Open Journal of Business and Management, 2026, 14(1), 172-182
https://www.scirp.org/journal/ojbm
ISSN Online: 2329-3292
ISSN Print: 2329-3284

Research Airline Cabin Crew Resource Planning

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How to cite this paper: Lv, X., & Xue, J. (2026). Research Airline Cabin Crew Resource Planning. *Open Journal of Business and Management, 14,* 172-182.
https://doi.org/10.4236/ojbm.2026.141011

Received: November 10, 2025
Accepted: December 28, 2025
Published: December 31, 2025

Abstract

Against the backdrop of rapid expansion in the global aviation industry, cabin crew members, as the core link of the service chain, have significantly increased the complexity of their resource planning. The fleet size of China's civil aviation industry continues to grow, with domestic passenger transport volume exceeding 640 million in 2024, 4270 registered transport aircraft, and a total of 97,000 flight attendants for China's civil aviation transport airlines. The number of flight attendants needs to be expanded synchronously to meet operational needs. The research object of this article is C Airlines. With the increase of flight capacity, the route network has become increasingly complex. The previous simple cabin crew resource planning methods are difficult to cope with dynamic demands, resulting in limited cabin crew resource strength, insufficient capacity, and a decline in cabin crew career stability. Enterprise human resource demand forecasting is an essential part of the human resource planning system. It is based on the present, focuses on the future, and takes the strategic goals, development plans, and work tasks of the enterprise as the starting point (Zhao & Mei, 2006). This article takes C Airlines as an example to analyze the current situation of "experience driven" crew resource planning work in the company. A multi factor based crew resource planning model is proposed, which fully considers the airline's aircraft capacity planning, cabin crew loss, and crew grounding loss factors, improves the scientificity of C Airlines' cabin crew resource planning introduction, and provides useful reference for achieving sustainable development. At the same time, this model also provides reference for crew resource planning of small and medium-sized airlines in the industry.

Keywords

Cabin Crew, Demand Forecasting, Resource Planning

1. Introduction

1.1. Research Background

With the rapid development of the global economy and the acceleration of globalization, the air transportation industry, as an important component of the modern transportation system, is showing a continuous growth trend. According to statistics from the International Air Transport Association (IATA), global air passenger traffic has maintained an average annual growth rate of approximately 5% over the past decade, and is expected to continue this trend in the next two decades. In this context, airlines are facing increasingly fierce market competition and constantly increasing customer expectations. How to improve operational efficiency and service quality through optimizing resource allocation has become one of the core issues of concern in the industry. There are many methods for predicting human resource demand, including qualitative and quantitative methods (Wu, 2009). Most existing research optimizes projects based on the premise of fixed availability of human resources in enterprises, without considering the potential impact of fluctuations in the total amount of human resources caused by personnel turnover on project planning (Tong, 2016). The research object of this article is C Airlines, and the long-term prediction of crew resource planning adopts the empirical prediction method. This method is simple and feasible, but the accuracy of prediction is relatively low. With the increase of flight capacity, the route network has become increasingly complex, and simple cabin crew resource planning models are difficult to cope with dynamic demands, resulting in resource waste, rising costs, and a decrease in crew job stability. The prediction of the number of cabin crew resources is related to the overall arrangement of production and is the foundation of airline production and operation. The increasing demand for production and operation quality by various companies also makes the production organization department have higher requirements for prediction accuracy to improve operational efficiency and quality (Li, 2023).

1.2. Significance of the Study

The theoretical significance of this study lies in constructing a crew resource demand measurement model suitable for the characteristics of China's civil aviation industry, enriching the theoretical system of human resource planning. The practical significance lies in providing a scientific decision-making tool for C Airlines, which helps optimize recruitment plans, reduce labor costs, and improve operational efficiency. At the same time, the research results also have reference value for the crew resource planning of other airlines.

2. Literature Review

2.1. Human Resource Demand Forecasting Method

Human resource demand forecasting is an important component of organizational planning. Domestic and foreign scholars have proposed various prediction methods, including trend analysis, ratio analysis, regression analysis, Delphi method, and computer simulation method. These methods each have their own advantages and disadvantages, and are suitable for different prediction scenarios. The trend analysis method is simple and intuitive, but it is difficult to consider the influence of complex factors; Regression analysis can handle multivariate relationships, but requires a large amount of historical data support; The Delphi method is suitable for long-term strategic forecasting, but it has strong subjectivity.

