factor identification, case reference, scenario simulation, and program evaluation, to obtain the best development plan for Jincheng Airport New Area, hoping to provide planners with more targeted and flexible response measures in different scenarios.

1. Introduction

With the development of economic globalization, the civil aviation industry has entered a stage of rapid development. The airport area has become an important place gathering people flow, logistics, capital, information and technology. It has increasingly become a catalyst to promote regional economic and social development [1]. The planning of airport area is a complex social, economic, political and environmental issue [2]. Planners adhere to the "causal theory" in urban development planning and future forecasting methods. The single scheme forecast under its guidance cannot deal with the uncertainty of the development of new urban areas [3]. Therefore, how to deal with the future uncertainty with the help of the foresight of urban planning has become a key issue in the new era.

As a progressive and dynamic planning method, scenario planning provides a research paradigm to deal with uncertainty. It improves the feasibility of planning through hierarchical and phased planning. At the same time, with the increase of information, it can clarify the confusion in the uncertain environment. When applied to the planning of new urban areas, it can help to understand the uncertainty of development and improve the ability of planning to deal with potential risks. It undeniably plays a great role in providing a coherent, systematic and collaborative framework for urban development.

Scenario planning first appeared in the 1960s, pioneered by Shell Group of Companies. It was

originally used as a business forecasting tool for strategic decision-making and policy analysis. Since the 1990s, it has been applied to urban strategic planning and land use planning.

In recent years, the application of scenario planning has gradually penetrated into the practice of urban planning in China. It is mainly used in conceptual planning to forecast and analyse urban population, land use, environment, transportation and industry [4]. But there are few researches on scenario planning of airport New District. Therefore, this paper studies the practice of scenario planning in urban planning from the perspective of interdisciplinary integration. Exploring the application of scenario planning theory in airport new area planning.

2. Overview of the Research Area and Research Methods

2.1. Research area

Jincheng has an important position in the Zhongyuan urban agglomeration of China, which is an important gateway of Shanxi Province. It also plays an important role in the development axis of the Taiyuan - Zhengzhou - Hefei. In September 2019, the site of Jincheng Civil Airport was officially approved. The improvement of the transportation system has brought huge development opportunities for Jincheng. The research area in this paper is defined around the airport. The overall research area is about 32 square kilometres, which is connected to Jinjiao Expressway in the north, Taihang Mountain Airport in the south, Chang-Jin Expressway in the west and Southeast Ring Expressway in the east.

As a resource-based city, Jincheng is highly dependent on the development mode of resource exploitation, which is difficult to drive the economic redevelopment of the whole region [5]. As a tourist destination airport of Taihang Mountain, Jincheng Taihang Mountain Airport is the northwest aviation node airport of Central Henan urban agglomeration. The construction of airport New Area will bring new development opportunities for Jincheng. Its construction will help Jincheng establish a comprehensive transportation network, emergency logistics system and regional logistics hub.

