Analysis of the Influence of Aviation Logistics on the Regional Ecological Economic Development of Jilin Province

Miao Feng¹, M, Qing Tan², *, Xing Lv¹, b

¹School of Economics and Trade, JiLin Engineering Normal University, Changchun 130000, China;
²Changchun Institute of Educational Science, Changchun 130000, China.

*Corresponding author Email: 317747398@qq.com, *1036909360@qq.com,
b728604791@qq.com

Abstract. With the economic development entering the stage of normalization, ecological and globalization, aviation logistics has become a growth point of economic development and has become an important force to promote regional ecological economic development. It can more effectively promote regional industrial division of labor and optimal allocation of resources. The industrial structure upgrade of the service area will be more professional and planned. Taking the aviation logistics of Jilin Province as an example, this paper explores the relationship between its development and the regional economy of Jilin Province, and punishes quantitatively and qualitatively, and discusses the important contribution of aviation logistics to the regional economic development of Jilin Province.

1. Introduction

As an important part of modern logistics, aviation logistics plays an indispensable role in economic development, especially in international trade. The relationship between logistics and regional economy has attracted the attention of many scholars, but the existing research mainly uses qualitative or traditional regression analysis methods to study the relationship between GDP and certain factors in logistics [1]. Investigating the development history and future trends of the regional economy and the experience of air transport development at home and abroad, we can find that air transport is not only a means of transportation, but also a high-quality resource. The regional economy makes use of air transport, and it is easier to transcend the boundaries of geography and space, directly participate in the international division of labor and the international economic cycle, and absorb and accumulate various energies and elements of productivity in the world. Many cities in the world attach great importance to the use of air transport resources to create a superior business, entrepreneurship, employment, settlement environment, and vigorously develop the regional economy.

2. Analysis of the value of aviation logistics function

2.1. Aviation logistics time benefit

The time benefit of aviation logistics refers to the value obtained by changing the time difference between the "object" and the supplier [2]. Firstly, shortening logistics time at the fastest speed can
reduce logistics losses, reduce logistics consumption, speed up cargo and capital turnover, and increase capital appreciation. Secondly, in the economic society, scientifically and systematically compensate for the time difference between demand and supply, and can achieve the corresponding "time value".

2.2. Air Logistics Space Benefits
The logistics space benefit refers to the value created by the "object" from the supplier to the demander due to the change of position. Since the products in different regions have different values, the concentrated production areas can produce more products at a lower cost through specialized, large-scale production and higher productivity, and then the low-value goods that are suitable for air transportation through air logistics activities. When the area is transferred to a high-value area with scattered layout, the corresponding value difference can be obtained. In the wave of economic globalization, a basic principle of international division of labor and global supply chain construction is to produce in lower-cost regions, and sell in higher-value regions through effective logistics systems and global supply chains.

2.3. Air Logistics Value-added Service Benefits
In the process of aviation logistics, through the special production form of circulation processing, the "things" in the circulation process are processed by specific methods to create corresponding added value, that is, the benefits of logistics value-added services. For example, aircraft repair centers usually require preliminary simple assembly and processing of aircraft parts during the distribution process, simple sales and packaging processing during the circulation of goods before sale, and so on.

2.4. Aviation logistics integration benefits
The integration benefits of aviation logistics, namely, through innovative aviation logistics system, improvement of aviation logistics system and organization, improvement of aviation logistics processes and other measures, more effectively integrate and integrate aviation logistics resources, thereby enhancing the ability of aviation logistics activities to obtain economic benefits. First, through the integration of scale to deal with large-scale logistics needs, such as the integration of airlines, airports and other logistics facilities and resources on the ground [3]. Secondly, through the integration of operational procedures, the complex and complex aviation logistics operations are organized and simplified, and redundant operations and invalid links are deleted; facilities, equipment and management are effectively integrated to improve the efficiency of aviation logistics production. A powerful example of the benefits of aviation logistics integration is "common distribution", which is jointly distributed to many enterprises that require air transportation to achieve scientific and rational distribution.