2.2. Research on Human Resource Planning of Airlines

In the field of air transportation, human resource planning research mainly focuses on two key positions: pilots and flight attendants. Foreign research started earlier, and Southwest Airlines in the United States developed a crew demand forecasting system based on operations research. By integrating factors such as flight schedules, personnel configuration standards, and absenteeism rates, it achieved accurate demand forecasting. European scholars have proposed a dynamic programming model that considers seasonal fluctuations, effectively improving resource allocation efficiency. In terms of domestic research, scholars have proposed some improvement methods based on the actual situation of China's civil aviation. For example, some studies have applied grey prediction models to forecast the demand for flight attendants, improving the accuracy of predictions. Other studies have focused on the impact of flight attendant turnover rate on demand, establishing dynamic demand models that consider personnel mobility. However, existing research often adopts a single prediction method and lacks a systematic analysis of the comprehensive impact of multiple factors.

2.3. Research Gaps and Innovation Points

Existing research has the following shortcomings: firstly, most models only consider a single or a few influencing factors, making it difficult to fully reflect the actual situation; Secondly, insufficient consideration has been given to the unique operational environment and management requirements of Chinese civil aviation; Thirdly, there is a lack of systematic research on optimizing recruitment time; Fourthly, the research on the dynamic adjustment mechanism of the model is not sufficiently in-depth. The innovation of this study lies in the construction of a multi factor comprehensive measurement model, which combines quantitative analysis with qualitative judgment, establishes a dynamic adjustment mechanism, and pays special attention to the optimization of recruitment time windows.

3. Analysis of Cabin Crew Resource Planning Issues in C Airlines

3.1. Traditional Cabin Crew Resource Strategy and Planning Driven by Experience

Failure to scientifically and accurately predict the quantity of cabin crew resources and recruitment milestones required for the future development of the company's transportation capacity has resulted in an inability to ensure a balance between supply and demand of cabin crew resources, leading to a short-term accumulation of cabin crew resources for large-scale recruitment. This has caused enormous pressure on cabin crew training and flight guidance work, making it difficult to adapt to the development needs of the company's transportation capacity growth. For a long time, the cabin crew resource planning method used by C Airlines has been relatively simple. Traditionally, it is believed that one aircraft is equipped with five sets of cabin crew, lacking complete resource planning model support. The following is a case study of the total demand for traditional crew resource planning of C Airlines:

Traditional model total demand of C Airlines			
Aircraft sorties	13	14	15
Cabin Crew configuration ratio		5	
Number of cabin crew members per unit		5	
Total demand	325	350	375

3.2. Lack of Multi Factor Data Support

C Airlines lacks multi-factor data support in its cabin crew resource planning work, such as not considering factors such as cabin crew turnover rate, long-term grounding rate, and new employee training attrition rate. In actual cabin crew resource planning work, serious loss of cabin crew resources is caused by cabin crew resignations, sick leave grounding, training losses, etc., which puts enormous pressure on daily flight production and operation work.

4. Cabin Crew Resource Planning Model and Application

4.1. Cabin Crew Resource Parameters

4.1.1. Daily Utilization Rate of Aircraft

The daily aircraft utilization index is a comprehensive statistical indicator that measures the utilization level of aviation aircraft, usually expressed as the average number of flight hours per aircraft per day (Ding & Ma, 1992). Calculate the daily aircraft utilization rate using the following formula:

$$\text{Daily aircraft utilization rate}\left(\text{hours/day}\right) = \frac{\sum \text{Transport flight hours}}{\text{Average number of available aircraft}} \times \frac{1}{\text{calendar days}}$$

4.1.2. Cabin Crew Turnover Rate

The personnel who leave the cabin crew position due to reasons such as resignation, transfer, dismissal, termination of internship agreement, etc.

Turnover rate = number of lost passengers ÷ total number of registered cabin crew members × 100%

Based on the average churn rate of C Airlines from 2022 to 2024, the estimated churn rate is 8.3%.