2.2. Research method

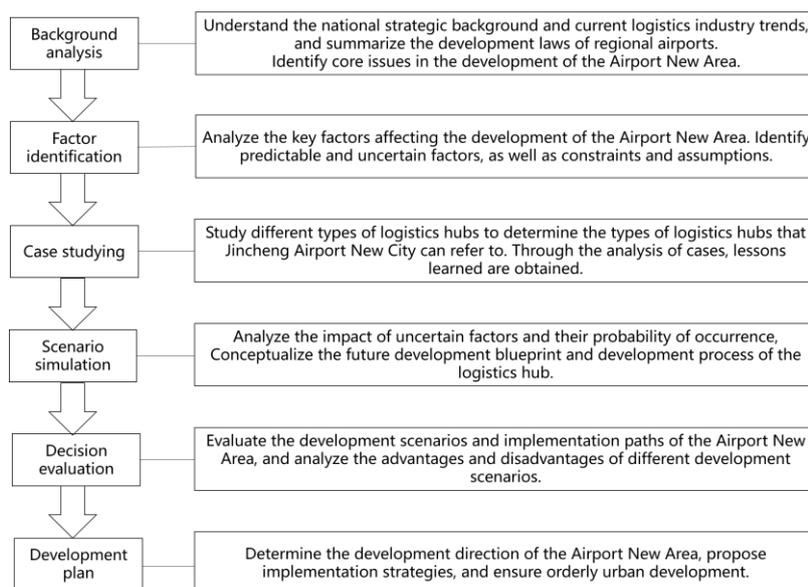


Figure 1: Scenario planning method in the overall conceptual planning of the Airport New Area.

Scenario planning method is applied to urban new district planning. The best scheme is generally determined through five steps: background analysis, factor identification, case reference, scenario simulation and scheme evaluation (Figure 1). If the conceptual planning scenario is taken as the dependent variable, a series of key factors constitute the independent variable with determinable range of variation, a variety of possible scenarios would have formed [6].

3. Establish Scenario of Airport New Area

3.1. Background Analysis

For small and medium-sized cities, airport construction is an important opportunity for local economic development. The surrounding area of the airport can form manufacturing, logistics, trade, cultural travel and other forms of business development. However, in recent years, domestic regional airports generally operate poorly, and most of them are in a state of loss. Small business volume and lack of funds lead to severe survival pressure [7]. In order to solve the problems in the process of construction and development of feeder airports, this paper puts forward a new idea of "passenger-cargo simultaneous development" of feeder airports in Jincheng from the perspective of planning. It is expected that Jincheng Airport New Area can undertake part of the functions of Zhengzhou Airport area. Then, stimulating the development of the local logistics industry system. Strengthen the industrial foundation for the development of the new airport District.

3.2. Identification of internal and external drivers

3.2.1. National strategy

The state strongly supports the development of the logistics industry. In September 2020, the Chinese President mentioned at the eighth meeting of the Financial and Economic Commission of the CPC Central Committee that "the logistics system plays a fundamental role in the national economy, and the construction of a modern system should be regarded as an important strategic task in order to build a new development pattern". The state supports the construction of modern logistics system, and the development of logistics has become the current needs. The logistics industry should meet the characteristics of contemporary consumption and combine with the development of the Internet of Things. Jincheng should be deeply integrated into the national strategy. It is vital to expand new space for the transformation and development of resource-based cities.

3.2.2. The demand of Jincheng

Jincheng desperately needs to foster new areas of economic growth. As a typical resource-based city, the development path of resources in Jincheng seriously affects economic vitality and brings pressure to local economic growth. Promoting industrial transformation has become a key issue. In terms of location, Jincheng is located along the Beijing-Hong Kong-Macao highway line and along the Lianyungang and Urumqi railway lines. Jincheng is the geographic centre of Zhengzhou, Taiyuan, Xi'an and Linyi, which are the first batch of national logistics hubs. Jincheng can be diffusing function of those cities, which makes Jincheng construction as a logistics node for cities in central China. From the economy and industry of Jincheng, the local financial pressure increases year by year. Low logistics efficiency raises the cost of industrial development. Jincheng logistics industry is facing difficulties. The existing logistics parks are small in scale, simple in function, dispersed in layout and weak in wisdom [8]. Therefore, how to develop Jincheng logistics industry, meet the needs of Jincheng industry and urban development, and finally provide important support

for the development of local economy is the issue that this paper needs to discuss.

