Journal of Air Transport Studies

In association with

ATRS
Air Transport Research Society

Volume10 - No2
Summer 2019

Hellenic Aviation Society

The *Journal of Air Transport Studies* (JATS – ISSN:1791-6771) is a peer reviewed journal aiming at publishing high quality research related to air transport. JATS is interested in publishing papers primarily focusing on economics, geography, policymaking, management, marketing, operations, technology, logistics/supply chain management and modelling.

The Journal is published electronically twice a year, i.e. in January and July by the Hellenic Aviation Society (www.aviationsociety.gr). The Winter issue usually contains papers (subject to changes) originally presented at the Air Transport Research Society (www.atrsworld.org) Conference of the previous year(s) whereas the Summer issue may be occasionally dedicated to a special theme. The Journal is accessible online free-of-charge.

Journal of Air Transport Studies (JATS)

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Volume 10, Number 2, Summer 2019, ISSN:1791-6771.

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- Forsyth P. (2002a), 'Privatization and Regulation of Australian and New Zealand Airports', *Journal of Air Transport Management*, 8, 19-28.
- Papatheodorou, A. (2008) The Impact of Civil Aviation Regimes on Leisure Market. In Graham, A., Papatheodorou, A. and Forsyth, P. (ed) *Aviation and Tourism: Implications for Leisure Travel*, Aldershot: Ashgate, 49-57.
- Skycontrol (2007) *easyJet welcomes European Commission's decision to limit PSO abuse in Italy*. 23rd April. Available from: http://www.skycontrol.net/airlines/easyjet-welcomes-european-commissions-decision-to-limit-pso-abuse-in-italy/ (accessed on 22/08/2008).

Industry Perspectives are usually shorter than full research papers and should provide a practitioner's point of view on contemporary developments in the air transport industry. Contributors should explicitly specify whether their views are espoused by their organization or not.

Conference Reports should be between 1,000 and 1,500 words. They should provide factual information (e.g. conference venue, details of the conference organizers), present the various programme sessions and summarize the key research findings.

Book Reviews should be between 1,000 and 1,500 words. They should provide factual information (e.g. book publisher, number of pages and ISBN, price on the publisher's website) and critically discuss the contents of a book mainly in terms of its strengths and weaknesses.

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for additional sources of revenue, airlines and airports became aware of the potential of air cargo. In this study, the competitiveness of European airports with respect to air cargo will be discussed. The relevant characteristics determining the competitiveness of an airport with respect to air cargo are identified by an extensive literature review and by interviews with industry-specialists. These characteristics can be divided into four different components: territory, air cargo market place, airport operations and product differentiation. Each component consists of a number of factors affecting airport competitiveness for cargo. This study can be used by airports to help assessing and enhancing its air cargo strategy, whereas (potential) shareholders are given an additional instrument to check whether an investment in an airport makes would be viable or not.

Konstantinos Marinakos and Ioulia Poulaki

Air transport and tourism development are considered to be two closely related concepts. According to international literature, one of the most important modes of passenger transport around the world is air transport, thus affecting the economic development of many areas, especially those isolated geographically and touristically, as well as local tourism businesses. Understanding the scale of these impacts is important not only for the development of tourism businesses and the local economy, but also for policy makers who make strategic decisions. Most studies focus on the impact of large airports on the national and regional economy, while much less attention has been given to the impact of airports on regional destinations. This study, exploring the potential of the Tripoli military airport in Greece as a civilian airport, seeks to analyze the functional relationship between small regional airports and local tourism businesses, the results of which can contribute to the financial planning and organization of a destination.

Emmanuel Chukwuka Bardi

This study aims at analyzing the spatial patterns of domestic air passenger traffic generated by the interacting city-pairs in Nigeria's air transportation system at five points in time – 2003, 2006, 2010, 2014 and 2018 to establish the spatial and temporal changes that have taken place over time. It also examined the relationships between the populations of the cities and the volumes of domestic air passenger traffic generated by the cities to establish the impact of population on the traffic generating capacity of the cities. The volumes of domestic air passengers handled by each city, the percentage share of total traffic, the populations of the cities, the Pearson's Product Moment Correlation Coefficient and the student's 't' test were used for the analyses. The study revealed that Lagos was the dominant domestic air passenger traffic generation centre. It established that few centres generated most of the domestic air passenger traffic in Nigeria and that the spatial pattern of traffic generation tended more towards concentration than dispersal. The study also found that there were statistically positive relationships between the populations of the cities and the volumes of traffic generated by the cities. Balanced regional development is recommended, among others, to help redistribute population among the cities in the air transportation system in Nigeria so as to increase their air passenger traffic generating capacity.

JOURNAL OF AIR TRANSPORT STUDIES, VOL. 10, ISSUE 2

EDITORIAL

This issue presents five papers focusing on a variety of topics related to the contemporary air transport environment.

In the first paper, **Angeline Ram, John F. O'Connell, Marina Efthymiou** and **Eric Tchouamou Njoya** investigate whether safety behaviour within Canadian Air Carriers is aligned to the objectives of the Safety Management System (SMS) given that the importance of safety within an organization is determined by the implementation of a SMS, organizational culture, management commitment and behaviour, the activity of staff themselves, and the degree to which safety reporting is upheld. Since Canada was the first country globally to implement regulation mandating a Safety Management System (SMS) programme, a primary research was undertaken to identify areas of improvement based on the opinions expressed by the interviewed safety experts.

Accessibility and connectivity to facilitate tourism development in a destination is the topic of the second paper where **Dalida Messian, Ioulia Poulaki** and **Konstantinos Marinakos** highlight the contribution of funding and investments in tourism development related to the destination's transport infrastructure focusing on air services. Paros Island is the destination selected as the case study, since it presents high interest due to recent funding and investments actions towards air transport sector. More specifically, the existence of a Public Service Obligation (PSO) route between Athens and Paros and the recent local airport expansion, partially funded by the private sector investment action, determine Paros as a noteworthy practice to be investigated.

In the third paper **Thomas Vaan Asch, Wouter Dewulf, Franziska Kupfer, Hilde Meersman, Evy Onghena** and **Eddy Van de Voorde** study the competitiveness of European airports with respect to air cargo, illustrating the relevant characteristics that determine the competitiveness of an airport, identified by an extensive literature review and by interviews with industry-specialists. Authors postulate that these characteristics can be divided into four different components: territory, air cargo marketplace, airport operations and product differentiation, with each component consisting of several factors affecting airport competitiveness for cargo.

Subsequently, **Konstantinos Marinakos** and **Ioulia Poulaki** explore the potential of the Tripoli military airport in Greece for civil aviation use, seeking to analyze the functional

relationship between small regional airports and local tourism businesses. The results of their study can contribute to the financial planning and organization of a destination, given the positive impact of air transport on tourism development when destinations experience an improvement in accessibility; this is especially the case for geographically isolated areas.

In the fifth paper **Emmanuel Chukwuka Bardi** analyzes the spatial patterns of domestic air passenger traffic generated by the interacting city-pairs in Nigeria's air transportation system at five points in time in order to establish the spatial and temporal changes that have taken place over the examined period. The relationships between the populations of the cities and the volumes of domestic air passenger traffic generated by the cities are also examined to establish the impact of population on the traffic generating capacity of the cities. The study revealed that Lagos was the dominant domestic air passenger traffic generation centre, highlighting that few centres generated most of the domestic air passenger traffic in Nigeria and that the spatial pattern of traffic generation tended more towards concentration rather than dispersal.

