Journal of Contemporary Management
Volume 15

The 'lean and green' paradigm: Drivers, barriers and practices in the South African airline services industry

W NIEMANN *

University of Pretoria, Department of Business Management

wesley.niemann@up.ac.za

** corresponding author*

T KOTZÉ

University of Pretoria, Department of Business Management

theuns.kotze@up.ac.za

B JOSI

University of Pretoria, Department of Business Management

u13166591@tuks.co.za

Abstract

The airline services industry suffers from high cost, waste management and environmental pressures, along with a competitive business environment. The lean and green (L&G) paradigm is a fusion of the well-established management concepts of lean thinking and green management and creates synergies between these concepts to produce heightened cost reducing and environmentally friendly benefits. The purpose of this generic qualitative research study was to explore the L&G paradigm's drivers, barriers, and practices among seven airline operators in the South African airline services industry. This was completed through 12 semi-structured telephonic interviews. This study found that airline operators are mature in their adoption of the L&G paradigm, with L&G practices focused around fuel efficiency and weight reduction. The drivers of lean adoption are regulatory requirements and a competitive operating environment, while the barriers are inherent service interruptions, a 'lean limit', and money market volatility. The major drivers of green management adoption are well-developed regulations and a fear of future regulations, while the barriers are a price focused consumer market and issues with efficient technology adoption. Academically, this study identified that firms may have unique 'lean limits', and highlighted the possible application of the L&G paradigm in a service-context by corroborating findings reported in the manufacturing-based literature. Practically, the findings can assist managers to identify where the 'lean limit' exists in their firm and to begin actively incorporating green management into their objectives rather than enjoying environmental benefits as a spill-over benefit from lean initiatives.

Key phrases

Lean and green barriers; lean and green drivers; lean and green paradigm; lean and green practices and South African airline services industry

1. INTRODUCTION

Firms are always seeking new ways to obtain a competitive advantage and to increase their profitability, efficiency and productivity (Verrier, Rose, Caillaud & Remita 2014:83). Lean thinking is one of the ways firms are pursuing these objectives (Govindan, Azevedo, Carvalho & Cruz Machado 2015:15). The financial and operational success behind lean thinking comes from developing a value stream that enables the identification and elimination of all wastes or activities that do not add value to the end consumer. This ensures continuous improvement within the supply chain and contributes to customer satisfaction (Bortolini, Ferrari, Galizia & Mora 2016:887).
Firms are facing pressures from stakeholders to operate their supply chains in an environmentally sustainable manner (Hajmohammad, Vachon, Klassen & Gavronski 2013:89), typically through green management. Green management incorporates practices that target waste streams and reduce non-renewable resources and pollutants (Bortolini et al. 2016:886; Galeazzo, Furlan & Vinelli 2014:192). Originally seen as a social and environmental obligation, green management is now voluntarily implemented by firms because of its associated economic benefits, such as cost reduction and resource efficiency leading to high profits (Zhu, Geng & Sarkis 2005:284).

Stemming from the aforementioned practices is a paradigm known as the Lean and Green (L&G) paradigm (King & Lenox 2001:244-256; Simons & Mason 2003:84-91). Research found "the combined practices [lean thinking and green management] have greater results than the sum of the performances" of their separate application, combining to form the L&G paradigm (Dües, Tan & Lim 2013:2; Hajmohammad *et al*. 2013:88). The L&G paradigm posits that lean thinking positively influences and catalyses green management. Implementing them simultaneously helps firms achieve "optimal triple bottom line performance" (Thanki, Govindan & Thakkar 2016:285) and generate greater waste, cost,

and time savings than if lean thinking and green management practices were implemented individually (Bortolini *et al*. 2016:887; Dües *et al*. 2013:2).

Although it is possible to implement the L&G paradigm in the services sector, most research on L&G to date has focused on the manufacturing industry (Pejić, Lerher, Jereb & Lisec 2016:600), even though the global economy is geared towards services. The services sector in South Africa contributes to 65% of the country's gross domestic product (Statistics SA 2017:Internet) and, as a result, service industries are becoming increasingly important (Garza-Reyes 2015:26). One of the reasons for the minimal research on the L&G paradigm in the services sector may be due to the lack of a clear definition of the L&G paradigm, even though there is an understanding of how it functions (Garza-Reyes 2015:18; Hajmohammad *et al*. 2013:91). This gap is a motivator for further research on the L&G paradigm, particularly in under-researched service industries, which "can be considered critical for the practical advancement of the area" (Garza-Reyes 2015:27).

While lean thinking and green management have been researched individually multiple times in service industries, the L&G paradigm has received scant research attention (Hallam & Contreras 2016:2175), creating a consequential research gap (Pejić *et al*. 2016:599-600). Mollenkopf, Stolze, Tate and Ueltschy (2010:30) concur that research on lean thinking or green management in isolation tends to focus on specific organisational functions, taking a "silo approach". This obstructs the ability to gain a holistic perspective of the phenomena due to the lack of a cross-functional focus (Hajmohammad *et al*. 2013:86). Researchers have called for studies in the under-researched services sector on aspects such as the practical implications, barriers, strategies and practices of L&G paradigm approaches in order to create more balanced literature on the L&G paradigm (Garza-Reyes 2015:18-29; Lakshmi Meera & Chitramani 2016:33).

The gap this study addressed is the lack of research on the L&G paradigm in a services context and its associated practices. Airline operators, which collectively form the airline services industry, were the units of analysis in this study because, of all the aviation supply chain partners, they suffer the worst from low profit margins, intense competition, and intense environmental pressures from stakeholders (Baker 2013:67-68; Tretheway & Markhvida 2014:3). These are all aspects the L&G paradigm intends to address.

The purpose of this generic qualitative study was to explore the L&G paradigm in the South African airline services industry. The L&G paradigm's adoption factors and implementation methods were explored through semi-structured telephonic interviews with key personnel in the airline services industry.

The study aimed to answer the following research questions:

- What are the drivers of the adoption of the L&G paradigm in the airline services industry?
- What are the barriers to the adoption of the L&G paradigm in the airline services industry?
- What L&G paradigm practices are used in the airline services industry?
- How are L&G paradigm practices implemented in the airline services industry?

This study has three contributions. Firstly, the study provides findings on the L&G paradigm within the economically important and under-researched services sector, which adds a new industry perspective to the literature. This includes the challenges, drivers and barriers associated with the L&G paradigm. Secondly, the study identified that a 'lean limit' exists within firms, which would have benefits for managers such as understanding the maximum possible degree of lean initiatives in their firm, and allows them to find potential ways for green management to play a role in breaking that limit. Lastly, the study identified that firms in an industry with an environment that is well-suited for the L&G paradigm appear to unconsciously adopt the paradigm, which could assist future researchers in more easily identifying other suitable industries to research the L&G paradigm.

The remainder of this article contains an introduction to the airline services industry followed by a review of L&G paradigm literature, with a breakdown of its constituents. Subsequently, the methodology used in this study is discussed. Lastly, the findings, conclusions and recommendations that emerged from this study are discussed.

