

Lean-Green Approach: A step Towards Enhancing the Competitive Advantage of Airlines

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Abstract

The lean green approach (LG) has gained importance in the service sector. LG is a recent approach that combines green management and lean thinking principles into a single paradigm. The simultaneous implementation of LG can help airlines improve resource efficiency, reduce costs, conserve the environment, and remain competitive. Although LG approach achieves many benefits for airlines, several challenges remain. The overall objective of this research is to explore the practices, opportunities, and challenges of the LG approach at airlines in Egypt. Moreover, this study also evaluates the effect of LG adoption on the airlines' competitive advantage (CA). Based upon the mixed methodology, this study conducted (18) semi-structured interviews with experts in airline companies operating in Egypt. Besides, a structured questionnaire was distributed to (89) participants to examine the effect of LG implementation on the CA of airlines. The empirical findings indicate that LG practices have a positive impact on the airlines' CA. The findings of interviews reveal that LG practices provide broad opportunities for airlines by enhancing the following issues: management of catering inventory, cost reduction, ground handling services, ecological behaviour for customers and employees, workflows and operational performance, aircraft maintenance, fuel consumption and recycling, and sustainability. The findings also illustrate a range of challenges that airlines may face when implementing LG practices, like keeping pace with technological development, human resource training policies, resistance to change, the culture of management, waste management, and sustainable aviation fuels. Finally, implications for practice as well as future research are discussed.

Keywords: *Lean thinking, green management, lean-green approach, airlines, competitive advantage.*

1. Introduction

Today's quickly changing, and highly competitive market has placed organizations under a lot of pressure to embrace sustainable practices to maintain the balance between financial, ecological, and social elements (Abualfaraa et al., 2020). These circumstances present numerous challenges for companies to look for new tools and ways to sustain. Along with its significant contribution to climate change, emitting about 2.5% of all CO₂ worldwide (Baumeister, 2020), the aviation industry faces intense competition and cost-reduction pressures while simultaneously endeavoring to be safer and more environmentally friendly (Helmold et al., 2022). As a result, the industry faces the challenge of balancing environmental excellence with operational effectiveness (de Brito & Ward, 2008). To overcome these conditions and increase

profits, LG is emerging as a new approach for improving resource efficiency while enhancing the surrounding environment (Lim et al., 2022).

On one hand, the main purpose of lean philosophy is to provide high-quality service at a low cost, so its implementation enables businesses to improve their operational performance and reduce costs (Waqas et al., 2022). Similarly, Demir and Paksoy (2021) reported that the prospective enhancements presented by the lean techniques will help the aviation industry provide safe and flawless services while reducing costs. According to Kumar and Rodrigues (2020), lean thinking reduces seven types of waste (excessive production, transportation, waiting time, extra processing, additional motion, inventory, and defects); thus, it can assist in providing high-quality goods/services with quicker delivery times using a cost-effective method. According to Dichter et al. (2018), the use of lean methods in airline operations results in notable cost savings, enhanced employees' working circumstances and clients' experiences, reduced wait times and delays for guests, and increased work-hour productivity.

On the other hand, organizations are forced to accomplish not only financial objectives but also social and ecological objectives (Teixeira et al., 2021). Therefore, alongside lean thinking, global attention has focused on minimizing the negative effects of environmental issues and taking environmental considerations into account (Waqas et al., 2022). Indeed, the emergence of many environmental problems, such as a lack of resources, the increase in toxic waste, and the degradation of environments, as well as an increase in government interest in environmental issues, led to the emergence of the green concept (Choudhary et al., 2019). The focus of green management (GM) is also on waste disposal; it aims to recognize and eliminate practices that harm the environment, referred to as "green wastes" (Hallam & Contreras 2016). Particularly, GM aims at minimizing the potential negative effects of producing and consuming goods/ services on the natural environment while also enhancing the organization's ecological footprint (Galeazzo et al., 2014). Therefore, considering what was previously mentioned, the lean-green approach, which consolidates lean practices concentrated on clients' requirements, and green practices concentrated on diminishing the business' ecological effect, has acquired prevalence (Abualfaraa et al., 2020). In fact, it is extremely difficult to achieve financial and environmental success by carrying out lean thinking alone. The simultaneous implementation of the LG approach assists organizations achieve several benefits rather than adopting either lean or green individually (Dües et al., 2013). Teixeira et al. (2022) demonstrated that the integration of lean and green practices, together with the subsequent application of the resulting approach in the service sector, are of significance in enhancing the organization's competitive advantage. Notwithstanding the advantages of combining lean and green approaches, there are a number of barriers to their integration (Sanchez Rodrigues & Kumar, 2019). These obstacles are divided into five groups: individual, technological, cultural, management, and quality barriers (Singh et al., 2022).

Nowadays, the LG approach has been widely discussed in the manufacturing sector, nevertheless, less attention has been paid to this approach in the service sector,

resulting in a subsequent research gap that needs to be filled (e.g., Hussain et al., 2019). Further, lean or green management has actually been studied separately in the service (i.e., Abou Kamar, 2018; Ahmed, 2018 & Rauch et al., 2020); nevertheless, there are still many concerns to be addressed concerning their incorporation into a single approach, their implementation, opportunities, and challenges (Singh et al., 2022). Moreover, although LG implementation can create and maintain the competitive advantage of any company, there is still a gap regarding the relationship among LG practices and the firm's competitiveness (Udokporo et al., 2020; Teixeira et al., 2022). In addition, by intensive review of the literature, no research on the phenomenon has been found within the Egyptian context. Consequently, this study aims to explore the application of the LG paradigm for airlines in Egypt and determine the opportunities and challenges of LG implementation in airlines. This paper also aims at exploring the effect of LG implementation on the airlines' competitive advantage. Thus, the current study answers the following questions:

- What LG practices do airlines employ?
- What are the opportunities that airlines can gain from implementing the LG approach?
- What are the challenges that airlines may face in implementing the LG approach?
- Does LG's implementation enhance the airlines' competitive advantage?

This study is organized as follows: The next section presents the relevant literature, followed by the research methodology and results. The last section outlines the discussion, conclusion, implications, and areas for future research.

2. Literature Review

2.1 The lean thinking

The beginning of lean thinking goes back to the production system of Toyota motor corporation (Hussain et al., 2019). Indeed, there is no commonly acknowledged definition for the lean idea. Instead, there is a wide variation in what lean is and where in the company it should be implemented (Shah & Ganji, 2017). The term "lean" refers to a series of actions or solutions that aim to eliminate waste, lessen non-value-added processes, and increase value-added processes (Abualfaraa et al., 2020). Likewise, it is a set of systematic methods that intend to make the most of an organization's resources by getting rid of tasks that don't add value (Demir & Paksoy, 2021). Along the same lines, Ugochukwu et al. (2012) brought up that lean is a management strategy that aims to organize human actions to provide customers with more added value and eliminate waste throughout an organization's value chain. Urban (2015) stated that lean management means accomplishing more with less. It encourages the idea of nonstop improvement, which implies that products and services may constantly be enhanced throughout time with slow but steady advancement (Demir & Paksoy, 2021). Therefore, the primary thought underlying lean idea is to reduce waste while amplifying the value delivered to customers.

Lean philosophy started in the manufacturing sector and gradually began to spread into the following new areas: services, trade, healthcare, and the public sector (Rauch

et al., 2020). However, there is still a lack of literature on the application of lean principles to the service industry (Kovilage, 2021). To maintain acceptable revenue margins and keep pace with rising demand, the service sector has been under pressure to adopt lean tools to cut costs and increase efficiency (Hussain et al., 2019). To accomplish this, lean philosophy aims at reducing seven types of waste (excessive production, transportation, waiting time, extra processing, additional motion, inventory, and defects) across processes to attain high quality, low costs, and quick delivery times (Kumar & Rodrigues, 2020). Other researchers highlighted an eighth waste called "waste of non-utilized talents", describing it as an unsuitable management practice that underutilizes the use of staff capabilities by assigning tasks that are not aligned with their level of qualification (Teixeira et al., 2021). All of these waste types should be disposed of once the system is lean (Shah & Ganji, 2017). Lean philosophy has provided some tools to get rid of these wastes and guarantee ongoing improvement. These include, however are not limited to, value stream mapping, poka-yoke, kaizen, just in time (JIT), 5S, and kanban. Table 1 provides a summary of some of the well-known lean thinking tools.

