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Lean for Airport Services: a systematic literature review and agenda for future research

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Abstract:	

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7 **Lean for Airport Services: a systematic literature review and**
8 **agenda for future research**
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12 **Abstract**

13 **Purpose** – The purpose of this paper is to present the key findings of a systematic literature
14 review (SLR) on Lean for services and, in particular, Airport Services.
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17 **Design/Methodology/Approach** – The authors have utilised a SLR methodology proposed
18 by Denyer and Tranfield (2009). A total of 23 papers published in 18 scientific journals have
19 been systematically reviewed for evaluating and establishing the current status of Lean for
20 Airport Services.
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23 **Findings** – It was observed that there are no journal publications on the use of Lean in UK
24 Airport Services. Although Value Stream Mapping (VSM) has been widely accepted as a
25 powerful Lean tool across many service organisations, its applications in Airport Services is
26 in its early stages. One of the biggest challenges in the implementation of Lean for Airport
27 Services is about maintaining the level of service standards. The most common barriers in the
28 implementation of Lean for Airport Services may include: resistance to change, varied
29 definitions of the term Lean for different people across the business and understanding the
30 need for Lean in Airport Services as there is a misconception that Lean is confined to
31 manufacturing.
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36 **Research limitations**– This paper seeks to contribute to and broaden the limited body of
37 evidence of the applicability of Lean to Airport Services and identify areas for further
38 research and review.
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41 **Originality/value:** This paper makes an attempt to demonstrate the use of Lean thinking for
42 service industries and, in particular, Airport Services. The authors have identified less than
43 five papers on the use of Lean thinking in Airport Services and this paper sets the foundation
44 for future research on the use of process excellence methodologies such as Lean. Moreover,
45 the authors firmly believe that the results of this SLR can be extremely beneficial to many
46 managers working in Airport Service contexts, irrespective of the country and culture of the
47 organisation.
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51 **Keywords:** Lean services, Systematic Literature Review, Airport Services, Lean
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Introduction

Originating from the floors of the Toyota Production System (Hines et al, 2004), Lean was initially intended to enable Japanese car manufacturers to compete with dominating American manufacturers through eliminating waste in the production chain (Hines et al, 2004). Lean has since become an internationally renowned management philosophy, with a purpose designed to enhance the efficiency of manufacturing processes. In recent years Lean is also increasingly applied to a wide range of service operations as it is believed that more benefits may be gained from this sector than in the original, i.e., manufacturing (Alsmadi and Jerisat, 2012).

Academics debate whether Lean is an appropriate strategy for the service industry, much due to the difficulties of measuring the outcomes of services compared to those in the manufacturing industry (Bowen and Youngdahl, 1998). Having that in mind, it is difficult to deny the many challenges involved with Lean implementation in the service industry. However, with customers expecting a higher quality from services, process excellence methodologies such as Lean has attracted interest from both organisations and academics who have read success stories of other companies (Suárez-Barraza et al, 2012). Thus, now they were inspired to achieve similar results in their organisations whilst still meeting the market expectations (Suárez-Barraza et al, 2012).

Though many organisations within the service industry are increasingly becoming more intrigued by Lean theories and wish to implement them into their own organisations, the amount of published literature on the topic is still under development (Bowen and Youngdahl, 1998). Many service sectors are still scarce for research within their topic exploring the potential for Lean management. An example of this lack of research could be found in Airport Services. The aviation sector is of great importance for the global economy with \$2.4 trillion of global economic impact (or 3.45% of the global GDP) and 58.1 million jobs related to aviation, out of which 470,000 are directly related to airport operations (Smyth and Pearce, 2007; ATAG, 2014). Regardless of the great size and importance of that sector, according to a Structured Literature Review (SLR) only a handful of articles have, to date, been published on the topic.

To best explore the opportunities and already existing literature on Lean implementation in the Airport Services, this paper conducted an SLR of published articles on Lean with a

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7 specific focus on Airport Services. With the use of an SLR approach, the rest of the paper will
8 identify key areas of Lean in Airport Services from the perspective of operational and
9 managerial aspects, which include: tools utilised, challenges, success factors, benefits,
10 limitations and agenda for future research.
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12 13 **Methodology**

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15 A literature review can be carried out through a narrative review (as was the case for many
16 years in management science), or SLR and meta-analysis (as was the case for many years in
17 medicine) (Tranfield et al, 2003). SLR has been widely adopted recently in management
18 studies. According to Suárez-Barraza et al (2012), SLR follows a scientific, systematic, and
19 transparent method. In addition, traditional narrative literature review has been criticised by
20 experts, Mulrow (1994) and Denyer and Neely (2004), as it can be heavily influenced by
21 research bias. Using the SLR framework, the bias and systematic error can be explicitly
22 minimised (Petticrew and Roberts 2006).
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28 According to Denyer and Tranfield (2009, p.677) management research is “a nascent field
29 still developing in terms of agenda and focus. In contrast with more mature fields, such as
30 medicine or engineering; management research does not enjoy consensus on research
31 methods and convergence on research questions”. Integration and creation of coherent
32 knowledge on specific phenomena is missing as there is usually a lack of synthesising
33 miscellaneous literature, which will create knowledge that could serve research and
34 practitioner communities (Denyer and Tranfield, 2009).
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39 Systematic reviews “bring together as many studies as possible that are relevant to the
40 research being undertaken, irrespective of their published location, or even disciplinary
41 background” (Thorpe et al, 2005; p. 258). That has to be done in a way which ensures that
42 any undertaken decision during the review process is transparent. By doing that, the
43 suitability of the studies reviewed could be revised by the readers who would be able to
44 extract outcomes for the robustness of the study (Denyer and Neely, 2004).
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49 The SLR applied herein has followed the five stages ([Figure 1](#)) developed by Denyer
50 and Tranfield (2009), namely: 1) Question formulation, 2) locating studies, 3) study selection
51 and evaluation, 4) analysis and synthesis and 5) reporting and using the results.
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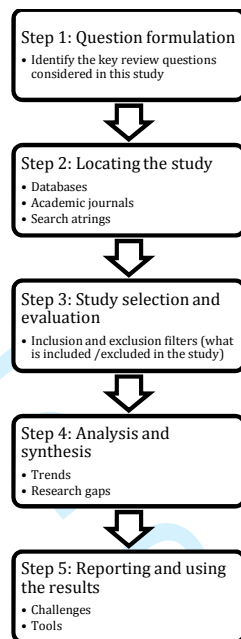


Figure 1 SLR roadmap (adapted by the authors from Denyer and Tranfield (2009))

Step 1: Question formulation (identify the key review questions considered in this study)

Building on the research objectives, the systematic review's main focus will be to determine key areas of lean in Airport Services, if there are any benefits or challenges to implementing Lean, and to identify which Lean tools are considered to be effective in Airport Services and how they are then measured. According to Denyer and Tranfield (2009) it is specifically important to engage experts for the formation of review questions when the literature is sparse. A group considered by many in the research environment to be world-leading academics reviewed the initial review questions under the spectrum of the Context-Intervention-Mechanism-Output (C-I-M-O) framework, [Table 1](#) (Tranfield et al, 2003). The purpose behind this framework is to help focus the review question and make it even more specific (Tranfield et al, 2003).