2. LITERATURE REVIEW

2.1 The airline services industry and its challenges

An airline operator functions at the point of service delivery where the most interaction with consumers occurs, and where the consumer expects the highest level of customer satisfaction (Rhoades & Waguespack 2008:22). Although airline operators are central to and

considered the most valuable partner in the aviation supply chain, they have the poorest economic performance of all players involved due to intense competition and high operational costs (Tretheway & Markhvida 2014:4). Another issue created for airlines is the presence of international regulations which "create no value but are unavoidable" (Al-Dhaheri & Kang 2015:958). Airlines also face environmental pressure from the consumer market due to the pollution and carbon emissions created by their service activities (Evans, Campbell & Stonehouse 2012:46; Somerville 2012:46). The best way for airlines to combat these challenges is to achieve a lower cost structure and greater environmental efficiency.

This would be interesting to explore, considering it is theorised that the L&G paradigm claims that environmental activities drive higher cost savings and operational efficiencies. Consequentially, environmentally responsible actions and reducing CO2 contribution would be beneficial to the airline services sector. In addition, Hussain, Khan and Al-Aomar (2016:1301) claim that there "is dearth in existing research on [environmental sustainability], particularly in service organizations, and techniques of sustainability are in the development stages compared to manufacturing companies."

Additionally, external forces, such as volatile fuel prices and the influence of natural disasters, can disrupt airline activities. Potential operational disruptions can always create losses for the airlines (Ali 2016:4; Tretheway & Markhvida 2014:3). The potential losses need to be offset during smooth operations, driving the highest profit margins whenever possible (Marchwinski 2011:Internet).

2.2 Lean thinking

Lean thinking is implemented in companies to boost their productivity, profit, customer satisfaction and competitiveness (Lakshmi *et al*. 2016:30) by eliminating specific wastes in the company. Although lean thinking originated in the manufacturing sector (Ali 2016), it is able to be applied in the services sector (Kanakana 2013:574.1). Both sectors have their own unique wastes to eliminate, but utilise the same tools in the waste elimination process. The service-specific lean wastes and the lean tools available to eliminate lean wastes will be addressed further.

2.2.1 The service-specific lean wastes

Lean thinking targets eight wastes. These wastes refer to "any use or loss of resources" that does not directly create value for a product or service demanded by a customer (Lakshmi *et al*. 2016:30). Qu, Ma and Zhang (2011:1-4) identified five services-specific wastes:

1. ***Service design wastes*** result from offering services not desired by the consumers. This is due to using a push system *versus* a pull system. These wastes are also caused by services that are unresponsive to consumer needs, or offer unwanted features.
2. ***Service item wastes*** are flaws in the service process whereby time is wasted and efficiency is low (Leite & Vieira 2015:531).
3. ***Service ability wastes*** occur when the serviceable capacity is not maximised. Resources are wasted because they are already deployed (Zhang & Chen 2015:489).
4. ***Service process wastes*** result from inefficient work done by employees.
5. ***Service delay wastes*** are incidents that make employees or consumers wait longer than expected for the service to be delivered.

2.2.2 Lean tools to eliminate service wastes

The 'major lean tools' utilised in a service environment are described below (Andrés-López, González-Requena & Sanz-Lobera 2015:27-28; Leite & Vieira 2015:539):

1. ***5S methodology*** involves maintaining a clean and tidy workplace to reduce complexity, making it easy to identify wastes. It follows a cycle of sort, shine, and store, standardise, and sustain.
2. ***Service value stream mapping*** creates visibility of the processes and timeframes of phases that take place along the value-creation process of providing a service. Any inefficiency or waste can be quickly identified and resolved at various stages in the value stream.
3. ***Visual management*** is essential for "developing work standards and creating a visual environment" (Andrés-López *et al*. 2015:27) that guides intangible process activities. Visuals are created to outline non-standard procedures enhancing visibility and understanding amongst employees. This allows them to more easily identify inconsistencies and spot inefficiencies.

4. ***Standardisation*** ensures a predictable process that follows best practice and reduces variation, thus reducing wastes and inefficiencies.

2.3 Green management

Green management (GM) aims to identify and eliminate activities that cause environmental damage known as green wastes (Hallam & Contreras 2016:2158). GM is adopted because of legal obligations, corporate social responsibility, voluntary top management commitment for an improved corporate image, or for process and cost efficiencies (Raghu Kumar, Agarwal & Sharma 2015:314). The green wastes and ways to eliminate them, which are discussed further, are the same in the manufacturing sector and the services sector.

2.3.1 Green management and its eight wastes

There are eight types of green wastes that can be present and eliminated in a firm, which are outlined below (Bortolini *et al*. 2016:886; Fercoq, Lamouri & Carbone 2016:568; Verrier *et al*. 2014:85):

1. ***Excessive water usage****,* using more water than required to deliver the product or service.
2. ***Excessive power usage****,* using more power (energy) than required to deliver the product or service.
3. ***Excessive resource usage****,* consuming more resources than required to deliver the product or service.
4. ***Pollution****,* in the form of water, noise, air, light, sound, soil, thermal or radioactive pollution.
5. ***Rubbish****,* a physical by-product of zero value that is created through the product/service offering.
6. ***Greenhouse gas effects****,* whereby emissions contribute to increasing global temperature.
7. ***Eutrophication****,* the run-off of chemicals or by-products that flow into aquatic systems, toxifying the environment.
8. ***Poor health and safety****,* which negatively affects the employees in the business and reduces their motivation, effectiveness, and commitment to the firm.

2.3.2 Green management practices to eliminate waste

GM practices include process improvement to manage pollution emissions and the adoption of more environmentally friendly resources for the value creation process (Galeazzo *et al*. 2014:192). Technologies that address the root causes of the pollutants are credited with generating cost reduction benefits and the "development of valuable resources" (Bortolini *et al*. 2016:886). Hallam and Contreras (2016:2160) claim lean tools should be applied to GM pollution prevention practices, maximising the effectiveness of lean tools. Since lean tools can be applied to GM, no specific green tools are mentioned.

2.4 The lean and green (L&G) paradigm

The L&G paradigm is a distinct concept from lean thinking and GM because it produces a different magnitude of impact than when the aforementioned practices are used in isolation. Managers should understand that although the L&G paradigm combines both lean thinking and GM, it cannot contain all of their characteristics. The L&G paradigm therefore needs to be strategically implemented if managers are to achieve the best operational fit (Galeazzo *et al*. 2014:197). The L&G paradigm is discussed in further detail below.

2.4.1 Reasons for the implementation of the L&G paradigm in firms

There are two major reasons for the implementation of the L&G paradigm in firms. Firstly, the synergistic nature of the L&G paradigm magnifies the competitive, cost, and environmental benefits of isolated lean thinking and GM. This enables firms to become responsible corporate citizens and achieve greater profitability and competitiveness (Thanki *et al*. 2016:292). This is attractive to firms in the current climate of increased competitiveness and operating costs (Lakshmi *et al*. 2016:29). Secondly, green wastes are often the symptoms of existing lean wastes. Eliminating lean wastes can eliminate green wastes simultaneously, saving time in the waste reduction process (Verrier, Rose & Caillaud 2016:152).The drivers and barriers of lean thinking and GM, which are subsequently drivers and barriers of the L&G paradigm, are discussed below.