Table 1: Some of lean thinking tools

<i>Tool</i>	<i>Description</i>
<i>Value stream mapping (VSM)</i>	This tool is used to get rid of non-value activities. It aids in the identification of process waste, reduction of production time, and the enhancement of a product's quality while also increasing flexibility and lowering operational costs for businesses. So, it helps businesses supply customers with maximum value and meet their desires.
<i>Poka-yoke (error proofing)</i>	This tool aids staff in avoiding mistakes. The goal of Poka-yoke is to eliminate, modify, or draw attention to human errors when they occur in order to achieve zero defects.
<i>Kaizen (continuous improvement)</i>	Kaizen is a strategy in which workers at all levels of a company proactively participate to achieve continuous improvements. It aids in enhancing staff and behavior.
<i>Just-in-time (JIT)</i>	A method for generating flow by delivering the appropriate quantity of goods/services at the appropriate time and location. Organizations that employ JIT will likely decrease all waste and achieve zero lead time, zero defects, and lower costs.
<i>The 5 Ss</i>	Tools whose purpose is to assist management in improving workplace conditions by: Sort : immediately get rid of things that aren't needed; set in order : organize leftover items; shine : maintain cleanliness of the workplace; standardize : create standards for the aforementioned; and sustain : apply the standards and evaluate how well the first four Ss are maintained regularly.
<i>Kanban (pull system)</i>	An influential tool that participates in controlling and maintaining the flow of resources throughout the company and with external parties. Its goal is to eliminate wastage, produce products that meet the needs of their customers, and enhance the final delivery of goods/services.

Source: Shah and Ganji (2017); Abou Kamar (2018); Ahmed (2018).

Lean thinking was based on five core principles. Womack and Jones (2003) identified these principles as follows: value, value stream, flow, pull, and perfection.

Principle 1: “Value” is about defining the value of a product or service from the customer’s point of view. Companies must comprehend what their target clients want and design their products/services in accordance with their demands and expectations.

Principle 2: “Value Stream” is concerned with identifying the value stream of all procedures and activities that products or services undergo as they pass from providers to final consumers. Whenever possible, all actions that waste time, resources, or space without adding value for the final client should be eliminated.

Principle 3: “Flow”: After getting rid of the obvious wastes in a value stream, the third principle aims at setting up a system for tracking the process's flow in the remaining value-added processes.

Principle 4: “Pull” means to take orders from customers and concentrate solely on what they want. Additionally, this step stipulates that nothing will be produced or delivered "upstream" unless it is required "downstream.”

Principle 5: “Perfection” entails striving for continuous improvement and attempting to deliver a product or service that meets the needs of the customer at a reasonable cost.

According to Helmold et al. (2022), the aviation sector is characterized by very high operating and production costs. As a result, overall revenue is relatively low. In this regard, lean thinking can eliminate undue processes and excessive utilization of resources, consequently, it can achieve process improvement. Lean is significant in the aviation industry, especially for airlines and airports, but its application is not as common as it is in other industries like manufacturing and healthcare. Now that its significance has been acknowledged, the concept of a lean airline and airport is spreading more widely.

2.2 Green management

Green management (GM) refers to practices that create environmentally friendly products/services and reduce the effect on the ecosystem via the selection of material sourcing, green manufacturing processes, green survey and development, and green marketing (Srivastava, 2007). The focus of GM is to recognize and eliminate practices that harm the environment, referred to as “green wastes” (Hallam & Contreras 2016). Particularly, it focused on the excessive usage of water, energy, and resources, in addition to pollution, trash, and the impacts of greenhouse gases (Verrier et al., 2014:83). Similarly, Marhani et al. (2013) noted that green practices center around decreasing hazardous emissions, eliminating resource wastage, recycling, and minimizing health risks throughout the production process to minimize the product's or service's environmental footprint throughout its entire life cycle. According to

Kumar et al. (2016), organizations are motivated to adopt GM due to corporate social responsibility, lawful commitments, and the voluntary commitment of senior management to improve the organization's image or for operational and cost efficiencies. Previous studies (Bortolini et al., 2016; Fercoq et al., 2016) highlight eight types of green waste in organizations: excessive consumption of energy, water, and resources; pollution; rubbish; greenhouse gas effects; eutrophication; and poor health and safety. These issues negatively impact the motivation, productivity, and commitment of staff, requiring proper disposal.

To carry out the green management strategy, Loknath and Azeem (2017) and Kovilage (2021) demonstrate that green firms implement green activities to reduce regulatory risk, reduce client exposure to harmful materials, expand the reuse and recycling of materials utilized in the production process, increase energy efficiency, use environmentally friendly resources, gather and spread data about the company's ecological effects and performance, reduce waste, and involve stakeholders in ecological decision-making. In fact, airlines are under pressure to make their operations environmentally friendly due to the pollution and carbon emissions they produce through their service acts (Somerville, 2012). In addition, the aviation sector is exposed to many global crises, like the Corona pandemic, so airlines should adopt a traveler-centric ecosystem and business strategy (Demir & Paksoy, 2021).

2.3 The application of lean and green (LG) approach in airlines

Nowadays, organizations are forced to accomplish not only financial objectives but also social and environmental objectives (Das, 2018). As a result, the green idea, that aims to dispose of environmental waste in conjunction with the lean idea, appears to be a potential strategy for enhancing the environmental and social settings of firms (Teixeira et al., 2021). LG is a recent approach to achieving sustainable processes that combine green and lean production principles, focusing on reducing emissions, staying away from wasteful resource use, and improving the environment (Lim et al., 2022).

Airlines are organizations that provide client-centric service; consequently, they generally center around better comprehending the requirements and expectations of customers (Demir & Paksoy, 2021). Furthermore, the airlines operate under a lot of pressures, such as customer expectations of the highest possible level of satisfaction (Rhoades & Waguespack 2008), high operating expenses and increasing competition (Tretheway & Markhvida, 2014), skill shortages (Helmold et al., 2022), and the obligatory international legislation (Al- Dhaheri & Kang 2015). Additionally, airport operations are facing some great challenges like delays in flights, lost luggage, missed connections, lengthy layovers, cancelled flights, under-used airplanes, delays at the gates, idle personnel, and equipment. Further, because of the pollution and carbon emissions generated by their service actions, airlines also face pressure to make their operations more environmentally friendly (Somerville, 2012). Consequently, airlines

are under pressure to accomplish three main aims: developing productivity, increasing safety, and ensuring sustainability (Helmold et al., 2022). The most effective strategy for airlines to overcome the previous obstacles is to improve environmental efficiency and reduce costs; as a result, the LG paradigm emerges in airlines (de Brito & Ward, 2008). Lean can diminish waste in the production process to enable the organization to achieve the greatest efficiency and maximize its profits. At the same time, the organization gets rid of the waste that comes from the production process by implementing the green approach in the production system. As a result, a company can also achieve sustainable development by incorporating these two ideas into the production process (Abualfaraa et al., 2020).

Previous studies reported that the simultaneous implementation of lean and green operations can improve operational and environmental performance (Dües et al., 2013; Galeazzo et al., 2014). The emphasis on limiting waste is a joint point among lean and green ideas, so this means that they should be combined and applied simultaneously (Teixeira et al., 2021). According to Hallam and Contreras (2016), to get the most out of lean tools, they should be applied with green management practices for preventing pollution. Similarly, Cherrafi et al. (2017) concur that neither lean nor green actions can maintain the anticipated balance between economic, environmental, and social factors when executed separately. When companies implement lean and green management practices simultaneously, they will achieve greater savings in waste, costs, and time than if they were applied independently (Bortolini et al., 2016). Based on the LG paradigm, lean thinking is a catalyst for green management because it simplifies the adoption of ecological practices (Dües et al., 2013). Moreover, it has been noted that lean practices contribute directly and indirectly to ecological performance via green practices. Thus, it is implied that lean and green practices complement each other (Inman & Green, 2018).

Farias et al. (2019) determined pull production, decreasing lot size and process duration, nonstop improvement, preventive upkeep, and staff involvement as the main lean practices, while energy proficiency, reducing water and material utilization, decreasing water pollution, and reducing greenhouse gas emissions were the prevailing green practices. In the same vein, the empirical findings of Niemann et al. (2018) identified some common types of LG practices in airlines. These include the following:

- **Lean and green fuel-centric practices:** Fuel accounts for between (30 and 35%) of airline operators' total expenses, trailed by labor and maintenance expenses. Fuel has been considered in four main areas, resulting in an excess of green benefits: weight reduction, efficient operating, minimum fuel loading, and reusing fuel.
- **Capacity management:** airplanes have a short lifespan estimated by hours flown, are costly to operate, and produce lots of emissions per flight. Therefore, airlines should guarantee that each flight is as close to its maximum travelers

and cargo capacity as possible. Furthermore, when there is full capacity, carbon emission allowances per traveler are lower, indicating that the service generates less waste, has greater overall value, and protects the environment.

- **On-board recycling:** Waste and recyclable materials are constantly collected and separated throughout the flight service. Following the 5S method (in table 1) and green practices, this keeps the environment clean and safe.