On behalf of the Editorial Board, I would like to extend my thanks to all the authors and reviewers for their hard work and contribution to this issue of the *Journal of Air Transport Studies*. We believe that these papers provide a valuable contribution to aviation research but may also be of significant added value to air transport practitioners.

Professor Dr Andreas Papatheodorou
Editor-in-Chief

HOW SAFE IS SAFE? A CANADIAN AIR CARRIERS (CAC) SAFETY BEHAVIOR INVESTIGATION

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ABSTRACT

The importance of safety within an organization is determined by the implementation of a Safety Management System (SMS), organizational culture, management commitment and behaviour, the activity of staff themselves, and to what degree safety reporting is upheld (Cohen, Wiegmann and Shappell, 2015). Canada was the first country globally to implement regulation mandating a Safety Management System (SMS) program. Many Canadian air carriers (CAC) proudly announce safety as a top priority, which is achieved through their SMS program. Amidst aviation's verbal safety saturation, safety is often communicated as the top priority within the industry; however, are the public declarations consistent with CAC practices? This paper investigates whether safety behaviour within CAC is aligned to the objectives of the SMS. In-depth interviews with seven senior safety experts were conducted to identify areas of improvement and a survey with 164 respondents. This research found that there are many areas of improvement of the safety performance of CAC. Factors, which affect safety reporting behaviour and the priority of safety, include management's support of a safety culture, job function, and the number of air carriers an individual has worked for. This research also suggests that a job function that was created to instil public confidence is more likely to deviate from safety procedures and less likely to report. A template for safety success, which influences organizational culture resulting in economic viability output, is proposed and recommendations for safety culture enforcement by the regulators.

KEYWORDS

aviation safety, Safety Management System, organizational culture, Canadian Air Carriers, safety management.

1. INTRODUCTION

Population growth, global aging and middle class growth has contributed to the development of air transport (Efthymiou et al., 2016). Aviation is a highly regulated industry where the word safety is scribed on walls and documented through regulation and standard operating procedures. Nevertheless, safety incidents are quite common and with the constant growth of aviation safety incidents will only increase unless transport authorities do not prioritize safety. In 2012, the Office of Auditor General of Canada communicated that Canadian aviation's principal obligation was to sustain safe air travel (Office of Auditor General of Canada, 2012). With this declaration, however, its implementation as a stated priority is not consistent with observed practices within organizations.

Several scholars have researched safety. Murphy and Efthymiou (2017) researched the aviation safety regulation in the multi-stakeholder environment. Janic (2000) looked at risk and safety in civil aviation and the main causes of aircraft accidents. Kelly and Efthymiou (2019) analysed the human factors in fifty aviation accidents and identified 1289 individual causal and contributory human factors with unsafe actions and preconditions for unsafe actions being the main subcategories of the accidents. O'Connor et al. (2011) and Gill and Shergill (2004) researched safety climate/culture in aviation. Pidgeon and O'Leary analysed organizational safety culture and identified the implication for aviation. Wiegmann et al. (2009) discussed the key organizational indicators of safety culture and the various assessment methods.

Cohen et al. (2015) suggest that the importance of safety within an organization is determined by the implementation of a SMS, organizational culture, management commitment and patterns of behaviour, the activity of staff themselves, and to what degree safety reporting is upheld. This paper investigates the underpinning factors that influence the priority of safety using Canada as a case study.

This article is organized as follows. In section two, an exhaustive literature review discusses the global aviation's safety perspective. The literature review provides a roadmap of factors that contribute to safety. These factors include management commitment/behaviour, organizational culture, SMS, financial benefits of safety, and employee perception and safety behaviours. Research has identified that multiple factors influence front line staff's perception and behaviour towards safety reporting as well as the relationship between safety and cost.

In section three, the research methods and analysis for the mixed-method approach of both quantitative and qualitative data are identified. In section four, the perspective of experts through exploratory analysis establishes five reoccurring themes, which are interlinked: management commitment, organizational culture, and effective implementation of a safety system. In section five, data analysis shows that both respondents and experts identify that safety is not the number one priority as a stated commitment, yet most respondents believe that safety should be considered when making a business decision. In the final section, the article is concluded by reiterating the importance of management commitment and the necessity of regulator enforcement of Accountable Executive participation in the safety system. Six recommendations to the regulator, a template to promote organizational safety culture and SMS by middle management and front-line staff titled Management in Middle (M in M) is proposed as well as further research topics.

2. STATE OF THE ART REVIEW OF SAFETY AREA

In the mid-1990s, at the commencement of the organizational era, the notion of organizational accidents was born (Reason, 1997). By understanding how accidents occurred within an organization, conditions, which allow for an undesirable outcome could be mitigated (ICAO, 2013).

James Reason's accident causation model, known as the "Swiss Cheese" model, is widely accepted by ICAO, academics, and aviation in explaining how accidents occur. Reason's theory draws on the relationship of the various layers that constitute an organization, while researchers like Edgar Schein (1985) explain why organizations behave as they do.

2.1 Safety Culture

The concept of organizational culture is multi-layered and complex. ICAO (2013) states, culture is characterized by the beliefs, values, biases, and resultant behaviour that are shared by members of a society, group, or organization (ICAO, 2013). Edgar Schein (1985, p6), defines culture as:

A pattern of basic assumptions, invented, discovered or developed by a given group; that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel concerning those problems.

Schein further adds that culture is comprised of subcultures specific to departments or groups of people who comprise an organization. In the context of aviation, this suggests that the subculture for job functions all differ.

Zhang (2002, p1406) suggests that safety culture is observed through behaviour from members of an organization. Research from a sample of 1,751 respondents including: captains, first officers, pursers and flight attendants surveyed showed that crew of a lesser status (all participants other than the captain) preferred to remain silent in order to maintain a "positive team dynamic" than speak up (Bienefeld and Grote, 2012, p10). This silence is in direct conflict to Crew Resource Management training which is taught to all operational aviation staff and reiterated annually in the interest of safety promotion and silo deconstruction (Bienefeld and Grote, 2012).

Wiegmann et al. (2017) have determined that an organization's upper-level management has long been recognized as playing a critical role in promoting organizational safety culture. While Antonsen et al. (2016, p232) add that an organization's behaviour and communication greatly influence the outcome of safety-critical decisions. Employees not only mirror the behaviours of management, but also those of co-workers, to understand what behaviours are acceptable (Pinion et al. 2017). When the underlying beliefs within an organization (culture) establish behavioural norms, most employees aspire to fit into an organization's culture (Schein, 1985).

Despite variations in safety culture research, the recurring factors identified within organizational safety culture by aviation research academics such as Wiegmann et al. (2017) and Zhang et al. (2002) include management commitment, employee behaviour, and safety reporting; which all contribute to the priority of safety in air transportation.

2.1.2 Management Commitment

Wiegmann et al. (2017) suggest that upper management is an essential component in creating an organization's safety culture. Commitment to safety is reciprocal between management and employees. Yuan et al. (2015, p165) affirm that when employees feel that there is a concern for their safety and well-being, they are motivated to fulfil safety and job requirements. Varmazyar et al.'s (2014) research establishes that commitment to safety in organizations directly correlates to resources provided by upper management, inclusive of training and equipment in addition to the safety measures implemented (Von Thaden and Gibbons, 2008).

