

## Lean Implementation for Continuous Improvement at Airports

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**Abstract:** In today's aviation business, continuous customer satisfaction is all that matters as it is the determining factor of business viability. The objective of this study is to evaluate the effectiveness and compare the implementation of lean management in the aviation sector of the King Khalid International Airport, European and other Asian airports. A field survey and visits were undertaken using an individual qualitative interviews and final group questionnaires for three airports in Saudi Arabia, Europe and Asia. Results indicated that with total commitment, good leadership to champion the lean program and with a clear defined objective included putting the passenger first, sustainable responsibility, beat the number, people and teamwork, airport security and health and safety, a lean Airport system is achievable with all its benefits in cost reduction, passengers satisfaction and continuous improvement. The Aluminium Conservatory Company showed that lean brought about a more organised and efficient production set up. There was also a reduction in travelling distances and also a huge reduction in process time. Being airports are a complex organizations whose areas of comparative advantages and efficiency hinges on elements that the airport management, it can be concluded that Lean management philosophy resulted to optimization of resources, efficiency in performance and gradual but continuous reduction of all forms of waste amongst all localities of airports under studied. This implies that Lean management philosophy if properly followed guarantees continuous customers' satisfaction which in turn ensures business viability of airports. Future work suggests that Lean management should be studied and implemented in other European and Asian airports.

**Key words:** Lean Production • Airport • Continuous Improvement • Leadership • Six Sigma

### INTRODUCTION

Lean is a process of continuous improvement of products or services with the purpose of achieving superior quality, timely delivery and competitive cost leading to customer satisfaction. Lean as a concept was first introduced by Womack *et al.* [1]. They used lean to describe the working philosophy and practices of the Japanese vehicle manufacturing and in particular the Toyota Production System (TPS) [2]. A vivid description of their work was the main content of the 1990 bestselling book 'The machine that changed the world'. Lean provides a focus approach for continuous process improvement and targeting of all available means and ways of bringing such improvement to bear within any system. Eliminating waste and all unnecessary actions in the parts towards the creation of products or services is the main philosophy of Lean. In the course of the

development of the Lean philosophy from its genesis, seven types of waste were identified by Ohno [3] and reported by Womack and Jones [4]. The seven waste identified are Overproduction which occurs when operations continue after they should have ceased, Waiting which results from waste of time of inactivity in queues, Unnecessary motion or movement of materials, Extra processing such as rework or reprocessing, Waste from keeping excess inventory that is not required to meet current customer orders. Waste refers to extra steps taken by employees and equipment to accommodate inefficient layout and finally defective waste which is due to finished goods or services which do not conform to specification or meet customer's expectation [2].

Working and thinking in the Lean way helps an organization to identify its value stream, eliminate the waste in its process and generate a flow of value to the customer [4]. There are also a lot of benefits associated

with Lean systems as its processes will be faster since even the speed of response to request within the business process will be faster which in turn could result in significant financial benefits. The application of Lean also creates within it a process of constant review which in itself reveals existing bottle necks and pockets of inefficiency within the system [5, 6]. The potential benefits of implementing Lean also include the fact that it decreases the operating cost, shows a better understanding of customers need, has more robust processes leading to less errors, Lean also has the benefit of making great people within its system as it empowers its staffs technically by training and building multi-skilled teams. This can be achieved via employee cross-training and job rotation. There is also an inbuilt increase in the Knowledge base of the organization as there is an increased understanding of the whole supply chain including external support processes and all other processes within the value stream [6].

Passenger's airport choice and in extension the destination of travel depends on the quality of service which customers expect and receive. In multi-airport regions (MARs), air passengers have the leverage to choose among different airports and the choice depends on first expectations and initial impressions on first visit. Thus it is very important to do it right and always being perceived to be the best at the first visit as this may be the only opportunity one may have in a market which may become saturated depending on existing competition and alternatives. The passengers decide and so they are kings. Within multi-airports regions (MARs), air passengers choose among different airports not only based on vicinity but also a series of other airport level-of-service (LOS) attributes [7]. Generally, the airport ticket price is the most important and is a major determining factors of choice. This is often termed as the primary factor of choice. Other factors, broadly referred to as secondary airport level-of-service attributes, may be categorized into two types. The first type is related to flight characteristics, including flight frequency, in-flight travel time, number of stops, transfer arrangement, congestion or punctuality of flights, airlines serving the route and aircraft type [7]. The second type is closely associated with airport characteristics, including airport access time, access cost, access mode, parking facilities, check-in facilities, lounge, restaurant and shopping facilities, transfer facilities, baggage, customs and immigration facilities and airport tax or passenger charge [7-9]. A successful airport business meets the needs of its

expected passengers or customers and in so doing leads to profitability, via reduction of waste, optimization and continuous improvement in services. These features must be upper most in the mind of the management and staff and the only time tested way of achieving all this is through the implementation of lean.