2.4.2 Drivers of the implementation of lean thinking in the services sector

- **Improved competitiveness**

Lean thinking aims to improve organisational processes, create higher quality products or services, and achieve higher efficiencies. These factors feed into improving the

competitiveness of an firm. The more competitive a firm is, the longer it survives in its market (Fargani, Cheung & Hasan 2016:492).

- **Resource efficiency for cost savings**

With lean thinking, firms can save money on unnecessary purchases, replenish stock less frequently, and reduce their complexity. Reducing the amount of resources used to create a product or deliver a service drives cost savings for a firm and allows it to obtain high profits and/or offer better prices to its consumers (Ainul Azyan, Pulakanam & Pons 2017:462, 468, 478; Fargani *et al*. 2016:493).

2.4.3 Barriers to the implementation of lean thinking in the services sector

- **Lack of dedication from internal human capital**

A firm can attempt to implement lean thinking, but if there is no buy-in and involvement from senior management, lean thinking will not to be sustainable (Jagdish, Shankar & Santosh 2014:127). Lean thinking needs to be included in the firm's vision and goals, and management needs to practically engage with lean practices to set an example for employees (Jagdish *et al*. 2014:127). If lower level employees do not perceive lean thinking to be a priority of top management, it will fall to the wayside (Jagdish *et al*. 2014:127; Ainul Azyan *et al*. 2017:460).

- **A hierarchical organisational structure**

A hierarchical organisational structure, which involves higher power distances between lower/middle and top management inhibits employee involvement and engagement with lean thinking (Hofer, Hofer, Eroglu & Waller 2011:161). In a hierarchical organisation, communication between the different levels of management can be slower and less efficient, making lean thinking harder to adopt and integrate (Nordin, Deros & Wahab 2010:379).

2.4.4 Drivers of green management implementation

- **Strategic outsourcing with environmental firms**

Outsourcing to external firms to handle waste is a driver of GM because it offloads the responsibility of the firm. It not only reduces complexity and allows the firm to focus on core competencies, but it has the potential to reduce costs. Expert firms have proper and efficient waste disposal methods, as well as a scale advantage, as they dispose for multiple clients.

This additionally provides a reputational benefit for the firm because it is seen as an environmentally committed firm (Babiak & Trendafilova 2011:19; Shibin, Gunasekaran, Papadopoulos, Dubey, Singh & Fosso Wamba 2016:174).

- **Satisfy customer and stakeholder needs**

Customers can demand green operations because environmental friendliness is increasingly becoming an important consumer requirement. In addition, stakeholders, with their power and influence on organisational activities and decisions, are demanding an increased environmental focus (Govindan et al. 2015:185). Stakeholders' and manager's motives play a large role in why and how GM is implemented, typically incorporating standards and an organisational culture aware of and focused on environmental commitment (Babiak & Trendafilova 2011:12).

2.4.5 Barriers to green management implementation

Two barriers to the implementation of GM are the lack of commitment from top management, and the lack of adoption of newer technologies. Regarding top management commitment, this is a barrier because motivation and commitment from top management moulds the organisational culture, and without commitment from the top, there will be little to no commitment throughout the rest of the firm (Govindan, Kaliyan, Kannan & Haq 2014:558-559; Wang, Mathiyazhagan, Xu & Diabat 2016:21). Concerning the lack of adoption of newer technologies, technological innovation has increased across all industries and has enabled companies to become more green and efficient. More green machinery and better tracking and monitoring of environmental wastes are now possible through technology. However, if companies fail to adopt these new technologies due to stubbornness, cost implications, firm culture, or lack of knowledge, GM performance is inhibited (Luthra, Kumar, Kumar & Haleem 2011:236-237). It is assumed GM is time-consuming and expensive to implement, and perceived as offering little to no financial return on the investment (Govindan et al. 2014:556; Wang et al. 2016:21).

2.4.6 L&G paradigm in practice

Lean thinking automatically contributes to GM practices because of the joint focus on waste elimination in production, service-delivery processes, and the supply chain (Fercoq *et al*. 2016:568; Raghu Kumar *et al*. 2015:311). This is beneficial because environmental

commitment is not typically a primary objective of firms and subsequently is not ingrained in the organisational culture, meaning it is not sustainable over the long-term. However, when paired with lean thinking, environmental commitment leads to extra benefits. This is important to consider when trying anchoring GM practices into the firm over the long-term (Lakshmi *et al*. 2016:33; Raghu Kumar *et al*. 2015:313).

In literature, a "push" relationship is considered to occur between lean thinking and GM, meaning lean thinking drives green outcomes to occur. In other words, operational processes that are improved through lean thinking also improve environmental performance (Hallam & Contreras 2016:2160). This similarly occurs for reasons such as lean thinking ensuring that there are fewer resource inputs, and thus there are fewer environmental wastes possible (Hallam & Contreras 2016:2175).

Managers implement the L&G paradigm by pairing "a unique combination of lean and green capabilities in order to address both the environmental and operational dimensions" of the firm (Galeazzo *et al*. 2014:197). The L&G paradigm is best implemented through management having a thorough understanding of the overlap between lean thinking and GM as well as an understanding of where there is potential for economic and efficiency gains and synergies (Mollenkopf *et al*. 2010:15).

Four "super lean tools" are considered very powerful when applying the L&G paradigm in a firm because they have a positive influence on all sixteen lean and green wastes (Verrier *et al*. 2016:153). These super lean tools are:

1. ***Sustainable Value Stream Mapping*** (Sus-VSM) allows for the visual evaluation of water usage, energy consumption, and raw material usage in the value creation process (Bortolini *et al*. 2016:888).
2. ***The Genba Walk****,* similar to Management by Walking Around, is when employees objectively observe their own work and aim to improve it.
3. ***Indicators*** involve creating standards within the processes of service delivery so that it is easy to monitor and rapidly identify where harmony and efficiency has been reduced.

4. ***Visual Management***, closely linked to both the Genba Walk and Indicators, creates an easily observable service environment such that the control of the processes or lack thereof, is immediately apparent to the observer.

3. METHODOLOGY

3.1 Research design

This study sought to understand how embedded the L&G paradigm is in the airline services industry and investigate the associated reasons for implementing it, the difficulties in implementing it, and the ways that the airline services industry implements it. As such, the researchers needed to draw upon the perceptions and experiences of airline employees regarding L&G paradigm adoption and implementation. A generic qualitative research design allowed the participants' responses to effectively reflect memories and opinions about the L&G paradigm in their firm (Babbie & Mouton 2001:75-76), which was particularly important in this study because of the aforementioned reasons, but also because of how the L&G paradigm should be culturally embedded in the firm, and by extension the employees. Since this study aimed to understand the airline services industry as a whole, rather than one specific firm as a case study, a generic qualitative research design was the most appropriate. Finally, since broad assumptions were intended to be made about the airline services industry, a generic qualitative research design was appropriate.

3.2 Sampling

The units of analysis for this study were airline operators (i.e., airlines) that transported passengers as part of their services and were either based in South Africa or flew in and out of the country as part of their flight routes, making South Africa the geographic context. Maximal variation sampling (MVS), a purposive sampling technique (Etikan, Musa & Alkassim 2015:3), was used to take operational differences between firms, airline type, and form of ownership into account. The sample was made maximally diverse on these criteria because different airline approaches to customer satisfaction and cost reduction were taken into account, along with the ways that their fleets and flights are managed based on their different needs (Etikan *et al*. 2015:3). In addition, including international airlines allowed the regulatory differences between countries to be taken into account, which would reveal how the South African airline services industry either differs or aligns with international markets

based on regulations. Data collection from seven airlines with different service philosophies provided the ability to make generalisations across the airline service industry (Nemiro 2001:99).

