Review on the Passenger Throughput Forecast of Airport

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ABSTRACT

In recent years, China's economy has developed rapidly and the people's living standards have continued to improve. A high-end means of transportation, airplanes, is favored and accepted by more and more people with its advantages of comfort, speed, and safety. Accompanying it is the increase in pressure on passenger transportation in the aviation industry. The development of China's civil aviation industry is relatively late and relatively immature. It has only ushered in a development frenzy after the reform and opening up. Therefore, the method of predicting airport passenger throughput is also imperfect. The outdated forecasting method cannot predict the situation of the airport well, so it is very important to seek a more scientific, more complete and systematic forecasting method of airport passenger throughput. This article has conducted a certain review and research on the prediction methods of airport passenger throughput, and hopes to have further research in this aspect.

Keywords: Airport; Passenger throughput; Prediction method

1. INTRODUCTION

The air transportation industry can reflect the development of economy and society. For example, the development of Beijing Capital International Airport largely reflects the development of China's civil aviation industry since the reform and opening up. Beijing Capital International Airport was officially built and put into use in 1958. So far, the airport has been in operation for more than 60 years. Since the reform and opening up in 1978, Beijing Capital International Airport has entered an unprecedented rapid development stage: in 1978, the annual passenger throughput of Beijing airport was only 1.03 million, but 60 years later, it exceeded 100 million, with an average annual growth rate of 12.1%. On December 28, 2018, Air China CA932 arrived in Beijing from Frankfurt and landed safely at the capital airport. So far, the annual passenger throughput of Beijing Airport exceeded 100-million person times for the first time. It marks that Beijing Capital International Airport is the first airport with an annual passenger throughput of over 100 million in China, and also the second airport in the world with an annual passenger throughput of more than 100 million after Atlanta Airport in the United States. It can be seen that the development of the airport is closely related to the development of the local economy.

As an important indicator to measure the development of civil aviation transportation, it is very valuable to predict the passenger throughput scientifically and reasonably [1]. It can not only promote the development of prediction theory, but also provide data suggestions for the subsequent management and construction of the airport. Therefore, this paper reviews the prediction methods of airport passenger throughput, hoping to do some research in this area [2].

2. Research significance

For the transportation industry, scientific and systematic decision-making is very meaningful for the effectiveness of planning and management [3], and scientific decision-making is based on scientific prediction. Scientific prediction can minimize the uncertain risks in the future and provide the airport authorities with decision-making basis for construction, investment, reconstruction, and operation. At present, China's civil aviation industry is in a period of rapid development, how to make the expansion of the airport meet the overall needs of the society is a problem to be solved: whether the construction project has value, whether the corresponding timing is appropriate, must rely on accurate passenger throughput forecast [4]. A scientific and reasonable prediction method of airport passenger throughput can correctly estimate the economic costs and benefits of construction projects, and will not lead to decision-making mistakes. From the perspective of overall benefits, scientific passenger throughput forecast data can also promote the coordinated promotion of surrounding industries, comprehensive transportation industry and civil aviation airport industry, so as to ensure reasonable overall layout and orderly development of national economy [5].

Therefore, the scientific analysis and prediction of the annual passenger throughput of the airport has a very far-reaching practical significance for the construction, planning, investment and operation of civil aviation airports and the results of the prediction can also be used for reference by other cities in China [6].

3. Literature review

In recent years, many experts and scholars have devoted themselves to the prediction of airport passenger throughput. Some experts and scholars mainly study the main influencing factors of airport passenger throughput, and some experts and scholars mainly study the main prediction methods of airport passenger throughput. Their research results have great reference value.

3.1. Overview of influencing factors of airport passenger throughput

Experts and scholars have done a lot of research on the influencing factors of passenger throughput of civil aviation airport. Pengpeng Jiao [7] used the PCA to analyze the main influencing factors of airport passenger throughput in "Research on the Influencing Mechanism and Prediction Method of Airport Passenger Throughput", and then established a multiple linear regression model. The results can accurately predict the future airport passenger throughput. Zidong Zhang and Jianhong Xu [8] also used the PCA to analyze the main influencing factors in the "Main Influencing Factors of Airport Passenger Throughput", and selected four domestic famous airports for empirical analysis, the results show that although the ranking of each influencing factor is different in different airports, the most important influencing factors are similar. Chongjun Xiong, Xuanxi Ning and Yingli Pan [9] and Cuiping Li [10] have used the time series data to conduct qualitative and quantitative analysis on the main influencing factors of the passenger throughput of civil aviation airports, and use the grey prediction method to carry out correlation analysis on various factors affecting China's civil aviation passenger transport system. The results show that the most important factors affecting airport passenger throughput are GNP, the average salary of employees and the total amount of foreign trade. Through the above literature on the main influencing factors of airport passenger throughput, we can know that any airport passenger throughput is the result of a variety of factors.