	2022	2023	2024	Average
Cabin crew turnover rate	8%	9%	8%	8.3%

4.1.3. Proportion of Long-Term Grounded Personnel

Long term grounded personnel refer to cabin crew members who have been grounded for more than 3 months due to pregnancy, grounding, or other reasons.

The proportion of long-term grounded personnel = number of long-term grounded personnel ÷ total number of registered cabin crew members × 100%

According to the average proportion of long-term grounded personnel for C Airlines from 2022 to 2024, the estimated proportion of long-term grounded personnel is 6%.

	2022	2023	2024	Average
The proportion of long-term grounded personnel	6%	6%	6%	6%

4.1.4. New Employee Training Attrition Rate

The loss of new employee training refers to the loss of personnel who withdraw from training due to reasons such as inadequate initial/mature new employee training, disciplinary violations, personal applications, etc.

New employee training loss rate = number of new employee training losses ÷ total number of new employee training times 100%

According to the average new employee training attrition rate of C Airlines from 2022 to 2024, the estimated new employee training attrition rate is 6%.

	2022	2023	2024	Average
New employee training attrition rate	5%	8%	5%	6%

4.1.5. Number of Crew Members per Unit

According to the "Rules for the Qualification Certification of Public Air Transport Carriers for Large Aircraft", for aircraft with more than 100 passenger seats, on the basis of equipping 2 cabin crew members, an additional cabin crew member shall be provided for every 50 passenger seats added. The remaining part less than 50 shall be calculated as 50 (Rules for the Qualification Certification of Large Aircraft Public Air Transport Carriers, 2024). Therefore, the minimum number of cabin crew members for the Boeing B737-800 aircraft model is 4. Considering the current aircraft requirements and safety considerations of C Airlines, the standard configuration is a five person flight, and the technical level requirements are as follows:

Technical level	B737
Chief Purser	1
First Class Stewardess	1
Trainee Purser	1
Economy Class Stewardess	2
Single group size	5

4.2. Cabin Crew Resource Planning Model and Application

4.2.1. Total Cabin Crew Resource Model and Application

Total number of registered cabin crew = B738 aircraft number × B738 on flight crew configuration ratio × B738 crew number per unit 5 ÷ (1 − Long term grounded personnel ratio of 6%).

The in flight crew configuration ratio in the overall model refers to the number of in flight crew configurations on one aircraft. The calculation formula is: in flight crew configuration ratio = aircraft daily utilization rate × monthly average days ÷ monthly average hours.

Based on the average monthly flight hours of cabin crew for Boeing aircraft models at C Airlines and the average monthly flight hours of cabin crew on industry trunk lines, it is determined that the average monthly flight hours of cabin crew for Boeing aircraft models are 63 hours.

The average number of days per month is calculated by dividing the total number of days per year by the number of months, and the average number of days per month is determined to be 30.4 days.

According to the current aircraft capacity of C Airlines, there are 13 B738 aircraft.

Taking the daily utilization rate of the following aircraft as an example, the calculation results of the total crew resource model are as follows:

Daily aircraft utilization rate	8	9	10	11	12
Average monthly days	30.4	30.4	30.4	30.4	30.4
Average hours per month	63	63	63	63	63
Flight cabin crew configuration ratio (crew per aircraft)	3.86	4.34	4.82	5.31	5.80
Total enrolled	267	301	334	368	402

4.2.2. Cabin Crew Resource Introduction Model and Application

(1) Total quantity calculation for each stage

The introduction model of cabin crew resources is calculated by year. Taking the introduction of C Airlines from 2025 to 2026 as an example, according to the 2026 capacity plan of C Airlines, one B737-800 aircraft will be introduced and put into operation in June and December 2026 respectively. The total demand changes are as follows:

Time	End of 2025	June 2026	December 2026
Daily aircraft utilization	10	10	10
Number of aircraft	13	14	15
Flight cabin crew configuration ratio	4.82	4.82	4.82
Total demand	334	359	385

(2) Recruitment and introduction quantity

Number of cabin crew recruitment and introduction = (total demand for cabin crew at the end of next year − total number of cabin crew at the end of last year + number of cabin crew turnover) ÷ (1 − new employee training loss rate of 6%).