For the participants, a snowball sampling method was used, wherein a key informant gave access to difficult-to-reach industry personnel. Participants referred the researcher to their relevant colleagues, who were determined to be suitable or unsuitable based on their job title and job description. The inclusion criteria for the participants were that they should be employed by an airline based in South Africa, or work on the flights that operate in and out of the country; and should be involved in some part of the service formation or delivery of their airline. Four of the participants were employed by the same private full-service airline, three participants were employed by the same public full-service airline, and the remaining five participants were from a variety of individual airlines. Multiple individuals were interviewed from the same airline when it was easy to gain senior management permission, while single individuals were interviewed from airlines that proved difficult to obtain permission for multiple interviews. Table 1 below provides a profile of the study participants.

Table 1: Profile of the individual participants

Participant Code and Gender (M/F)	Participant's Job Title	Company Code	Airline service industry - Type of Airline	Interview Duration
K1001 (M)	Logistics and Contracts Manager	K100	Private full-service South African airline	00:38:54
K1002 (M)	Executive Manager of Fleet Support	K100	Private full-service South African airline	00:55:38
K1003 (M)	First Officer	K100	Private full-service South African airline	00:54:19
K1004 (M)	Operational Health and Safety, and Environmental Manager	K100	Private full-service South African airline	00:33:47
K2001 (M)	First Officer	K200	Full-service international airline	00:48:14
K3001 (F)	Cabin Supervisor	K300	Full-service international airline	01:28:27
K4001 (M)	Continuous Improvement Manager (Junior Industrial Engineer)	K400	Low cost South African airline	00:46:09

K5001 (M)	First Officer	K500	Charter and contract operator	00:46:43
K6001 (M)	Captain	K600	Public full-service South African airline	01:03:38
K6002 (M)	First Officer	K600	Public full-service South African airline	01:18:44
K6003 (M)	Airbus Technical Specialist	K600	Public full-service South African airline	01:07:04
K7001 (M)	Captain and Flight Performance Manager	K700	Low cost South African airline	00:58:51
Average:				00:56:49

Source: Author's own compilation.

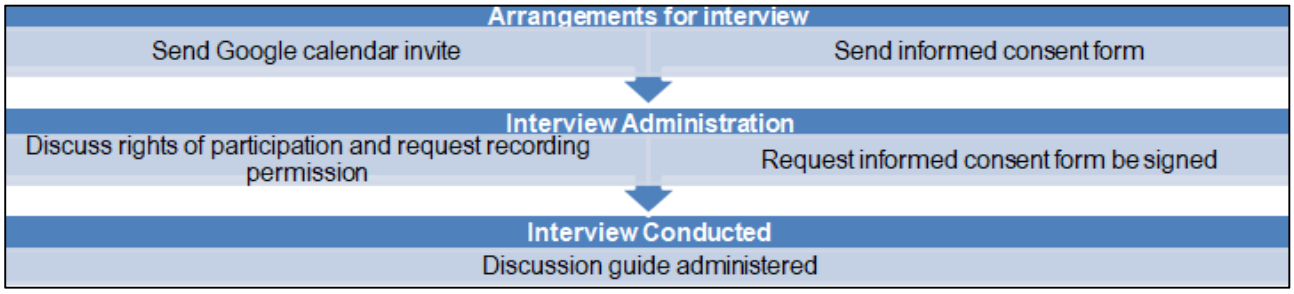
The principle of data saturation was used to ensure an appropriate sample size (Francis, Johnston, Robertson, Glidewell, Entwistle, Eccles & Grimshaw 2010:1230; Plano Clark & Creswell 2015:336). Data saturation is reached once no new information has been obtained from interviews (Francis *et al*. 2010:1234). In this study, 100% of the codes were developed by the tenth interview and no new codes emerged from the last two interviews.

3.3 Data collection

Twelve semi-structured telephonic interviews were used to collect primary data for this study. Semi-structured interviews were appropriate because it allowed the researcher to probe further for opinions and perceptions and to clarify meaning from the participants (Creswell 2012:214). The interviews were conducted telephonically due to the vast geographic gap between the primary researcher, located in Japan, and the participants, located in South Africa.

A discussion guide was created based on the comprehensive literature review. The discussion guide was tested in a single successful pilot interview with a logistics costs and contracts manager and minimal changes were made to the discussion guide. The process followed for the main data collection, which ensued thereafter, can be seen in Figure 1 below:

Figure 1: Process followed for all interviews



Source: Author's own compilation.

The interviews, all recorded with the participants' permission, lasted 56 minutes on average, with the longest and shortest interviews lasting 98 and 33 minutes respectively. The interviews were transcribed by the primary researcher within five days after the interview.

3.4 Data analysis

A thematic analysis was used to analyse the data, which entails attaching key words ('codes') to segments of text to summarise what the participants meant in their answers (Creswell 2012:244). The transcripts were read three times each prior to coding while listening to the audio recordings to gain full understanding of the responses (Braun & Clarke 2013:60; Creswell 2012:243). Each transcript was then coded, and once all interviews were coded, they were revisited in order to update all transcripts with the correct codes (Braun & Clarke 2013:63), while codes that were redundant were disregarded. Similarities in codes were used to create sub-themes, which were then used to develop main themes to answer this study's research questions (Braun & Clarke 2013:63).

3.5 Trustworthiness

Trustworthiness was ensured in this study by addressing the areas of credibility, dependability, confirmability and transferability (Shenton 2004:64). For credibility, the researchers were in constant communication to ensure that the line of questioning was correct, effective and would elicit data that could be used to answer the research questions (Shenton 2004:67). For dependability, a rich and thick description of the study was provided which detailed the research design, and the methods of data collection and analysis (Shenton 2004:71). For confirmability, the study was conducted under the supervision of an experienced supervisor. For transferability, details of the participants, the study's context, the

methodology and the study's discussion guide are provided. This allows the reader to understand exactly how the study was carried out and to determine whether the information can be used in another context (Polit & Beck 2012:588; Shenton 2004:70).

3.6 Ethical considerations

This study was approved by the relevant Research Ethics Committee at a South African university prior to fieldwork. Participants were requested to sign an informed consent form after being verbally briefed on their participation rights, and were ensured confidentiality and anonymity, enforced through the use of pseudonyms. Participants were not forced to answer all of the questions and were allowed to stop the interview at any time.

4. FINDINGS

Five main themes were developed from the data, with between two and three sub-themes building up each main theme. Twenty three unique codes were used in total to create the five themes and the 14 sub-themes. Table 2 below summarises the themes and the corresponding research questions (RQ) that each theme addresses.