3.2.3. Airport Industrial Zone in Jincheng.

In the Jincheng development plan of "One economic and technological development Zone and five industrial parks", the Airport New District is developing in a differentiated way. In Jincheng's existing economic development zones and industrial parks, except for the airport New District, others are dominated by manufacturing industry. Jincheng lacks a professional and centralized logistics industrial park. So, Jincheng needs a comprehensive and efficient logistics park. From the current situation of Jincheng logistics park, the small logistics centre located in the eastern district of the city. In the logistics centre, the spatial layout is dominated by the industrial function. In terms of logistics mode, the logistics hub of Southeast Shanxi and the comprehensive logistics Park of East Jincheng take highway and railway as the main mode of transportation. Highway transportation serves coal and other bulk goods, and railway transportation serves comprehensive logistics parks. The negative impact of this kind of logistics centre is bulk cargo transportation will affect the lives of residents in the area around the road and railway.

To sum up, to solve the bottleneck of the development of the real economy, it is necessary to improve logistics efficiency and reduce logistics costs. Jincheng needs to integrate into the national logistics system to promote high-quality economic development. Therefore, the construction of airport New District in Jincheng, as a regional modern logistics comprehensive hub, is the inevitable.

3.3. Case study

In 2018, the National Development and Reform Commission and the Ministry of Transport issued the National Logistics Hub Layout and Construction Plan. It plans to build 212 national logistics hubs. National logistics hubs are divided into six types: land port, port, airport, production service, trade service and road border port. According to the present conditions of Jincheng to develop Airport New District, this paper selects reference cases from four types of logistics hubs: land port, airport, production service and trade service. It supposed to provide experience for the planning and construction of Jincheng Airport New Area.

3.3.1. Airport logistics hub -- Ezhou

Relying on the airport, the airport logistics hub mainly provides fast and efficient air transport, transfer, and distribute, as well as the intermodal services with railways and highways. Ezhou is China's first air hub for cargo. As a 4E civil airport, SF International Cargo Airport provides convenient passenger and cargo services for Ezhou Airport Economic zone. There are two experiences worth noting in Ezhou logistics hub. One is to emphasize the combination of various transportation modes. It emphasizes the efficient conversion of different transportation modes in the process of cargo transportation. Second, appropriate spatial layout. Logistics Park layout is closely linked with the airport. The park introduces industries related to aviation. Form an industrial network and increase the industrial carrying capacity and integration of the airport [9].

3.3.2. Trade logistics hub -- Linyi

Relying on Trading cluster district, large specialized commercial and trade market, consumption market in cities, Trade logistics hub provide professional services in terms of trade and consumption. Services include logistics services for commodity warehousing, transportation, and distribution, as well as value-added services for finance, settlement, and supply chain management.

Linyi, a city of logistics, has the largest wholesale market cluster in China. It is an important logistics turnover center and trade wholesale center [10]. Linyi's logistics routes cover county-level cities, with more than 2,000 transport lines. More than 200,000 tons of goods are sent daily. Linyi's logistics hub reveals that the development of logistics and trade industry are closely combined and mutually supported. Linyi has 124 wholesale markets and 24 logistics parks, so the logistics network is fully covered, and the transportation cost is low. At present, Linyi logistics development in a professional way. Its airport logistics construction is starting gradually.

3.2.3. Land port Logistics hub -- Weifang

Land-port logistics hub relies on land transportation channels and logistics bases such as railways and highways to connect inland transportation. It provides effective logistics and allocation services to ensure regional production and life, optimize industrial layout and enhance regional economic competitiveness. Weifang holds the strategic point of Shandong. It has a perfect three-dimensional transportation system. Large-scale logistics enterprises are committed to the steady improvement of the overall logistics development. Weifang logistics hub reveals that it is very key to increase the support for leading enterprises. It is a trend for logistics parks to develop in the direction of scale, specialization, and intelligence. Weifang has developed various types of logistics hubs and has formed advantages in cold chain logistics and agricultural product logistics [11].

3.2.4. Production and service Logistics hub -- Ordos

Ordos has a similar population size and industrial structure to Jincheng. In recent years, with the logistics industry development opportunities. A modern logistics service system adapted to local economic development has been established. A convenient, efficient, professional, high degree of information and network logistics system. In this system, airport logistics park construction is starting and developing. Related manufacturing enterprises and supporting facilities are arranged around the comprehensive bonded area [12]. Ordos is committed to the development of multimodal transport, forming a comprehensive railway, high-speed, airport advantages of the transportation system.

