Urban Development Influenced by Major Airports: Beijing Daxing International Airport Case Study

Chenxinyi Tian

The Experimental High School Attached to Beijing Normal University
Beijing, 100000, China

writing@pathacademics.org

Abstract. Globalization and urbanization are accelerating, making large international airports critical drivers of urban growth. However, they have a considerable impact on the local economy, social structure, citizens' lifestyles, and the environment. The expansion of China's international airports, notably the recently opened Daxing International Airport, is accelerating, but the specific implications require further investigation. This research investigates Daxing International Airport's impact on employment, industrial structure, people' lives, and the environment. It uses literature reviews, case comparisons, and field trips to examine the airport's economic and social implications, as well as the environmental repercussions of its facilities. According to the results, the airport greatly enhances employment and industrial growth, particularly in service-oriented and high-tech industries, but it also increases market rivalry, which hurts local company. Furthermore, concerns about aviation noise and air pollution develop. To maximize benefits and avoid negatives, the government and related agencies should work together to optimize policies, train workers, restructure industries, and innovate technology for long-term regional growth.

Keywords: Urban studies; Urban, Airports, Beijing Daxing International Airport

1 Introduction

The civil aviation industry has seen tremendous growth globally and in China in recent years. According to the National Civil Transportation Airport Statistical Bulletin released annually by the Civil Aviation Administration of China (CAAC), the annual passenger throughput of China's airports grew steadily with each passing year before the COVID-19 outbreak. For example, Prior to the COVID-19 outbreak in 2019, the annual passenger flow of China's airports topped 1.3 billion, hitting 135,162,000 people, a 6.9% rise over the previous year. Even with the impact of the economic downturn caused by the COVID-19 outbreak, China's civil transportation airports completed 1,259,766,000 passenger trips in 2023, which is still 142.2% higher than the previous year, recovering to 93.2% of the 2019 level, which is a testament to the potential and resilience of China's civil aviation industry.

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To meet growing capacity demands and local development objectives, numerous cities have initiated the construction of new airports. A notable example is Shache Airport in Kashgar, Xinjiang Uygur Autonomous Region, China. Approved by the government in 2014 to accommodate local transportation requirements, the airport's construction was officially completed in 2021. Expansion of existing airports has also been an important means of coping with increased traffic, for example, the Beijing Capital International Airport was expanded in 2004 to cope with early saturation and to accommodate the 2008 Olympic Games. In addition, the construction of new airports has become an option for many cities, such as Beijing's Daxing International Airport, the second 4F standard international airport approved for construction in 2014.

However, new airports, whether they are constructed or expanded, have multiple impacts on the cities in which they are located. According to studies of many existing airports abroad, the radial impact of airports on cities is mainly reflected in the following aspects: industrial structure, transportation, employment, economy, environment and housing. Each of these aspects may be affected in different degrees. For example, the construction and operation of airports can drive the development of logistics, tourism and service industries, and promote the transformation and upgrading of the city's industrial structure. At the same time, airports can also bring about an increase in traffic flow, placing higher demands on the city's transportation network and infrastructure. In addition, the employment opportunities directly created by airport construction and operation, as well as the employment growth in related industries indirectly driven by the airport, can significantly enhance the local economy. However, the impact of airport construction on the environment and residents' lives should not be ignored. Issues such as noise, air pollution and land use changes need to be scientifically assessed and reasonably addressed.

As China's newest large-scale international airport, Beijing Daxing International Airport has been in operation for a relatively short period of time, and fewer studies have been conducted on its impact on the city. Therefore, this paper aims to analyze in depth the multifaceted impacts of Beijing Daxing International Airport on the surrounding areas by means of literature review, case study analysis and field research, and to compare it with studies on foreign airports to comprehensively assess the radiant effects of Daxing International Airport in terms of employment, residents' lives, transportation, industrial transformation, and the environment.

The research significance of this paper is to provide a scientific basis for the future development of Beijing Daxing International Airport, and to provide a reference for other large-scale airport projects under construction or planning. At the same time, through comparative analysis with foreign experience, this paper will also provide a reference for improving the planning and management level of Chinese airports, to better exert the positive role of airports on urban development.

2 Case Description

Beijing Daxing International Airport (Code: IATA: PKX, ICAO: ZBAD) is one of the 18 Class 4F airports in operation in China and Beijing's second international airport,

with a projected area of 45 square kilometers. It is located between Daxing District of Beijing and Guangyang District of Langfang in Hebei Province.