Context: Which relationships, institutional settings or wider systems are being studied? - Lean services applied to airports	Intervention: Which effects of the events, actions or activities are being studied? - Lean tools
Output: What are the effects of the interventions? - Benefits and challenges of Lean implementation	Mechanism: What are the mechanisms that explain the relationship between interventions and outcomes? - Use of Lean services

Table 1 C-I-M-O framework (Source: Denyer and Tranfield, 2009)

Step 2: Locating the study

In the second step, the identification of the databases, search engines and journals that could be considered to find literature through the use of the defined search terms takes place (Denyer and Tranfield, 2009). The databases used for the systematic literature review search were 'Emerald Insight', 'Ingenta' and 'Science Direct'. Search engines utilised were primarily Discovery (Heriot Watt University) but also Google Scholar. The primary focus was on academic journals, where Table 3 displays the relevant articles used for the study.

Step 3: Study selection and evaluation (inclusion and exclusion filters)

In the third step, a selection of the articles was carried out (Figure 2), based on the inclusion and exclusion criteria used in the review (Table 2). Petticrew and Roberts (2006) state that filters determining what is to be included and excluded must be specified in the report as they depict the type of study, intervention, population and outcomes that are appropriate to review in-depth. After entering the search string 'lean + services', 322 articles were found; as this hit was too wide the scope had to be further narrowed down. Through the use of the inclusion and exclusion filters, a more achievable amount of literature was then found allowing research to focus on the most relevant articles for the SLR. Similarly, due to the low amount of existing literature on Lean in Airport Services, articles including information on how quality

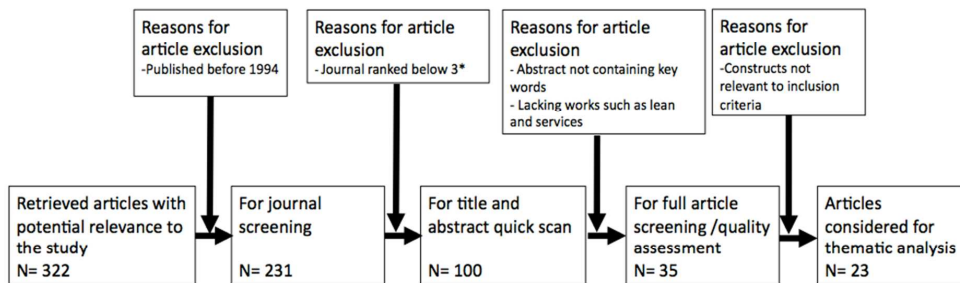
and success of other services are measured were of relevance to the search. Therefore, despite some journals not meeting the filter of being within an ABS rank 3* or 4*, there are still articles retrieved from specialised journals in the field of Lean which were found to be relevant for this research.

Filters for Inclusion	Filters for Exclusion
Articles published after 1994	All articles published before 1994
Academic journals ranked 3* or 4* (according to ABS ranking list)	Journals ranked below 3* (unless of relevance to topic)
Specialised journals (journals with greater focus on the subject matter)	Abstract does not contain keywords 'lean + services' or information of relevance
Articles referring to management of airport quality/services	
Abstract containing key words 'lean + services' or information of relevance	

Table 2 Inclusion and exclusion filters

Healthcare articles appear to be the category with the largest number of Lean service articles and it is the only sector that is extensively studied academically according to Suárez-Barraza et al, (2012). Additionally, health care services appear to have several similarities with services provided within airports. Moreover, airports and health care services seem to have the same level of complexity as they have to manage a high number of contractors (Fitzsimons, 2011; Smythe, 2015). However, in our study, articles related to the healthcare sector were excluded, due to the fact that healthcare is classified under the public sector in the UK rather than classified under the service sector. In the US, health care is considered as a service because it is private thus hospitals are trying to provide the best possible quality of service. The authors did not include conference proceedings and, for that reason, we have excluded some papers that were identified in our search.

Article selection process



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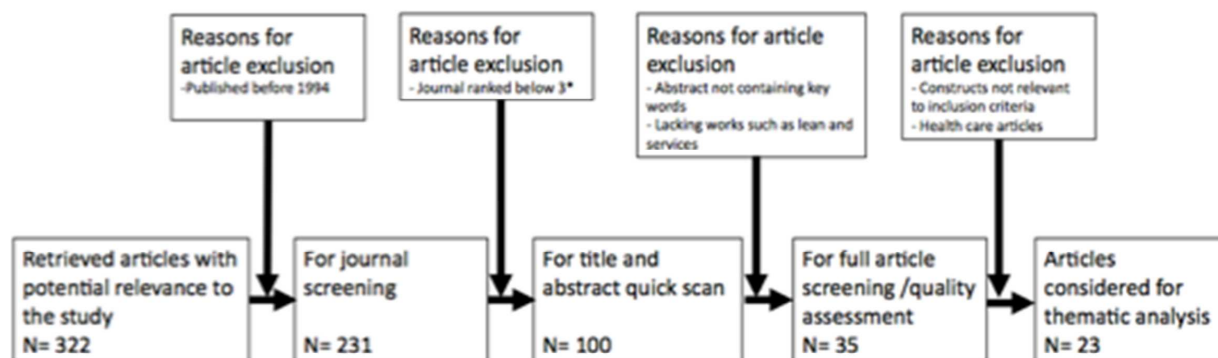


Figure 2 Article selection process for the SLR

Step 4: Analysis and synthesis

According to Denyer and Tranfield (2009) the aim of the analysis is to describe individual studies which were broken down to their components and identify how those parts are related to each other. The aim of the synthesis is to link the parts identified in individual studies. Within this study, an exploration of the topics related to Lean services and Lean in Airport Services was conducted. Subsequently, a thematic analysis (O’Gorman and Macintosh, 2014) was conducted (Table 3).

The analysis commenced by familiarising with the data available before generating initial codes of the literature available, labelling what topics literature came from, where they were published and when. Searching for themes then refocused the analysis. These themes were recoded through the use of visual graphs and tables to create a map of the analysis. The visual representations of the data further aided in defining themes and trends in the literature. Based on the trends found in the literature, which countries produce the largest amount of journal articles within Lean services and Lean within Airport Services, which journal produces the highest amount of relevant articles and, finally, the analysis identified the research gaps found in the systematic review. These trends are the foundations that the review will be shaped by.