The study by Tucci et al. (2021) demonstrated that some lean techniques can be used to enhance operational, financial, and environmental performance in aircraft refueling operations. They show that flight delays are successfully decreased when lean techniques are implemented in the aircraft refueling procedure. Additionally, decreasing flight delays reduces the environmental effect on water and air levels, for example, by diminishing water use, energy utilization, and carbon dioxide emanation during the airplane refueling process. The LG approach, according to Niemann et al. (2018), asserts that environmental operations result in higher cost reductions and operational efficiencies. Likewise, previous studies have shown that the synergy between the lean and green concepts leads to a variety of benefits, including improved sustainable performance (e.g., Kovilage, 2021; Teixeira et al., 2022); improved product or service quality (Abualfaraa et al., 2020); strengthened relationships with suppliers, clients, and other stakeholders; and increased employee morale and commitment (Cherrafi et al., 2018). Further, it fostered process innovation (Kumar & Rodrigues, 2020), improved operational performance and waste reduction (Farias et al., 2019), enhanced competitive advantage (Teixeira et al., 2022), green innovation (Waqas et al., 2022), and ensured sustainability (Abualfaraa et al., 2020).

2.4 Challenges to Lean Green implementation

Despite the importance of the LG paradigm, its joint implementation faces several challenges. Singh et al. (2022) classified these challenges **into five categories**, as follows:

- **Management barriers:** are related to the lack of support from leadership for the LG approach. Kumar et al. (2015) emphasized the significance of top management in the implementation of LG practices. Numerous organizations suffer from a lack of coordination among the divisions, resulting in the absence of appropriate communication, which is considered a great obstacle for the execution of incorporated lean and green practices (Cherrafi et al., 2017). Similarly, Bai et al. (2019) clarify that many businesses lack the management abilities, experience, and tools necessary to combine lean and green practices.
- **Organizational and cultural barriers:** according to Cherrafi et al. (2017), poor corporate culture or a narrow-minded culture that divides decisions about environment and constant improvement is a great barrier to LG adoption. There is a lack of new knowledge about LG philosophy as well as a lack of drive to implement LG practices.

- **Technological barriers:** focused on the inability to embrace cutting-edge technology and specialized technology training. Similarly, Niemann et al. (2018) identified cost and delay in using new and effective technologies as barriers to adopting LG in airlines.
- **Individual barriers:** Cherrafi et al. (2017) determined the low quality of human resources as a major barrier for LG implementation. Numerous organizations lack education and training facilities, and accordingly, employees are unable to acquire the necessary and appropriate skills (Govindan et al., 2014). In the same context, the absence of knowledge and ability to implement LG practices, the lack of enthusiasm for modern initiatives, and the lack of self-assurance to face new challenges are individual obstacles for LG adoption.
- **Quality barriers:** include the lack of process control, insufficient maintenance, the absence of zero errors, and the right first-time strategy. The flawless and first time-right culture will assist airlines become more eco-friendly and energy efficient by reducing fuel consumption and waste.

Cherrafi et al. (2017) added high costs and a lack of government support as two major barriers to implementing LG. According to Niemann et al. (2018), airline operators are less worried about building an environmental image and carrying out environmental practices because their client market places a higher value on cheap plane tickets.

2.5 LG approach and competitive advantage

Omeregbe and Taiwo (2017:210) defined CA as “the organization's capability to achieve a higher level of performance, via its “qualities and assets” than other organizations working in the same field”. According to Chen (2019), CA can emerge through outstanding quality, further developed technology, a speedy reaction to changes and market requirements, and product/ service differentiation. Further, Omeregbe and Taiwo (2017) stated that CA assumes that an organization possesses no less than one of the following characteristics: compared to its rivals, it offers lower prices, a higher level of quality, more dependability, and a faster delivery time. Generally, companies are always looking for new methods to gain CA and boost profitability, quality, and efficiency (Verrier et al., 2014). Indeed, lean thinking gives businesses the ways they need to achieve these goals and become more competitive through decreasing resource consumption, eliminating waste, and raising customers' added value (Govindan et al., 2015). Additionally, lean management, with its theory of persistent improvement, gives airlines a possible strength and competitive advantage (Demir & Paksoy, 2021). Similarly, a green approach can also improve an organization's competitiveness (Rao & Holt, 2005) and achieve efficiency through reducing waste (Verrier et al., 2014).

Cherrafi et al. (2017) demonstrated that the supply chain's competitive advantages are significantly enhanced when LG practices are implemented together rather than separately. In today's unstable market, LG supply chain practices can create and

maintain an organization's CA, which improves a company's reputation (Khan and Qianli 2017). The empirical results of Waqas et al. (2022) revealed that LG practices are positively associated with supply chain CA. Also, Teixeira et al. (2022) proved that lean and green (LG) practices positively affected the organization's CA through sustainable performance. Consequently, the following hypothesis is proposed:

H1: The LG practices have a positive impact on the airline's CA.

3. Methodology

3.1 Sample and data collection

This research used a mixed methodology, "quantitative and qualitative." The targeted population were airlines working in Egypt. A questionnaire was distributed to the managers and employees working in airline companies in Egypt. A questionnaire was used to obtain data on lean and green practices in airlines and their effect on achieving competitive advantage. The intended respondents were only airlines that are familiar with and apply some or all of lean and green management practices, so purposive sampling was used. Purposive sampling is a technique that involves deliberately selecting appropriate situations, individuals, or events in order to obtain important data that cannot be obtained from other options (Taherdoost, 2016; Al-Azab & Zaki, 2023). According to the Egyptian Travel Agents Association (2009), there are 72 Airlines in Cairo, Egypt. EgyptAir and its branches represented about 45% of this number, as it is the largest local airline in Egypt, and the rest were foreign airlines. Because the airline industry is one of the most active in implementing lean and green approach practices and handles a significant volume of daily operations pertaining to reservations, customers, appointments, boarding, maintenance, investment, revenues, marketing offers, ground and logistics services, and even during the flight, airlines were selected as a sample for this study (Mohamed & Al-Azab, 2021).

Goodhue et al. (2012) proposed that the appropriate study sample size range between 10 and 20 times the number of latent constructs. Therefore, the sample size needed for the study was established at 25–40, which appears to be more adequate for analysis given that the two latent constructs included. Using the online survey through a Google Form, a total of 200 questionnaires were distributed to 40 airlines (5 each). with 135 returned during a two-month period from August to October 2023, with a response rate of 67.5%. Only 89 responses were suitable for further investigation. To ensure that the questionnaire's statements were clear and to assess the reliability of the measures, a pilot test was performed on 30 respondents and three experts in the aviation industry. Following this preliminary phase, the wording of few items was changed for the purpose of the survey that proceeded. Out of the 89 respondents, (68.5%) were male, while (31.5%) were female. Most of them (40.5%) are between 36 and 45 years old, followed by 27% of respondents who are more than 55 years old. Around 63% of the respondents held a bachelor's degree, followed by 14.6%

who held a master's degree. A total of 38.2% of respondents have experience above 20 years, 29.2% (11–15 years), 15.8% (16–20 years), and 4.5% (below 5 years), as indicated in Table 2.

Table 2: Demographic profile of respondents

Age	Freq.	% (n=89)	Gender	Freq.	% (n=89)
18-25 years	4	4.5	Male	61	68.5
26-35 years	7	7.8	Female	28	31.5
36-45 years	36	40.5			
46-55 years	18	20.2			
More than 55 years	24	27			
Years of Experience	Freq.	% (n=89)	Educational level	Freq.	% (n=89)
Below 5 Years	4	4.5	Bachelor’s degree	56	63
6-10 Years	11	12.3	Diploma	10	11.2
11-15 Years	26	29.2	Master degree	13	14.6
16-20 Years	14	15.8	Doctorate degree	8	9
Above 20 Years	34	38.2	Others	2	2.2

3.2 Measures

Table 4 indicates the measurement items in detail. Lean and green management practices were measured using 12 items adapted from Kuo and Lin (2020) and Agyabeng-Mensah et al. (2020). To measure competitive advantage, six items were developed based on Yu et al. (2017). All of these items were assessed on a five-point Likert scale ranging from 1 “strongly disagree” to 5 “strongly agree”.

3.3 Results and discussion

For data analysis, SPSS V.26 was used. Reliability analysis was performed to ensure the internal validity and consistency of the items used for each variable (Mohamed & Al-Azab, 2017). Hair et al. (2019) recommended that Cronbach alpha values from 0.6 to 0.7 were deemed the lower limit of acceptability. An alpha of more than 0.7 would indicate that the items are homogeneous and measuring the same constant (Al-Azab & Abulebda, 2023). For this study, Cronbach's alpha for all survey variables is presented in Table 3. The results demonstrate that the questionnaire is a reliable measurement instrument.