Airports are complex organizations whose efficiency depends on the coordination of operations such as taxiing, gate departures and arrivals. Airport efficiency hinges on elements that airport management is more likely to control such as the general airport configuration which includes the run way [10]. So making the airport system as efficient and effective as possible is to a great extent within its hands. Lean management system is known globally as an efficient and effective system and its implementation in the airport will drive all players in the airport service delivery process to deliver high levels of operational effectiveness and efficiency which is the hallmark of quality service. The relationship between customers service quality and passenger demand is a critical issue for air carriers, because it enables airline managers to make strategic decisions on the level of service and related resources needed to achieve market share targets [11]. It is hope that this research will show that the needed level of service and its related resources can be fully optimized for maximum benefit for both passengers and the organization by implementing Lean management system. Some of the attributes in terms of services related performance which passengers rate include the airport environment, the organization within the airport, the quality of staff, the readily available customer care nature of the staff of the airline and the airport, good on-time performance, efficient baggage handling, fast check-in and boarding and good food and beverage service among others [11]. These attribute are believe to be those in which the passengers care most about must always be at its best at all time, its performance should also be measured to feel the pulse of the passengers and areas of improvements could also be looked into continuously.

The lean management system requires continuous measurement of performance to avoid any sort of waste [12, 13]. If these wastes are eliminated, the resources involved can then double their output [1] in terms of service rendered and general performance and this will thus increase its profitability as customers who are happy passengers will thus be more satisfied with what they are getting as more can now be adequately given without waste. Lean implementation in the airport will encourage

continuous performance improvements to attain perfect service quality, to remain a leading service provider with good process technology performance, to practice just-in-time service delivery and to offer cost competitive services [14, 15]. To measuring the effectiveness of customer needs-fulfillment will require the implementation of Lean Six-Sigma statistical analysis methodologies. The researchers are currently evaluating the best methodologies to use in the airport service sector. The difficulties develop from acquiring valid and accurate customer feedback which is truly associated with airports. To be able to fully re-engineer the whole system in the airport, there must be a great creation of awareness about what Lean actually stands for. Additional requirements are well informed and organized Leadership to champion the course providing the necessary moral support and financial backing.

The implementation of Lean needs leadership commitment and that commitment must be championed by a top officer of the organization with the support of the management for it to be effective and for the require goal to be met. Many theories have attempted to explain variation in business performance and more often than not link it to the leadership ability. Leadership theories are associated with the belief that variance in the firm's performance can be associated with the leadership qualities of top managers [16]. There are argument from using human capital theory, that in small organizations a considerable proportion of variance in organizational activities and outcomes could be associated with individuals [17]. Another study using multidimensional performance construct of market performance and financial performance, showed that the Chief Executive Officer's (CEO) characteristics had considerable impact on performance [18]. Some of this characteristics that might have specific charismatic effects on followers are; having a strong desire to influence others, being a role model for the beliefs and values leaders want their followers to adopt, articulating ideological goals with moral overtones, communicating high expectations and showing confidence in followers' abilities to meet these expectations, which then increases their self-efficacy and sense of competence; this in turn increases their performance [19, 20, 21]. A leader should also be able to always arouse task-relevant motivation by tapping followers' needs for esteem, power and/or affiliation and always able to link the identity of the followers to the collective identity of the organization [19, 20]. To be able to implement and sustain Lean as a way of continuous

improvement in a corporate cultural manner, an organization must have a champion for this course, a leader whose main duty is to create awareness of its benefits, follow the process through every inch of the way and build a corporate team of active participant in the entire organization. A leader is the one who proactively develops his or her firm's mythology drenched in the company's social identity frame work to create the culture of the firms, in this case it is the implementing the Lean culture the culture of eliminating waste and ensuring continuous improvement as a tool to shape and improve the set of shared attitudes, value, goals and practices characterizing the organization. This social identity identification process defines and shapes the social reality for the firm's employees [22]. This reality must be the reality of continuous improvement if the firm is to continue as a major player in is industry by continuously meeting the ever changing needs of its customers. A leader must have the self motivation to change and must manage its organization effectively through the challenges of the changes to meet the changing needs of its customers.