<i>Phase</i>	<i>Description of the process</i>
<u>1. Familiarisation with the data</u>	<u>Data transcription (if necessary). ‘ Active’ reading and writing down initial ideas</u>
<u>2. Generating initial codes</u>	<u>Coding data (posteriori) in a systematic fashion across entire data set.</u>
<u>3. Searching for themes</u>	<u>Re-focusing the analysis at the broader level. Forming codes into potential themes</u>
<u>4. Reviewing themes</u>	<u>Checking themes against the coded extracts and in relation with each other. Forming a thematic ‘map’ of the analysis.</u>
<u>5. Defining and naming themes</u>	<u>Further refinement of identified themes. Locating the overall story of the analysis.</u>
<u>6. Producing the report</u>	<u>Writing-up the analysis results with vivid extract examples and comprehensive commentary.</u>

Table 3 Phases of thematic analysis. (O’Gorman and Macintosh, 2014).

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Step 5: Reporting and using the results

The final step according to Denyer and Tranfield (2009) provides a report which demonstrates clearly how the review process was conducted together with the overall results. This allows the repeatability of the review and makes clear what the outcomes of the research would be. The next section presents the results of the SLR.

1. Discussion of results and key themes emerged

In total, the review identified 322 journal articles, of which 23 met the final inclusion criteria. Those 23 articles are presented in [Figure Figure-3](#) where they are segmented according to country of origin between the years 1998 and 2015. The UK and USA are the dominating countries with the highest number of articles identified, with five articles respectively, followed by the United Arab Emirates and Sweden with two articles respectively. The remaining identified countries have published one article according to the results demonstrated in [Figure Figure 3](#).

As announced by Airport Council International (ACI) in 2007, customer demands are continuously moving towards higher service quality expectations (Fodness and Murray, 2007). The consumer trend is reflected in the increase in published research on Lean services from the late 2000s ([Figure Figure 3](#)). As illustrated in [Figure Figure-3](#), Lean services were initially mentioned in 1995 by Bowen and Youngdahl (1998). However, the real popularity for Lean services has come about as a result of customers' increasing desire for quality from their services (Bowen and Youngdahl, 1998; Fodness and Murray, 2007). This is illustrated by [Figure Figure-3](#) indicating a boost from the mid-2000s where, roughly, only one article per year is published on the topic, to 2014 where there are three available articles on the topic.

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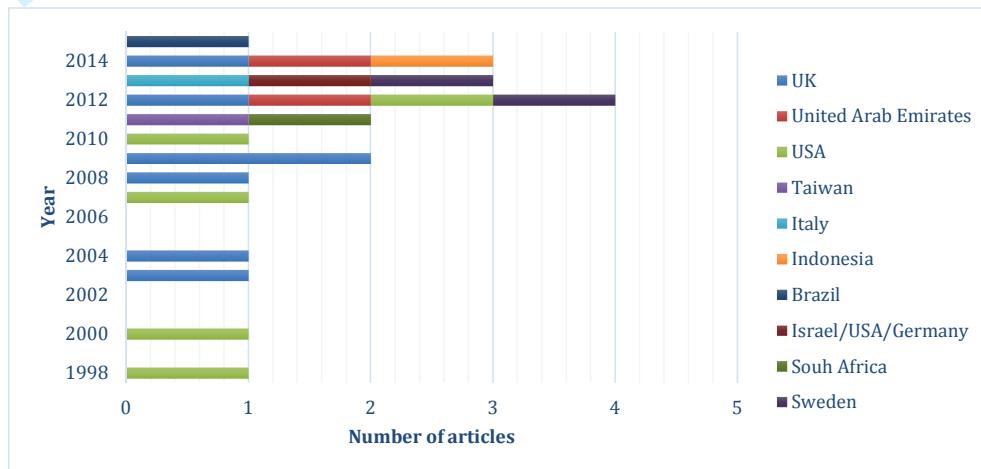
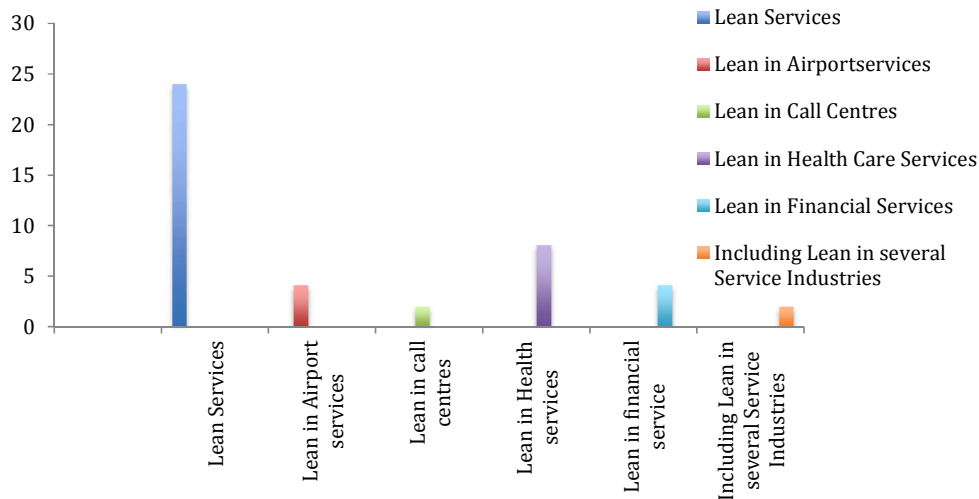


Figure 3 Country and year of publication

Another outcome of the SLR is demonstrated in Figure 4, where it is evident that there are certain areas of Lean Services that are more frequently mentioned than others. The majority of articles published on the topic of Lean in the service industry are published in the health care sector (Table 4), where there are eight articles based purely on Lean in healthcare services. Based on the UK definition of healthcare services as a public service, contra to the USA where it is considered a private service, there is no surprise that the majority of the articles published on this sector were in the US. According to our findings, the second largest number of articles published are articles analysing Lean applications in-across several industries, with no specific industry as the main focus. Figure Figure 4 further visualises how much development research has had in journal publications on Lean services as a concept rather than niche research in areas such as Lean in Airport Services/industry, emphasising the current research gap within the field. When comparing Figure Figures 4 and 5 it appears that, initially, more publications occurred in topics considering Lean in several service sectors. Publication growth on Lean in niche service sectors, however, has become more frequent in the last few years.

