RESEARCH ARTICLE

LEAN MANUFACTURING IN MEASURING CUSTOMER EXPECTATIONS AT AN AIRPORT

[1]*Dr. A. K. Shaik Dawood, [2]Dr. A. Riaz Ahamed and [3]R. Karthikeyan

[1]College of Engineering, Department of Industrial Engineering, King Khalid University, KSA
[2]College of Engineering, Department of Mechanical Engineering, Jazan University, KSA
[3]Department of Management Studies and Research, Karpagam University, Coimbatore, India

ABSTRACT

The objective of this study is to apply the concept of lean manufacturing and find out the different approaches to measure customer expectations. The lean concept is applied for reducing waiting time of passengers at various sections of the airport. A value stream mapping is designed, to improve the delay time and enhance customer satisfaction. During the Flight travel the checkpoint wait times for airport passengers were becoming excessive. They were particularly concerned that projections indicated wait times could reach three hours during the peak summer travel period, if the screening process was not improved. An experimental approach was done to identify the methods to minimize the check point delays and to create an improvement in customer enhancement service. Airport is reviewed and the importance of services, new approaches for development as well as the role of lean manufacturing is discussed. The literature is used to build up experiences of passengers at various airports, waiting time, which is tested to find out most important service quality attributes for the customers based on the data. A Value Stream Mapping is done. A Questionnaire survey is chosen as a primary method of data collection. The target group includes young professionals with completed or about to complete university education.

INTRODUCTION

Airlines have continuously being keeping an eye on minimizing the costs, managing & stabilizing the varying needs of passenger demands (Andersson *et al.*, 2003). Customer satisfaction has been on very low levels for decades. According to American Customer Satisfaction Index, airline industry scores lowest out of 47 other industries. However, the demand for air transportation has been stable and despite current economic crisis and such events as September 11, the growth reached 7.8% in 2011(Andersson and Värbrand, 2004). It is extremely important for carriers not only to understand the perception of passengers of their service offerings, but as well find out what customers expect from the services and what kind customer aspects to be enhanced (Andreatta and Romanin-Jacur, 1987). Views service experience as a process, starting with a search for a parking zone and ending with departure towards flight services. Among the various modes, a customer waiting time is taken during the process are listed and discussed. Service quality is created on each step of the process and it is important to understand the customer preferences and expectations from the services (Barnhart *et al.*, 2003). Evaluation of customer expectations based on two to five key requirements among twelve and analyzed using Value stream

mapping methods. To understand its relative importance, a target customer group was chosen for a survey to minimize the waiting time. VSM is a tool that is used to graphically represent the processes or activities involved in the manufacturing and delivery of a product (Kosonen and Buhanist, 1994).

MATERIALS AND METHODS

Questionnaire survey

The questionnaire was divided into three parts (parts as 1, 2, 3) asked respondents to evaluate their overall experiences they received from their last domestic airline flight travel. The questions were phrased in the form of statements scored on a 5-point Likert type scale, ranking from 1 "strongly disagree" to 5 "strongly agree". Three parts are contained in the questionnaire regarding respondents' socio-demographic characteristics including age, purpose of visit (business or non-business travelers), gender, education, occupation, and education, frequency of flying and general commands. The data gathered was used to analyze the mind of passengers during their flight journey. Identifying what creates value (from the customer perspective), figure 1 displays the routine process of flight travel of busy passengers. The experiment began from the questionnaire survey. The questions included various customers' value basic services in process areas such as (a)

*Corresponding author: Dr. A. K. Shaik Dawood
College of Engg, Department of Industrial Engg, King Khalid University, KSA