As of February 2021, Beijing Daxing International Airport has four runways. Runway 1 is 60 meters wide and 3400 meters long. Runway 2 is 60 meters in width and 3800 meters long. Runway 3 is 60 meters in width and 3800 meters long. Runway 4 is 45 meters wide and 3800 meters long. Runways 1 and 3 are designed to accommodate future expansion needs of Daxing International Airport, with a lateral spacing of 2350 meters between West Runway 1 and East Runway 1. Runway 01L is a Category III B precision approach runway, Runway 35L is a Category II precision approach runway, and Runways 17R, 19R, 29R, and 17L/35R are Category I precision approach runways, while Runway 11L is a takeoff runway. Runways 1 and 3 operate independently for both remote and close-in stands.

In dynamic scenarios, Runways 35L and 01L, and 17R and 19R operate in segregated parallel operations, independent parallel departures, and dependent parallel approaches. Runways 35R/17L and 35L/17R operate as a single runway. Runways 01L and 35L are equipped with Category II/III precision approach lighting systems. Runways 17R, 19R, 29R, and 17L/35R are equipped with Category I precision approach lighting systems. Runway 11L, designated for takeoff, does not have an approach lighting system. The apron has a total of 223 stands, divided into 76 close-in stands and 147 remote stands, as shown in Figure 1.

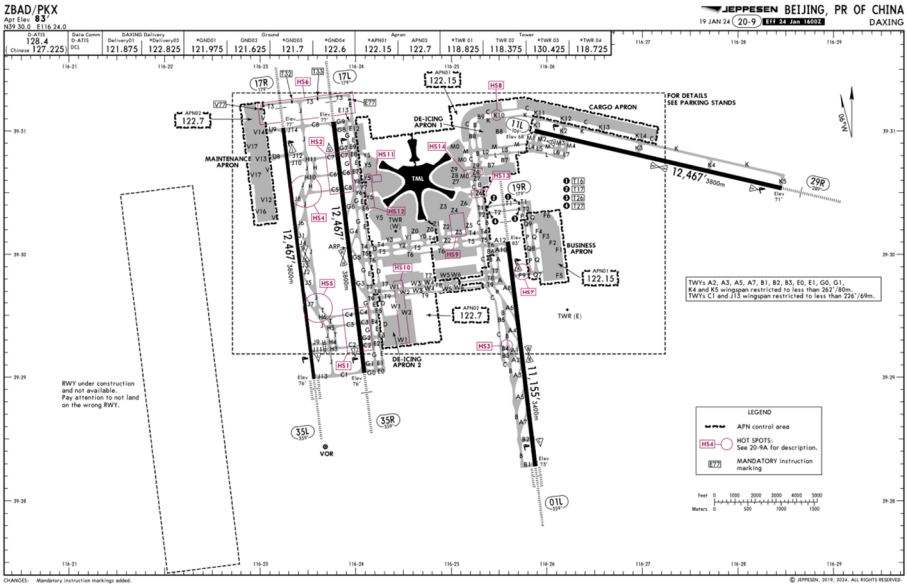

Fig. 1. "Jeppesen Map（AIRAC2410）-ZBAD-AIRPORT" [1]

In 2011, to alleviate the operational pressure on Beijing Capital International Airport, the site selection and planning work for Beijing Daxing International Airport officially began. In 2014, the site selection for Beijing Daxing International Airport was

officially confirmed and approved by the State Council and the Central Military Commission [2]. Construction commenced in September 2015. On June 30, 2019, Beijing Daxing International Airport completed its final inspection and was successfully inaugurated on September 25, making it another 4F standard airport in China.

The location of Beijing Daxing International Airport has historically been an important gateway to the southern part of Beijing, with a rich historical heritage and strategic significance. The local economy has significant development potential, abundant human resources, and a total population exceeding 100 million people. The area is part of the Beijing-Tianjin-Hebei coordinated development zone [3], playing a crucial role in the economic integration of the region, supported by the government's "Beijing-Tianjin-Hebei Integration" development policy [4]. However, the area still faces prominent issues such as ecological environment degradation, imbalanced urban system development, and widening gaps in regional and urban-rural development.