<i>Articles published purely on Lean in Healthcare Services</i>	
<i>Nat Natarjan (2006)</i>	<i>'Transferring Best Practices to healthcare: opportunities and challenges'</i>
<i>Weinstein (2014)</i>	<i>'Continuous improvement at CHG: CHG healthcare services got back to basics, focusing on Lean Management strategies and other organization strengthening initiatives'</i>
<i>Dahlgaard et al, (2011)</i>	<i>'Quality of lean and healthcare: a system for assessing and improving the health of healthcare organisations'</i>
<i>Dotun et al, (2014)</i>	<i>'Prioritizing lean supply chain management initiatives in healthcare service operations: A Fuzzy-AHP approach.'</i>
<i>Cheng et al, (2015)</i>	<i>'Improving access to health services – challenges in Lean application'</i>
<i>Daultani et al, (2015)</i>	<i>'A decade of lean in healthcare: Current state and future directions'</i>
<i>D'Andreamatteo, (2015)</i>	<i>'Lean in healthcare: A comprehensive review'</i>
<i>Pokinska et al, (2013)</i>	<i>'The daily work of lean leaders. Lessons from manufacturing and healthcare.'</i>

Table 4 Articles published purely on Lean in Health Services



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Figure 4 Journal article publications within the different topics of Lean for Services

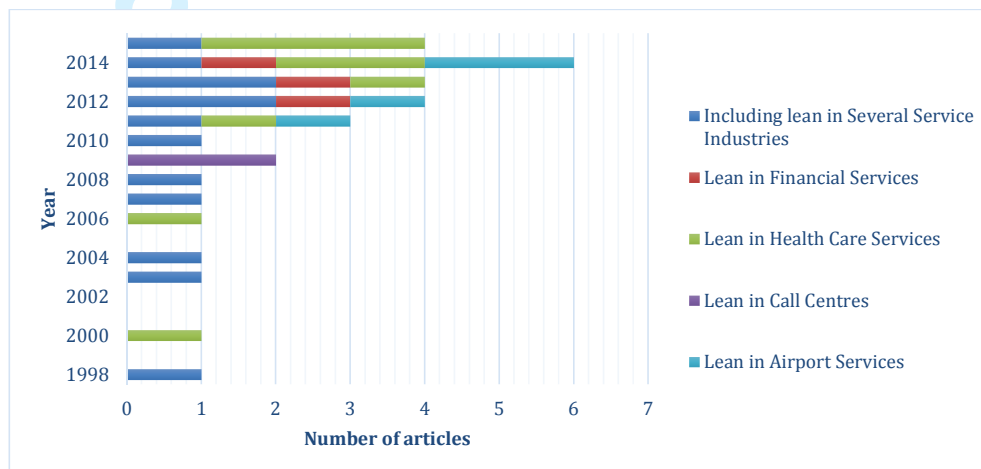


Figure 5 Journal article publications within the different topics a year of publication

As evident in Figure 6 the maximum number of articles on Lean in Airport Services was published in Asia. Two articles were published in South Africa and one in the USA in collaboration with universities in Germany and Israel. The latter two, however, focused on benchmarking and airline services rather than Airport Services and, therefore, do not qualify as pure Lean in Airport Services publications. The geographical spread of publications as illustrated in Figure 6 the research gap on Lean in Airport Services outside of Asia. This gap further raises questions such as why the focus on Lean in airports is so much higher in Asia than in the rest of the world?

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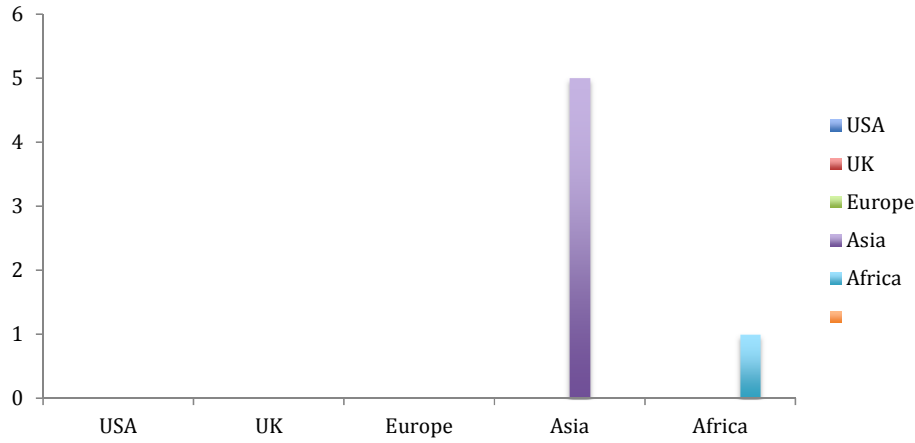


Figure 6 Geographical spread of publications on Lean in Airport Services

As demonstrated in Table 5 the maximum number of articles on Lean Services is published in the Total Quality Management and Business Excellence journal (eight publications), followed by the International Journal of Operations and Production Management with seven publications related to Lean Services. Lean in Airport Services, on the other hand, has a more diverse spread. Each journal article available on the topic is published in different journals, illustrating that no journal has yet made a focus on this niche area of research.

Journal	ABS 2015 Rating	Database	No. of Relevant Articles	Country of Publication
Journal of Total Quality Management (Total Quality Management and Business Excellence)	2	Business Source Premier Discovery	8	UK
Research Journal of Applied Sciences, Engineering and Technology	N/A	Discovery	1	United Arab Emirates
International Journal of Social Management, Economics and Business	N/A	Discovery	1	---
Journal of Service Management (former International Journal of Service Industry Management)	2	Emerald Insight	1	USA

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Applied Soft Computing	N/A, 5-year impact factor 3.222	Science Direct	1	Taiwan
Journal of Service Marketing	2	Emerald Insight	1	UK
International Journal of Operations and Production Management	4	Emerald Insight	7	UK
Journal of Service Science and management	N/A	Discovery	1	---
Production	N/A	Discovery	1	---
Omega	3	Science Direct	1	USA
Journal of Air Transport Management	1	Science Direct	1	USA
Managing Service Quality: An International Journal	N/A	Emerald Insight	1	UK
Quality Engineering	<u>N/A</u>	Business Source Premier	3	USA
Journal of Operations Management	<u>4*</u>	Science Direct	2	USA
International Journal of Public Sector Management	2	Emerald Insight	1	UK
Global Business Review	<u>N/A</u>	Sage Journals	1	UK
European Journal of Marketing	<u>3</u>	Emerald Insight	1	UK
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Table 54 Journals from which relevant papers were sourced

The SLR conducted, has demonstrated various aspects that they were unknown so far for Lean in airport services. Due to the small number of articles identified we have made a comparison of Lean publications on health services and airport services. That was the case because the authors felt that Healthcare services and Airport services share a number of things and moreover Lean in Healthcare sector is much more advanced and therefore a number of lessons can be learned from this sector (Smythe, 2015). Most of the papers published in Lean airport services were published in Asia without their representation by a main journal so far.