looking for parking spot, (b) Parking area, (c) Walking & waiting (check-in) zone, (d) check in area section, (e) walking & waiting (pass port) zone (f) Passport section, (g) Waiting line (security) zone, (h) security search section, (i) Walking to sitting area(seating section), (h) Sitting waiting for the plane, (i) Walking to exit gate, (j) Final inspection(Boarding pass check).
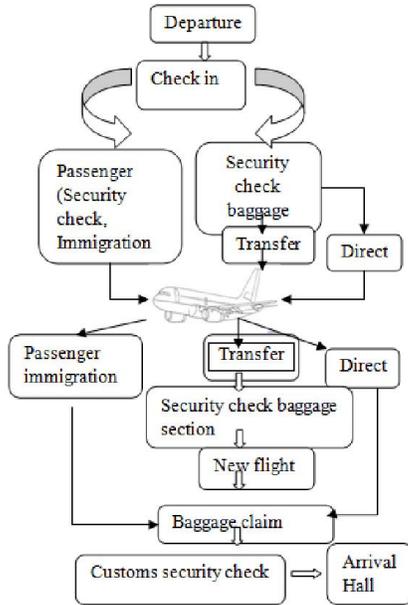
Figure 1. displays the routine process of flight travel of busy passengers

Data collection

The Data collection from a sample size of 100-125 respondents was considered adequate, with the following taken into consideration from the questionnaire given to the passengers. Hence this paper mainly talks about the efforts taken to minimize the waiting time of passengers in air flight travel with the aid of lean tools. From the Questionnaire survey and data collection final waiting modes was summarized as among the above mentioned parameters the main delay was found as shown in Fig 2.Waiting time of passengers in minutes

(1) Looking for parking spot,
(2) Walking & waiting (check-in) zone,
(3) Waiting line (security) zone,
(4) Sitting waiting for the plane
(5) Final inspection (Boarding pass check).
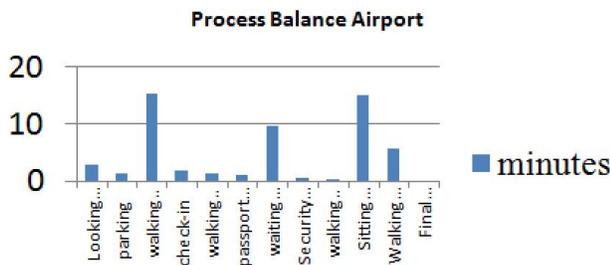
Figure 2. Waiting time of passengers in minutes

Applying lean tool –value stream mapping (initial stage) for main passenger waiting modes

Concentration on the waiting time (Muda) of passengers, every year 19,19,535 passenger fly from this Airport to other airports from this airport. Value Stream Mapping (VSM) is a visual mapping tool that outlines all the steps in a process and helps to identify ineffective procedures and waste, as well as to develop implementation action plans for making continuous improvements (Gosling and Novak 1980). A Figure 3 VSM identifying the current process-Initial Stage is shown. VSM displays information that the cycle time of 2.08 mins for baggage arrival with ideal time of 4.8 mins and cycle time of 55.79 mins with ideal time of 20.33 mins for passengers.
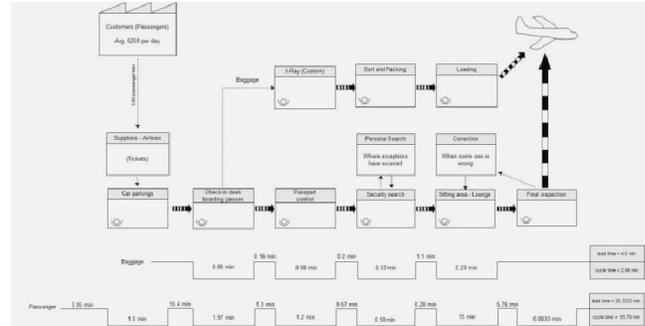
Figure 3. VSM identifying the current process-Initial Stage
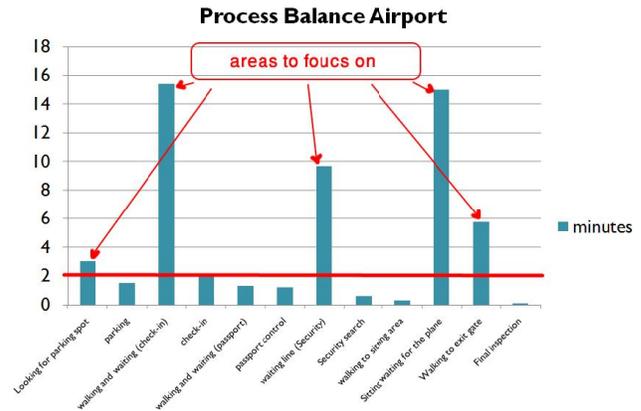
Figure 4. Graph of actual situation
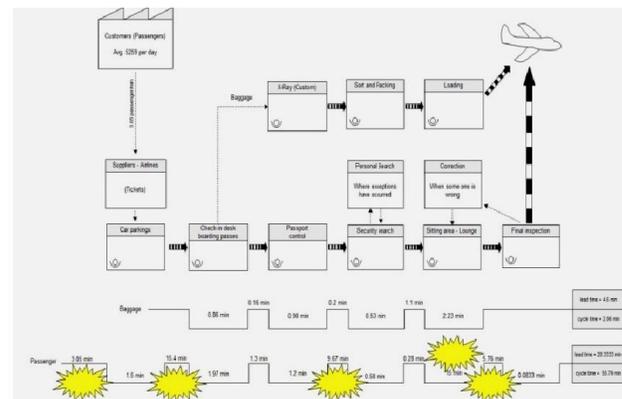
Figure 5. VSM Highlighted waiting modes