3 Case Analysis

3.1 Employment Impact

According to Economic growth theory [5], airports attract related businesses and generate economic benefits, creating jobs and increasing local demand. The construction of new airports generates many jobs in the neighboring towns, both during the process and after they are put into operation, for example, the construction of the new airport project in Istanbul has had a significant impact on employment. During the construction period, the project provided jobs for more than 7,500 workers. When the construction of the airport is completed, it will provide more diverse and majority employment opportunities. For example, Schiphol Airport in Amsterdam, the Netherlands, generated more than 57,000 direct jobs and 57,000 indirect jobs in a variety of sectors, including construction, airport operations, customer service, security, retail, and logistics [6]. Meanwhile, according to employment data around 25 major U.S. airports, the concentration of jobs within 2.5 miles of these airports is almost half that of central business districts (CBDs), specifically generating 3.1 million jobs, or 2.82 percent of all U.S. employment. Within 5 miles generates 7.5 million jobs, or 6.78 percent. Within 10 miles it generates 19 million jobs, or 17.17% of all U.S. employment, which highlights the airport's radiant impact on neighboring employment. Daxing International Airport is surrounded by an urban layout of mostly villages and towns, so the demand generated by the airport's various functions will drive employment in neighboring villages and towns.

Although the airport brings new job opportunities, it also disrupts the existing employment landscape and patterns. Prior to the construction of Daxing Airport, the surrounding area was predominantly agricultural land with farming as the primary employment. Building the airport necessitated extensive land use, resulting in the expropriation of local lands and the displacement of residents and laborers. Therefore, in the short term, or even in the long term, if the affected population cannot find alternative land, it will cause employment disruption. There may also be an impact on the original local employment after the airport construction is completed and operational. Airport

jobs will attract not only local residents, but also labor from other areas, thus increasing competition and pressure for jobs.

3.2 Industrial Structure

According to Urban growth theory [7], airports can create new zones of economic activity and become major hubs within a city in its vicinity, which are usually called airside economic zones. The attraction of airside economic zones to labor, talent, and businesses will inevitably lead to the transformation of local industries. According to the cases of foreign airports, transportation providers such as airlines, aircraft maintenance, and airport operations are most likely to be located around airports; transportation-supporting jobs such as lodging and retail services for air travelers and wholesale services for air transportation; and transportation-using firms such as high-level production service companies, finance, real estate, and information-processing firms. companies, etc. For example, the U.S. Memphis Airport's Airside Economic Zone is known for its well-developed aviation industry, specifically covering logistics and freight transportation (FedEx, United Parcel Service, etc.), aviation repair and maintenance (Honeywell, Boeing), aviation operations and consulting (Delta airlines, etc.), and manufacturing (Siemens Electric). The Daxing International Airport Airside Economic Zone has attracted more than 3,000 business registrations as of 2021, and is currently dominated by secondary and tertiary industries, such as the offices of major domestic airlines (Air China, China Eastern Airlines, and China Southern Airlines), and express delivery companies (SF Express, and Jingdong Logistics) are expected to be in the future. The development of cross-border e-commerce, digital economy and other services and trade in the new business model, and then radiate the influence of the surrounding areas, to attract highly sophisticated technology enterprises.

However, it should be noted that before the construction of the Daxing International Airport, the local primary industry, i.e., agricultural production and related support industries, and after the construction of the airport, the dominant industry has become the secondary and tertiary industries, and other large-scale enterprises. Local small and medium-sized enterprises (SMEs) are at risk of closing down or downsizing because they are unable to compete with large-scale foreign enterprises. The proportion of traditional industries in the region is gradually decreasing. Therefore, local traditional enterprises need to consider challenging solutions such as transformation or relocation. Meanwhile, the Daxing Airport's airside economic zone itself, due to its relatively short development time, still has some problems. Firstly, the hub character of the zone needs to be improved, with major constraints including the failure to realize the air-railway linkage, and the low efficiency and complexity of the airport's procedures due to the current customs policy. Secondly, the degree of perfection of supporting services is not high. For example, in the field of trade, the current service platform only includes the Bank of China, which can promise to complete all kinds of offshore trade business procedures within 1-10 working days, so the efficiency is lower than that of the same level of international airside economic zones. Therefore, it is also crucial to enhance the overall service capacity of the Daxing Airport CEA.