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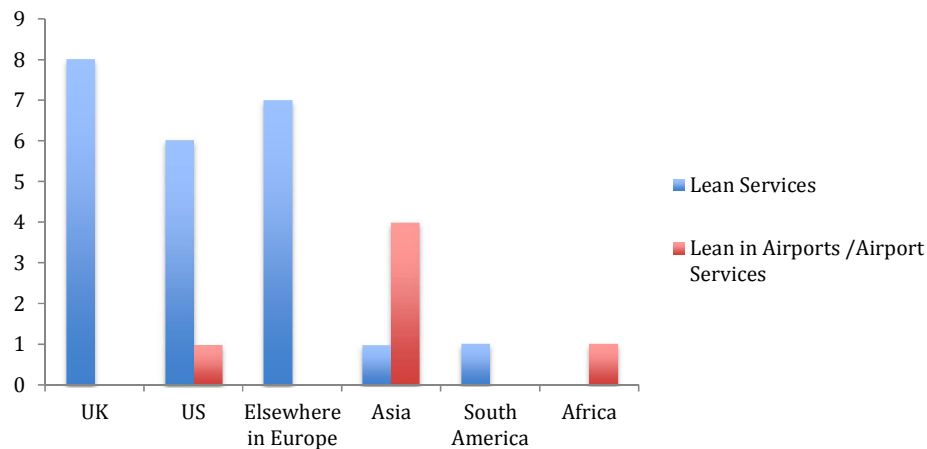
Key findings and Discussion

A common finding in the majority of Lean Services literature is that though most literature is written from a favourable perspective, very few have identified the actual proven advantage Lean has had to the services (Hines et al, 2004; Leite and Vieira, 2015). Furthermore, with the purpose of determining whether or not Lean is an efficient operational strategy for services, it is difficult to be objective when very little literature challenge Lean's efficiency in the service industry (Hines et al, 2004; Suárez-Barraza et al, 2012). Research does identify challenges and possible barriers; however, few actually challenge and argue for why Lean should not be applied in a service context.

The findings compared with existing authors are fairly unique. However, to date little research has been conducted on the use of Lean and Six Sigma for Airport Services. Al Muhareeb and Graham-Jones (2012) analyse the available services at King Khaled International Airport (KKIA) and how their operational function may improve through the implementation of Lean and Lean Six Sigma.

The aviation industry, in general, is 3.6 times more productive than other jobs (ATAG, 2014). However, that productivity is not equally distributed around the globe (ATAG, 2014). In order to measure the aviation footprint to an economy, airport connectivity is used as it is highly linked with GDP increase and labour productivity (Smyth and Pearce, 2007). Thus, emerging economies seem to focus on increasing their airport connectivity, which is

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7 remarkably low compared to developed economies (Smyth and Pearce, 2007). Their airport
8 connectivity could be increased by the Airport Services offered (Fodness and Murray, 2007).
9 This seems to be the case through the application of Lean Services in an airport operation.
10 Through the improvement of airport operations, connectivity of developing countries could
11 increase; thus developing economies could increase as well. As demonstrated in Figure 7
12 developing economies are trying to increase their Airport Services (and their airport
13 connectivity) with the use of Lean tools and techniques.
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34 **Figure 7** Geographical comparisons of journal publications by topic

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37 It seems that mainly in developing countries (Asia and Africa) we observe an increased
38 “willingness” for Lean application in the airport operation section in comparison with the
39 overall Lean services used in other sectors. Figure 7 further illustrates the geographical spread
40 in Lean services publications. Countries that are generating high numbers of publications on
41 Lean services are barely publishing on the use of Lean thinking in Airport Services.
42 Contrastingly, the Asian and African countries publish close to a very few or no articles on
43 the topic of Lean in Services. However, the most available literature on the use of Lean for
44 Airport Services emerges from the Asian and African contexts rather than from the rest of the
45 world.
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Lean Tools for Airport Services

Given the early stage of research Lean in Airport Services is currently at, it has been challenging from the SLR to identify Lean tools applied in Airport Services. Rooted from Lean manufacturing, Womack and Jones' five Lean principles is the methodology applied in all sectors of the economy (Piercy and Rich, 2009a; Womack and Jones, 1996). Most of the analysed case studies within Lean services identify the importance of Womack and Jones' methodology for creating and optimising the value and use of 5S as a fundamental Lean tool for standard housekeeping. 5S, referring to sort, set in order, shine, standardise and sustain were used for analysing problems in the departure area in KKIA (Al Muhareeb and Graham-Jones, 2014).

In 2007 the Airport Council International (ACI) announced that airport managers ought to pay attention to the importance of passengers in the operations of airports. ACI stated that if passengers had the opportunity of choice they would prefer airports offering the best level of service due to their increasing expectations of high service quality standards (Fodness and Murray, 2007). As one of the ACI's main functions is their Airport Service Quality System (ASQS), an internationally standardised service quality survey, the ACI have reasoning behind their bold statement (ACI, 2015). The ASQS is not a Lean tool; however, it is a benchmarking tool that allows airports to see where they position themselves compared to their competitors (ASQS, 2011; Fodness and Murray, 2007).

Lean tools such as process mapping, VSM, reporting and communication have been strongly advocated in other Lean services publications (Di Pietro et al, 2013; Piercy and Rich, 2009a; Leyer and Moormann, 2014). These tools though not as extensively discussed in Airport Services publications, can be of relevance for the Airport Services. Ikatrinasari and Haryanto (2014) demonstrate such potential for value stream mapping in Airport Services in Indonesia. Of the 82 companies analysed, Ikatrinasari and Haryanto's hypothesis was that Lean thinking would improve operational lead times in the Airport Services. Lead time for a particular process has reduced significantly from 71 days to less than 30 days after the implementation of Lean tools.

Building on the reflective statements from Ikatrinasari and Haryanto (2014) that "in Lean application, a project management needs to be formed" and "training should not be limited to only one Lean tool because it will only study the potential of VSM application alone", we

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7 may conclude that, potentially, one Lean tool is not sufficient for a proper Lean application in
8 the Airport Services, due to the complex nature of the services provided (Ikatrinasari and
9 Haryanto, 2014). It is quite apparent that Airport Services are in their early stages in the
10 adoption of Lean and there is a huge potential for pursuing research to understand the
11 maturity of Lean tools within Airport Services. It could be possible that Lean in Airport
12 Services still needs more time before it can progress from very basic tools to advanced Lean
13 tools. The development of a Lean toolbox, specifically, for Airport Services would be highly
14 beneficial to many managers and Lean champions who are engaged in continuous
15 improvement methodologies for Operational and Service excellence.
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20 *Challenges in the use of Lean for Airport Services*