Selection of main passenger waiting modes

The main areas are highlighted in VSM are waiting modes of passengers, to minimize the cycle time of passengers, this VSM is designed as shown in figure 5 Highlighted waiting modes and Areas of focus are shown in fig 4.

Step-1: Looking for parking spot

A selected airport has 5 parking lots with total capacity of 800 parking space about 60% of airport passengers are using the parking lot to park their cars good parking lots are the key feature of any successful airport.

Understanding the value of the process

The total time that the process takes is about 4.55 min in average detailed as Parking the vehicles in a safe place and shifting the luggage from parking area to airport, is a very essential task. The parking area must be near to the airport for easy shifting of luggage. For traveling to a long distance flight journey is the best and fast. Travel by car to airport is a common trend, the problem arises at the parking spot.

Causes of the waste time (non-value added) are

1- No clear directions to parking lots
2- Not knowing where is the best and nearest parking spot
3- Enter parking lot with unavailable parking spots
4- Road leading to parking lots is busy
5- Cars in parking spots are not orderly arranged
6- Congestion in parking area

Step 2: Check-in

The total time that the process takes is about 15.4 min in average

Causes of the waste time (non-value added) are

The large waiting time is caused by the shortage of operators serving the passengers. Totally they are 5 operators in avg. and the maximum is 12 of them. To solve the problem we have to reduce queue time and to make check-in process more efficient By modeling the system in arena simulation software:

(Model time = 8 hours – 1 shift)

The check-in section should have the availability of more than one check-in option at the airport and ease of check-in (Check-in process step). It is easier for the customers to speed up their check-in if there are several options available, and instead of spending a long time in the queue for check-in area.

Here the delay is due to following reasons as

(1) Single lane for the check-in
(2) Single operator at the check-in section

Step-3: Security check

The Airport's security checkpoints were studied with two goals in mind. First, it was important to improve the passengers understanding and comfort with the security screening process, in order to increase their ease of maneuvering this part of their travel. Second, reduce the wasted time in the process. The current situation is that there are 2 gates for domestic terminal to security search and one for international terminal.

Causes of the waste time (non-value add) are

1- Long queue lines, it takes long time to pass the security search because there are few number of security gates.

2-Absence of clear instructions or signs generate a very long time of lag waiting queue.

Step- 4: Sitting and waiting area

This Airport sitting area is very large hall. The passengers are sitting waiting for loading their luggage on the airplane. The capacity of that area is over 600 chairs. The problem with this area is the long time of waiting for airplane to be ready for boarding the Passengers. ACA regulation stand that passengers have to sit in sitting Area for 20 mints at minimum. The total time that the process takes is about 15.28 min

Causes of the waste time (non-value add) are:

1- Over process, the passenger have to stay idle waiting for gates to open. Bad design of this stage, why waiting for luggage loading when we can synchronize the loading with boarding the passengers?

Step-5: Final inspection

The final inspection stage is take place in the departure gate, This is to prevent the passenger towards the board in a wrong plane. Final inspection is the last process before going to the airplane. The total time that the process takes is about 6.963 min

RESULTS AND DISCUSSION

Step-1: Looking for parking spot-effective solution

Parking lot management system (IPLMS)

Intelligent *parking* lot management system. As shown in Figure: 6 Display by IPLMS, It's a digital intelligent display system used for making the parking process more effective and easier.