Table 2: Summary of themes and sub-themes

RQ1 Theme 1: The drivers of lean thinking	RQ2 Theme 2: The barriers of lean thinking	RQ1 Theme 3: The drivers of green management	RQ1 Theme 4: The barriers of lean thinking	RQ3 & 4 Theme 5: Lean and green practices
• A comprehensive understanding of service-specific lean wastes • The presence of low cost carriers (LCCs) • A global network of data sharing and recommendations	• Service interruptions • A lean limit • Currency volatility and strength	• Well-developed international regulations • Fears of future regulations due to non-compliance	• A price focused consumer market • Only done if regulatory or complements lean • Cost of and lag of new, efficient technologies	• Lean and green is centered around fuel • Capacity management • On-board recycling

Source: Author's own compilation.

The airline services industry was found to regularly and jointly conduct L&G practices, and waste is extensively tracked to improve performance. Further findings are discussed below.

4.1 The drivers of lean thinking

This theme addresses research question one and highlights what motivates airline operators to implement lean thinking. One sub-theme is a more general, yet strongly present driver, while two of the three sub-themes are specific to the airline industry.

4.1.1 A comprehensive understanding of service-specific lean wastes

The participants in this study revealed that they had a comprehensive understanding of service-specific lean wastes (Qu *et al*. 2011:1-4). This was made apparent by either mentioning solutions to services wastes currently implemented in their firms or by indicating it is a current problem in their firm. Eleven out of 12 participants mentioned every single service-specific lean waste. These five wastes are design wastes, item wastes, ability wastes, process wastes and design wastes. One participant mentioned three out of five of the service-specific lean wastes, namely item wastes, ability wastes and process wastes. This comprehensive understanding of service-specific lean wastes is an important driver of lean thinking, because understanding where and how wastes are possible is the first step in eliminating them. An example of this understanding is represented by the quote below:

> "If [my company] wasn't cost effective and didn't do reduce thrust take offs and they did high speed cruises, I mean that would be a direct impact on the environment with extra fuel being burnt, monoxide being released …" (K1003, male, first officer).

4.1.2 The presence of low cost carriers (LCCs)

LCCs, airline operators offering bare minimum services for low prices and leading in cost management, presented themselves as a major driver for lean thinking in the airline services industry. Every participant who mentioned LCCs brought them up unprompted and spoke of LCCs with disfavour due to the competitive pressure (Tretheway & Markhvida 2014:4) and reduced service quality standard they have placed on the industry. The general sentiment is reflected in the following quote:

> "… they're [airlines] trying to reduce as much as they can to compete with these low cost airlines who – in my opinion – is kind of messed up air travel … Generally it's in the product-service that you're getting in the back [that gets reduced], which is quite sad." (K2001, male, first officer).

4.1.3 A global network of data sharing and recommendations

Although not mentioned in the literature, data collection in the airline services industry is a well-developed practice and widely implemented, mentioned by every one of the 12 participants. This data is used to improve their own firms and create benchmarks, and is also shared amongst other airlines in the industry. This is largely due to the focus the industry has on security and safety, and the strong presence of international regulatory bodies, which require data from the airlines that fall under their jurisdiction. These international bodies are then able to set best-practices and standards, including various cost reduction methods and techniques. This is summarised by the following response:

> "We have a governing body called ICAO, an international governing firm, and they recommend standards and practices that operators are almost obliged to comply with. So, generally the overall idea is that everyone needs to basically get on the same level, and that includes obviously efficiency and effects that the operation would have on the environment. So I wouldn't say in general they hold their cards close to their chest, generally everyone knows what they can do to improve" (K5001, male, first officer).

4.2 The barriers of lean thinking

This theme addresses research question two and highlights what prevents or discourages the implementation of lean thinking by airline operators. The three sub-themes that emerged are all inherent aspects of the airline industry. They are things that happen that, to a large extent, cannot be controlled or avoided by the airline operators. These are discussed further below.

4.2.1 Service interruptions inherent in the airline services industry

Weather, technical failures, and passenger disruptions were consistently mentioned by the participants as frequent service interrupters (Ali 2016:4; Tretheway & Markhvida 2014:3). An example of a weather related interruption is a thunderstorm requiring a diversion to an

alternative airport. Technical failures include an important flight instrument losing functionality and the plane being unable to take off. Passenger disruptions include passengers being late for the flight. These disruptions increase the embarkation and disembarkation times and increase turnaround time. To a large degree, these three interruptions are uncontrollable and need to be managed as they arise. They cost the airline operators thousands of rands, and so profits need to be maximised when service operations are going smoothly (Marchwinski 2011:Internet). This is well-reflected by the following responses:

> "Environmental factors affect punctuality greatly. Thunderstorms, there is not much you can do besides delay the aircraft or divert for the thunderstorms.… There are aircraft failures where the aircraft breaks down and you can't depart on time and you have to get the aeroplane fixed or replace the aeroplane. There are late connecting flights, for either technical or environmental factors, for passengers who haven't arrived in time to board the flight. It is a major cost for us …"(K6001, male, captain).

> "… None of these things can be controlled. You can't control weather, you can't control technical problems" (K1003, male, first officer).

4.2.2 A lean limit

'Lean limit', a seemingly unique finding of this study, means that cost reduction can only be pursued to a certain extent. In the airline services industry, lean thinking has a limit because it will start reducing customer satisfaction to unreasonable levels or start breaking regulatory requirements if pushed too far. Security and safety are key objectives and requirements of the airline services industry, so encroaching upon them in the name of cost reduction will incur penalties and legal action. This regulatory limit and customer satisfaction limit was expressed below:

> "It's an area where we're looking to optimise rather than cut because with safety as paramount importance, any efforts to reduce costs have got to be based on interventions that improve efficiencies rather than compromise quality. I would say that our focus on costs is significant but with an outlook that says it can

never be at a stage where it compromises quality" (K1002, male, executive manager of fleet support).

"It's a fine line to … dance and say "How much are we gonna push this? How much are we gonna reduce until we start losing people?'" (K2001, male, first officer).

4.2.3 Currency volatility and strength

The aviation industry uses highly technical and specialised equipment to carry out its operations, which is mostly sourced from the United States of America and Europe. As such, whenever spare parts are required, they need to be delivered by air from these regions and paid for in either dollars or euros, which increases the costs of spare parts due to the relative strength of these currencies compared to the volatile South African rand. This affects the rand-based budgets set for the year by the airline operators. This finding was not reflected in the literature and is a barrier specific to South African airline services industry rather than the global airline industry. The following quote illustrates this barrier:

"… Any time there's a fluctuation in international currencies, we really feel the impact and that impacts our bottom line ..." (K1004, male, operational health and safety manager).

4.3 The drivers of green management

This theme addresses research question one and highlights what motivates airline operators to engage in GM. The two sub-themes are centred on the same external pressure, which are regulations; both the current and anticipated future regulations. The influence of current regulations in the industry is reflected in the literature (Al-Dhaheri & Kang 2015:958), but the anticipation of future regulations is a seemingly new finding. These are discussed further below.

4.3.1 Well-developed international regulations

Airlines operate across international territories by nature and therefore have to abide by well-developed international environmental regulations, or alternatively operate domestically under regulation that has evolved due to international regulatory developments. However, South Africa typically lags behind international regulations, meaning that domestic airlines

(such as LCCs) have less environmental regulatory pressure than international operators. The following quotes represent the participants' sentiments:

> "… There are already certain things in place which we pretty much don't have a choice on, it's imposed on by regulation … which say 'this is how we expect you to operate' …" (K6002, male, first officer and lean manager).