21 Research performed in healthcare services highlights that measuring the outcome of Lean in
22 services is more complex than in production or manufacturing scenarios as the processes in
23 services are not very transparent; moreover, the flow of process and information from one
24 department to another is not at all straight forward (Nat Natarajan, 2006). In Airport Services,
25 Lean application is very challenging due to the difficulty of maintaining the level of service
26 standards (Al Muhareeb and Graham-Jones, 2014). Another challenge identified is the lack of
27 understanding about the relationships between customer expectations about a service,
28 management perceptions about the service, external service delivery and service quality (Al
29 Muhareeb and Graham-Jones, 2012; Spreng and Mackoy, 1996).
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36 Another challenge associated with Lean application in Airport Services is to understand the
37 key performance indicators and their performance goals. Very limited research has been
38 pursued on this topic and there is clearly scope for research to understand the importance of
39 performance measurement systems related to Airport Services and the use of Lean tools to
40 improve the service performance (Ikatrinasari and Haryanto, 2014). Ikatrinasari and Haryanto
41 (2014) claim such a challenge can be dealt with through continuous measurements and careful
42 strategic planning.
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46 Leyer and Moormann (2014) argue that a Lean mindset which reflects the attitudes and
47 behaviours leading to cultural change in organisations is believed to be more important than
48 the mere application of Lean tools and techniques (2015). Piercy and Rich (2009b) claim the
49 greatest challenge when implementing Lean into a pure service environment is the retraining
50 of staff. In the call centre service, a great issue is to solve customer issues and provide
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7 excellent service through only one point of contact rather than an ongoing conversation
8 (Piercy and Rich, 2009b). The challenge thus when implementing Lean in a call service is
9 identifying the best method of training, so that the transformation to new customer call
10 processes would be as smooth as possible.
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13 Finally, a challenge in the use of Lean for Airport Services is that within the airport there are
14 several services that exist. For example, one company may provide the electrical generators
15 which airplanes use when they are docking in the airport and a second could provide the
16 ladders while a third could provide the catering services. Therefore, within the airport we
17 could have several companies providing various services. As no Lean related papers have
18 been available in any of the above areas, the authors would argue that there are immense
19 opportunities for the use of Lean thinking across all types of services. Moreover, it is
20 important for Lean practitioners to understand the type of tools which can be used for
21 improving the quality of service for the above types of services.
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27 ***Common barriers in the implementation of Lean for Airport Services***

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29 Suárez-Barraza et al (2012) states one of the greatest initial barriers of Lean in services is the
30 difference in interpretation of what Lean actually means. With research still in development,
31 there are few definitions of Lean and its role in the service environment. This lack of a unified
32 understanding of what the value of Lean in services actually means is a barrier as participants
33 in a Lean transformation would potentially be working towards different goals.
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37 Similar to any change process, the application of Lean in services is victim to resistance of
38 change (Leite and Vieira, 2015). Resistance by internal and external stakeholders can become
39 a threatening barrier if efforts to mitigate resistance are not applied (Leite and Vieira, 2015).
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42 Al Muhareb and Graham-Jones (2014) evolved their research stance from focusing on the
43 efficiency of Lean in Airport Services to consider the benefit of using it along with Six Sigma
44 tools. Their findings suggest that a barrier for Lean in Airport Services could be its need to be
45 complemented with Six Sigma tools to achieve the greatest and superior results. Barriers and
46 explanations identified in the literature are summarised and illustrated in Table 6.
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Barriers	Examples/Explanations	References
<i>Need for Lean to be complemented with Six Sigma tools</i>	<i>–Al Muhareb and Graham– Jones evolved from pure Lean strategies in their 2012 research to Lean Six Sigma strategies in their 2014 research.</i>	<i>Al Muhareb and Graham–Jones 2012 + 2014</i>
<i>Resistance to Change</i>	<i>Leite and Vieira through an analysis of 25 service companies found that resistance to change was a common barrier for Lean in services</i>	Leite and Vieira, 2015
<i>Differing interpretations of definitions for the term Lean in service settings</i>	<i>Varied interpretations of definitions leading to research was restricted due to the lack of homogenous results</i> <i>Gaps in theory and practice making a standardised implementation of Lean in services challenging</i>	Fodness and Murray, 2007 Suárez-Barraza et al, 2012

Table 6 _Barriers of Lean in Airport Services

Success factors – what are the critical success factors for implementing and sustaining Lean in Airport Services?

In health services, one of the main success factors was to start small when implementing Lean and then kick-off more complex projects which employ more advanced tools of Lean which demonstrate significant savings in terms of lead time or waste reduction (Nat Natarjan, 2006). Another critical success factor for Lean implementation is having a strategy and project management plan. Ikatrinasari and Haryanto (2014) demonstrate, in their case study, that Lean application in Airport Services could be successful if training and other methods are

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7 enforced in order to achieve the desired Lean outcomes. Though the research process lacked
8 complete data and exclusively positive results, it highlighted the need for Lean application to
9 occur over a longer time period. Furthermore, it also emphasised that Lean implementation is
10 more likely to be successful if more than one tool is used in the implementation. This could be
11 the reason why Al Muhareeb and Graham-Jones (2012) found it more effective to also include
12 Six Sigma tools, as the integrated approach of Lean and Six Sigma produces superior results
13 than using Lean or Six Sigma alone (George et al, 2005). However, no empirical research has
14 been carried out to evaluate the critical success factors for implementing and sustaining Lean
15 in Airport Services.
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20 ***Benefits of Lean in Services/Airport Services***

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22 It has already been asserted that more and more service organisations want to implement Lean
23 thinking having read others' success stories (Suárez-Barraza et al, 2012). With such a
24 growing trend it is difficult not to assume that there are great benefits to be gained from Lean
25 in services, especially when applied successfully.
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29 Long-term, significant financial benefits can be gained once training and restructuring
30 processes have been integrated into new routines (Ikatinasari and Haryanto, 2014). Improved
31 operational efficiency is another Lean benefit where, in airports, this could mean a cut in the
32 waiting time for passengers between getting off the flight and collecting their bags
33 (Ikatinasari and Haryanto, 2014). One of the benefits of Lean in healthcare services,
34 according to a number of sources, is the improved staff notion of self-value (Nat Natarjan,
35 2006; Poksinska et al, 2013). With employees encouraged to take greater responsibility for
36 their work and being included in the shared vision, the everyday work environment benefits
37 as well.
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42 From a consumer perspective a benefit of Lean is the improved quality of service delivered
43 (Nat Natarjan, 2006). This is also a benefit for the organisation and service provider as they
44 can offer a higher quality and more competitive service to their customers. Table 7 presents
45 some of the benefits of Lean in services and the authors argue that the same benefits can be
46 relevant to Airport Services.
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Benefits	References
<i>Improved operational efficiency</i>	<i>Ikatrinasari and Haryanto, 2014</i>
<i>Improved staff notion of self-value</i>	<i>Nat Natarjan, 2006; Poksinska et al, 2013</i>
<i>Long term financial benefits</i>	<i>Leite and Vieira, 2015</i>
<i>Improved quality of service delivered</i>	<i>Nat Natarjan, 2006</i>

Table 7 Benefits of Lean in services (Source: Authors)