Table 3. Cronbach’s alpha (Reliability)

Scale	Cronbach’s alpha
Lean and Green Management Practices	0.959
Competitive Advantage	0.845
Cronbach’s alpha (Reliability)	0.948

Table 4 indicated the mean and standard deviation for all the study variables, as it is clear that the mean of lean and green management practices was (3.71) with a standard deviation of (0.718), and the mean of competitive advantage was (3.79) with a standard deviation of (0.705).

Table 4. Descriptive statistics for the study variables

Variables	Mean	Std. Deviation
Lean _ Green Practices	3.71	.718
Our airline uses its resources in a rational way.	3.57	.535
Our airline reduces its unnecessary and or redundant activities.	3.71	.756
Our airline promotes objective training, information and awareness actions for the correct performance of its activities.	4.00	.816
Our airline promotes good management practices, such as cleaning, tidiness, organization, standardization and discipline.	4.14	.690
Our airline standardizes the activities performed by its employees and suppliers in order to standardize their processes.	3.86	.690
In our airline we have systems to reduce the time to prepare for new activities.	3.00	1.414
Our airline develops products and/or services in an ecological way.	3.86	1.069
Our airline promotes training, information and awareness actions on good environmental practices for its employees and suppliers	3.71	.756
Our airline defines environmental requirements for its employees and suppliers.	3.71	1.113
In our airline there are good practices in environmental management, according to the normative reference ISO 14001:2015.	3.57	.976
In our airline there is a waste management system, as well as identified and approved environmental procedures.	3.86	1.069
Our airline holds its hierarchies and employees accountable for improving their environmental practices.	3.57	1.134
Competitive Advantage	3.79	.705
Our airline is able to provide customized products and/or services, compared to other companies in the market.	4.14	.378
Our airline has a good social reputation among its stakeholders (e.g., employees, customers, suppliers, community, etc.), compared to other companies in the market.	4.14	1.069
Our airline applies competitive prices, compared to other companies in the market.	3.86	.900
Our airline is able to quickly present new products and/or services to its customers, compared to other companies in the market.	3.71	1.113
Our airline is able to adjust its offer of products and/or services to existing demand, compared to other companies in the market.	3.43	1.134
Our airline has skills and/or other intangible internal resources (e.g., knowledge and techniques) that are difficult to replicate by other companies in the market.	3.43	.976

Bivariate correlations between two variables are listed in Table 5. LG practices and competitive advantage are significantly related to each other (0.786). This shows that the more airlines implement lean and green management approach, the more they will achieve a competitive advantage in the tourism market.

Table 5. Correlations between the study variables

Variables		Competitive advantage
Lean and green management	Correlation Coefficient	0.786*
	Sig. (2-tailed)	0.01
	N	89

A separate linear regression analysis was conducted based on 89 completed surveys collected from the study. In testing (H1), a regression analysis was performed, with LG approach practices as an independent variable and competitive advantage as a dependent variable. Table 6 presents the regression results used to test H1. As shown in Table 6, LG practices had a significant effect on competitive advantage, with $p < 0.01$. The effect of LG approach practices explains 47.7% of the variance in competitive advantage among the study participants. Thus, Hypothesis 1 was supported. This finding is in line with the findings of Cherrafi et al. (2017), which demonstrated that the supply chain's competitive advantages are significantly enhanced when LG practices are implemented together rather than separately. Additionally, Teixeira et al. (2022) proved that lean and green (LG) practices positively affected the organization's CA through sustainable performance.

Table 6 Regression results of the Study Variables

Model	Un-standardized Coefficients		Standardized Coefficients	t	Sig.	R ²	supported vs. rejected
	B	Std. Error	Beta				
Lean and green management	.678	.318	.691	12.136	0.01	.477	Supported P< 0.01

a. Dependent Variable: Competitive advantage

3.4 Procedures of interviews and data collection

The study also used a qualitative approach, since it provides a comprehensive understanding of the topics under study. The qualitative method based on the use of interviews was chosen in order to properly collect a large amount of data about the participant's experience, perceptions and information about the opportunities and challenges facing lean and green approach practices in airlines. Its probing style and primary emphasis on experiences and emotions encourage participants to share

significant ideas from their point of view (Altinay & Paraskevas, 2009). When exploring, describing, or explaining is the main goal of the study, qualitative research is generally appropriate (Leavy, 2017). Experts in the aviation industry were interviewed to gain a comprehensive understanding of the research topic (Veal, 2018).

Between October and December 2023, 18 experts and managers from several airlines in the Arab Republic of Egypt participated in semi-structured interviews personally or virtually (via Zoom Cloud Meetings) until data saturation was attained (Gill, 2014). The longest interview took 35 minutes, while the shortest one lasted 22 minutes. According to Lepkowska-White and Parsons (2019), a sample size of 18 would be considered somewhat large for a qualitative study. The method of data gathering that has been selected is intensive, semi-structured interviews. The majority of interviewees, who ranged in experience from general manager to retired with many years in the aviation industry, held several roles in airlines using purposive sampling (see Table 7). When a researcher wants to create a historical reality, explain a phenomenon, or build an idea about which little is known, purposeful sampling is important (Kumar, 2014). Large amounts of useful and valuable information pertaining to operations, processes, efficiency, and service can be found in this data, providing airlines with a significant competitive advantage when implementing lean and green management methods.

3.4.1 Interview's Data analysis

Inductive qualitative analysis through thematic coding was used to evaluate the data, which included determining the data, classifying it, and reducing it under connected order themes (Mac Con Iomaire et al., 2020). Information about interview recording and transcription was covered in the transcription stage (Kvale, 2007). To ensure comparability, dependability, and consistency, every interview was performed, recorded, and verbatim transcribed at the end of the interview. Strauss and Corbin (1998) stated that axial and open coding are usually used to evaluate the data. The dimensions and properties of the concepts in the dataset were specified through the usage of open coding. In order to find the optimum category and topic, as well as to relate concepts and categories to one another, axial coding was employed. Certain codes were produced during and after data analysis, while others were canceled; certain data segments were captured, while others were thought to be more appropriate for a different theme than the one to which they had been initially allocated. Finally, verbatim comments from the respondents were presented along with an analytical interpretation (Gill, 2014).

Table 7 Interview participants’ profile

ID	profession	Airline name	Years of experience
1	General manager	Egyptair	15
2	Business development manager	Kuwait Airways	16
3	Marketing manager	Egyptair	12
4	Route economics manager	Turkish Airlines	15
5	Station Officer	Egyptair	10
6	General manager	Egyptair	18
7	Former VP advisor	Egyptair	20
8	Operations and airport services	Lufthansa	15
9	Deputy manager	Emirates Airlines	13
10	Retired	Egyptair	25
11	Planning specialist	Saudi Arabian Airlines	12
12	General manager	Gulf Air	12
13	Retired	Egyptair	27
14	Senior Station officer -Ground operations	Nile Air	10
15	Cabin crew	Etihad Airways	23
16	Quality officer	Saudi Arabian Airlines	16
17	General manager	Egyptair	14
18	Retired	Egyptair	22

3.4.2. Validity, reliability, and transparency

Independent coding was done in order to improve the category's credibility, validity, and reliability, as well as the themes and sub-themes that were discovered. To examine and test the inter-rater agreement, two experts in the aviation segment who took part in the research and three academics who refrained from participating in the interviews were contacted. After receiving a sample of the data, these individuals were instructed to create themes and sub-themes until the data was prepared for analysis. The majority of the transparency criteria outlined by Aguinis and Solarino (2019) were applied in the research. Purposive sampling, methodological design, saturation degree, transcribing level of information, data coding by multiple coders, and inter-rater reliability were all employed.

3.4.3 Results and discussion of interviews

3.4.3.1 opportunities of implementing lean-green management in airlines

All interviewees unanimously agreed that the LG approach offers numerous opportunities to enhance an airline's competitive advantage by lowering costs, improving value, perseverance, quality, and time to market. They also help with product development, client lead times, stock levels, and delivery times. The following is a review of the most important opportunities provided by lean and green approach practices.

3.4.1.1 Improving the management of catering inventory

A topic that emerged in interviews was the relevance of the managing catering inventory. When it comes to managing catering inventory, like soft drinks, lean practices are really helpful. It can help you cut costs associated with catering, ensure that the catering is as accurate as possible, and shorten the time spent maintaining on-hand inventory (Marmol, 2017). As noted by one interviewee:

“....., This may enhance the rationalization of consumption of food and beverage stocks on the plane, reduce the number of people in hospitality, as well as reduce costs” (ID 15).

This comment ties with Icelandair's adoption of a lean and green management strategy in cabin services, which has resulted in benefits like fewer cabin crew members going to and from the kitchen, a decrease in pointless expenses, a lighter galley trolley, and increased regularity. It cut expenses and relieved the cabin crew of a needless workload (Thorhallsdottir, 2016).