The number of cabin crew turnover is equal to the total number of cabin crew members multiplied by the turnover rate. The calculation results of the recruitment and introduction quantity from 2025 to 2026 are as follows:

Time	End of 2025	June 2026	December 2026
Number of aircraft	13	14	15
Daily aircraft utilization	10	10	10
Total demand	334	359	385
Lost count		28	
Number of hires		85	

(3) Recruitment plan arrangement

Due to the initial training to qualification period of 6 months for new cabin crew members, combined with C Airlines' capacity plan and recruitment requirements, recruitment and training of new employees will be carried out in two batches, with priority given to the first batch of recruitment and training personnel to ensure capacity demand. Therefore, the recruitment plan for cabin crew members in each stage from 2025 to 2026 is as follows:

	December 2025	May 2026	June 2026	November 2026	December 2026
The first batch	Recruit 50 people for training	Training ended	place in service		
Second batch			Recruit 35 people for training	Training ends	place in service

5. Conclusion

5.1. Application Analysis

This article takes C Airlines as an example to introduce a crew resource planning model for practical application scenarios. This model has strong generalizability and is based on parameterized design and a multi factor modular framework. By adjusting key variables in a targeted manner, it can adapt to different fleet compositions, route structures, and labor regulations scenarios without the need to reconstruct the core logic.

5.1.1. Adaptation to Different Fleet Compositions (Wide Body Aircraft vs Narrow Body Aircraft)

The number of crew members in a single crew group for wide body aircraft (such as A330, B787) is high (usually 200 - 400 seats), and often includes a three cabin layout (first class/business/economy). According to CCAR-121 or EASA rules, the crew configuration standard is higher (for example, one person is added for every 50 seats, and less than 50 seats are counted as 50), and the number of crew members in a single group may reach 8 - 12 people; Narrow body aircraft (such as A320, B737) typically have a single crew of 4 - 5 people. The model can directly replace the parameter of "number of crew members per unit" without modifying the core formula.

Daily utilization rate and average monthly flight hours of aircraft: Wide body aircraft often operate long haul routes with a single flight duration of 4 - 12 hours, and their daily utilization rate may be lower than that of narrow body aircraft (such as 6 - 8 hours for wide body aircraft and 8 - 12 hours for narrow body aircraft); And the average monthly flight hours for wide body aircraft crew members are subject to stricter regulatory restrictions (such as 50 - 55 hours for international routes and 60 - 65 hours for narrow body aircraft on domestic routes). The "daily aircraft utilization rate" and "monthly average hour" in the model are independent parameters that can be calibrated based on the actual operational data of the fleet.

Loss rate difference: Wide body aircraft have higher qualification requirements for cabin crew (such as bilingual and advanced emergency certification), and the loss rate may be slightly higher than narrow body aircraft. The model can adjust the "cabin crew loss rate" parameter separately to adapt to the characteristics of the fleet.

The model is based on the core logic of "number of aircraft × configuration ratio × number of people in a single group ÷ (1 − loss rate)", and is not bound to a specific aircraft model. It can adapt to a mixed fleet of wide body/narrow body aircraft only through parameter replacement. For example, a mixed fleet can be classified and calculated by aircraft type, and then the total amount can be summarized, fully compatible with the existing framework.

5.1.2. Adaptation to Different Route Structures (International Route vs Domestic Route)

Cabin crew resource depletion factor: International route crew members need to meet bilingual, visa, long-distance adaptability and other requirements, with high recruitment thresholds, and a turnover rate that may be 2 - 3 percentage points higher than domestic routes; Moreover, the rest system for international routes is stricter (such as mandatory 48 hour rest after cross time zone flights), and the daily wear and tear rate (training, vacation, aviation and health grounding) may increase to 12% - 15% (about 10% for domestic routes). The model can independently adjust the parameters of "loss rate" and "daily loss rate" to match the characteristics of the route.

In flight crew configuration ratio: The duration of a single flight on international routes is 3 - 5 times that of domestic routes, and the number of flights that can be executed by the same aircraft per month is fewer. Therefore, more crew members need to be equipped to ensure turnover. The "in flight crew configuration ratio" in the model is calculated from "aircraft daily utilization rate × monthly average days ÷ monthly average hours", and only needs to update the "monthly average hours" (lower for international routes) to automatically adapt to the configuration ratio requirements.