Bosak et al. (2013) add that management's attitude toward safety impacts acceptable levels of risk. Lu and Chen (2015) contend that when management leads by regulatory requirements and strategy, such as the documented processes of the regulatory framework of SMS, the focus is on efficiency and not the safety interests of individuals. Gillen et al. (2004, p248) emphasizes the impact of management's actions, stating that the way safety policies are implemented is also important to workers, so that they can respect, rather than resent, the enforcement.

2.1.3 Communication

The messages most often communicated have a positive or negative impact on the workforce and encourage motivation, participation or lack thereof (Huang et al., 2017). The information disseminated throughout the organization further reinforces the perception of employees' safety beliefs. Bosak et al. (2013) indicate that consistent safety communication demonstrates management's commitment to safety. Somoo (2012, p12) suggests that demonstrated written and verbal commitment and involvement in the organization's safety indicates management's commitment to assuming ownership of the organization's safety program.

Wiegmann et al. (2017) corroborate that communication, verbal and in writing, is only one aspect of an organization's commitment to safety. Management's commitment to tangible safety is equally as impactful as the subconscious effects of their communications and interactions with stakeholders.

Lin (2012), whose research focused on the impact of policies on the pilot group, proposes that efforts to enhance safety will not be readily accepted if employees are unable to identify what messages or policies are communicated. Additionally, Lin (2012) adds that if management's messages are incongruent with employee actions, feelings of animosity may arise.

Zohar and Polachek (2014) suggest that changes in messages from management result in altered priorities, which trickle into behaviours that are only measured during safety audits. If managers state that the personal safety of their employees is of the utmost importance, yet fail to act on safety concerns, the manager is implicitly communicating that the priorities of employees are not as important as previously communicated. Von Thaden et al. (2008, p5) assert that obscurity in management's messages may encourage employees to place less value on safety while making it acceptable to cut corners where safety is concerned. Pinion et al. (2017) conclude that when managers and top-level leadership explicitly and implicitly express safety values through verbiage and behavioural modelling, employees will follow suit.

2.2 Concept of Safety

The word safety has been synonymous with aviation since the inception of the International Civil Aviation Organization (ICAO) in 1944. ICAO (2013, p2-1) defines safety as the state in which the possibility of harm to a person or of property damage is reduced to, and maintained at or below, an acceptable level through a continuous process of hazard identification and risk management. In contrast with the Cambridge Dictionary, ICAO establishes that safety is a state with an acceptable level of risk; the standard dictionary definition refers to a state of being or with free or danger or risk free (Cambridge, 2017; ICAO 2013; Siegenthaler, 2015).

ICAO (2013, p2-1) suggests that as long as safety risks are managed to organizations acceptable levels, a dynamic safety can effectively balance production and protection (Siegenthaler, 2015). Further dimensions of safety include culture, reporting, performance indicators, risk, risk management, and oversight (ICAO (2013).

Risk management is an essential component of safety management. According to ICAO (2013, p5-1) SMS is meant to assure the safe operation of aircraft through effective management of safety risk. The SMS is designed to continuously improve safety by identifying hazards, collecting and analyzing data, and continuously assessing safety risks. To ensure that states are meeting SMS requirements, ICAO requires system oversight by regulators.

2.3 Safety as a Business Function

Aviation's SMS expectation is that risk management is incorporated into business decisions and managed similarly to a business management activity. The process includes a review, performance oversight, and financial monitoring (ICAO, 2013). Lercel et al. (2011) affirm that the safety program's financial oversight allows for tracking costs associated with safety events and cost-saving through safe practices.

Håvold, who studied safety programs in the petroleum sector, agrees with Lercel. Håvold (2010, p513) states that an organization with a 'safety culture' is one that gives appropriate priority to safety and realizes that safety must be managed in the same way as other areas of the business by being included in the business plan.

Gnoni and Saleh (2017) suggest that historically importance was not placed on safety improvement throughout an organization. However, Gnoni and Salehl (2017), and Marcario et al. (2015) agree that the prioritization of safety assists in the prevention of accidents. Von

Thaden and Gibbons (2008) argue that a SMS should be viewed as a necessary business investment.

2.4 Financial Benefits of Safety

Profitability is paramount to the survivability of aviation as an industry (Efthymiou et al., 2019; Efthymiou and Papatheodorou, 2018; O'Connell et al., 2020) and accident prevention supports profitability. In 2014, the world witnessed the financial effects suffered by Malaysian Airlines (Hodgson et al., 2015). The New York Times (2014) published that the airline, which was under financial difficulty before the accidents, suffered an increased quarterly loss of USD 97.6 million compared to $55.9 million in the previous quarter. Hodgson et al. (2015, p35) suggest that the impact on Malaysian Airline's reputation with passengers was one from which they failed to recover, with a decrease in sales, an increase in flight cancellations, and refunds requested from passengers despite reduced fares and free ancillary offerings. Hodgson et al. (2015, p34) add that Malaysian Airlines lost 40% of its customer base because of the first accident and following the second accident (within four months),80% of the customer base had chosen other air carriers.

Lercel et al.'s (2011, p9) study of a Maintenance Repair Organization (MRO) demonstrates inadequate safety management of one event associated with the incorrect installation of a door connector following painting. One event costs USD 27,000. Due to inadequate action, the same event occurred four times that year, with a total of $108,000 to rectify the damage. Lercel et al. (2011) estimate that the MRO would have seen a 983% return on investment if a system had proper SMS action been taken resulting in a suitable corrective action. With thin profit margins in aviation, a financial loss of any kind further impedes revenue streams. Identifying safety gaps or repetitive damage drives profitability in the long-term.

As of March 2019, global aviation has witnessed the grounding of all B737-Max aircraft following the 2018 Lion Air Crash followed by the 2019 Ethiopian Airlines Crash. In August 2019, the Federal Aviation Association (FAA) of the United States of America issued a statement stating the FAA (2019) commitment to return safe aircraft into service.

In January 2020, the FAA communicated the importance of extending SMS into various aspects of American Aviation, including the certification process (FAA, 2020). The absence of adequate safety controls has cost Boeing an estimated loss of $40 million in the last quarter of 2019 (Flight Global 2019).

2.5 Safety Culture and Safety Management

Somoo (2012, p12) links organizational culture to SMS arguing that effective safety management requires senior leadership responsibility in establishing a safety culture. Somoo's safety culture versus causation model shows the interrelationships between the implementation of an SMS program and safety culture. This model establishes that positive organizational safety culture impacts management's commitment and safety promotion, which results in the successful implementation of a safety management system. This relationship between SMS and safety culture is further explained by Gordon et al. (2007, p. 674) who describe safety culture being less tangible than the system yet working hand in hand to achieve safety within an organisation.

2.6 Defining Safety in Canada

The Canadian Aviation Regulations (CARs) do not define the word safety but do define its management through the Safety Management System. Both ICAO and Transport Canada Civil Aviation (TCCA) strive for an elimination of aircraft accidents and serious incidents (ICAO, 2013; Transport Canada, 2008), with one major divergence as detailed in TCCA Advisory Circular No 107-001. TCCA recommends (2008) that CAC communicates the expectations of zero incidents.