3.4.1.2 Cost reduction

Interviewees showed great importance of lean and green management practices on cost reduction. One other element of the airline sector that warrants attention is its high expenses. The airline sector is still under tremendous pressure to reduce costs and remain competitive, all the while trying to increase safety and sustainability (de Brito & Ward, 2016). Due to the aviation industry's intense rivalry and high operating expenses, airline companies are constantly looking to improve both their planning and operational procedures. Traditional cost-cutting techniques are insufficient to support this policy. Airlines must do a thorough assessment of their organizational structure and business procedures. (Demiral, 2006). One of the primary goals of the civil aviation industry, which includes a service production sector, is to deliver services in a fast, comprehensive, safe, and secure manner. Green and lean management techniques undoubtedly help achieve this objective and increase productivity and quality by getting rid of pointless business procedures (Helmold et al., 2022).

“..... resource use optimization is achieved by doing away with the utilization of incorrect and superfluous resources in operational and organizational procedures. As a result, expenses are decreased, and output may be realized on schedule with this management system” (ID 1).

3.4.1.3 Ground handling services

Companies that provide aviation services, such as airlines, ground handling companies, and caterers, use a variety of procedures. There may occasionally be issues with these procedures' simultaneous application and integration. Currently, by

removing both conflicts and interruptions in the processes, simplifying the processes within the framework of lean and green management principles aids in the correction, design, or improvement of the complete value chain (Helmold et al., 2022). One of the interviewees reported:

“The organization must be viewed as a whole, and every process that contributes to services either directly or indirectly must do so in a way that is straightforward and supportive of one another. Within the context of corporate risk management, this criterion is always stressed” (ID 8). This statement is related to the findings of Gergin et al. (2017), which looked at ways to raise the caliber of ground handling for Atlas Global Airlines. They offered recommendations to streamline the procedure in their work, which covered the whole ground operation. They came to the conclusion that the ground operation took less time when using the lean and green management strategy, particularly when it came to check-in and luggage delivery timings.

The handling procedures carried out by a service provider from the time the baggage is unloaded from the airplane until the passengers pick it up from the bands at the terminal are included in the baggage operations and processes in aviation. By eliminating tasks that don't offer much value, streamlining the luggage check-in procedure can boost output, enhance customer satisfaction, and increase employee productivity (Barroso et al., 2020). The overall time spent on ground handling can be reduced using the lean and green management approach because of the operational durations required, particularly during the procedures of preparing the aircraft for flight, cleaning, check-in, and baggage reception and delivery.

“The amount of time it takes for travelers' luggage to arrive is a critical performance indicator for airports. As a result, managing the ground handling procedure is crucial, and handling and unloading of airplane baggage may be improved continuously. (ID 14)

"Lean and green procedures can identify inefficient processes in the luggage transfer from aircraft to carousels and establish benchmarks to enhance the procedure that reduces passenger wait times" (ID 18).

3.4.1.4 Enhancing Customer Service

In addition to providing services, the airline business is customer-focused and constantly looks for methods to better understand the demands of its clients at various service levels. Because of its power to draw in and keep clients, service quality is essential in this sector (Malifete et al., 2018). Tennakoon and Weerasooriya (2020) state customer service as “the process of measuring the effectiveness and efficiency of the organization,” where efficiency refers to how well an organization uses its resources to satisfy customers and effectiveness measures how well customer requirements are met.

“The competitive landscape of the aviation business is quite dynamic. As a result, for airlines, brand awareness and customers' perceptions of service quality are crucial.” (ID 12)

This observation is consistent with the findings of Jabbour et al. (2016), which show that customers and stakeholders expectations are satisfied through effective resource management, operational spending, and compliance with quality requirements. Thus, companies can outcompete their rivals by increasing operational efficiency in addition to having the capacity to enhance product availability and charge lower costs.

3.4.1.5 Enhancing ecological behaviour for customers and employees

The opinions that customers and employees have of an airline regarding its environmental commitment are often reflected in its green image. It is essential for building a green airline's brand and has a big influence on airline choices. By using green practices, an airline can gain a competitive edge and a reputation for being socially responsible (Qiu et al., 2021). Some airlines have made the decision to implement green practices at the managerial level. These include integrating environmental initiatives into their corporate missions by establishing environmental goals and initiatives to reduce carbon footprints; creating workplace policies; conducting audits of environmental practices; rewarding employees for their environmental efforts; utilizing technologies to manage air pollution and recycle paper; and providing financial support for environmental projects (El-Mawardy, 2023).

“....., Passenger searches for airlines that implement green practices in all sectors of the company have increased recently, especially after the COVID-19 pandemic.” (ID 3)

A number of studies have demonstrated that passengers have a favorable attitude toward the environment and are prepared to embrace green habits (e.g., Mayer et al., 2012). Kuo and Lin (2020) reaffirmed the importance of lean and green management in implementing green initiatives and encouraging employees' environmentally conscious behavior. Furthermore, as a commonality between lean and green practices, Agyabeng- Mensah et al. (2020) asserted that lean management increases environmental performance.

Ultimately, it was determined that airlines should be encouraged to take action regarding green aviation in order to obtain a competitive edge and positive reputation by improving their green image, given the comparatively high awareness among passengers of the detrimental environmental effects of the aviation industry (El-Mawardy, 2023).

"Employees' application of the company's policy regarding environmental considerations generates environmental behavior that is reflected in the employee's performance, customer service, and the company's mental image." (ID 11, ID 16)

3.4.1.6 Enhancing workflows and operational performance

At many points during the passenger trip, including online check-in, airport check-in, boarding gate, and transit locations, airlines devote a substantial amount of time and resources to the verification of travel documents. In addition to the standard trip data—such as the passenger's country, destination, transit stops, reason for travel, and length of stay—airlines also have to deal with some more unusual and difficult travel criteria (IATA, 2024). According to a study by Silva et al. (2020), lean and green practices can improve production process efficiency by cutting waste, lead time, and expenses while also producing green benefits.

"While airlines seem to broaden the concern by pursuing the long-term well-being of all stakeholders, lean and green approach appear to be more focused on respecting people (customers and employees) through facilitating and simplifying work procedures and sustainable performance." (ID 7)

3.4.1.7 Improved departure time

Operations systems are not what they were in the past. Businesses and manufacturing businesses will have to deal with entirely new generations of technologies, services, and products based on intelligent and smart technologies in the twenty-first century (Daim & Faili, 2019). Airlines must adjust to shorter delivery times, higher product variability, and increased market volatility in order to remain competitive on global markets and to maintain long-term profitability. This will allow them to respond quickly and sensitively to both ongoing and unforeseen changes. The integration of lean and green practices, along with digital information and communication technologies, into production systems, processes, and technologies is one of the key pillars for overcoming these obstacles. These technologies enable innovative advances by fusing the physical world with quick data access and processing (Helmold et al., 2022).

"Lean and green continue to complement each other in areas such as waste reduction, lead time reduction, product design, and the application of diverse methodologies and strategies for the management of individuals, groups, and the supply chain." (ID 10, ID 4)

3.4.1.8 Aircraft maintenance

The existence of maintenance organizations in the aviation industry is contingent upon their ability to meet the growing demands of customers with respect to quality and shorter lead times (Ayeni et al., 2011). Applying lean and green management to

maintenance exposes several advancements in the aviation sector and guarantees sustainability. Aircraft maintenance and repair is a complicated industry that calls for a reliable system of inspection, detection, and quality control (Helmold et al., 2022). This adds to the unpredictable nature of the repair process, which could take place during planned or unplanned maintenance. A number of procedures are involved in the maintenance process in the aviation industry, such as disassembly of the aircraft or part, either partially or completely; inspection of the components; repair, replacement, or modification of the defective parts; reassembly; testing and inspection of the reassembled aircraft; and quality assurance of the repair process (Four Principles, 2024).

"Aircraft maintenance activities can greatly improve the quality of the maintenance process if lean and green principles are applied." (ID 9). This comment ties with Kolanjiappan's (2015) findings that eliminating all forms of waste from the production process, including pointless components from the maintenance process, is the goal of lean and green management.

3.4.1.9 Improving fuel consumption and recycling

The term "green production" refers to a new paradigm for production that incorporates methods and strategies to boost eco-efficiency. Examples of these include designing systems and products with minimal energy and material consumption, using environmentally friendly raw materials, and encouraging the recycling of unwanted outputs (Deif, 2011). The integration of green and lean methods is typically observed during many stages, including product/process design, procurement, production, transportation, logistics, and product and component disposal (Samar et al., 2019). These practices include preventing pollution by reducing energy use, raw material consumption, solid waste, product and water reuse, use of renewable materials and energy sources, redesign of products and processes, and employee training, which facilitates appropriate implementation of product stewardship practices (Ghazilla et al., 2015).