> "… It's driven by the legislative environment we're in … that seems to be the biggest driver in South Africa at the moment … where we piggyback on international regulations ... Those are progressively being ratcheted up by international bodies so that over time aircraft that don't meet those standards are being declined in terms of being authorised for operations in a jurisdiction in South Africa" (K1002, male, executive manager of fleet support).

4.3.2 Fear of future regulations due to non-compliance

To maintain future flexibility and stave off restrictions, airlines comply with the regulations and try to make a visible commitment, or else there will be future regulations and restrictions from the governing bodies. Essentially, the airlines are being lean with their GM, doing only the minimum required to keep regulators happy. Participants communicated this through the following example quotes:

> "If we mess up the environment then there is going to be further restrictions … if we reach such an ecological footprint that it starts damaging the ozone … then I mean, [you'll get] restrictions on flights and how many flights …" (K1003, male, first officer).

> "… Everyone is trying to be more fuel efficient, because you're going to start being penalised on their [aircraft] emissions" (K4001, male, continuous improvement manager).

4.3.3 The barriers of green management

This theme addresses research question two and highlights what prevents or discourages airline operators from implementing GM. Each of the three sub-themes can be considered to be neither uniquely internal nor external considerations by the airline operators, but rather a mix of the two. These are discussed further below.

4.3.4 A price focused consumer market

Airline operators are less concerned with building an environmental image and implementing environmental practices simply because their customer market values a low-priced plane ticket more, which contradicts the literature (Evans *et al*. 2012:46; Somerville 2012:46). However, there is a belief that the younger consumer market is more concerned with environmental commitment and there may be a shift in the future. These sentiments are reflected in the following responses:

> "I think that the paying public is very focused on price when it comes to paying tickets for airlines. I don't yet think that there's enough recognition for sound environmental practices and people will book on an airline that's the cheapest rather than one that they see as perhaps more caring in terms of environmental issues than another" (K1002, male, executive manager of fleet support).

> "Young guys we can definitely see they're worried about the [environmental] impact, but older people, no. Don't care. All about cost" (K1004, male, operational health and safety officer).

4.3.5 Only done if regulatory or complements lean

The majority of participants claimed that environmental benefit is the unintentional result of cost-driven initiatives (Verrier *et al*. 2016:152), or actions done due to regulatory requirements. Therefore, if a green action does not have regulatory or cost saving benefits, it is unlikely to be pursued. Participants said that:

> "… It's part of the business's DNA to constantly strive to reduce costs … this carbon emissions consideration, it coincidentally goes in line with what the airline was trying to achieve although it wasn't like their primary [goal] …" (K6002, male, first officer and lean manager).

> "… Cost efficiency [is more important than environmental commitment].The spin off, if you are dealing with fuel, is that you will always be able to sell the environment commitment. But in our current environment it is cost efficiency" (K6003, male, Airbus technical specialist).

> "… From the company's perspective I'd say its cost efficiency they're mainly focusing on. If it is becoming environmentally friendlier … it's great, it's a bonus

that they get two for the price of one. But I think the main reason why they look at certain things is because of the cost efficiency" (K3001, female, cabin supervisor).

4.3.6 Cost of and lag of new, efficient technologies

Technology is a major enabler of environmentally friendly operations (Bortolini *et al*. 2016:886), but upgrading technology in the airline services industry is not only highly expensive, but takes many years to develop due to its specialised nature. The long wait for more efficient technologies and the possibility of not being able to afford it is a major barrier to becoming greener (Luthra *et al*. 2011:236-237), reflected in the following responses:

" … Every generation of aircraft has to … be a percentage more efficient than the other … but they do not come out year on year, if you look at the gap each time it's very significant" (K4001, male, continuous improvement manager).

"You don't need one [aircraft], you need many, so it is a good couple of billion to acquire - depending on the configuration and aircraft, but it is a huge amount of money" (K7001, male, captain).

4.4 Lean and green practices

This theme addresses research questions three and four, and was developed with nine codes, from which three sub-themes focused on areas of management related to the aircraft assets emerged. The airline services industry makes extensive use of data to create indicators, which help identify and eliminate waste. A strongly embedded reporting culture to collect the data is enabled through use of the *Genba Walk*. Once benchmarks and standards are set, and best practices identified, visual management is heavily used in the firm to outline work processes and allow employees to identify what is deviating from the norm. This shows the varied ways to pursue L&G initiatives, as stated in the literature (Galeazzo *et al*. 2014:197). Certain L&G tools are more popular in the airline services industry than others, according to the participants in this study. The specific practices are discussed below.

4.4.1 Lean and green is centred around fuel

Averaging between 30-35% of total costs, fuel is the largest incurred cost for airline operators, followed by maintenance costs and labour costs. It is also the most targeted area

by airlines, producing powerful L&G paradigm benefits. There are four major areas where fuel is taken into account, providing an overspill of green benefits:

1. ***Weight reduction****,* whereby all unnecessary weight is removed from the plane (Qu *et al*. 2011:1-4). The heavier the plane, the more fuel it burns, as it takes more power carry the weight. Therefore, if the plane is lighter, it will burn less fuel and release fewer carbon emissions. It is important to note that for every tonne of fuel burned, 3x the equivalent weight is released in carbon emissions due to chemical reactions (*ex gratia* 1 tonne of fuel burned releases 3 tonnes of carbon emissions), and for every tonne of fuel put on-board, 300kg of fuel is burned to carry it.
2. ***Efficient operating****,* whereby the aircraft does not expend unnecessary energy. Taxiing on the runway with half engine power and using the winds rather than thrust to maintain cruising speed reduces fuel usage. By extension, there are fewer carbon emissions and less noise pollution (Galeazzo *et al*. 2014:192):

   "… By climbing steeply to get away from the noise sensitive areas, we are also getting to a more efficient altitude quicker" (K7001, male, captain).
3. ***Minimum fuel loading*** (MFL) follows a highly lean mind set, because you need to burn fuel to carry fuel, as it translates into more weight carried. MFL is best expressed by the following quote:

   "… Making sure that we only take the minimum required fuel on the flight which would have that effect … [of] less fuel burn, less CO2 emissions, less cost to company, and ultimately … less damage to the environment" (K5001, male, first officer).
4. ***Fuel recycling*** is when an aircraft containing fuel has a maintenance issue and requires the fuel to be drained. Rather than 'dumping' the Jet A-1, it can be mixed with oil to create diesel at a relatively low cost. This can then be used to power diesel equipment without having to buy additional diesel to fuel machinery. This avoids wastage and eutrophication risks and reduces cost for the airline.

4.4.2 Capacity management

Aircrafts have a limited life span measured by hours flown, are expensive to operate and emit tonnes of emissions per flight. Airlines attempt to ensure that every flight is as close to full capacity with passengers and cargo as possible, because:

> "… if you're operating an aircraft for a couple of weeks or months and you don't have full passenger capacity, you're losing out on money but your overheads will still stay the same. So it's important to keep looking for ways to reduce those costs so you can really get the most out of the money that you get in" (K5001, male, first officer).