According to the urban population size, industrial structure and logistics development conditions, Jincheng can develop production services, trade services and land port logistics hub (Table 1). Jincheng can take Ordos as the benchmark case and learn from the experience of logistics hubs in other cities to develop a comprehensive logistics park.

Table 1: Comparison of cases.

Type	Airport logistics	Land port Logistics	Trade logistics	Production and service Logistic	Research case
General situation	Ezhou	Weifang	Linyi	Ordos	Jinchen
Urban population size (10000 people)	105.97	935.15	1066.7	208.76	235.3
GDP (100 million yuan)	1140.07	5688.5	4066.25	3605	1362.4
industrial structure (Proportion of three industries)	0.9: 4.8: 4.3	0.9: 4.0: 5.1	0.85: 4.05: 5.1	0.3: 5.8: 3.9	0.4: 5.4: 4.2
Cargo throughput (10000 tons)	highway	30586	38689	2256.7	5990
	Railway	182.2	1426	39856	5793
	aviation	1.4	1.04	1.03	
Scale of airport logistics park	* Ezhou Airport will be completed in 2025 It is planned to reach 3.3 million tons by 2030	The scale of the aviation logistics center is about 12-13 hectares	International Airport Logistics Center 1-2 square kilometers	The overall planning and construction land of the airport logistics park is 25 square kilometers	It is planned to reach 3300 tons by 2030

4. Scene construction

Scenario planning is an effective planning method to deal with the changes and challenges in the process of urban development. This paper sorts out the key factors affecting the airport new area. Based on the concept of sharing and resilience, create multiple scenarios. The starting area of 1.5 square kilometres will be concentrated in advance, and three possible development scenarios will be set up. Further development and construction according to the actual situation. Finally achieve flexible land use. This process is expected to provide suggestions for the construction of the new airport district.

Scenario 1(Figure 2): If the logistics industry develops well, the airport new area continues to expand in scale. Relying on Taihang Mountain Airport, the starting area takes Airport Avenue as the development axis and centralizes the main functions. The starting area takes aviation logistics and aviation manufacturing as its main functions. It also provides infrastructure and air commerce services. The second phase of construction started based on good development of the starting area. In this period, the logistics park expanded along the development axis of Jincun Avenue to the north and expanded logistics functions on the north side of the starting area. Trade logistics and supporting facilities have been enhanced. The third phase of construction expands along the original two development axes and actively connects with the built-up area. The functions of urban distribution and emergency logistics are introduced. In the long term, we can consider updating the surrounding village areas.

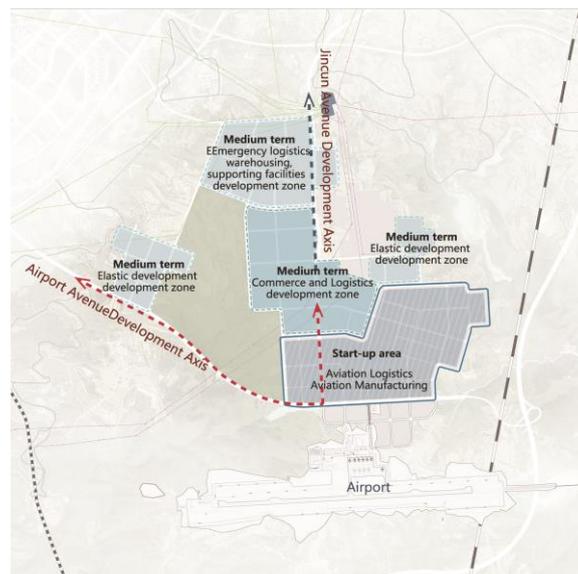


Figure 2: Scenario 1.