Without a definition of aviation safety, or reference to ICAO's definition of safety, employees of CAC may not know ICAO's definition of safety and may subscribe to a ubiquitous understanding of safety. Adding to the misperception, (ICAO, 2013), a goal of "zero incidents", if taken literally, would indicate that CAC believes a goal of "zero incidents" is a realistic benchmark (Transport Canada, 2008). TCCA (2008) expects CAC to strive for "zero safety incidents" achieved through an SMS. However, by the very definition of aviation safety, safety refers to a reduction in risk rather than an elimination.

Without defining safety in Canadian aviation, subjective judgment calls from air carriers and regulatory inspectors may lead to variation in the implementation of safety regulations or focus, as observed by the author, who has worked in Canadian Aviation in various Safety Management roles. Such subjectivity means that safety errors and gaps are not uniformly and consistently managed. Subjectivity prevents a ubiquitous understanding and application of an organizational understanding of safety.

In Canada, eight airlines, have undertaken IATA's safety validation process (Transport Canada, 2017). All airlines that have IATA ratings are the largest carriers or subsidiaries of the largest carriers in the country and have benefited from international business, such as codeshares through this validation process. Of the Twenty-six non-IATA air carriers in Canada, most (19, or 70%) referred to safety on their website, and less than half (12, or 44%) referred to the use of a SMS[1].

It appears that most CAC has acquired and international safety best practice qualification and are assumed to operate at the minimum acceptable level of safety as outlined in the Canadian Aviation Regulations (CARs). However, the majority of CAC communicate the importance of safety and almost half promote the use of a safety system program to the travelling public.

3. RESEARCH METHODS

3.1 Methods to reach Research Objectives

The methodology in this paper is based on a mixed-method approach, which allows the consolidation of quantitative data from surveys, qualitative data from semi-structured expert interviews and responses from semi-structured survey questions. The mixed-method approach was chosen as a means to compare the opinions of those managing safety in Canada to those who are responsible for the implementation of safety practices. The survey and interview data were gathered under the condition of anonymity and approval of the ethics committee. Interviewees were given a number and descriptor.

Table 1 summarizes the method and approach used to accomplish the paper's aim. Given the regulatory framework and subjective execution of "safety" throughout CACs, three objectives have been identified.

Table 1. Research objectives and methodological approach

Objectives	**Approach**
Objective 1: *Conduct a comprehensive literature review identifying the underpinning factors which impact the priority of safety globally and how it is translated to CAC.*	*This objective was met by conducting a comprehensive literature review including publications from ICAO, TCCA, academic journals, trade books, and safety theses, in addition to attending Cranfield's SMS short course (2016) and*

[1]A concept not understood by the public and often misunderstood by aviation professionals.

	Wiegmann and Shappell's HFACS methodology workshop (2017).
Objective 2: *Conduct a case study with expert feedback regarding a robust SMS program, the priority of safety, and the support of sufficient resources and engaged management in upholding safety within CAC.*	This is the secondary objective of the article. This objective was accomplished by conducting semi-structured expert interviews with seven experts from the Canadian aviation industry, including experts from the TCCA and ICAOs Safety Management International Collaboration group. All interviews were analyzed for commonalities to identify trends.
Objective 3: *Comprehend the perception of safety management culture from the perspective of CAC employees, and identify the impact of organizational culture and how the views of the experts align with the practical world.*	This is the final objective of the article. Due to the limited and proprietary nature of the information of data in Canada aviation, primary exploration from the perspective of respondents from CAC was an essential component in collecting primary data unique to this topic. This objective was undertaken through an extensive, comprehensive semi-structured online survey of 164 responses from associates from Canadian air carriers. Following the structured questions, a short answer option was available for respondents. The data were analyzed in conjunction with expert opinions. Trends, commonalities, and differences were identified and reported.

3.2 Quantitative and Qualitative Approach

The survey was created online in Google Forms. The data collection was open from January 6, 2017, to February 21, 2017. The survey had a total of 16 questions; there was a combination of question styles; incorporating a five-point Likert scale ranging from "strongly disagree" to "strongly agree"; together with multiple choice, and ranking questions.

The survey was designed to incorporate key elements of previous research including organizational safety communication, task focus, and management as role models, reporting, and organizational culture. The survey questions included the following topics: demographics (4 questions), company safety perspective (Q1), management as an example (Q2), risk in aviation (Q3), role of TCCA & safety departments (Q4), deviation from procedures (Q5), work focus (Q6), communication (Q7), reporting (Q8-9), factors contributing to safety (Q10), and organizational focus and priority (Q11-12).

The survey link was disseminated to individuals who are known employees of CAC through the researcher's list of personal contacts on LinkedIn and Facebook. In addition, postings were

made on Facebook Canadian aviation chat groups2, inviting members' participation in the survey. Some primary recipients shared the link on their Facebook pages.

The qualitative approach consists of semi-structured interviews conducted with seven aviation experts. Interviews were administered in person, by phone, by email, or some combination thereof and recorded, then annotated. The sample for the qualitative research included Canadian aviation safety experts whose aviation experience ranged from 20-45 years, both in Canada and internationally, within various safety roles. The average in-person interview was 90 minutes long, involving discussion on approximately 24 questions. The semi-structured interviews provided a uniform format while still enabling experts the freedom to elaborate on specific topics. The interview questions were grouped into six categories: safety challenges, successful implementation of SMS, measuring safety culture, Reason's "Swiss Cheese" model and other models, which support an SMS, and the importance and priority of safety from their perspective.

Table 2. List of Safety experts interviewed

Expert Identifier	Area of Expertise
Expert 1	Director of Flight Operations, CAR 604/704 Operator – Business Aviation
Expert 2	Director of Safety, CAR 705 Operator – Commercial Aviation
Expert 3	SMS Manager, CAR 705 Operator – Commercial Aviation
Expert 4	Transport Canada – Regulator
Expert 5	ICAO Safety Management International Collaboration Group Member – Regulator
Expert 6	Director of Approved Training Organization
Expert 7	Manager Cabin Crew, CAR 705 Operator – Commercial Aviation

Qualitative data was also gathered from nine open response questions incorporated into the online survey. Examples of open-ended questions include: "we would like to know more about your thoughts regarding safety," and "if you disagree with this statement, please tell us why." All interviews were transcribed for data analysis.

The data were analyzed through descriptive statistics and both univariate and bivariate analysis. Categorical data were summarized using frequency and percentages. A chi-square test was used to explore relationships. A chi-square inferential test and cross-tabulation tables were used to quantify relationships between two categorical variables. All inferential analysis

[2] An example of a Facebook Aviation group is Canadian Women in Aviation.

was performed with 0.05 level of statistical significance. Content analysis was used to identify common themes from both the expert interviews and the open-ended survey questions.

4. CASE STUDY FINDINGS

To gain a better understanding of SMS and the priority of safety in Canadian aviation, seven aviation experts were interviewed. These experts have been instrumental in the development and/or implementation of SMS within Canada. The experts were asked to list the top three challenges faced in achieving safety in Canada. The top three areas of development identified include: management commitment, organizational culture, and implementation of an SMS.

Expert 6, having implemented multiple SMS programs within Canada, declares a lack of management commitment results from the belief that "a lot of airlines think that they are safe; it's like telling someone to eat well and exercise when they already feel good." Expert 6 adds "it is a stark reality that an accident or an incident will cost them so much more than a SMS...if they have an accident, it will wipe their company out."