3.3 Impact on Residents' Lives

The construction of airports not only has an impact on the type, attributes, and number of businesses in the surrounding area, but also has a profound influence on the lives of the residents of the area. These impacts can be categorized into economic, social, and health aspects.

In terms of economic aspects, conventional wisdom suggests that the construction of an airport will have a positive impact by increasing the price of real estate in the surrounding area, which in turn will create more income-generating opportunities for local residents. However, the reality does not always follow this empirical reasoning, and based on extensive research, there is often a neutral impact on the economic side. For example, in a study of home prices and sales in Bonaero Park near OR Tambo Airport, researchers found that the construction of the airport had a neutral impact on real estate prices in the neighborhood [8], meaning that the airport's construction and associated advertising didn't have a disproportionate increase in home prices in the neighborhood. One environmental explanation is that noise, air quality, and other environmental issues offset the price increases associated with location advantages. At the same time, the employment and business transformation issues discussed above may also explain the results of the study: even if local land prices do rise, resulting in a large number of land transactions, some people will lose the agricultural land that they depend on for their livelihoods that the government is using for the airport construction, resulting in a weakening of the positive impact on the economy. In a study exploring the effects of Suvarnabhumi Airport on nearby residents' quality of life, researchers surveyed over 450 locals to assess the economic impacts. The findings indicated a neutral average rating. The most cited reasons for this neutrality were related to changes in employment and business dynamics, similar to those observed with Daxing Airport. Prior to the construction of Daxing Airport, the primary source of income for local residents was agriculture, suggesting that the airport's economic influence might not have been entirely beneficial for the community.

On the social side, the traditional view is that the positive impact is due to the improvement of the convenience of life - with the construction of the airport, the development of the airside economic zone, which will lead to the development of the service industry around the residents, which will have a positive impact on the social life of the residents. However, the study on Suvarnabhumi Airport's influence on the life of inhabitants in adjacent localities points to the fact that the construction of the airport has led to an increase in the mobility of the community and the complexity of the social structure, which means that there is a possibility of an increase in the crime rate. However, it is worth noting that the issue of social security mentioned here is still essentially determined by the intensity and manner of local policing, and that the Daxing International Airport is located in a place where the law and order situation is good, so it will not be affected too much by the complication of the social personnel, and therefore there will be a positive impact on the social aspect.

One aspect that will inevitably have a negative impact is the health aspect. In numerous national and international studies of airports, researchers have rated aircraft noise as the factor that has the greatest impact on the health of the surrounding population,

especially sensitive groups (sick, elderly, etc.). Specifically, some of the most common effects include: 1, aircraft noise affects low-frequency, 4000 Hz and higher frequency hearing loss, systolic and diastolic blood pressure, and psychological responses [9]. 2, aircraft overflight noise affects the heart amplitude and thus produces a not, and the relationship between the two is positively correlated [10]. 3, long-term exposure to aircraft noise, the residents of the insomnia and daytime sleepiness will be about three times higher than the long-term exposure to the normal noise environment [11]. Therefore, Daxing Airport, as a busy airport operating 24 hours a day, the residents of the surrounding residential areas are also exposed to health effects such as these.