".....Also, reducing pollution and using clean fuel as much as possible is one of the successes of the lean and green management system." (ID 16)

3.4.1.10 On-board recycling

Trash and recyclable items are continuously collected and segregated during the flying operation. In addition to having the deliberate environmental benefit of waste collection and recycling, this upholds a clean and safe atmosphere by utilizing the lean and green methodology, which is advantageous since it makes it simpler to identify where service concerns are (Andrés-López et al., 2015).

"We always strive for continuous improvement. Whatever the amount of waste and plastic on board the plane, you will find it so little that it may not even fill the trash can." (ID 15, ID 6)

3.4.1.11 Sustainability

The notion of sustainable aviation is associated with the increasing "awareness" about sustainability in the transportation sector, which is connected to the sustainable development movement of the past twenty years. The United Nations (UN, 2022) Agenda of the 21st Century is framed by sustainability, which also gave rise to international accords like the Kyoto Protocol on climate change, which sets a cap on greenhouse gas emissions.

"Airlines have no choice but to implement sustainability standards in order to compete in the global aviation market" (ID 2)

Since cutting waste is a common objective of both lean and green management strategies, combining them should improve an organization's performance in both the environmental and social domains (Fercoq et al., 2016). In this regard, the adoption of lean and green concepts can be better understood by applying the value creation theory. According to this theory, any "trade, transaction, investment, or relationship" should generate value for a variety of stakeholders, including the general public (Windsor, 2017). Thus, through the application of lean and green guidelines, businesses can develop an ecological stance that can promote cost savings, higher profits, and improved brand recognition (Fercoq et al., 2016).

"Less pollution and diseases are associated with clean and clear skies." (ID 18)

In contrast to the above, according to Varela et al. (2019), some authors continue to argue that the lean and green approach does not always translate into increased environmental performance or any other aspect of sustainability.

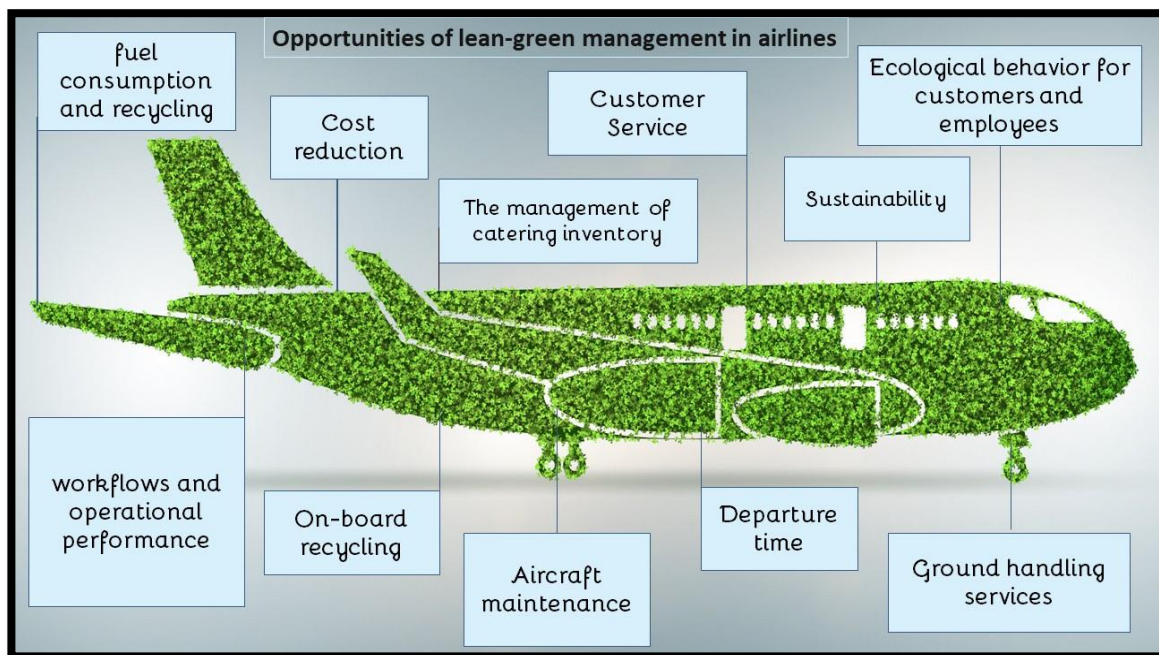


Fig. 1. Theoretical framework emerging from the study.

3.4.2 Challenges of implementing lean-green approach in airlines

The aviation sector faces a challenge in balancing environmental excellence with operational efficiency without sacrificing safety (de Brito & Ward, 2008). Future pressures to reduce costs, shortages of skilled workers, and ever-increasing competition will present formidable obstacles for the aviation sector. Furthermore, there is a constant push to further enhance the safety of an already safe business due to the increasing volumes of air traffic. Moreover, there is a growing push in favor of environmentally friendly flying. Consequently, there is pressure on the industry to guarantee sustainability, raise safety standards, and boost production (Helmold et al., 2022). The following is a review of the most important challenges facing the application of lean and green management in airline companies.

3.4.2.1 Keeping pace with technological development

Regarding the reluctance to adopt newer technology, technological innovation has risen in all sectors of the economy and made businesses eco-friendlier and more productive. Thanks to technology, it is now feasible to detect and monitor environmental waste more effectively and to produce eco-friendlier machines. However, the performance of lean and green techniques is hampered if airlines refuse to implement these new technologies because of obstinacy, cost concerns, company culture, or ignorance (Luthra et al., 2011). According to Bortolini et al. (2016), technology plays a significant role in facilitating environmentally friendly operations. However, because airline service technology is specialized, it takes years to develop and is very expensive to upgrade. One of the main obstacles to going greener is the long wait for more efficient technology and the potential cost barrier (Luthra et al. 2011), which is reflected in the following responses:

"Aviation industry technology is very expensive, and in order to remain in the market and provide new things to your customers, you must constantly keep pace with new technology" (ID 10)

3.4.2.2 Human resource training policies

The capabilities of technicians, traffic controllers, pilots, cabin attendants, dispatchers, supervisors, and all other licensed people in the aviation business are supported by lean aviation training systems. Clarity in situational awareness is enhanced by lean training. The best learning environments are those that have a well-defined training procedure, resources from lean training systems, and learning systems themselves. A key factor in firms' sustained progress is the integration of green management and lean methodology. Here, an organization's training performance may be enhanced by a lean training process, which can also maximize the use of resources in these procedures. Thus, training programs that are lean and environmentally conscious could benefit the professionals of the future (Helmold et al., 2022).

"Erroneous calculations cause delays in baggage carousels, maintenance, and check-in times. Optimizing personnel levels and making effective use of employee time are made possible by lean management tools." (ID 4)

"The training processes should focus more on timeliness and service non-conformity characteristics, which reduce non-value-added activities, as they have more noise or uncontrollable factors and are more susceptible to the influence of human behavior characteristics." (ID 7)

As human capital is at the core of green-lean integration, employee collaboration and engagement are crucial prerequisites for implementing these practices. However, it is still vital to comprehend the many trade-offs between lean and green (Caiado et al., 2018).

"Continuous training of employees on problem-solving skills, project management, and delegation of authority, so that every individual is responsible in his place, whether in ground operations, maintenance, or on board... This contributes to the success of green management practices." (ID 14)

3.4.2.3 The resistance of change

The word "change" perfectly captures the essence of our contemporary cultures and the difficulties managers confront. Therefore, a leader's daily strategy must include managing change (Njenga & Moronge, 2018). A manager and employee's capacity to respond, function, and adjust to change determines their level of success. In the current era of swift technical advancements, worldwide communication, heightened competition, and evolving consumer preferences, traditional business practices are no longer viable for achieving desired outcomes or adapting to rapidly evolving circumstances. Strong techniques and resources are needed to structure change processes successfully (Kotter, 2009).

The culture of continuous improvement and respect for others is one of the most crucial approaches to embrace change. The fundamental value of continuous improvement lies in fostering an environment that not only accepts but actively welcomes change, rather than solely focusing on the changes that individuals make. Only in places where individuals are respected can such an atmosphere be established. It takes respect to collaborate with people. We refer to "people" as clients, suppliers, and workers. Adopting that idea will also force you to continuously assess your actions to determine whether you're doing things flawlessly and not upsetting your customers. That develops your problem-solving skills, and if you pay attention to details, it will result in ongoing progress (Less, 2024).

"The path to eradicating change resistance is to concentrate on knowledge management, attempting to extract, compile, preserve, and share the knowledge acquired through experience." (ID 2)

3.4.2.4 The culture of management (top management vision)

Airlines may try to apply lean thinking, but it won't be sustainable if senior management doesn't support and participate. The company's vision and goals must incorporate lean thinking, and management must actively implement lean methods to lead by example for staff members (Jadhav et al., 2014). Lean thinking will be abandoned if lower-level staff do not believe that top management prioritizes it (Ainul Azyan et al., 2017).