3.2. Overview of airport passenger throughput forecasting methods

According to the literature, the prediction methods of airport passenger throughput can be roughly divided into qualitative prediction method and quantitative prediction method, and the quantitative prediction method can be divided into econometric method and time series prediction method. Time series forecasting method is based on the continuity of the development of things, using the past time series data for statistics and analysis to calculate the development trend of things, and then predict the future development and change of a regression forecasting method, which can be used for short-term, medium-term and long-term prediction. The common time series forecasting methods include moving average method, exponential smoothing method and trend forecasting method. Econometric method is based on the relationship between the object of study and other things to promote or restrict each other, so as to find its internal laws for data fitting. Some common econometric models include neural network model, multiple linear regression model and so on.

3.2.1. Qualitative prediction method

Qualitative prediction method is also called empirical judgment method. The qualitative prediction method is based on people's experience, judgment and analysis ability to judge the nature of things, focusing on predicting the development trend, direction and major turning point of things. The common qualitative prediction methods mainly include market survey forecasting method, analogy method, expert prediction method and Delphi method. Among them, Delphi method is a kind of expert investigation method, which is a method to judge and predict the research problems according to people's existing experience.

3.2.2. Quantitative prediction method

Quantitative prediction method is a kind of method that uses some specific historical data or factor variable values, uses certain mathematical methods or models to scientifically and thoroughly analyze and process the obtained data, find out the potential laws in the data or the regular relations with other factors, so as to realize the prediction.

With the development of the times and the progress of science and technology, there are many effective airport passenger throughput prediction methods, some of the more common quantitative prediction methods are: time series prediction method, trend extrapolation prediction method, regression analysis prediction method, econometric prediction method, neural network prediction method and grey prediction method [11].

3.2.3. Comparative analysis of the two methods

Table 1 Comparative analysis of advantages and disadvantages

	Advantage	Disadvantage	Suitable situation
Time series	(1) Simple operation (2) Only needs the passenger throughput data over the years. (3) Small non-system error.	(1) The prediction value is easy to lag behind. (2) It is not suitable for long-term prediction.	Short-term forecast
Trend extrapolation	(1) The process is simple and fast. (2) The data processing is easy to operate.	(1) It can only predict stable and continuous trend in time and space. (2) requires high data timing.	Airports with relatively stable social and economic environment
Regression analysis	(1) The preliminary data is easy to obtain. (2) The model is easy to establish and the calculation is simple.	(1) Univariate regression model is simple, but its accuracy is low. (2) Multiple regression model data collection is difficult.	Airports with early navigable years

Econometric prediction method	(1) The economic meaning of the model is clear and the calculation is simple. (2) If exogenous variables and throughput trend are correctly judged, the prediction accuracy is higher.	(1)The workload of data collection is heavy. (2)Exogenous variable selection is easy to vary from person to person.	Airports in the period of investment and growth
Neural network	(1) The prediction model can be modified continuously. (2) The calculation is very fast after the correction.	(1) It is easy to over fit in training. (2) The actual prediction error is large.	Large airports
Grey prediction method	(1) Less data is required and the principle is simple. (2) The accuracy of short-term prediction is high and the model can be tested.	(1) It involves more advanced mathematical methods. (2) The calculations are cumbersome.	Short-term forecast or new airport

In recent years, with the rapid development of China's air transport industry, experts and scholars have developed many main prediction methods of airport passenger throughput. Guoyan Li, Nan Li and Zhiqing Wang [12] introduced the main prediction methods of China's airport passenger throughput and some shortcomings and deficiencies in "Prediction Method and Current Situation of China's Airport Passenger Throughput". Shanlin Hui [13] made a discussion on the shortcomings of the prediction model of China's civil aviation airport passenger throughput in "Discussion on the Prediction Method of Passenger Throughput of Civil Airport", it is proposed that the most appropriate prediction method should be selected according to the actual situation for targeted prediction, and a more accurate prediction result is finally obtained by combining the qualitative prediction method with the quantitative prediction method. Hui Zhang and Zhe Wang [14] compared and analyzed the prediction methods of various airport passenger throughput in "Discussion on Airport Throughput Prediction Methods", and elaborated in detail each advantages and disadvantages of the two methods, the applicable airport types and so on.

This paper mainly compares the advantages and disadvantages of some common quantitative prediction methods (see Table 1). From table 1, we can draw a conclusion that each forecasting method has its own advantages and disadvantages, as well as its applicable situation. When we predict the passenger traffic volume of the airport, we need to consider not only the airport's own factors, but also the applicability of each prediction method, and make appropriate use of it according to the local conditions.

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