With the implementation of new, policies, philosophies or ideas comes great resistance to the required change and this need to be managed well if the success desired must be achieved. Some of the natural resistance to change includes Skepticism on the validity of the lean philosophy, an assumption that it is just another improvement initiative and the lack of availability of time, there is also the cultural challenge which could pose a barrier for the changes Lean implementation would bring [6]. Organizational changes are recognized as a specific project type that can be beneficial to all if well managed [23]. Projects intended to implement significant changes in the way an organization works seldom turns out as expected [24]. The necessity for change may come as a result of external threats that might arise from the competitors in the industry, it may be due to some new technological development, it may be as a result of new ideas and improved knowledge base, it may be as a result of change in the management or just a policy shift whatever be the case change is a constant either internally or externally induced and in our today's airports this changes are inevitable because of the changing profile of today's airport users. Their culture, educational background, age and financial status plays a key role in their choice of what to do, which airport to use, where to fly and how to fly in terms of the comfort they can afford.

To be able to direct or stare the ship of change, a champion and leader must have the inner motivation to carry out this change which is required to move the system forward. In an airport that intends to implement Lean the Champion must be very decisive and must carry everybody along as the system is such that any mistake may be decisive in the direction in terms of the profitability of the business. To be able to manage the changes when implementing Lean, requires great awareness and good education on what is expected of everybody in the process and what the benefit of this introduction of Lean philosophy will bring to the company and the individual in particular. Everybody must be carried along and also involved in the processes because Lean as a philosophy is all inclusive as this will help in its cardinal aim of eliminating waste from all areas of the system and continuously ensure improvement in services.

In today's complex and relatively unpredictable business environment, the need for continuous improvement in products, services and processes is widely recognized [25]. One major advantage of Lean practice is it's believed on continuous improvement because the continuous improvement process is said to be a source of competitive advantage for firms [26-29]. What makes a firm competitive is not so much the equipment, location, buildings, capital base or the number of employees which it possesses because anybody, organization or government with deep enough pockets can duplicate this resource position but what makes a firm or business competitive is what it knows about and how it behaves [25]. This is an attribute which the organization must build and Lean as a philosophy falls in this category of what an organization can implement and build on over time for competitive edge. In Implementing Lean for continuous improvement in the airport, there must be a clear definition of its goals and what its implementation is set to achieve. There must also be an awareness of what it entails and its step by step implementation process. Everybody must know their duties and responsibility in ensuring that these goals are achieved. There must be full participation in working towards the Lean attitude of continuous improvement were everyone would be encouraged to bring ideas and these ideas properly looked at, followed up and when and where possible implemented in the airport. Communication is also vital in ensuring continuous improvements. Airports needs to have good communication network to keep the business informed about what is happening in its industry, about

what the customers, passengers or users wants. More importantly a Lean communications systems know how best to act on this information in order to meet the needs of the customers and also achieve the required results. Motivating staff will also help to encourage companywide continuous improvement this motivation can come in any form in terms of involvement in decision making, awards for recognition for ideas and contributions to continuous improvement and any other means which management deems fit given each circumstances. Finally, continuous improvement means a continual appraisal of what have been done, what is yet to be done, what needs to be done and actions taken and yet to be taking. It is always what next for improvement.

For continuous improvement to work there must be a strong united effort by all which is teamwork. Lean philosophy also advocates the teamwork practice where teams are built to look into various issues and work in chains of cells leading to the production of the final product or the delivery of the final service. Team performance has been studied in many safety-critical organizations including aviation, nuclear power plants, offshore oil platforms and health organizations [30] and the results seems to be evident that the team practice is the best practice as the saying goes that 'very good heads are better than one'. Teams usually function in environments where task complexity exceeds individual capacity, decisions have multiple aspects to be traded off, information uncertainty prevails, errors may have critical consequences and peoples' lives depend on collective insights of individuals [31]. This is actually the case in airports and in general aviation services but even in areas where the risk is low like in customer service, having an effective and motivated team which builds confidence and delivers first class services to passengers goes a long way in getting the desired feedback that will help for continuous improvement.

The nature of team task and allocation of responsibilities can generate many dependencies that require orchestrated action to converge them all towards the master plan [32]. In order to determine the performance of all towards the goals of better service, customer satisfaction and continuous improvement, a champion who is an able leader with focus must be in the driving seat to lead the team in the implementation of lean.

The objective of this study is to evaluate the benefits of Lean implementation airports in areas of waste reduction, continuous improvement and general profitability.