Capacity management is to avoid service ability wastes and is addressed generally in the literature (Zhang & Chen 2015:489). Additionally, there are lower carbon emission allocations per passenger flying when there is higher capacity, meaning more overall value is generated from the service than environmental detriment. Low capacity flights are comparable to holding inventory.

4.4.3 On-board recycling

During the flight service, there is a constant collection and separation of rubbish and recyclable materials. This maintains a tidy and safe environment, following a 5S methodology, which is beneficial because it makes it easier to see where service issues lie, and additionally has the conscious green benefit of waste collection and recycling (Andrés-López *et al*. 2015:27). Interestingly, full-service airline participants made statements such as:

> "… The amount of plastic that we collect on an aircraft is … insane …. We've told [management] through our reports numerous times that there is so much wastage on board" (K3001, female, cabin supervisor).

Whereas LCC participants, who are leaders in low cost management, made statements such as:

> "… We don't have like a full-service … You don't get served like a full meal on-board. You only get served what you buy, and people very rarely want to spend money …. Even if you do have waste, it won't even be enough to fill a rubbish bin. It's … very, very small" (K4001, male, continuous improvement manager).

This stark difference in attitude between full-service airlines and LCCs suggests that perhaps the most L&G way to manage your waste is to prevent its generation in the first place.

5. CONCLUSION

5.1 Summary of findings and theoretical implications

This study explored the drivers, barriers, and practices associated with the L&G paradigm in the South African airline services industry. The first two research questions aimed to identify the drivers and barriers of the L&G paradigm in the airline services industry respectively. It was determined that employees in this industry, regardless of their department, are highly aware of lean and green wastes in their service environment and take multiple steps to reduce these wastes. Regulations, LCCs, and the importance of cost savings to improve competitiveness are the two major drivers of the L&G paradigm in the airline services industry. In terms of barriers, consumer demands play a particularly important role for both lean thinking and GM, albeit in different ways – consumer demands limit how lean the airlines can go, while their lack of demand on the environmental side limits the emphasis that airlines place on GM.

The third and fourth research questions aimed to identify which L&G practices are used and how they are implemented in the airline services industry respectively. L&G practices in the airline services industry are enabled mostly through the Genba Walk, indicators, standardisation and visual management as L&G "super tools". As a whole, the L&G paradigm in the industry is focused on fuel management because the less fuel is used to deliver the service, the more money is saved, and the less carbon emissions are created. The amount of fuel used is largely dependent on the amount of weight on board the aircraft and how the aircraft is operated. The airlines, therefore, prioritise reducing unnecessary services and load only the bare minimum required fuel. Privy to this, airlines ensure that no energy is expended unnecessarily.

Theoretically, these findings firstly illustrated that an industry which has a business environment conducive to the L&G paradigm may inherently push the firms that form it to adopt L&G practices intentionally or, as is the case with the airline services industry, unintentionally. Secondly, it agreed with current theory that leans thinking both drives green

management and works as the solution to environmental issues (Thanki *et al*. 2016:285). Lastly, it highlighted that the L&G paradigm is indeed culturally embedded in firms that use it, and it operates beyond departmental silos – whether intentionally or not. All the participants had opinions on both the lean and green aspects of their airlines, circling back to similar practices, wastes, and mind sets, regardless of their department or roles and responsibilities.

5.2 Managerial implications

This study has three main managerial implications. Firstly, management in the airline services industry should start to find ways to formally tie their well-developed cost reduction objectives together with less-considered environmental objectives, after increasing their assessment and awareness of the benefits of GM to truly reap the operational benefits that are outlined in the literature. This will additionally assist in overcoming one of the future fears of tighter regulations in the industry. Managers should also have a long-term, integrated outlook towards green management rather than focusing on the short-term costs of implementation and change management. Secondly, managers should formally identify what is the 'lean limit' of their firm. Managers can do this by assessing where customer satisfaction begins to drop due to lean initiatives to the degree that customers begin considering alternative airlines. This can be done through customer surveys, research and analysis. Managers can also identify their lean limit by clearly defining the farthest that lean initiatives can go before regulations start being transgressed, and planning lean initiatives around approaching but not breaking this legal boundary. Lastly, managers, particularly of full-service airlines, can start taking employees' comments about environmental objectives more seriously. Using the intensive, already well-developed reporting structure and culture that enables continuous improvement, airlines are primed to effectively receive feedback on environmental performance from employees. These employees are "on the ground" and visibly see the waste created. Their feedback can be used to develop cost efficient, beneficial green practices.

5.3 Limitations and directions for future research

A limitation for this study is that many variables and concepts had to be taken into consideration and investigated, and were not able to be explored as in-depth as each individual concept could have been. Future researchers should consider conducting a study that focuses on a specific area, such as solely lean and green practices in a services-sector

industry, and provide an in-depth report on that specific concept rather than providing a high-level overview on a variety of concepts. A second limitation is that the airline services industry implements the L&G paradigm in many tangible, physical areas of their business – such as with recyclable plastics and fuel management. This makes it less of a 'pure' services-sector application of the L&G paradigm. Future research in a service industry that has less tangible inputs and outputs, such as auditing, consulting or customer service, would be interesting and would provide a more unique services perspective to L&G paradigm literature.

REFERENCES

AINUL AZYAN ZH, PULAKANAM V & PONS D. 2017. Success factors and barriers to implementing lean in the printing industry: A case study and theoretical framework. *Journal of Manufacturing Technology Management* 28(4):458-484.

AL-DHAHERI A & KANG PS. 2015**.** Using lean philosophy to improve passenger departure flow in Abu Dhabi airport. *International Journal of Scientific & Engineering Research* 6(7):955-961.

ALI A. 2016. Exploring lean strategy for service quality improvements in UK based airline. London: Brunel University (DPhil thesis).

ANDRÉS-LÓPEZ E, GONZÁLEZ-REQUENA I & SANZ-LOBERA A. 2015. Lean service: reassessment of lean manufacturing for service activities. *Procedia Engineering* 132:23-30.

BABBIE E & MOUTON J. 2001. The practice of social research. South African ed. Cape Town: Oxford University Press.

BABIAK K & TRENDAFILOVA S. 2011. CSR and environmental responsibility: motives and pressures to adopt green management practices. *Corporate Social Responsibility and Environmental Management* 18:11-24.

BAKER DA. 2013. Service quality and customer satisfaction in the airline industry: a comparison between legacy airlines and low-cost airlines. *American Journal of Tourism Research* 2(1):67-77.

BORTOLINI M, FERRARI E, GALIZIA FG & MORA C. 2016. A reference framework integrating lean and green principles within supply chain management. *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering* 10(3):886-891.

BRAUN V & CLARKE V. 2013. Successful qualitative research: a practical guide for beginners. London: Sage.

CRESWELL JW. 2012. Educational research: planning, conducting and evaluating quantitative and qualitative research. 4th ed. Boston, MA: Pearson.

DÜES CM, TAN KH & LIM M. 2011. Green as the new lean: how to use lean practices as a catalyst to greening your supply chain. *Journal of Cleaner Production* 40:93-100.

ETIKAN I, MUSA SA & ALKASSIM RS. 2015. Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Physics* 5(1):1-4.

EVANS N, CAMPBELL D & STONEHOUSE G. 2012. Strategic management for travel and tourism. New York, NY: Routledge.