3. Correlation Analysis between Aviation Logistics and Regional Ecological Economy in Jilin Province
There is a high correlation between aviation logistics in Jilin Province and regional economic development. We use the GDP value of Jilin Province from 1998 to 2018 and the added value of transportation and storage, and make time series regression through e-views software. After eliminating autocorrelation, we establish a first-order regression model:

\[ GDP = 6.48WL + 85.25 + 0.847AR \]  

Among them, GDP is the annual gross domestic product of Jilin Province, the unit is 100 million yuan; WL is the annual added value of transportation and storage in Jilin Province, the unit is 100 million yuan; AR is the autocorrelation parameter added to eliminate the first-order autocorrelation. The modified fit of this model has reached 0.9957. The indicators are within the error range, indicating the high correlation between GDP and the added value of aviation logistics. They have
interdependence and mutual promotion. For every 100 million yuan increase in the value of aviation logistics, it can bring GDP growth of 648 million yuan to Jilin Province. Similarly, the demand for aviation logistics is the derivative demand of the national economy, which grows with the growth of the national economy and also with the nationals. Negative economic growth and depression [4]. Aviation logistics in Jilin Province not only promotes the development of regional economy, but also effectively protects the healthy and orderly development of the economy. At the same time, it not only solves local employment problems, but also increases taxes and promotes the development of related industries. The development of aviation logistics has brought capital, technology, advanced management ideas and a large amount of information, which has brought new vitality to the development of other industries, become a new growth point of the economy, and can optimize the regional industrial structure. In recent years, the intensive role of aviation logistics has demonstrated its important value in reducing environmental pollution and promoting sustainable development.

4. Relationship Analysis Based on System Dynamics
According to the viewpoint of system dynamics, there is a positive feedback system between the regional economic level of Jilin Province, the trade level of China-ASEAN Free Trade Area, aviation logistics demand and aviation logistics supply. The main feedback loop is as follows: Jilin Province regional economic level Positive feedback loop with aviation logistics demand; positive feedback loop of regional economic level and aviation logistics supply in Jilin Province; positive feedback loop of regional economic level of Jilin Province and trade level of China-ASEAN Free Trade Area; trade level and aviation logistics of China-ASEAN Free Trade Area Demand positive feedback loop; China-ASEAN Free Trade Area trade level and aviation logistics supply positive feedback loop.

4.1. Aviation Logistics Requirements Subsystem
In the system dynamics model constructed, the factors affecting the demand of aviation logistics are summarized into two categories: the promotion factors and obstacles of aviation logistics demand, and are expressed by the growth rate and obstacle rate of aviation logistics demand. The demand for aviation logistics comes from two aspects: first, the demand from the region; second, the demand for transshipment from outside the region.

![Dynamic map of aviation logistics demand subsystem](image)

**Fig.1** Dynamic map of aviation logistics demand subsystem

Therefore, the growth rate is affected by the price of aviation logistics, the growth rate of the air transport market, and the price ratio of air and logistics within and outside the region, and the growth
rate of transshipment. To a certain extent, the impediment rate should be related to the service level of aviation logistics and the trust of enterprises in aviation logistics enterprises. In order to simplify the model, this paper mainly reflects these factors in the supply and demand ratio of aviation logistics. If the aviation logistics supply capacity and demand capacity are too different, it means that the aviation logistics service level cannot meet the needs of enterprise logistics, which will inevitably lead enterprises to choose other logistics methods, thus resulting in the loss of aviation logistics demand.

4.2. Aviation Logistics Supply Subsystem

The aviation logistics supply capacity is mainly affected by investment and loss. This paper describes the growth rate and consumption rate of aviation logistics supply. The main influencing factors of growth rate are investment effect and investment delay time. As a necessary condition for economic development, the aviation logistics infrastructure must ensure that certain commitments are made to aviation logistics infrastructure such as airports and supporting transportation facilities to increase supply capacity. In addition, in order to ensure their own sustainable development, enterprises engaged in aviation logistics will also convert part of their income into investment to substantially improve the level of logistics services. The consumption rate mainly refers to the decline of logistics supply capacity due to the aging and depreciation of aviation logistics facilities [5].