Scenario 2(Figure 3): It is assumed that the development of the starting area attracts other industries to invest in the construction, which brings new opportunities. The starting area is dominated by aviation logistics and aviation manufacturing. In the period, it is favourably receiving other industries with investment intention. In the middle stage, the flat terrain in the second stage is suitable for the development of diversified industry. In the long-term planning, the North and West districts will connect the main urban area and other built-up areas.

Scenario 3(Figure 4): If the first-phase construction is slow, the blank leaving strategy is adopted in the medium-term land use planning, which leaves room for future planning and development. Under the condition of slow development of logistics industry, the undeveloped area within the start-up zone can maintain the current state. The other areas will adopt the blank-leaving strategy as the future construction space without affecting the current village and ecological environment. It is

likely that these plots will be developed gradually as airport traffic increases.

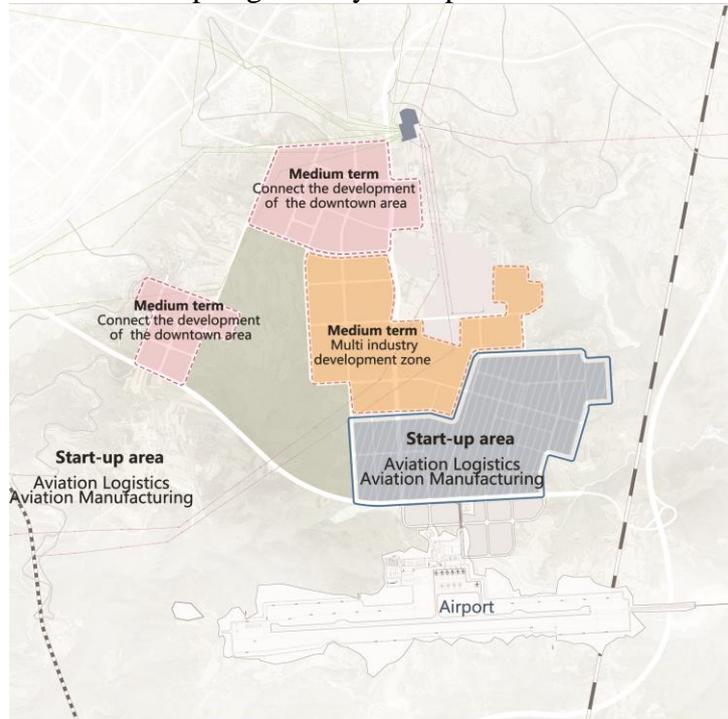


Figure 3: Scenario 2.

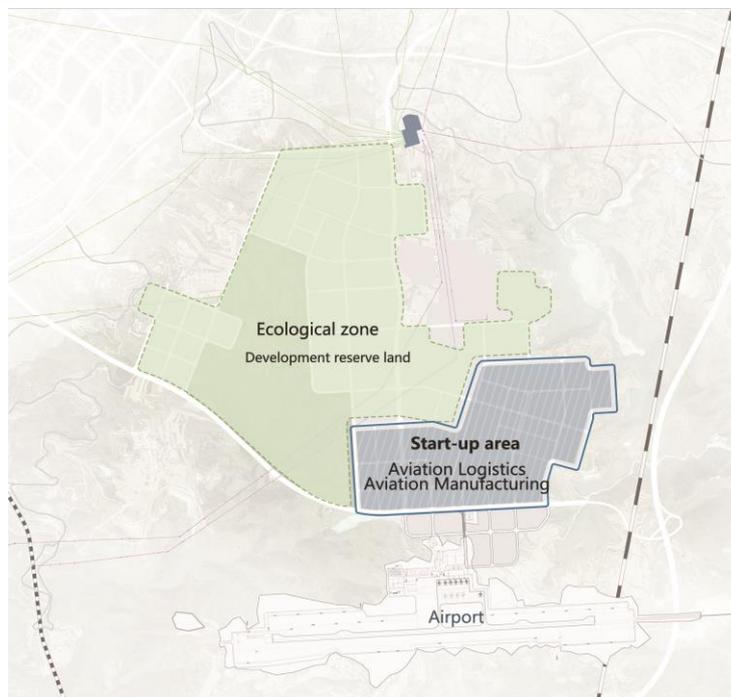


Figure 4: Scenario 3.