Limitations and Theoretical/Practical Implications of the study

The SLR identified three main limitations of Lean for the Airport Services; lack of research within the field, theoretical implications and practical implications (Table 8). It was apparent from the SLR that there has been a dearth of literature on Lean in Airport Services and this implies very limited analysis can be carried out on the existing secondary data. As Suárez-Barraza et al (2012) state, the lack of publications reflecting negative experiences and challenges associated with Lean in Services resulted in challenges for the SLR to produce a critical analysis. For the present study, the authors have reviewed 3* and 4* journals as well as some subject specialised journals to identify relevant articles. As the authors have not looked through 1* and 2* journals in ABS journal ranking guide (2015), a number of articles could have been missed in the study. Perhaps a more advanced and rigorous search could be pursued in the future. Moreover, a number of conference papers and other grey literature were not taken into account for the present study. Piercy and Rich (2009) and Leite and Vieira (2015) considered the theoretical implications on Lean in services. The scarcity of articles published makes it difficult to create clear definitions and statements on the topic, which further leads to confusion in the interpretation of Lean and its context in services (Piercy and Rich, 2009a; Leite and Vieira, 2015). In implementing Lean for Airport Services, there must be a clear definition of the goals and what its implementation is set to achieve. Lean implementation will help Airport Services to attain improved service quality, to remain a leading service provider with good process technology performance, to practice just-in-time services delivery and to offer cost competitive services. The third limitation of Lean in Airport Services is the application of Lean methodology and the relevant Lean tools to make

business processes in Airport Services more efficient and effective. There is an immense potential to pursue further research on the development of a customised Lean toolkit for tackling various problem areas in Airport Services. For instance, the authors would highlight the point that different services at the Airport would require different tools of Lean to make processes more efficient and effective. The choice of tools from the Lean toolbox depends heavily on the nature of the problem, whether or not the solution to the problem is known or unknown at the start of the problem definition, ease of implementation of the solution and so on. This leads to the development of a Lean maturity tool-grid showing the basic tools all the way through to very advanced tools.

Limitations	Details/explanations	References
<i>Lack of research within the field</i>	<i>Difficult to conduct critical analysis due to limited number of papers</i>	<i>Suárez-Barraza et al (2012)</i>
<i>Theoretical implications</i>	<i>Scarce articles in literature Little evidence upon which to build statements</i>	<i>Leite and Vieira (2015) Piercy and Rich (2009^a)</i>
<i>Practical implications</i>	<i>Lean practices and principles that have yet not been well defined and reported</i>	<i>Leite and Vieira (2015)</i>

Table 8 *Limitations of Lean in Services*

Conclusion and Future research directions

Although there are a number of papers published on Lean in manufacturing, it seems there are a limited number of papers published in the existing literature on Lean in Services and, in particular, Airport Services. This paper presents the results of an SLR carried out on Lean in services and, in particular, Airport Services. Despite the limited number of papers on the topic, the authors firmly believe there is an immense potential for pursuing research on Lean in Airport Services. The authors have noticed that there are no case studies on Six Sigma

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7 published in top notch academic journals and this is a clear gap in the existing literature.
8 Perhaps we are still in the very early stages on the use of Six Sigma methodology and the
9 associated tools for tackling various process and quality related issues at Airports. The results
10 of the SLR show that the application of Lean in Airport Services is in its early stages and only
11 four relevant papers were identified in the literature. The paper presents some of the
12 challenges, benefits, success factors and limitations of Lean in services/Airport Services
13 based on the SLR methodology. However, it is essential to carry out an empirical study to
14 understand if the findings of the empirical study are in alignment with the current literature.
15 This could include an online survey to understand the current status on the use of Lean/Six
16 Sigma or any other continuous improvement (CI) methodologies in the Airport Services
17 context followed by carrying out semi-structured interviews to have a greater and deeper
18 insights into the extent of application of these process excellence methodologies.
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25 So, what does the future agenda look like for this topic? Firstly, the application of Lean tools
26 in Airport Services is limited and it is important for academics and practitioners to look into
27 the development of a basic and advanced toolkit for the implementation and sustainability of
28 Lean in Airport Services. Secondly, the measurement of Leanness in Airport Services would
29 be a very useful topic for senior managers to understand the key ingredients for Airport
30 Services to become Leaner. Instead of applying the concepts of Lean everywhere across the
31 Airport Services, the measurement of Leanness assists senior managers what areas to focus on
32 and how to reduce process inefficiency issues in such critical processes. The last
33 recommendation would be a good understanding of the fundamental barriers in the
34 development and deployment of Lean in Airport Services.
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Reviewer 1

Comments reviewer 1	Actions
1) The paper works on systematic literature review about Lean practices in Airport Services. This is a new and interesting area and current state will help in understanding more about Lean practices in a different set-up.	Thank you for the positive comment from this reviewer.
2) The number of articles presented are less. But given the newness of the field it is acceptable	Thank you for the comment.
3) The paper is based on seminal works on Systematic Literature Review. This helps in building the concepts well.	Thank you for the comment.
4) This is where, I feel the paper needs to improve. The results need to be combined. Outcome of different analysis is not presented well. The paper needs to state why it is still not a narrative review as the paper seems to state what is represented through figures. Just using the framework does not make it a systematic review. The analysis also needs to be in-depth.	A paragraph was added in the end of the results section, in order to summarise our key findings. Based on the limited literature review of the topic with none ever doing a similar research that is the deepest available point that we could reach at the moment. Although the reviewer asks for detailed literature review authors felt that we can not find any further literature due to the limited number of papers published (6). In depth analysis therefore cannot be carried out based only on six papers. Instead, our sole purpose of the article was to set the foundation for future research.
5) The study definitely has implications for practice and research as the author could find only handful of articles in this area. But the paper needs to be careful also in case of Airport Services. Here the service ownerships are scattered and so the responsibility to have a world-class service experience also varies. For example, the baggage handling system in an airport will be done by one service provider whereas the housekeeping service providers will be different. So, Lean in airport services has to be understood in that perspective.	The authors would like to acknowledge the interesting point raised by the reviewer. We think this is a common problem across many service organisations as the service is provided by different service providers and therefore achieving world class experience across the organisation is more challenging due to variation in the quality of services from various service providers. We have taken this point into account and we have added a few sentences in the discussion part of the paper under the challenges in the use of Lean for Airport Services section.
6) The paper can be improved upon in-terms of language and grammar.	Authors have used a proof reader to ensure that all the grammatical and language errors have been fixed.