Expert 2elucidates on the second top-ranking area of development and organizational culture, affirming its link to management. "Culture needs to be fostered from an organization and leadership; however, safety cultures vary with the leadership." Expert 2 describes the implementation of SMS as "not fully implemented as ICAO intended. We are gaining a better understanding of quality management into safety, and are moving from reactive to proactive to predictive, but slower than expected."

4.1 Safety Challenges - Implementation of National SMS

The challenges faced by the implementation of a national SMS framework are transverse to areas of safety development. These challenges include management commitment and implementation of their SMS program. Experts 4,5, and 6 agreed that continuous SMS momentum through organizational support (management commitment) is incumbent on successful implementation. Expert 6, who trained TCCA Inspectors and consulted with numerous air carriers at the onset of SMS regulation, asserts the importance of continuous improvement with SMS implementation. "I've come back after a year and found that organizations… have fallen back to the way they have done things in the past." Experts 4, 5, and 6 agree that SMS needs to be more than just regulatory compliance. Expert 5, a key

player in SMS development, expresses "it's not about compliance; it's about developing criteria that work for an airline. Expert 6 further adds "that is the whole point with SMS, they are supposed to meet the regulation and so much more. Expert 7 agrees with both challenges listed in Table 3, "consistent management commitment to the objective," is our limitation to SMS implementation.

Table 3. Challenges with SMS implementation as identified by the Experts

Challenges of SMS Implementation	**Experts Who Responded**
Management Commitment (continuous SMS momentum)	Expert 1, 3,4, 5, 6
Implementation of a system rather than regulatory compliance	Expert 4, 5, 6

In the absence of a one size fits all approach to successful SMS implementation, Experts 4,5, and 6 affirm that safety should be tailored to rectify the gaps and needs of each organization. The top three factors for successful implementation of SMS include management commitment, organizational involvement, and quality principles for SMS (table 4).

Table 4. Factors that contribute to successful SMS implementation as identified by the Experts

Factors that contribute to successful SMS Implementation	**Experts Who Responded**
Organizational involvement	Expert 1, 2, 3, 4, 5, 6, 7
Management Commitment	Expert 1, 2, 4, 5, 6, 7
Quality principles of SMS	Expert 2, 3, 4, 5, 6, 7
Risk control/mitigation	Expert 4,5,6
Reporting and feedback to employees	Expert 3
Incremental changes in the right direction	Expert 1

4.2 Safety and SMS Success

Experts' 1, 2, 4, 5, 6 and 7 opinions reveal that the challenges/areas of development for safety and SMS are identical to the factors that have contributed to the successful implementation of SMS: management commitment and organizational culture.

Expert 5 shared that successful implementation of a SMS can be achieved through a safety-conscious organizational culture, which is shaped by management. "A safety management system is just infrastructure unless you have a culture…which lays the foundation," and gives safety a high level of importance.

4.3 Success of National SMS in Global Comparisons

In benchmarking Canada's success with SMS implementation, experts were asked how they view the success of SMS to that of other countries. Experts 1, 3, 4, 5 and 6 agreed that Canadian aviation organizations have been progressive with the implementation of SMS. "We have moved regulation forward [in various capacities of aviation], although EASA may have done a better job" (Expert 5). Expert 3 states, "I believe it has been a great success because Canada was the first country to make it mandatory." Expert 4, having worked with SMS on an international level states, "ours is broader than [ICAO] Annex 19; we include an internal audit program. It's not a limitation, it's an enhancement."

Expert 1 compared Canada's SMS to that of the USA and concluded that Canada was progressive when compared to "third world countries,"[3] yet it fell short of effective implementation in comparison to the EU.

4.4 Measuring Safety Culture

The experts identified three commonalities in measuring CAC safety culture. These include adequate resources, management commitment, and regulatory compliance as shown in Table 5. Experts 4 and 5 attest that there is a relationship between resources, management commitment, and regulatory compliance. Adequate resources include the appropriate number of staff, staff training, resources for safety enhancements, and demonstration of a "just culture" environment. This environment supports a culture in which employees are comfortable raising concerns, are encouraged by management to be safety-minded, and where a safety program is fostered and promoted across the organization.

Experts 2, 4, 5, 6 and 7 agreed that adequate resources allocated to a safety department demonstrate investment in and value given to safety. When the "Accountable Executives supports safety, safety is given importance and value in an organization," Expert 7 states. Expert 2 adds that a company's commitment to an investment in a SMS program is "based on the Accountable Executive".

Experts 4 and 5 agree that the "compliance and effectiveness of a system is an indicator of culture. Expert 3 was the only one who identified reporting as an independent variable, and

[3]Although Canada's SMS was progressive when compared to that of "third world countries," it is noteworthy to add that that in 2011, countries listed on the Third World Human Development Index include Kenya, Ethiopia and Pakistan; all whose national airlines are IOSA qualified and code share internationally (Nations online, 2017).

as a measure of safety culture. However, Expert 2 maintains that the correlation of multiple factors contributes to safety culture. Expert 2 asserts: "Reporting is an indicator of a safety culture, but a reporting culture is not the only measure of a safety culture. Balance of operations and safety, and costs for safety investments, how we support our employees when they make mistakes, those are all other indicators."

Table 5. Top 3 attributes of safety culture

Top 3 attributes of safety culture	**Experts Who Responded**
Adequate Resources	Expert 2, 3, 4, 5, 6
Accountable Executive Support (management commitment	Expert 3, 3, 7
Regulatory Compliance	Expert 4, 5

4.5 Company Wide SMS Involvement

When asked if safety should be viewed as equally important to all individuals within an organization, most experts agreed that safety affects all employees and is equally important, as shown in Table 4. The perspective of Expert 1 differed from the others. "[Safety] should not be equally weighted in all departments" (Expert 1). Giving the example of the variation in job functions and exposure to safety, Expert 1 states, "a bomb disposal expert might want to have a greater focus on safety than the person who does his laundry." Expert 3 opposes the perspective of Expert 1, stating that safety should be equally important to all employees in an organization, though some job functions give it less importance.

Expert 2 describes the importance of a companywide involvement: "It is the organization which delivers safety, an organization is a system. The jobs which are performed are a part of the system, which includes safety reporting. Unfortunately, we describe safety reporting as SMS, but SMS is not a thing, it's a concept of safety as our organization, and all jobs affect the organization, because the system delivers safety."

5. DISCUSSION

This section includes the consolidation of 164 responses from the survey together with the inputs from expert interviews, in addition to open question responses.

Of all respondents, the largest job function represented were pilots (32%), followed by administrative staff (19%), and management (19%). Maintenance was least represented with only four respondents (2%). Many respondents listed multiple job functions as their primary

role. For analysis, we simplified job functions. For example, all participants who selected management and other job functions as primary were categorized as management. More than half (55%) of the respondents had ten or more years of industry experience. Many respondents (31%) had worked for four or more air carriers.

5.1 Perception of Safety for Canadian Air Carriers Survey

During the survey, respondents were asked to rate how strongly they agreed or disagreed with the following statements shown in table 6. Using the 5-point Likert rating scale, responses ranging from strongly disagree to disagree and agree to strongly agree were combined. They are reflected as agree and disagree.