"Airline management changes carry a significant risk." (ID)

Thus, in order to provide value to the consumer, lean must be ingrained in the company culture. The CEO and other top leadership members ought to take a proactive role in the lean process. Greater knowledge among employees, who are crucial stakeholders, about value-added activities can lead to waste reduction and improved customer value. Employee support for lean and green initiatives is higher when they witness senior leadership actively participating in the process. (McDowell, 2015).

"A company's management commitment to continuously invest in its people and promote a culture of continuous improvement is the power behind lean and green." (ID 13)

"This system needs to be implemented as a continuous, inclusive, and coordinated strategy for organizational learning and change." (ID 7)

"....., because people are the most important factor in the end, implementing lean thinking is a culture shift that demands leadership." (ID 12)

3.4.2.5 Waste management

One of the biggest problems that airlines face is waste control. It involves getting rid of procedures that don't improve production processes and increasing value-adding and customer-ensuring activities that provide high levels of efficiency in the delivery of the final product. Moreover, the most often applied ideas are waste identification and elimination, which are quantified in terms of inventory, time, and expenses throughout the whole lean supply chain (Thiong'o & Thogori, 2023). Waste reduction ultimately contributes to cost and quantity savings in raw materials, which impacts the firm's economic and environmental performance; it also increases market share, which boosts the competitiveness of products and services; and it creates value for a seamless downstream product and communication flow process in a supply chain network (Nwanya & Oko, 2019).

"Top management's support and oversight of implementation contribute to the waste management process's success." (ID 9)

In conjunction with lean management, green management aims to eradicate waste as well (Chaudhary, 2020); however, this waste is primarily associated with

environmental issues, such as "excessive water, power, and resource usage" and "pollution, rubbish, greenhouse effects, and eutrophication" (Verrier et al., 2014). This kind of production includes techniques like designing systems and products with lower energy and material consumption, also known as eco-innovation, and substituting materials of renewable origin for those used as a raw material source in addition to recycling (Toke & Kalpande, 2019).

"..... green practices promote the elimination of many wastes, like pollution, litter, needless water and power use, and resource exploitation." (ID 13)

3.4.2.6 Sustainable aviation fuels

Due to the pollution and carbon emissions produced by their service activities, airlines are also under pressure from the consumer market to protect the environment (Somerville 2012). Reducing costs and increasing environmental efficiency are the greatest ways for airlines to address these issues. Fuel is the focal point of lean and green. Fuel is the biggest expense borne by airline operators, accounting for an average of 30–35% of overall costs (Niemann et al., 2018). This is followed by labor and maintenance costs. Additionally, airlines target this sector the most, which has significant benefits for the L&G paradigm.

"A plane burns more fuel the heavier it is. As a result, a lighter aircraft will consume less fuel and emit fewer greenhouse gases." (ID 15)

"Ensuring that only the minimal amount of needed fuel is used would reduce fuel consumption, CO2 emissions, costs to the company, and, in the end, environmental harm." (ID 5, ID 16)

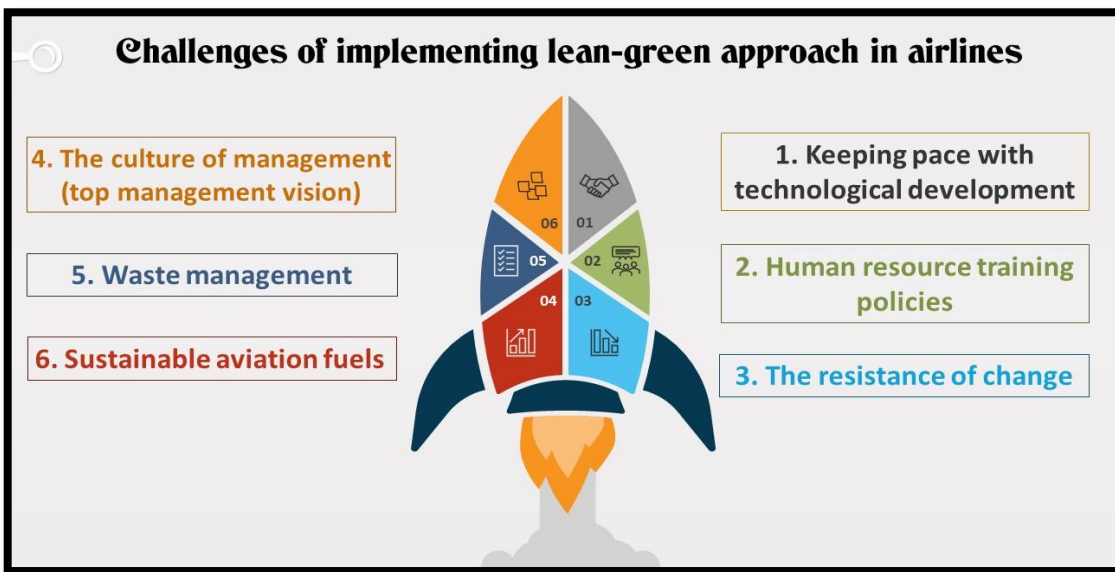


Fig. 2. Theoretical framework emerging from the study.

3.5 Conclusions

The aviation industry is acknowledged as one of the fastest expanding industries globally and has had a favorable impact on society (Malifete et al., 2018). The aviation industry is blamed for widespread pollution and for being a major contributor to climate change. Further, numerous airlines suffer from rising costs and waste management, along with increased competition. The overall objective of this research is to explore the practices, opportunities, and challenges of the LG approach at airlines in Egypt. Moreover, this study also evaluates the effect of LG adoption on the airlines' competitive advantage (CA). Based upon the mixed methodology, a structured questionnaire was distributed to (89) participants. Besides, this study conducted (18) semi-structured interviews with experts in airlines operating in Egypt to examine the effect of LG implementation on the CA of airlines. Service problems of operational flaws in the aviation business make customers dissatisfied and the company's reputation suffers when flights are delayed or cancelled, connections are missed, luggage is lost, or there are lengthy layovers. Airlines prioritize process improvement and safety in order to increase customer happiness. These procedures need to be carefully planned and carried out. Moreover, airlines search for efficient ways to reduce operating costs and better satisfy consumer requests as a result of increased worldwide competition and rising passenger expectations. The principles of lean and green management include minimizing waste, continuously enhancing the manufacturing process, comprehending and planning operations from the viewpoint of the customer, and attaining sustainable operational performance (Demir & Paksoy, 2021).

In summary, if the aviation sector is lean and environmentally conscious in both operations and management, it may provide more effective and efficient sustainable support to the business environment and sustainable growth (Helmold et al., 2022). In addition to a highly competitive economic climate, the aviation services sector has challenges with waste management, excessive costs, and environmental constraints. The lean and green practices combine the well-known management ideas of green management and lean thinking, fostering synergies that result in increased cost savings and environmental advantages (Niemann et al., 2018). Furthermore, some research notes that when lean practices are implemented in an organization, green practices can also be adopted more easily (Ramos et al., 2018) because the two approaches to waste removal are more similar. Additionally, lean practices can have a greater positive impact when combined with green practices (Inman & Green, 2018), suggesting that both approaches can improve performance and, as a result, increase competitiveness. Since airline firms are customer-focused service providers, they constantly prioritize learning more about the requirements and expectations of their customers. Airlines can benefit from lean and green management's continuous improvement mentality, which gives them a competitive edge (Demir & Paksoy, 2021). It's not always easy to combine lean and green or sustainability in its whole, but the key to moving forward is to see past trade-offs and create powerful, creative

win-win solutions. An integrated lean-green approach can be helpful in "looking beyond trade-offs" (de Brito & Ward, 2008).

The findings indicate that LG practices have a positive impact on the airlines' CA. The findings of interviews reveal that LG practices providing many opportunities for airlines by enhancing the following issues; management of catering inventory, cost reduction, ground handling services, ecological behaviour for customers and employees, workflows and operational performance, aircraft maintenance, fuel consumption and recycling, and sustainability. Moreover, the findings illustrate a range of challenges that airlines may face when implementing LG practices; like keeping pace with technological development, human resource training policies, resistance of change, the culture of management, waste management, and sustainable aviation fuels.

3.5.1 Theoretical implications

This work contributes to literature mainly by clarifying five main gaps: (1) It assesses empirically how lean and green approaches together affect airlines' ability to compete. (2); it offers many benefits to airlines in the form of effective opportunities to apply both lean and green management approaches; (3) it presents the most important challenges that airlines may face when applying lean and green management approaches together; (4) this study is one of the few that pursued to combine lean and green practices in airline especially in Egypt trying to encourage airlines to implement this approach to achieve sustainable competitive advantage; (5) it employed the mixed quantitative and qualitative methodology to test the role and impact of the lean and green management approach on the operational performance and competitiveness of airlines. Moreover, this study shows that airlines operating in Egypt, and who adopt lean and green management, can improve their sustainable performance and, consequently, their competitiveness when applying both practices.