![Dynamic map of aviation logistics supply subsystem](image)

Fig.2 Dynamic map of aviation logistics supply subsystem

5. Analysis of the impact of Jilin Province's aviation logistics on regional economy

The model was simulated using the simulation software Vensim. The basic data was derived from field research, customs statistics and statistical yearbooks for the relevant years. The simulation time starts from 2009 and is simulated in units of 10 units. In order to facilitate the processing, the actual data of 2009 is rounded up. The initial values are shown in Table 1.

| Initial time (year) | Jilin Province GDP (100 million yuan) | China-ASEAN trade volume (100 million US dollars) | Aviation logistics demand (10,000 tons) | Aviation logistics supply capacity (10,000 tons) |
|---------------------|---------------------------------------|-----------------------------------------------|---------------------------------------|-----------------------------------------------|
| 2009                | 2900                                  | 800                                           | 3.9                                   | 3.7                                           |

Tab. 1 Simulation initial value
The validity of the historical data was tested on the actual Jilin Province GDP and China-ASEAN trade volume, and the data from 10 years from 2009 to 2018 were intercepted for error analysis (see Table 2). The absolute value of the relative error between the simulated result and the actual data is less than 5%, which indicates that the simulation result is in good agreement with the actual data, the prediction accuracy of the model is high, and the consistency between the model and the actual system is good.

### Tab. 2 Jilin Province GDP simulation results and error analysis

| Years | Statistics (100 million yuan) | Analog quantity (100 million yuan) | Relative error |
|-------|-------------------------------|------------------------------------|----------------|
| 2009  | 2735.1                        | 2700                               | -1.28%         |
| 2010  | 3547.2                        | 3457.5                             | -2.53%         |
| 2011  | 4075.8                        | 4125.2                             | 1.21%          |
| 2012  | 4851.9                        | 4751.2                             | -2.08%         |
| 2013  | 5724.4                        | 5812                               | 1.53%          |
| 2014  | 7745.6                        | 7821.6                             | 0.98%          |
| 2015  | 8521.6                        | 8492.1                             | -0.35%         |
| 2016  | 8954.7                        | 8901.1                             | -0.60%         |
| 2017  | 10542.1                       | 10412.2                            | -1.23%         |
| 2018  | 11487.1                       | 11054.2                            | -3.77%         |

### 6. Jilin Province Aviation Logistics Development Policy Proposal

From the above simulation results, it can be found that the supply of aviation logistics has a great impact on the regional ecological economy and the development of trade with ASEAN. Improving the supply of aviation logistics and its service level is one of the effective ways to promote economic and trade development. Based on this, the following suggestions are made: First, increase investment in aviation logistics infrastructure, including investment in airport infrastructure and supporting logistics infrastructure, and provide infrastructure support for the development of aviation logistics; second, establish the concept of "big logistics" and integrate The aviation logistics resources in the region will form a scale effect, build an aviation logistics information management platform, enhance logistics service capabilities, reduce logistics costs and expenses, thereby improving the regional competitiveness of aviation logistics in Jilin Province; third, vigorously support the development of third-party logistics enterprises And create a good investment environment for them, encourage third-party logistics companies to engage in aviation logistics services, encourage them to adopt new logistics technologies and management concepts to improve the level of logistics services; Fourth, encourage the establishment of air cargo logistics companies, etc., and encourage them to operate aviation The logistics business provides preferential treatment from registration, land, taxation, etc., and subsidizes the opening of cargo flights to create a good investment and business environment. Fifth, vigorously develop high-tech and special agricultural products, suitable for aviation logistics, and establish aviation. Logistics park or airport the logistics (industrial) park promotes the agglomeration of the aviation logistics industry and related industries, forming a cluster effect.

### 7. Conclusion

The 21st century is the century of aviation. Air transportation interweaves the world's people flow, logistics, information flow and capital flow at a high speed, and becomes the main channel for countries and regions to participate in international economic competition and exchange personnel and goods with the global market. In the context of economic global integration, it laid the foundation for the region to find market opportunities and resource support in the country and even the world. Therefore, air transport is not only a means of transportation, but also promotes regional eco-economic development through air transport and maximizes the use of resources on a global scale, which will become the mainstream form and dominant model for future global economic development. Vigorously develop air transport, bring together the energy and vitality of domestic and international cities, promote the dynamic exchange of air transport and regional eco-economy, and make it a source
of regional eco-economic growth. It is extremely important for regional eco-economic development and participation in international competition.

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