

# Research and Application of Civil Aviation Ground Service Management based on Lean Management

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**Abstract.** This paper briefly introduces the theory of lean management, and then discusses the value needs of air passengers and analyzes the value needs of passengers during the waiting period. In addition, it analyzes the defects of civil aviation ground services and points out non-value-added activities in services. Finally, the idea of lean management is used to reposition the framework of the civil aviation service system, and the specific measures for improving the ground service of civil aviation by using lean management are summarized, which provides a new idea for the improvement of the ground service of civil aviation enterprises.

**Keywords:** Lean management; Civil aviation ground service; Value system; Passenger value demand.

## 1. Introduction

Lean approach as a concept and method for eliminating waste and creating value has been the focus of the world since Professor Womack first proposed it in 1990 [1]. Lean approach is effective innovation management to improve work efficiency and improve product and service quality. mode. In recent years, the lean approach has been successfully applied not only in the manufacturing industry but also in the service industry. In 2005, Womack proposed the concept of lean consumption based on the five basic principles of Lean proposed [2], which is a guide to the lean application of the service industry. At present, the quality and efficiency of civil aviation services are receiving more and more attention. Womack analyzes the leanness of passengers from the “departure point” to the “destination” duration from a macro perspective. Improvement measures were not analyzed to eliminate the waste of the airport service process.

The core concept of lean management is to eliminate waste and create value for customers. Lean management is a complete management system that emphasizes providing customers with the right time, the right place, and the competitive price with less manpower, equipment, space (site), raw material input and shorter time. The right amount of the right product. The five principles of Lean are: (1) Identify value. Value is the starting point of lean management, which can only be determined by the end customer; (2) Identify the value stream. The value stream is a combination of all activities for providing products (or services); (3) The value flow flows smoothly. The main method of lean is to eliminate the non-value-added activities and make the value flow smoothly through the analysis of the value stream; (4) The customer pulls the value. Lean thinking not only refers to how to provide the products and services that consumers really need, but also provides products and services at the right moments when consumers really need them; (5) Constantly pursue perfection. It motivates people to continue to reduce the amount of energy, time, space, and cost they consume while producing more and more customers who really need products.

## 2. Analysis of Passenger Ground Value

### 2.1 Passenger Time Value

A large part of the value of passenger ground service is reflected in the benefits of passenger travel time savings, which is necessary to measure the benefits of passengers' travel time savings; in addition, the analysis predicts passenger travel decisions and then predicts the passenger traffic Also consider the monetary cost that passengers are willing to pay for time savings, that is, measure the value of time from the perspective of the willingness of the passenger to pay. In view of the practicality of

passenger time value research, many foreign experts and scholars have carried out a lot of research, but there are still many controversies about the calculation of time value. However, China is still directly drawing on the research conclusions of foreign countries, and the calculation of the benefits of time savings is relatively rough.



Fig. 1 Ground service passenger time value

People's activities are mainly divided into production activities and leisure activities, so the corresponding time is divided into production time and leisure time, which involves the calculation of working hours and leisure time value. The value of working hours is related to the wage rate. The value of time savings is lower than the wage rate level, because the time saved and the hard work can get the corresponding income. Therefore, the value of saving time for work should be the benefit for work at work minus the loss of leisure benefits. There are formulas as follows.

$$B_w = B_{wage} - B_l \quad (1)$$

In formula (1):  $B_{wage}$  is the hourly wage rate,  $B_{wage} = Y_{wage} / (50 \times 40)$ ,  $Y_{wage}$  is the annual average wages, and  $B_l$  is the value of saving time for leisure (time value of leisure).

The value of passenger time value is understood by the two purposes of saving time for work and for leisure. In theory, the value of unit time can be expressed by formula (2):

$$W = P_w B_w + (1 - P_w) B_l \quad (2)$$

In the formula:  $P_w$  is the probability that the passenger will save time for work;  $B_w$  is the benefit that the passenger will save time for work;  $B_l$  is the benefit that the passenger will save time for leisure (free time value). Substituting equation (1) into equation (2) yields equation (3):

$$W = P_w B_{wage} + B_l - 2P_w B_l \quad (3)$$

The probability of saving time  $P_w$  has certain difficulties, generally about 0.5.

## 2.2 The Value of the Boarding Process

The process of the terminal building is complicated. From the perspective of passengers, this paper selects the domestic departure passengers during peak hours as the research object, and analyzes the domestic departure process of the general passengers. The range of passenger boarding value flows is from the time the passenger arrives at the airport to the time when the passenger completes all check-in procedures and is ready to enter the terminal. The meanings of "duration" and "handling time" at the right end of the timeline are: (1) Duration: the time each passenger passes through the

entire process, that is, the time the passenger travels from the beginning to the end of the value stream; (2) Processing time: Each passenger receives the time required by the operator in the process. Among them, the passenger's "non-value-added time" is "walking time + waiting time", and the sum of all the time constitutes the total duration. Since the time for passengers to move is determined by the inherent spatial layout of the airport, it will not be considered for the time being. The security inspection process has the longest processing time. The following focuses on the lean improvement of the security inspection process.