Training attrition rate: New employees on international routes need to receive additional bilingual, cross-cultural services, and long-distance first aid training, with a longer training period (8 - 10 months). The attrition rate may increase to 8% - 10% (about 6% on domestic routes). The "new employee training attrition rate" in the model is an independent variable that can be directly replaced by calibration.

The difference in route structure is essentially the difference in "operational efficiency parameters + loss parameters", and the model has modularized and decomposed these differences without changing the core calculation logic. Even if it is a mixed route structure of "domestic + international", it can be calculated by dividing the proportion of routes and then merging the results.

5.1.3. Adaptation to Different Labor Regulations for Long-Term Grounding Rates

Labor regulations in different regions have different provisions for maternity leave and sick leave (such as EU maternity leave up to 14 - 18 months, China about 6 months), resulting in significant differences in long-term grounding rates (EU may reach 8% - 10%, China about 6%). The model can directly adjust the parameter of "proportion of long-term grounded personnel" to adapt to local regulatory requirements.

The upper limit of monthly average flight hours: Different countries have different restrictions on the monthly flight hours of flight attendants (such as the US FAA's regulation of no more than 100 hours per month, China's CCAR-121 regulation of no more than 110 hours, and the EU's stricter regulation of 90 hours), which directly affects the "on flight crew configuration ratio". The "monthly average time" parameter in the model can be calibrated according to the local regulatory limit to ensure compliance with the configuration ratio.

The impact of labor regulations is concentrated on "personnel availability" (attrition rate, flight time restrictions) and "configuration standards", and the model has identified these factors as core input variables rather than fixed assumptions. As long as the regulatory requirements of the target area are obtained and converted into corresponding parameter values, it can be quickly adapted.

5.2. Problems and Improvements

Although the planning model is relatively complete in theoretical design, it may still face several problems in practical application. Firstly, the accuracy and completeness of data acquisition may be limited. For example, if the loss data of cabin crew is theoretically calculated based on the average of the past three years, there may be some stage of data deviation, resulting in distorted calculated data. Secondly, the planning model introduces four types of factors for calculation. In actual work, there may be interference and errors from other factors, such as the training of new employees and the ability of existing flight attendants, inspectors, and instructors in airlines. In addition, due to the complex and ever-changing operating environment of various airlines, there are differences in their operating systems, which puts higher demands on the planning ability and dynamic adjustment flexibility of enterprises. Regarding the above issues, it is recommended to improve from the following aspects: firstly, strengthen the construction of data collection and management systems to ensure the accuracy and real-time nature of data sources; Secondly, regular training should be conducted to enhance the understanding and operational ability of management personnel towards the evaluation system; Thirdly, establish a dynamic adjustment mechanism to optimize the model system and parameters in a timely manner based on industry development and technological progress. When model disturbances occur, they can be quickly recalculated and an optimized adjustment plan can be provided to address the risks of crew resource management; The fourth is the expansion of the model's application. This model can be extended to the localization and technical level promotion of cabin crew, such as calculating crew resources according to specific territories, recruiting or allocating new employees according to localization requirements, or calculating gaps based on the technical level of cabin crew and proposing technical level promotion plans. If the existing crew strength is insufficient to meet the technical position gap, it is necessary to supplement the strength by recruiting mature crew members.

5.3. Future Outlook

With the rapid development of the aviation industry and the intensification of market competition, the cabin crew resource planning system of airlines will present the following development trends. Firstly, the diversification of factors affecting cabin crew resource planning will become an important direction in the future. In addition to traditional loss indicators, more relevant indicators reflecting the career development and mental health of cabin crew members will also be included to comprehensively improve the level of cabin crew resource management (Zhu & Huang, 2021). Secondly, the application of artificial intelligence and big data technology will further enhance the scientific and intelligent level of the planning model system, such as predicting the trend of changes in cabin crew resource levels through machine learning algorithms, thereby optimizing planning schemes (Li, 2016). In addition, cross-enterprise cooperation and standardization construction will also become an important trend for future development. Through the joint participation of multiple airlines in the industry to develop a unified cabin crew resource planning system standard, not only can the comparability of planning results be improved, but also the overall level of the industry can be promoted. In summary, the future development of the airline cabin crew resource planning model system should focus on technological innovation, indicator expansion, and industry collaboration to better meet the high-quality development needs of the aviation industry.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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