3.4 Environmental Impact

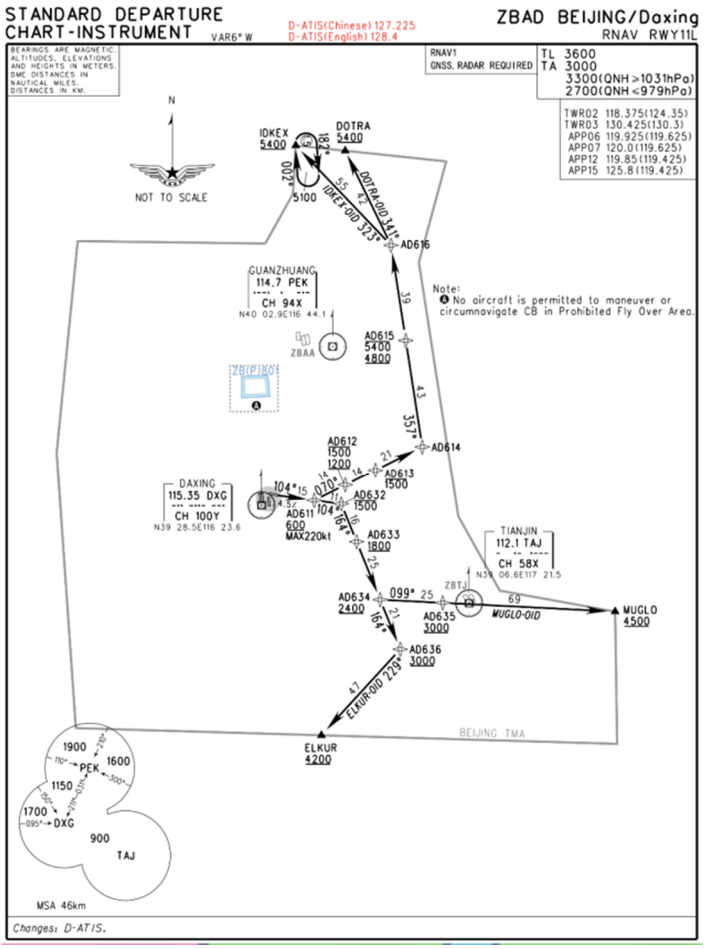

Fig. 2. "CAAC Standard Departure Procedure Charts for ZBAD" [13] (note that: In all CAAC Standard Departure Procedure Charts for Daxing Airport, it can be observed that the ZB(P)801 area, which represents the city area outlined by a dashed box, has no routes passing through it.)

Finally, we need to pay attention to the impact of Daxing Airport on the urban ecological environment. Although the construction of the airport will inevitably have negative impacts on the surrounding ecological environment, such as noise, land use, air pollution, etc., as discussed earlier, airport managers and urban planners can still optimize the airport planning scheme to minimize the impacts as much as possible.

In terms of air pollution, Daxing Airport is more effective. According to research, airplanes have the most significant impact on air quality in cities during the climb phase, especially during the initial ascent phase (large thrust climb emissions) [12]. Therefore, the location of the airport, the set departure and approach procedures have a great impact on urban air quality. If the climb departure procedure has a route through the city center, the impact on urban air quality will be very serious. Daxing Airport's departure program has set up the flight paths to protect the urban air quality. As we can see from the standard departure procedures of Daxing Airport by CAAC, none of the flight paths cross the city center, as shown in Figure 2.

In terms of noise management, the International Civil Aviation Organization (ICAO) stipulates that aircraft must not exceed 250 knots below 10,000 feet, effectively reducing noise pollution. Additionally, to ensure the health and safety of nearby residents, with the support of local governments, all houses in areas of Beijing and Hebei Province affected by noise levels above 70 decibels have been subject to relocation or soundproofing measures [14]. Therefore, Daxing Airport has become one of the world's leading international airports regarding noise control.

The construction of Daxing Airport significantly influences local employment, industrial structure, residents' lives, and the environment. These impacts encompass both positive and negative aspects. To fully realize its potential as the new gateway to the capital, it is crucial to enhance its strengths and mitigate its weaknesses.

4 Suggestions

4.1 Employment

With regard to employment, the main problems facing Daxing Airport are competition between local small enterprises and foreign enterprises in the market, and the future employment of the local population, especially those who are engaged in farming. First, to address the problem of competition between local small businesses, the government should actively support the development of local small and medium-sized enterprises (SMEs) by providing low-interest loans or subsidies to help local SMEs expand their production and business. At the same time, business incubators should be set up to provide financial, technological and market support to indigenous people who wish to start their own businesses, to speed up the process of development and transformation of local enterprises. About the future employment of the local population, the Government should offer courses in specialized skills such as aviation services, logistics management, hotel management and other related courses, and match them with relevant local enterprises to ensure stable employment.

4.2 Industrial Impact

The current problems of the Daxing International Airport Airside Economic Zone are mainly that the industrial structure is still incomplete, trade-related services are inefficient, and the logistics industry has not been fully developed. To address the above problems, the government should actively develop freight transportation, put freight transportation on the same level of importance as passenger transportation, and attract more international airlines and logistics companies to move in and attract more talents by formulating preferential policies. Encourage more high-tech, high value-added and innovative enterprises to move in through policies to enhance the competitiveness of the overall region. Further improve the trade service platform to provide customers with more convenient and faster services. Actively promote trade liberalization and participate in the negotiation and signing of regional and international trade agreements to promote trade liberalization and investment facilitation and attract more international trade and investment. Customs should improve import and export policies, thereby increasing the efficiency of airport operations and docking with cities.