Table 6. Survey Questions

Question Description
The Company's safety perspective/safety policy has a positive effect on my attitude towards safety.
My management provides and example of how to behave, think and act safely.
I find it necessary to modify safety/company procedures to make my job easier

5.2 Organizational Influences

Most respondents (69%) agree that their Company's safety perspective/safety policy positively impacts their attitude towards safety. Of the 164 respondents, one respondent who disagreed with the statement communicated the importance of individual responsibility. This respondent advised, "I have to be more vigilant in my attitude towards safety, to find things that others have overlooked, or to be fully aware of what's going on, possibly to exercise my right to refuse unsafe work." The top three common themes from open question responses are listed in Table 7.

Table 7. Common themes from open question responses

Themes	**Ranking**
The Company does not deliver/follow up on safety initiatives	1
Safety is only considered when it is a means to meet regulatory requirements.	2
Safety is only important to avoid liability issues	3

5.3 Management Behaviour

The majority (65%) of participants agreed that their management provides an example of how to behave, think, and act safely. These findings are consistent with Wiegmann et al. (2017, p126), who confirm that management has long been recognized as playing a critical role in promoting organizational safety culture. One respondent expressed that as management, they required a "daily push" specific to safety. Expert 5 corroborates the importance of a daily push. Expert 5 states, "certainly when it comes to safety there needs to be a demonstrated commitment by people, that you walk the talk. People are enthusiastic when they are working together with management… there is safety leadership". The top three common themes identified by respondents who did not agree with the statement are listed in Table 8.

Table 8. Common themes from open question responses

Themes	Ranking
Management are punitive with those who disagree with them.	1
Management violate regulation to generate revenue.	2
Management provide inadequate solutions/equipment	3

5.4 Modifying Procedures

With buy-in to safety policies, and management as an example for safety behavior, respondents (32%) agree with the statement "I find it necessary to modify safety/company procedures to make my job easier and more efficient". Dekker and Breakey (2016, p189) assert that when a clear majority of workers routinely avoid certain rules, this signals that the rules are not written with their legitimate interests and their knowledge in mind, or in ignorance of the goal conflicts and resource constraints that drive real work.

One respondent justified procedural shortcoming as follows: "procedures must be adhered to, but it's necessary to keep in mind that I am working with the travelling public and there may be another way to get the same procedure [al] goal accomplished more effectively."

Expert 6 suggests that the most important priority of companies should be "to get the procedures right". The response to this survey question shows that the majority of respondents (54%) disagree with the need to modify safety/company procedures. Table 9 explores the relationship with two categorical variables using the chi square, and 0.05 level of statistical significance. Industry experience, $X^2(4) = 3.58$, $p = .47$, and number of air carriers years worked for, $X^2(6) = 4.41$, $p = .62$, have no statistically significant association with the

statement "I find it necessary to modify safety/company procedures to make my job easier and more efficient (Q4)". For this question, job function is approaching statistical significance, $x^2(10) = 17.64$, $p = .06$, in comparison to the other categories.

The top three job functions that modify procedures to simplify their job and improve efficiency include: Maintenance (50 %), Admin/Other (46.9%), and Flight Attendant respondents (37%). With only four respondents from the Maintenance job function, it may be more accurate to remove them. With their removal, the top three job functions which modify procedures include Admin/Other, Flight Attendants, and Management (32.3%) respondents. The Pilots respondents are least likely to modify safety company procedure (17.3%). One respondent mentioned that procedures "make my job easier."

Table 9. Variables associated with the modification to safety procedures to may make job easier and more efficient.

Industry Experience	**Strongly disagree, disagree**	**Neutral**	**Strongly agree, agree**
3 years or less	44.1%	23.5%	***32.4%***
4-9 years	54.5%	12.5%	***35.0%***
10+ years	58.2%	12.1%	*29.7%*
Number of airlines worked for	**Strongly disagree, disagree**	**Neutral**	**Strongly agree, agree**
1	41.9%	16.3%	***41.9%***
2	58.1%	16.1%	25.8%
3	62.5%	12.5%	25.0%
4 or more	54.9%	13.7%	***31.4%***
Job Function	**Strongly disagree, disagree**	**Neutral**	**Strongly agree, agree**
Administration/Other	37.5%	15.6%	***46.9%***
Flight Attendant	48.1%	14.8%	***37.0%***
Maintenance	50.0%		***50.0%***
Management	61.3%	6.5%	***32.3%***
Operations	36.8%	31.6%	***31.6%***
Pilot	69.2%	13.5%	17.3%

Note: Bold and italicized values are statistically significant.

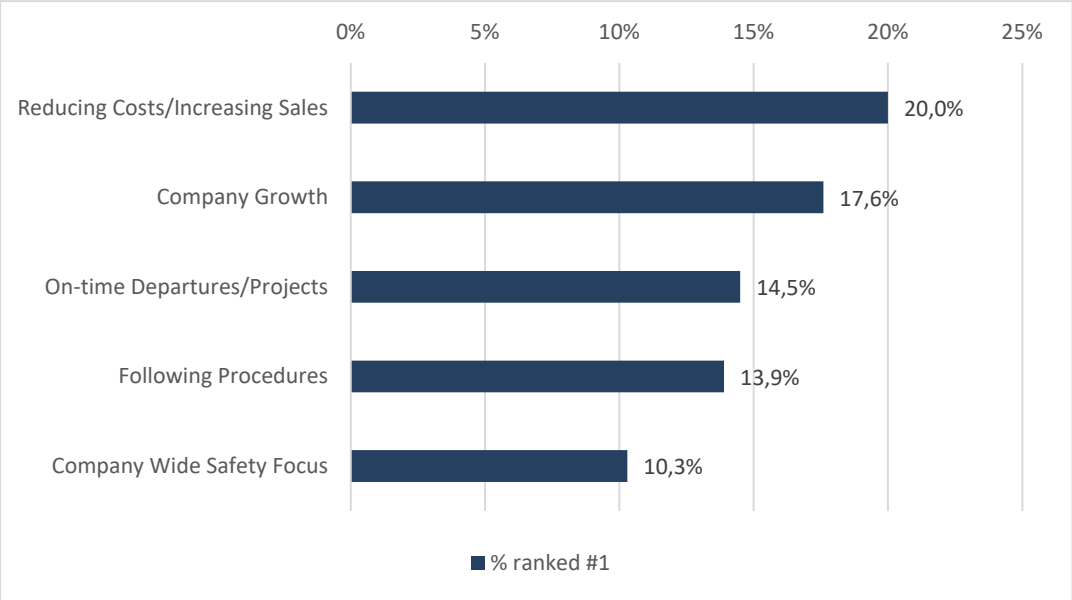
The top three common themes that justify deviation from the procedure are: procedures modified to simplify tasks, not complying with obsolete procedures, which are still in circulation, and procedures that are too stringent.

5.5 Communication

Although CAC specifies safety on their websites, the perception of the most communicated message by management within the last 12 months was cost. Expert 2's perspective explains why this inconsistency may exist. Expert 2 discloses that "marketing safety for the engagement of employees and to gain public confidence is easily understood when safety is considered the number one priority, however, we are in business to make money, and one way to make money is through safety, the overall objective is to make money."