Reviewer 2

<u>Comments reviewer 2</u>	<u>Actions</u>
1) Good effort in implementing SLR in this topic. However, it requires more rigorous analysis for several themes: Tools, challenges, success factors.	Although the 2 nd reviewer asks for a more rigorous analysis, the purpose of our SLR is to report the tools which have been used on lean in Airport services, some of the challenges of implementation of lean and success factors. However, the authors felt that a rigorous analysis is an impossible task especially based on a limited number of identified articles. The authors firmly believe that the current analysis shown in the manuscript fits the purpose.
2) The analysis is focused too much on services instead of Airport services.	Due to the limited literature on lean in Airport services, the authors looked on other service sectors such as health services that seem to have high similarity with the airport service sector. Moreover Lean in health care services is much more advanced than any other sector and therefore many lessons can be learned from this sector.
3) The formatting of tables and wording of several sentences are confusing.	Authors have now fixed this issue.
4) Methodology especially inclusion/exclusion criteria required major review as it affected results.	Due to limited literature on the field of lean in Airport services, authors argue that there would not be any changes in the results of our study.
5) Major review required on the discussion as it needs to discuss the themes relates to lean for Airport services and the conclusion section needs to answer the research questions.	All the themes have been discussed on the discussion part. Please note that we do not have any research questions in our research; therefore, we do not have to answer them.
6) This paper portrays significant information on the implementation of Lean in the Airport Services.	Thank you for the feedback.
7) SLR does not originally propose by Denyer and Tranfield as it was applied long time ago in healthcare research area. However, Denyer and Tranfield, 2003 one of the early study explained on the adaptation of it in management research area. The statement- "Though many organisations within the service industry are increasingly becoming more intrigued by Lean theories and wish to implement them into their own organisations, the amount of published literature on the topic is still under development (Bowen and Youndahl, 1998). " is cited from a 1998's paper (18 years ago), which the claim already outdated. How about the most recent situation? Is the topic still considered underdeveloped in current literature?	Authors feel that lean services in general is in its early stages. Therefore, the topic is still considered underdeveloped in the current literature. That reference mentioned by the reviewer (Bowen and Youndahl, 1998) is "possibly" one of the most cited and that is why we are using it. The purpose of the paper is not to include all the lean in services context. This paper is not a SLR on Lean in Services rather it is about Lean in Airport Services.
8) There is only 1 search string reported in this study. However based on the topic there are other potential search strings can be applied, where in SLR it is important to report the author has tried every potential search string in order to show the exhaustive search of literature and to avoid missing	We would like to distinguish that we are focusing only on airport and health sector. We have not included all the health service articles. That comment is irrelevant because it is too general. We have only one research stream

any potential sources (paper).	here.
<p>9) Inclusion/exclusion criteria is to clearly show the details/criteria applied when choosing the papers:</p> <ul style="list-style-type: none"> -Provide justification on why the year 1994 is applied in the inclusion/exclusion criteria. -List the specialised journal used in this study. -List the keywords meant in inclusion/exclusion criteria. 	<p>The reviewer in his/her previous comment says that research from 1998 is outdated. In our inclusion/exclusion criteria we use 22 years' timeframe (since 1994) in order to cover all the literature which is related to our research. That is a big contradiction. In any case, we have not identified any worth mentioning literature before 1994.</p> <p>The specialised journals used in this study were the following:</p> <ul style="list-style-type: none"> - Managing Service Quality: An International Journal - International Journal of Six Sigma and Competitive Advantage - The TQM Magazine - Journal of Total Quality Management (Total Quality Management & Business Excellence) <p>Our key words include: Lean Thinking, Airport Services and then we have also looked at some relevant "healthcare and lean " related articles.</p>
<p>10) Figure 2: The reasons for article exclusion (last stage)- only healthcare articles were considered to be excluded from the study, how about articles from other service industry i.e., financial, insurances, real estates, construction, transportation? The author should include the type of analysis were done and how it was done in Step 4.</p>	<p>Thank you for spotting this error. Deleted healthcare as an exclusion from Figure 2, as this was an error.</p> <ul style="list-style-type: none"> - Real estate, insurance and transportation were not included as exclusion filters because they did not appear when the search string "lean + services" were typed in during the data collection process. - Financial services are briefly analysed further down in the review, and is therefore not listed as an exclusion filter. - A paragraph on the type of analysis and how it was done is now implemented. A table illustrating the steps is also inserted.
<p>11) Would there be any justification on why the UK and USA have the highest number of publications?</p>	<p>Lean as a methodology for operational and service excellence is really advanced in the USA and UK. These are the two advanced countries for lean research apart from a few other European countries. Moreover there may be a massive number of Lean publications in other languages but our search criteria were those publications in English.</p>
<p>12) The results (Figure 4) explaining topics for Lean for Services, however, the topic for this paper is Lean for Airport services</p>	<p>Yes we have got reviewer's point. However what we want to demonstrate in Figure 4 is the level of lean for airport services in comparison with other topics dealing with Lean for services.</p>
<p>13) "The second largest number of articles published is articles discussing Lean application in several industries"- This sentence is confusing</p>	<p>OK, this is now fixed. A great number of articles published on Lean in services discuss the application generally across several industry</p>

	sectors rather than health care or airport services.
14) The Table 3 is explaining Lean in Health Services, however, the author has declared 'health care' as one of the exclusion criteria. So the results should not include the analysis for healthcare	As a result of healthcare being removed from the exclusion filter, Table 3 should no longer be in contradiction with Figure 2.
15) Again 'Health services' is included in Figure 4 and Figure 5.	We have provided an answer on that question on comment number 2 demonstrated above.
16) Figure 5 already covered information in Figure 4.	Yes, but Figure 4 demonstrates the sum of services for each lean service sector in papers while Figure 5 demonstrates the sum of papers per year per sector.
17) Table 4 is incomplete (section databases).	This has now been completed. Thank you for spotting this.
18) Table 4- Following the ABS 2015 rating (I believe it is according on its *); There are journals rate as 2* here in the table, however in the exclusion criteria; any journal fall below 3* will be excluded. Therefore, those papers should not be in the result.	Yes that is according to stars of ABS list. As we have mentioned in Table 2, we include journals 3* and above, however some topic specialised journals (e.g. TQM magazine) were included in our study as they were relevant to the topic of research.
19) The analysis and results for Lean tools are rather weak. There is barely analysis were done for the themes; tools, challenges etc	Authors disagree with the comment. There are a limited number of papers on lean tools and their applications in airport services context. Therefore, authors felt that the analysis provided in the lean tools section is adequate. Moreover this study also reveals the most important point that there is a dearth of literature on Lean in Airport Services and this calls upon more future research on this topic.
20) Not sure how this sentence- "The SLR analysis found that companies where employees share the Lean vision perform daily operations in a Lean manner"- fall under 'challenges'	Having read the sentence again, we also felt that this sentence adds no value to the paper and therefore has now been deleted. Thank you for spotting this.
21) Confusing limitation- "Piercy and Rich (2009) and Leite and Vieira (2015) considered the theoretical implications on Lean in services"	There are only a handful number of papers which talk about theoretical and practical implications of Lean in Services. The authors have carefully studied the articles appeared in the current literature and we felt that these implications are quite valid on Lean in Airport Services too.
22) If there are limits of theoretical implications and practical implications of this study, the author may risk the need for this study to be published	The authors have now expanded the limitations of the research further and the revised manuscript has now taken this point into consideration.
23) The limitations are confusing and require major revision	The limitations section has been revised and all the confusion aspects have been removed to our best ability.
24) The conclusion needs to explain the information match with the research objectives	We do not have research objectives thus we cannot match them with any information. However we have included a couple of research gaps in the conclusion section of the paper.

25) The author requires to review/add the implications of this research	This is a SLR and the purpose is to understand the current status of Lean on airport services and report the gaps in the existing literature.
26) Figure 2 appeared to be blurry.	Figure 2 has been replaced with a clearer version.
27) .Page 7, line 55 and Page 8, line 21, line 15, line 52, page9, line 10, line 15: The author missed to write which Figure contains information of Country and year of publication, etc.	This has been taken care of by the authors.
28) Ensure the tables following the format of this journal	Yes this is also taken care of by the authors.....