### 2.3 Security Area Value Stream

The selected value stream analysis object is: from the time when the passenger joins the security inspection area, and after leaving the security inspection area after taking the luggage. It has been observed that passengers arrive at the security inspection area with a certain probability distribution, pass the baggage after verification, and then the passengers are separated from the baggage. The passenger process security door, about 90% of the passengers need manual safety inspection (hand inspection); Check that about 10% of the baggage needs to be opened for inspection. If there is no abnormality, the passenger will leave the baggage. The outstanding problem in the current situation of the security inspection area is that passengers have more waiting time in each link of the value stream, and the waiting time (on-line data) accounts for half of the total duration. Therefore, the goal of lean improvement is to shorten the waiting time of passengers, thereby shortening the overall duration of the passengers in the process.

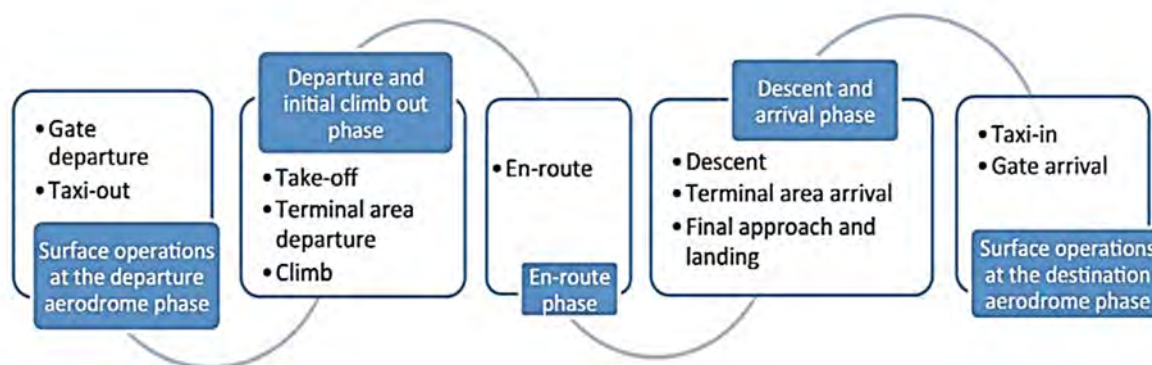


Fig. 2 Ground service activity process

### 3. Civil Aviation Ground Service Non-Value-Added Activities

The basic idea of the lean approach is to "reduce all unnecessary activities and eliminate waste". Waste is all activities that do not create value for customers but consume resources [3-4]. The seven wastes Toyota proposes are: waiting, defects, inventory, overproduction, over-processing, movement and transportation waste. Through a large number of observations, practices, investigations and interviews, the waste in the civil aviation service process is mainly manifested as:

(1) Waste of waiting. Waiting for waste is the difference between the total duration and the time required to create value. (2) Waste of defects (negligence). It means that the service process is defective or does not meet the requirements of the customer, and remedial measures such as rework are required, resulting in waste of manpower and time. (3) Waste of passenger movement. Excessive walking is not value-added for passengers. The over-the-air conference has significantly increased the waste of passenger movement. (4) Waste of action. Mobility refers to any human activities that employees cannot directly obtain from products, tools, or information at their workplace. The lean approach emphasizes the use of standardized methods to specify the steps and corresponding time to eliminate the waste of actions. (5) Waste of overproduction. In a production unit, the time period required for each passenger to handle each process is inconsistent. The pre-process is relative to the post-process, and the quantity produced is too early, too fast or too much [5]. (6) Waste of over-processing. Refers to the customer's needs and necessary procedures, such as repeated inspections.

(7) Waste of transportation. Due to the unreasonable layout of the work site, the transportation of materials (from one work place to another is a waste of time and waste of manpower. (8) Searching for waste means that the number of airport signs is insufficient or the passengers are the familiarity of the airport is not enough, causing passengers to look around.

#### 4. Lean Management of Ground Service Processes

Based on the analysis of the typical process of civil aviation passenger ground service, the paper establishes the meanings of the various parts of the lean civil aviation service system shown in Figure 3 as follows:

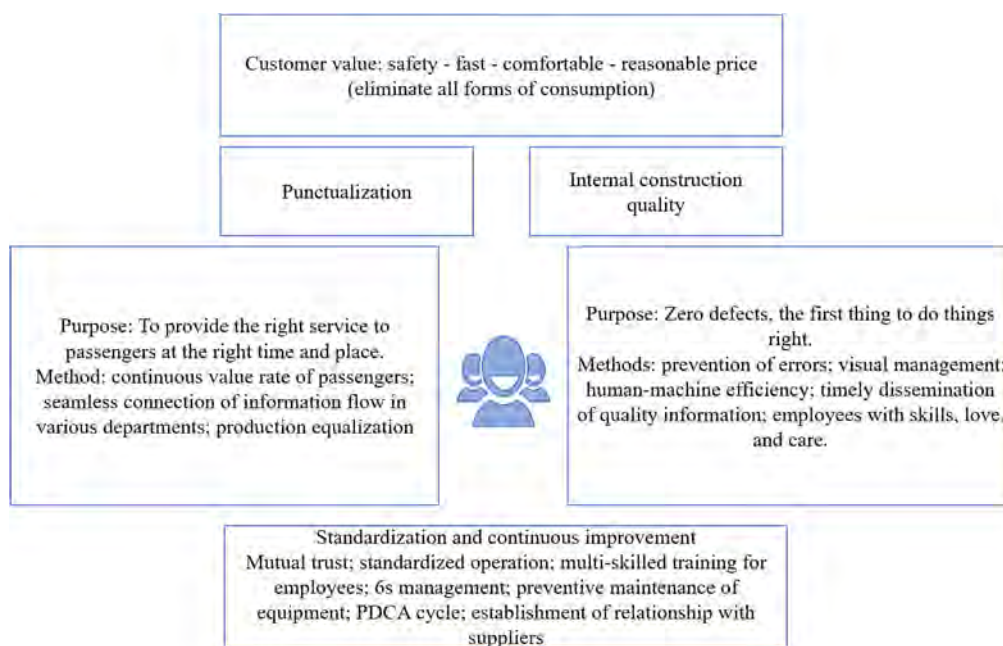


Fig. 3 Lean Civil Aviation Service System

##### 4.1 Lean Civil Aviation Service System Top

The value of civil aviation ground service systems for civil aviation service companies, the value of passengers is reflected as: safe, fast, comfortable and reasonable price services. The basic way to realize the value of these passengers is to eliminate all kinds of non-value-added activities, that is, waste.

##### 4.2 Lean Civil Service System on Time Pillar

Just-in-time production is an important feature of the lean approach. In order to meet passengers' requirements for "quickness", we should also provide timely services, that is, provide the right services for passengers at the right time and place. Without the "quickness" reflected in the punctual service, other services will be greatly reduced. The main means of punctuality is to establish a continuous stream of values.

##### 4.3 Lean Civil Aviation Service System Internal Construction Quality Pillar

Internal quality building is another important feature of the lean approach [6]. It refers to the elimination of defects in all processes of providing products/services. An important feature of the quality of civil aviation services is heterogeneity, that is, each passenger has his own unique expectations, which leads to service variability and potentially low customer satisfaction. Therefore, it is more important to improve the quality of customer-oriented services. The goal of "built-in quality" is zero defects. Zero defects not only mean no defects, but also emphasize that things are done right the first time. Such as: say the first sentence; do the first reception posture; provide the



first service project, and the above throughout. The tools of “built-in quality” include error prevention, 5WHY, visual management, and human-machine efficiency.

#### **4.4 Lean Civil Aviation Service System Standardization Operation and Continuous Improvement**

The basis for standardized operations and continuous improvement is standardization and continuous improvement. Tools include: standardization operations, mutual trust between employees, multi-skilled training for employees, 6S activities, preventive maintenance of equipment, and PDCA cycles. Standardized operations are an important tool for reducing operator processing time and reducing passenger waiting time. Standardized operations should identify minimum repetitive unit activities and use standardized operating procedures to perform simple, repetitive, and routine service tasks within a specified timeframe. Standardized operations cannot only improve service speed, reduce costs, reduce service errors, but also enable service personnel to have more time and energy to provide passengers with diverse and personalized services in a more flexible and timely manner. Training multi-skilled operators can timely replenish personnel to work in heavy workloads at the peak of passenger flow to relieve bottleneck pressure.

#### **4.5 Lean Civil Aviation Service System Staff Service Awareness Enhancement**

Skilled, caring and dedicated employees the civil aviation service industry mainly provides services directly to passengers through the staff. The quality of the service depends largely on the performance of the staff. It can be said that the employee is the service itself, and the behavior of the service employee directly determines the quality of the customer's perception. Lean improvement is a never-ending process that requires all employees to continually improve and continuously eliminate non-value-added activities in the value stream. In short, the system is a series of measures to discover the true value of customers, eliminate non-value-added activities in their business processes, seamlessly stream value flows, and drive value to customers, and is continuously improved by innovative employees. Work to achieve the goal of improving service quality, shortening cycles and reducing costs.

### **5. Conclusion**

The essence of lean thinking is continuous improvement and elimination of waste. It is an important theoretical basis for management model innovation. However, implementing lean improvement measures is often expensive and time consuming, and there are real-world obstacles and risks. This paper identifies the priority of passenger value and points out that shortening waiting time is an important manifestation of the value of air passengers. Passenger check-in and security inspection process is the main process of passengers at the airport. This paper collects data and conducts statistical analysis on the site, analyzes the various waste performance of operators, and points out the basic ways to eliminate waste. Finally, a lean civil aviation service system was established, which provides guidance for civil aviation companies to further improve lean.

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