4.3 Resident'S Lives

According to the research and comparative study, the biggest negative impact on the lives of the residents around Daxing Airport is the noise problem. Therefore, the government should establish a good communication and inquiry mechanism with the residents in the neighborhood to ensure that the residents' opinions can be fed back smoothly. The government should introduce boundary planning around the airport to effectively balance the use of land resources and the residents' living experience, supervise the Civil Aviation Administration to formulate better and more reasonable low altitude flight noise mitigation measures to ensure the noise level of low altitude flight paths near the airport and the living area near the airport, and provide subsidies to the communities that are seriously affected by the pollution of noise when necessary. Airlines should actively use noise reduction equipment on their aircraft, such as Chevron Nozzle for engines. Airports should limit operational restrictions to specific time periods. This will minimize negative impacts by improving the quality of life of people living near airports through multi-party collaboration.

4.4 Environment

Although environmental pollution is unavoidable around airports, scientific measures can be taken to minimize pollution in many ways. Airports should increase the use of ground power and ground air sources to replace aircraft auxiliary power systems (APUs) to effectively reduce environmental pollution when aircraft are parked and require power and pilot air and use electric or low-emission ground support equipment (GSEs) instead of traditional fuel-fired equipment for this ground equipment to reduce ground pollutant emissions. Airlines should promote the use of sustainable aviation fuel (SAF) to reduce carbon dioxide and other harmful emissions. The government should carry out greening projects near airports to build green barriers without compromising

flight safety and reduce the impact of noise and air pollution on the surrounding communities. The Civil Aviation Authority should continue to improve flight path design planning to minimize urban air pollution due to flight paths. The Government should also increase environmental monitoring around airports to identify and address pollution problems in a timely manner.

5 Conclusion

5.1 Main Findings

This study analyzes the multifaceted impacts of large airports, particularly Beijing Daxing International Airport, on urban development. Firstly, for employment, the construction and operation of the airport has significantly increased local employment opportunities, directly creating jobs in areas such as construction, airport operations, customer service, security, retail and logistics. However, it has also led to increased competition for jobs, which has had an impact on residents who were originally dependent on agriculture. Therefore, the government and relevant enterprises should provide professional skills training to help the local labor force adapt to the needs of the new industry.

Secondly, for the industrial structure, the airport has driven the development of secondary and tertiary industries, attracting large enterprises in the fields of aviation, logistics and high technology. However, local small and medium-sized enterprises (SMEs) are facing fierce competitive pressure, and the business environment has become more complicated. Therefore, while implementing the introduction of industries, the government should consider measures to safeguard the interests of local small and medium-sized enterprises, enhance their comprehensive competitiveness, and allow them to share the industrial economic benefits brought by the airport.

The airport's presence has led to mixed economic effects on the residents: while some have gained from increased property values, others have suffered due to land acquisition. Socially, while the airport has enhanced access to various services, it has also been associated with a rise in crime rates. Regarding health concerns, residents have been adversely affected by noise pollution and other environmental detriments caused by the airport's operations. To reduce these negative impacts, the government should strengthen environmental protection measures, optimize airport design to minimize damage to the surrounding environment, and provide compensation and support to affected residents through policy instruments.

Finally for the environment, airport operations have led to noise pollution, air quality problems and significant land use changes. However, some of the negative impacts can be mitigated through effective planning and environmental management measures such as multi-party cooperation to optimize flight paths and implement noise and pollution mitigation measures.

5.2 Research Significance

This study has significant social value, providing multiple insights into the impacts of the construction of large airports on urban development. For industry stakeholders, understanding these impacts can assist in strategic planning and policy formulation. For companies, the findings emphasize the need to align business operations with local economic and social dynamics for sustainable development. For governments, the findings expose some of the existing problems and give possible solutions.

5.3 Limitations

This study relies heavily on secondary data and may not fully capture the nuanced impacts of the airport on the local community. In addition, the analysis was limited to a relatively short period of time after the airport was constructed, which may have overlooked long-term impacts. In future studies, first-hand data should be obtained through surveys and interviews with residents, businesses, and other stakeholders to gain a more comprehensive and full understanding of the impacts of airports. At the same time, longitudinal studies should be conducted to observe the long-term impacts of airports on urban development. The scope of the study should also be expanded to include comparative studies with more similar international airports at other levels to provide valuable insights for future practice and improvement.

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