Figure 1 shows that most respondents (20%) rank cost as the number one topic communicated to them in comparison to other messages. The overall message of cost is communicated twice as much in comparison to safety (10.3%). Although cost is most often communicated to respondents by management, respondents ranked decreasing cost and increasing revenue as their lowest priority of focus (12.1%). This question may infer that the messages communicated by management may not have an impact on work focus.

Figure 1: Most communicated management topics within the last 12 months



5.6 Reporting

The largest area of focus in the survey, which aims to understand the respondents' behavior, is safety reporting. Although reporting is a component of a SMS, reporting behavior from respondents allows the researcher to understand when and why employees contribute to the SMS.

The top three safety reportable observations that have not been reported include: procedural violations (24.2%), unsafe behavior (23.0%), and blocked fire exits, tripping or similar safety hazards (20.6%). The least unreported is a reportable safety event (an event required by the regulators/company to be reported) (6.7%). Respondents (50%) agree that their job exposes them to hazards, which need to be reported, and 55.2% had not observed any safety related reportable issues at work.

Experts 2, 3, 4, 5, and 6 agree that "conceptually people may believe that they do not see "a reportable occurrence, or that reporting parameters are either too narrow or broad" (Experts 4, 5 and 6). Experts 1, 2, 4, 5 and 6 communicate that they agree that the working environment is a factor, which inhibits reporting (organizational culture). Expert 5 expresses "if the safety culture is such that you don't have confidence that if you report something someone will get fired, it comes down to culture, how management supports things."

5.7 Organizational and Managerial Impact on Safety Reporting

Table 10 shows variables considered when exploring the relationships between a company's safety perspective/policy's impact on respondent attitude, management as a safety example, and an impact on reporting events, which include: unsafe acts, unsafe behavior, and unsafe working environment. Statistically significant differences were observed.

When exploring the company's safety perspective/policy across all six categories of reporting events, those who answered "agree" to the statement regarding the positive impact of the safety perspective/policy, are more likely to report safety events compared to the respondents who "disagree." A similar pattern was observed when exploring the relationship between management as a safety example across all six categories of reporting observed events. Those who answered "agree" that management provides a safety example are more also more likely to report events compared to respondents who disagree.

We found that management's behavior and actions have an impact on reporting in five out of six categories. The only event that management does not impact is a known safety event. The lack of statistical significance may be because such events are mandatory reportable as dictated by a regulatory requirement.

In exploring the sub-groups of disagree and agree there is a significant gap difference in reporting safety events. For example,58.8% of respondents who disagree with the statement "The company's safety perspective/safety policy has a positive effect on my attitude to safety", do not report unsafe working environments in comparison to the 10.5% who agree with the

statement and refrain from reporting unsafe working environment. That gap difference indicates that the group that disagrees with the statement is six times less likely to report than those who agree. Similarly, for the same safety event, 52% of the respondents who disagreed with the statement my management provides an example of how to behave, think and act safely do not report an unsafe working environment in comparison to the 8.3% who agree with management as an example. Once again, the gap difference indicates that the group that disagrees with the statement is six times less likely to report than those who agree.

Table 10. Exploring factors associated with not reporting safety events

Safety events observed, but not reported						
Related question/factor	Blocked Fire Exit, Tripping, or similar safety hazard	Procedural Violation	Safety Event	Unsafe Act	Unsafe Behaviour	Unsafe Working Environment
The Company's safety perspective/safety policy has a positive effect on my attitude towards safety.						
	X^2 (2) = 3.07 p=.22	X^2 (2) = 5.94 p=.05	X^2 (2) = 3.69 p=.16	X^2 (2) = 11.60 p< .01	X^2 (2) = 16.44 p< .001	X^2 (2) = 24.82 p< .001
Strongly disagree, disagree	35.3%	47.1%	17.6%	***47.1%***	***58.8%***	***58.5&***
Neutral	23.5%	26.5%	5.9%	***20.6%***	***29.4%***	***29.4%***
Strongly agree, agree	17.5%	20.2%	5.3%	***13.2%***	***15.8%***	***10.5%***
My management provides an example of how to behave, think and act safely.						
	X^2 (2) = 6.84 p = .3	X^2 (2) = 9.93 p < .01	X^2 (2) = 0.66 p = .72	X^2 (2) = 6.19 p < .05	X^2 (2) = 9.62 p < .01	X^2 (2) = 28.33 p < .001
Strongly disagree, disagree	***40.0%***	***36.0%***	8.0%	***32.0%***	***40.0%***	***52.0%***
Neutral	***18.8%***	***40.6%***	9.4%	***25.0%***	***34.4%***	***31.3%***
Strongly agree, agree	***16.7%***	***16.7%***	5.6%	***13.0%***	***15.7%***	***8.3%***

Note*: Shown percentages are for **not** reporting safety event, bold and italicized values are statistically significant.*

5.8 Job Function and Reporting

Table 11 shows that there is an association between job functions and reporting events. A difference exists in reporting rates based on job functions. Except for procedural violations and reportable incidents, the categories showed a statistically significant relationship. The Admin/Other category (37.5%) have not reported blocked fire exits, tripping, or similar safety hazards. The Flight Attendant job function responded with the largest percentage of not reporting procedural violations (40.7%), reportable incidents of unsafe acts (40.7%), unsafe behaviors (44.4%), and unsafe working environment (44.44%).

Table 11. Not reporting events by job category

	Blocked Fire Exit, Tripping, or similar safety hazard	Procedural Violation	Safety Event	Unsafe Act	Unsafe Behaviour	Unsafe Working Environment
Job category	X^2 (5) = 12.88 p=.02	X^2 (5) = 5.88 p=.32	X^2 (5) = 2.25 p= .81	X^2 (5) = 23.23 p< .001	X^2 (5) = 10.93 p< .05	X^2 (5) = 25.18 p< .001
Administration/Other	***37.5%***	25.0%	9.4%	***34.4%***	***28.1%***	***34.5%***
Flight Attendant	***18.5%***	40.7%	11.1%	***40.7%***	***44.4%***	***44.5%***
Maintenance	*0%*	25.0%	*0%*	*0%*	***25.0%***	***25.0%***
Management	***25.8%***	16.1%	6.5%	***6.5%***	***16.1%***	***3.2%***
Operations	***26.3%***	26.3%	5.2%	***10.5%***	***10.5%***	***5.3%***
Pilot	***7.7%***	19.2%	3.8%	***7.7%***	***17.3%***	***11.5%***

*Note: Shown percentages are for **not** reporting safety event, bold and italicized values are statistically significant.*

5.9 Organizational Focus and Priority

In response to what respondents believe, the most important organizational focus is, most chose profitability (35%), followed by safety (24%), and closely followed by customer service (22%). Respondents believe that employee welfare is of the least focus (3%).

Table 12. Top Priorities and Focus of the Companies and CAC, *n* = 164.

Focus categories	N (%)
Most important focus for the company as communicated by respondents.	
Profitability	58 (35%)
Safety	40 (24%)
Customer service	37 (22%)
Expanding the business	25 (15%)
Employee welfare	5 (3%)
What the priority of Canadian air carriers should be.	
Consider safety implications when making business decisions	73 (44%)
Focus on safety at all costs	48 (29%)
Focus on employee and passenger welfare	44 (27%)

The final question aimed to understand whether both survey respondents and experts believed safety to be the number one priority of CAC. Respondents (44%) believe that the priority is to consider safety implications when making business decisions. Likewise, all experts agree on the balance between safety and business practices. Expert 5 states:

'If you are not committed to safety, you will not be economically viable. Safety needs to be a consideration. As a number one priority, that is something we aspire to. People may always

say it, but it's not true. If you're managing your business effectively you will be looking at all aspects (of the organization). Safety leads to good economics'.