5. Scenarios evaluation

The three scenarios represent the development paths proposed for different scenario assumptions under the uncertainty of future conditions. The evaluation of each scenario program considers the

impact of the program on the local socio-economic development and ecological environment, the difficulty of implementation, and the sustainability and potential of the program. Scenario one conforms to economic development and the trend of local industry, which can reduce logistics transportation costs and improve circulation efficiency. This scheme has the advantages of strong sustainability and great development potential. The disadvantage is that certain investment and development costs are needed in the early stage, especially the large amount of investment in logistics facilities. The second scenario closely links the upstream and downstream of Jincheng industrial chain and coordinates the development of surrounding regions. But the uncertainties are large. It is difficult to predict the future direction of industrial transformation and put forward suitable development strategies. Scenario three is low-cost and ecologically friendly. But the development potential and sustainability are weak. The promotion of Jincheng's overall economic development is limited.

After comparing the three scenarios, appropriate policies can be formulated according to the current development situation and local needs. This requires formulating adjustable development goals and development paths to cope with uncertain situations in the future. At present, it is the primary task to improve the overall economic level of Jincheng City. Scenario one can achieve the land space planning indicators in the near and medium term, and the development of logistics industry can improve the overall economic level of Jincheng City, meeting the requirements of urban development at this stage. Therefore, this paper selects scenario one as the best development direction to improve the planning scheme.

6. Optimal scenario

6.1. Industrial development path

Jincheng Taihang Mountain Airport plays an important role in connecting Shanxi Province comprehensive reform pilot zone with the function of China's aviation logistics network. Under the opportunity of this airport, it is reasonable to develop industries with strong advantages such as aviation logistics in the airport District. At the same time, Jincheng, as a typical resource-based city, is in the industrial transition period. With the advantage of "railway-road-air" combined transport, comprehensive logistics industry can be developed around the airport. The airport New Area will be built into a trade service Logistics Park. It is suggested that the logistics industry can be concentrated in goods warehousing, trade logistics, cold chain logistics, bonded logistics. In this way, the demand for bulk goods can be satisfied. Local businesses also have access to convenient logistics services. Then, to become a comprehensive modern intelligent logistics park, which includes professional trading market group. More aviation-related industries will be involved in the long-term industrial planning. Based on the mechanical equipment manufacturing industry which is the traditional industry of Jincheng, it is suggested to develop the aviation related manufacturing industry around the airport. Including aircraft assembly, aircraft parts manufacturing, precision instruments and production equipment manufacturing.

6.2. Functional format layout

The Airport New Area has formed a "5+1" industrial system. Including starting area, urban logistics area, business logistics area, management service area, industrial joint area, development reserve area. The five theme areas develop along with the starting area. The starting area is the key area of this planning. This area mainly develops aviation logistics and aviation manufacturing. The projects include Jincheng Aviation Industry Park, cold chain logistics Park, bonded logistics Park, smart service Bay, e-commerce logistics park, standard storage area, airport resettlement area,

enterprise customized park and supporting apartments.

7. Conclusions

Scenario planning is an important method in urban planning. This paper applies this method to the conceptual planning of Jincheng Airport New District. Through the steps of background analysis, factor identification, case reference, scenario simulation and scheme evaluation, the best scenario scheme is selected. This emphasizes the sustainability of urban development plans, enhances the operability of planning implementation, and makes planning schemes more flexible. It provides alternative forecasting methods for urban development planning. However, the application of scenario planning method in urban planning is still being explored. Both theoretical research and practical application need further research.

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