FARGANI H, CHEUNG WM & HASAN R. 2016. An empirical analysis of the factors that support the drivers of sustainable manufacturing. *Procedia CIRP* 56:491-495.

FERCOQ A, LAMOURI S & CARBONE V. 2016. Lean/green integration focused on waste reduction techniques. *Journal of Cleaner Production* 137:567-578.

FRANCIS JJ, JOHNSTON M, ROBERTSON C, GLIDEWELL L, ENTWISTLE V, ECCLES MP & GRIMSHAW JM. 2010. What is an adequate sample size? Operationalising data saturation for theory-based interview studies. *Psychology & Health* 25(10):1229-1245.

GALEAZZO A, FURLAN A & VINELLI A. 2014. Lean and green in action: interdependencies and performance of pollution prevention projects. *Journal of Cleaner Production* 85:191-200.

GARZA-REYES JA. 2015. Lean and green – a systematic review of the state of the art literature. *Journal of Cleaner Production* 102:18-29.

GOVINDAN K, AZEVEDO SG, CARVALHO H & CRUZ-MACHADO V. 2015. Lean, green and resilient practices influence on supply chain performance: interpretive structural modelling approach. *International Journal of Environmental Science and Technology* 12:15-34.

GOVINDAN K, KALIYAN M, KANNAN D & HAQ AN. 2014. Barriers analysis for green supply chain management implementation in Indian industries using analytic hierarchy process. *International Journal of Production Economics* 147:555-568.

HAJMOHAMMAD S, VACHON S, KLASSEN RD & GAVRONSKI I. 2013. Reprint of lean management and supply management: their role in green practices and performance. *Journal of Cleaner Production* 56:86-93.

HALLAM C & CONTRERAS C. 2016. Integrating lean and green management. *Management Decision* 54(9):2157-2187.

HOFER AR, HOFER C, EROGLU C & WALLER MA. 2011. An institutional theoretic perspective on forces driving adoption of lean production. *The International Journal of Logistics Management* 22(2):148-178.

HUSSAIN M, KHAN M & AL-AOMAR R. 2016. A framework for supply chain sustainability in service industry with confirmatory factor analysis. *Renewable and Sustainable Energy Review* 55:1301-1312.

JAGDISH RJ, SHANKAR SM & SANTOSH BR. 2014. Exploring barriers in lean implementation. *International Journal of Lean Six Sigma* 5(2):122-148.

KANAKANA GM. 2013. Lean in service industry. Stellenbosch: Southern African Institute of Industrial Engineering. (25th Annual Conference; 9-11 Jul.) (574.1-574.10.)

KING AA & LENOX MJ. 2001. Lean and green? An empirical examination of the relationship between lean production and environmental performance. *Production and Operations Management* 10(3):244-256.

LAKSHMI MEERA BL & CHITRAMANI P. 2016. Causal effect between lean and green supply chain management practices on environmental performance of manufacturing firms. *International Journal of Management & Business Studies* 6(2):29-35.

LEITE HD & VIEIRA GE. 2015. Lean philosophy and its application in the service industry: a review of the current knowledge. *Production* 25(3):529-541.

LUTHRA S, KUMAR V, KUMAR S & HALEEM A. 2011. Barriers to implement green supply chain management in automobile industry using interpretive structural modelling technique - An Indian perspective. *Journal of Industrial Engineering and Management* 4(2):231-257.

MARCHWINSKI C. 2011. A turbulent industry looks to lean for smoother flying. [Internet:https://www.lean.org/common/display/?o=1784; downloaded on 2017-04-15.]

MOLLENKOPF D, STOLZE H, TATE WL & UELTSCHY M. 2010. Green, lean and global supply chains. *International Journal of Physical Distribution & Logistics Management* 40(1-2):14-41.

NEMIRO JE. 2001. Connection in creative virtual teams. *Journal of Behavioral and Applied Management* 2(2):93-115.

NORDIN N, DEROS BM & WAHAB DA. 2010. A survey of lean manufacturing implementation in Malaysian automotive industry. *International Journal of Innovation, Management and Technology* 1(4):374-380.

PEJIĆ V, LERHER T, JEREB B & LISEC A. 2016. Lean and green paradigms in logistics: review of published research. *Transport Logistics* 29(6):593-603.

PLANO CLARK V & CRESWELL JW. 2015. Understanding research: a consumer's guide. 2nd ed. Upper Saddle River, NY: Pearson Education.

POLIT DF & BECK CT. 2012. Nursing research: generating and assessing evidence for nursing practice. 9th ed. Philadelphia, PA: Wolters Kluwer Health.

QU L, MA M & ZHANG G. 2011. Waste analysis of lean service. Wuhan, China: International Conference on Management and Service Science. (2011.) (MASS, 12-14 Aug, 1-4.)

RAGHU KUMAR BR, AGARWAL A & SHARMA MK. 2016. Lean management - a step towards sustainable green supply chain. *Competitiveness Review* 26(3):311-331.

RHOADES DL & WAGUESPACK B. 2008. Twenty years of service quality performance in the US airline industry. *Managing Service Quality: An International Journal* 18(1):20-33.

SHENTON AK. 2004. Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information* 22(2):63-75.

SHIBIN KT, GUNASEKARAN A, PAPADOPOULOS T, DUBEY R, SINGH M & FOSSO WAMBA S. 2016. Enablers and barriers of flexible green supply chain management: a total interpretive structural modelling approach. *Global Journal of Flexible Systems Management* 17(2):171-188.

SIMONS D & MASON R. 2003. Green and lean: 'doing more with less'. *ECR Journal* 3(1):84-91.

SOMERVILLE H. 2012. International transport and climate change: taking responsibility seriously. In: Leslie D (ed). Responsible tourism: concepts, theory and practice. London, UK: CAB International. (pp 43-53.)

STATISTICS SA. 2017. Your job, your economy, your province. [Internet:http://www.statssa.gov.za/?p=9794; downloaded on 2017-04-25.]

THANKI S, GOVINDAN K & THAKKAR J. 2016. An investigation on lean-green implementation practices in Indian SMEs using analytical hierarchy process (AHP) approach. *Journal of Cleaner Production* 135:284-298.

TRETHEWAY MW & MARKHVIDA K. 2014. The aviation value chain: economic returns and policy issues. *Journal of Air Transport Management* 41:3-16.

VERRIER B, ROSE B, CAILLAUD E & REMITA H. 2014. Combining organizational performance with sustainable development issues: the lean and green project benchmarking repository. *Journal of Cleaner Production* 85:83-93.

VERRIER B, ROSE B & CAILLAUD E. 2016. Lean and green strategy: the lean and green house and maturity deployment model. *Journal of Cleaner Production* 116:150-156.

WANG Z, MATHIYAZHAGAN K, XU L & DIABAT A. 2016. A decision making trial and evaluation laboratory approach to analyze the barriers to green supply chain management adoption in a food packaging company. *Journal of Cleaner Production* 117:19-28.

ZHANG R & CHEN H. 2015. A review of service supply chain and future prospects. *Journal of Service Science and Management* 8:485-495.

ZHU Q, GENG Y & SARKIS J. 2016. Shifting Chinese organizational responses to evolving greening pressures. *Ecological Economics* 121:65-74.