## **MATERIALS AND METHODS**

A field survey was undertaken using an individual qualitative interviews and final group questionnaires. In the course of this research two organizations which have implemented lean were visited. One of the organizations visited is a regional airport while the other company designs and builds Aluminium Conservatories. The Asian airports have also been visited and their methods of operation were observed in detail. Areas that needed any form of improvement were noted and the intention of this research is to implement the lean philosophy there so that there would be a system of measurable continuous improvement.

The technologically advanced equipment to collect numerical data from airports, all form of airport users and business concerns and the flying passengers and public in general were collected and analyzed using acceptable statistical analytical tools. The interviews served as insights and possible verification of the statistical results from the data collected.

## **RESULTS AND DISCUSSION**

**The Airports:** Based from the interviews, an effective continuous improvement is required on King Khalid International Airport. This includes a clear understanding and awareness of the organisational goals and objective with a good strategy to achieve the goals and set objectives. There must be a clear “champion” leader. The importance of a Champion to lead the process of improvement continuously. This is very important as the Champions drive the process allowing every other persons and staff to fully participate. This provided the important aspect of Leadership which is both essential for Lean and 6 Sigma which was being practiced together as a combination of some sort at the airport (Southampton Airport).

Continuous Improvement (Lean) with all being involved. It is all about how things can be done better, how can customers be served better, how can customers be satisfied and served better and at the same time all sorts of waste within the system be reduced. This aspect is so well organized as suggestions and ideas on things that could be done for improvement were being received from all staff who sends in their suggestions and idea by mails and it is immediately looked at and compiled by an administrator for immediate assessment at the Continuous Improvement team meeting where it would be decided on

which action would be taken on it. The Six Sigma was being practiced to help identify variance in performance so that performance can be well harmonized and brought to the best level which is the optimum level at all time. Communication was very vital for the success of the programme because as was explained there was constant flow of information about what was happening, where they were and where they were going at every point in time. The information flow and general communication process was very good. Staff was motivated in the programme as they were encouraged with their full involvement, good communication process. Staff received recognition awards for their ideas and suggestions for improvement. Constant meetings are vital for continuous appraisal of what have been done, what have been achieved, what was yet to be done, reasons for actions taken or not yet taken, New ideas and suggestions, general discussions and decision taken and feedback. These meeting had the essential purpose of identifying, prioritising, initiating and reviewing progress of continuous improvement activities at the airport. Finally, there should be well set standards which should be maintained for all activities.

In general, the finding from the airport showed that with total commitment, good leadership to champion the lean program and with a clear defined objective as shown in the airports 6 Star Strategy (which included putting the passenger first, sustainable responsibility, beat the number, people and teamwork, secure airport and finally health and safety) a Lean airport system is achievable with all its benefits of cost reduction, passengers satisfaction and continuous improvement.

**The Aluminium Conservatory Design and Builders:** The Aluminium conservatory company implemented lean six years ago under a joint project with the University of Portsmouth. The lean program saved 40% lead time in painting and pay back was under one year. The result of the project improves product quality and factory output, which meant the company, could bid for and win larger contracts. Currently company practice shows a continued improvement within the organization since the introduction of lean. The continuous improvements showed that the factory, work stations and production area were much more organized according to the flow of the job which has increasingly saved lead-time and invariably saved cost. Everybody in the company was also fully involved in the lean practice. The biggest problem post-lean implementation was getting reliable data to justify further and continuous improvements and

managing expatriations from the prior very successful lean project. It was seen that the implementation of lean brought about a more organized and efficient production set up. There was also a reduction in travelling distances and also a huge reduction in process time.

## CONCLUSION

The importance of the role of an airport within the air transportation system is not contestable but what is most sure is that the viability of an airport in today's global village is dependent on what it can offer to the passengers and airport users and most importantly how these services offered tend to continuously meet the need of the customers (passengers and other airport users) who are the deciding factor on profitability. Implementing Lean at the airports will surely be a plus to passengers and in general all airport users but most importantly it will be of immense benefit to the airport owners and authorities as all forms of waste in terms of time, space and resources will be eliminated to be able create more means and resource to satisfy the customer. This business of satisfying the customer is a continuous one in lean as one of its major philosophies is continuous improvement to meet the ever evolving needs of the customer and to make the system better. Building this culture of continuous improvement is and will always be a source of competitive advantage [33-36]. Further work will be carried out on this research in areas of visiting more Asian international airports and airports to see how things work there and also possibly have a feel of what the effect of such implementation which will definitely result to some form of change will be.

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