Figure 6. Display by IPLMS

Step-2: Check-in -effective Solution

The best solution for this problem is making the number of operators always between 8 and 12 (as needed) to eliminate the queue. In the most times 8 operators is enough.

Step-3: Security check -effective solution

Increase number of gates to 4 in total for both terminals (domestic and international), that action will reduce queue time to 0.26 min (15.6 sec)

Using a signs to understand the security search procedures, this is the best way to avoid the lag time as shown in Figure 15 Display signs of various goods to be placed in particular position and Figure 7. A display sign clear board with English and Arabic language.

Figure 7. Display signs of various goods to be placed in particular position

Step-4: Sitting and waiting area -effective solution

Eliminate the waiting time by synchronize the loading time with boarding time.

Step-5: Final inspection -effective solution

By modeling the system in arena simulation software final values with Number of operators and queue time. A final Process Balance chart is plotted to highlight the improved waiting time of passengers as shown in figure 8 final improved process balance chart.
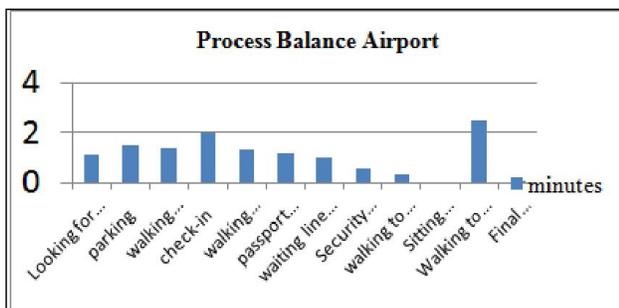
Figure 8. Final improved process balance chart
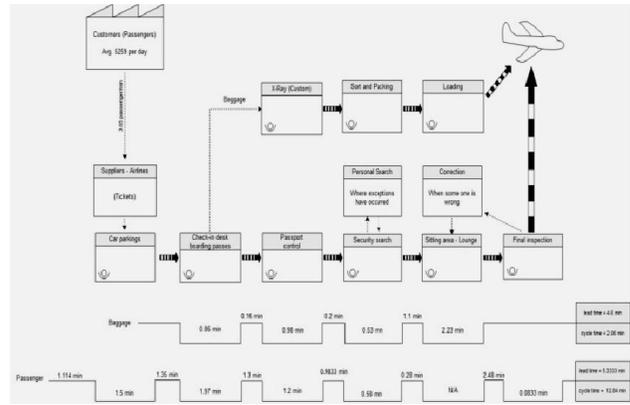
Figure 9. final revised Value Stream Mapping (VSM)

Conclusion

- The objective of this study is successfully applied in an airport with the help of lean manufacturing.
- The lean concept is applied systematically for reducing waiting time of passengers at various sections of the airport.
- A value stream mapping is designed, to improve the delay time and enhance customer satisfaction. This final revised Value Stream Mapping (VSM) acts as tool and it helps to highlights the result.
- A good vast improvement in reduction of waiting time of passengers from 55.07mins to 12.64mins as shown in Figure 9 final revised Value Stream Mapping (VSM)

REFRENCES

Andersson, K, Hall, W, Atkins, S, and Feron, E, 2003. "Optimization-Based Analysis of Collaborative Airport Arrival Planning", Transportation Science, pp. 422-433.

Andersson, T, and Värbrand, P, 2004. "The Flight Perturbation Problem", transportation Planning and Technology, pp. 91-117.

Andreatta, G, and Romanin-Jacur, G, 1987. "Aircraft Flow Management under Congestion", Transportation Science, pp. 249-253.

Barnhart, C, Belobaba, P, and Odoni, A, R, 2003. "Applications of Operation Research in the Air Transport Industry", Transportation Science, pp. 368-

Kosonen, K., Buhanist, P. 1994. *Customer focused lean production development.* Laboratory of Industrial Psychology, 41, pp. 211-216.

Gosling, G.D., and Novak, E 1980. *Feasibility Evaluation of an Off-Airport Terminal Demonstration Project.* UCB-ITS-WP-80-7. Institute of Transportation Studies, University of California, Berkeley

****