Also, the current study's conceptual framework expanded the present knowledge in tourism literature, along with existing studies in the airline's management and leadership. Moreover, the present study might aid in fully comprehending the consequences of LG management in airlines contexts. Equally important, it is regarded as the first attempt to develop a mixed methodology to study LG practices Together in airlines within airlines in one of the Middle Eastern countries, Egypt.

3.5.2 Practical implications

The purpose of this study was to determine whether lean and green management approaches may improve airlines' ability to compete. The current research proved that lean and green techniques have a positive impact on airlines' competitive advantage. The study also discussed the opportunities and challenges that airlines may have in applying lean and green management techniques. These findings showed that in order to maximize benefits for the airline and its stakeholders, airlines should integrate LG

practices into their operations and customer services to achieve optimal performance. Therefore, the attention of airlines towards LG practices must increase in order to benefit from the many opportunities provided by these practices to achieve competitive advantage.

The study also recommends managers of airlines on the need to internalize lean and green management practices in their operations and performance through the prevalence of signs in maintenance facilities, crew lounges, and luggage piers at airports urging staff to adhere to lean and green principles. However, some airlines that have fully adopted lean and green practices view it as a mindset and culture that systematically seeks and eliminates causes of waste, unpredictability, and inflexibility in operations instead of seeing them as only some of posters, one-off productivity fixes, and cost-cutting (Dichter et al., 2018).

To evaluate sustainability in a more comprehensive way, concentrating on environmental or corporate social responsibility, managers of airlines should integrate lean, green, and social management systems. Overall performance will improve, along with financial gains, a stronger position in the market, and a better reputation (Haddach et al., 2016). Therefore, while cutting waste for consumers and the environment is usually the main goal of lean and green concepts, combining the two allows for improved triple bottom line performance and competitiveness (Teixeira et al., 2021).

In order to achieve the concept of sustainable airlines, lean—an integrated socio-technical system—needs to be supplemented with green practices (Tortorella et al., 2017). From an internal perspective, this requires that LG practices have a strategic orientation, with top management's backing and leadership connecting them to strategic planning. Furthermore, it's critical to establish a culture that values knowledge management derived from experiences and empowered, trained individuals. From an external perspective, the industry needs rules and standards, supply chain integration using the right and moral use of tools and procedures, fortifying partnerships, and including all internal and external stakeholders (Caiado et al., 2018).

Furthermore, recent research (Inman and Green, 2018) noted that while lean methods can benefit the environmental pillar, their effects are amplified when combined with green practices. According to Caldera et al. (2019), this means that using LG to transition to sustainable business practices will help airlines—especially small and medium-sized companies contribute to the circular economy more quickly. Given the existing high costs associated with financing, raw materials, and distribution, the LG combination may therefore provide producers with a competitive edge (Verrier et al., 2014). This supports the numerous opportunities that the study presents to airline managers to achieve a sustainable competitive position in an intense, rapidly competitive and evolving market.

This research is also likely to offer new insights to airlines by identifying the challenges that may face the application of lean and green management practices, which makes airline managers prepared in advance to face those challenges related to human resources, waste and fuel management, rapid technological development, and resistance to change. This may lead to airline managers applying the latest methods of modern technology, paying attention to training employees on it and other environmentally friendly green practices, and being prepared to change the culture and vision of senior management to be compatible with lean and green management practices.

The purpose of this study was to determine whether lean and green management approaches may improve airlines' ability to compete. The current research proved that lean and green techniques have a positive impact on airlines' competitive advantage. The study also discussed the opportunities and challenges that airlines may have in applying lean and green management techniques. These findings showed that in order to maximize benefits for the airline and its stakeholders, airlines should integrate LG practices into their operations and customer services to achieve optimal performance. The concept has been internalized by many airlines, as seen by the prevalence of signs in maintenance facilities, crew lounges, and luggage piers at airports urging staff to adhere to lean and green principles. However, airlines that have fully adopted lean and green practices view it as a mindset and culture that systematically seeks and eliminates causes of waste, unpredictability, and inflexibility in operations instead of seeing them as only some of posters, one-off productivity fixes, and cost-cutting (Dichter et al., 2018).

To evaluate sustainability in a more comprehensive way, concentrating on environmental or corporate social responsibility, lean, green, and social management systems should be integrated. Overall performance will improve, along with financial gains, a stronger position in the market, and a better reputation (Haddach et al., 2016). Therefore, while cutting waste for consumers and the environment is usually the main goal of lean and green concepts, combining the two allows for improved triple bottom line performance and competitiveness (Teixeira et al., 2021).

Therefore, in order to achieve the concept of sustainable airlines, lean—an integrated socio-technical system—needs to be supplemented with green practices (Tortorella et al., 2017). From an internal perspective, this requires that LG practices have a strategic orientation, with top management's backing and leadership connecting them to strategic planning. Furthermore, it's critical to establish a culture that values knowledge management derived from experiences and empowered, trained individuals. From an external perspective, the industry needs rules and standards, supply chain integration using the right and moral use of tools and procedures, fortifying partnerships, and including all internal and external stakeholders (Caiado et al., 2018).

Furthermore, recent research (Inman and Green, 2018) noted that while lean methods can benefit the environmental pillar, their effects are amplified when combined with green practices. According to Caldera et al. (2019), this means that using LG to transition to sustainable business practices will help airlines—especially small and medium-sized companies contribute to the circular economy more quickly. Given the existing high costs associated with financing, raw materials, and distribution, the LG combination may therefore provide producers with a competitive edge (Verrier et al., 2014).

3.5.3 Future studies

In terms of limitations, the following should be acknowledged: First, the target population of this study was only airlines working in the Egyptian market. So, further studies could be carried out to test the lean and green practices in different countries. Second, this study used a mixed methodology. Therefore, future studies should also examine the mediating and moderating variables like attitude, government policies and procedures, environmental awareness, organizational commitment, and organizational culture between LG practices and their relationship with CA. Finally, future research should focus on how the integration of LG practices can impact airlines' sustainable development and their indirect impact on competitive advantage.

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الملخص العربي

النهج الأخضر- المرن: خطوة نحو تعزيز الميزة التنافسية لشركات الطيران

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قسم الدراسات السياحية- كلية السياحة والفنادق- جامعة مدينة السادات

الملخص

اكتسب النهج الأخضر-المرن أهمية في قطاع الخدمات. يُعد بمثابة نهج حديث يجمع بين الإدارة الخضراء ومبادئ التفكير المرن في نموذج واحد. يمكن أن يساعد التنفيذ المتزامن لهذا النهج شركات الطيران على تحسين كفاءة الموارد، خفض التكاليف، الحفاظ على البيئة، والحفاظ على قدرتها التنافسية. على الرغم من أن هذا النهج يحقق العديد من الفوائد لشركات الطيران، إلا أنه لا تزال هناك العديد من التحديات. الهدف العام من هذا البحث هو استكشاف الممارسات والفرص والتحديات التي يواجهها النهج الأخضر-المرن في شركات الطيران في مصر. علاوة على ذلك، تقوم هذه الدراسة أيضًا بتقييم تأثير تنفيذ ممارسات هذا النهج على الميزة التنافسية لشركات الطيران. بناءً على المنهجية المختلطة، أجرت هذه الدراسة (18) مقابلة شبه منظمة مع خبراء في شركات الطيران العاملة في مصر. علاوة على ذلك، تم توزيع استبيان منظم على (89) من المديرين والعاملين بشركات الطيران لفحص تأثير تطبيق النهج الأخضر-المرن على أعمال شركات الطيران. وتشير النتائج التجريبية إلى أن ممارسات النهج الأخضر-المرن لها تأثير إيجابي على الميزة التنافسية لشركات الطيران. تكشف المقابلات أن ممارسات هذا النهج توفر فرصًا واسعة لشركات الطيران من خلال تعزيز القضايا التالية: إدارة المخزون، خفض التكاليف، خدمات العمليات الأرضية، السلوك البيئي للعملاء والموظفين، سير العمل والأداء التشغيلي، صيانة الطائرات، استهلاك الوقود وإعادة التدوير، والاستدامة. توضح النتائج أيضًا مجموعة من التحديات التي قد تواجهها شركات الطيران عند تنفيذ ممارسات هذا النهج؛ مثل مواكبة التطور التكنولوجي، سياسات تدريب الموارد البشرية، مقاومة التغيير، ثقافة الإدارة، إدارة النفايات، ووقود الطيران المستدام. وأخيرًا، تم مناقشة الآثار المترتبة على الممارسة وكذلك البحوث المستقبلية.

الكلمات المفتاحية: التفكير المرن، الإدارة الخضراء، النهج الأخضر- المرن، شركات الطيران، الميزة التنافسية.