6. CONCLUSION AND RECOMMENDATIONS

For almost two decades, Justice Moshansky's (1992) declaration has led CAC to believe that there is a decision between safety and profitability; safety being the priority. The declaration of safety as top priority continuously is published throughout TCCA literature and CAC websites.

This research set out to investigate whether safety is the number one priority for CAC and the factors that influence the compliance with TCCASMS program objectives. Through this process, an awareness of what factors safety impacts and what safety has an impact on, were critical to understanding how it is understood by the regulator, industry experts, and employees of CAC.

This research demonstrates that safety as a stated priority by CAC, is in fact not in alignment with the perception of safety's priority. The respondents believe that profitability is the most important focus within their organizations based on the most communicated message. The choice between safety and economic viability must not be an option and should be rebranded to suggest that it is through safety we achieve economic viability. The idea that safety is a choice is false. It is through management's commitment and support in safety management that an organization is held adequately meets safety targets.

CAC management should consider how safety is positioned within an organization and encourage employees to actively participate in a SMS, while creating an effective safety system that incorporates all elements as outlined by the framework of TCCA. Wiegmann et al. (2017) state that if managers are seen to care about safety, employees may feel more engaged. When employees are personally invested in their safety and supported by their management, they are highly motivated to participate in safety initiatives. With the emphasis on organizations, they cannot be expected to operate independently of regulatory enforcement. Regulators must enforce safety requirements for categories of aviation in Canada, not just wide body high-density aircraft.

Safety is not just a set of regulations that are enforced by an inspector and documented through policy, processes and procedures. Measures for industry safety standards and best

practices have been established by both ICAO and the regulator but require the support and continuous support of management. Based on the finding, we recommend that regulators:

1. Establish a system that holds Accountable Executives responsible for safety. This may be accomplished through the development of third party approved safety audit organizations based on SMS, quality management principles, safety culture criteria, academic and practical standardized criteria that approves safety standards on behalf of the Regulator.
2. Ensure that all individuals responsible for financial decisions, which include the Accountable Executive, other executives and department leadership, attend mandatory safety management training with an approved safety program for leadership.
3. Promote safety and create a responsible and accountable safety culture. The Accountable Executives for all Canadian carriers are required to annually submit an annual plan for organizational safety culture management plan, key performance indicators, followed by a check for effectiveness mechanism such as an audit. This would be reviewed by an approved safety audit organization and certified as acceptable or unacceptable for the regulator.

This template suggests the importance of management's continuous involvement in the safety system (not to be confused with the management aspect of the system), and management's involvement in creating positive safety and organizational culture.

Through safety promotion from SMS data from the reported events or known high risk, information is communicated throughout the organization, placing an emphasis on front line staff and their direct managers (usually middle management). The next step requires that senior leadership commits to safety as an objective to promote profitability through risk management within the organization. Simultaneously, adequate resources, such as training, financial and manpower provided to the safety department. Middle management and employees set safety objectives based on data that has been promoted within the organization. As a result, middle management buys into safety as an objective to promote profitability, and internally, it is promoted within the team. Through this promotion, it feeds into the safety system and adds value to a successful safety culture through the unification of safety views and behavior. The result is economic viability through risk mitigation.

Areas of further research could include aviation's organizational influences on safety, competing priorities impact on safety, the impacts of executive management on aviation

safety, the regulators' role in mandating organizational safety culture and the Management in the Middle Template.

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FUNDING AND INVESTMENTS FOR TOURISM DEVELOPMENT: AIR TRANSPORT SERVICES IN PAROS ISLAND

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ABSTRACT

Tourism development in a destination may be achieved under specific conditions and circumstances which include sufficient destination accessibility and connectivity. This paper aims to highlight the contribution of funding and investments for tourism development related to the destination's transport infrastructure focusing on air services. Paros Island is the study case since it presents high interest due to recent funding and investments actions towards air transport sector. More specifically, Public Service Obligation (PSO) route Athens-Paros and local airport expansion, partially funded by the private sector investment action, are of high interest. Research methodology includes a secondary research of passenger traffic and hotel beds. Moreover, a primary research has been undertaken with personal interviews of tourism stakeholders of Paros Island regarding funding and investments on air services and destination's tourism development. Findings indicate that indeed air traffic flows have been significantly increased and so does tourism figures of the island.

KEYWORDS

Funding, investments, air services, tourism development, Public Service Obligation, airport

1. INTRODUCTION

Accessibility is strongly affecting the tourism development in a destination. Air transport has now reached regions characterized by discontinuity and the governments are aware of the importance of air services for a destination as a basic requirement towards its tourism development. Thus, there are funding released to ensure and support air connectivity, for example Public Service Obligation form of subsidizing regular air services (Hromadka, 2017). A holiday package requires transport time and cost. Thus, the generalized transport cost influences the choice of the transport mode. Air transport liberalization has led in the yield drop and thus, air transport is now more attractive than ever to the tourists. Consequently, the tourism development in a destination depends on the sufficient transport infrastructure, while destination expansion in international markets requires an airport able to serve such operations, i.e. an international airport (Prideaux, 1999).

The aim of this paper is to highlight the importance of accessibility to the islands, especially when it is ensured by funding and investments by the state governments and private sector in favor of social welfare, tourism and economic development. In Greece, the last contest for the Public Service Obligation routes included a significant change in the operational context of eight out of twenty eight air routes, including Paros Island that has been classified by Hellenic Civil Aviation Authority under the new PSO regime (more than one operator) that along with airport infrastructure improvement, co-funded by the state and private sector (runway extension and terminal expansion along with better services offered) have led to passenger traffic increase. Therefore, the new air transport environment of Paros is being investigated to examine its contribution to the island's tourism development.

In this context, this paper aims to investigate the case of Paros Island, which is a popular tourism destination that was accessible by ferry and limited serviceable by air until 2016, when above changes have been made in terms of funding and investments on the island's air services, so that is an exceptional paradigm to relate them with tourism development. Initially, literature review section develops funding and investments, air transport interrelation with tourism development and the framework of Public Service Obligations routes. Research methodology section develops the steps followed by the authors to conduct this study and end up in its findings and results. Summary of findings indicate that the research hypothesis is valid for the case of Paros. Finally, in the conclusion section, apart from the evident contribution of funding and investment in air services towards tourism development, the over-tourism threat is highlighted for Paros Island and thus, it is proposed for further research.

2. LITERATURE REVIEW

2.1 Funding and Investments

Funding is defined as the money given by a government or organization for an event or activity or for a particular purpose. In other words, funding is the act of providing financial resources, usually the form of money, or other values such as effort or time, to finance a need, a program or a project, usually by an organization or company. On the other hand, investments are defined as the action or process of investing money for profit. An investment is an asset or item that is purchased with the hope that it will generate income or appreciate in the future. More specifically, investing is the act of allocating funds to an asset or committing capital to an endeavor (a business, project, real estate etc.), with the expectation of generating an income or profit. In colloquial terms, investing can also mean putting in time or effort –not just money- into something with a long-term benefit.

There are several governmental bodies to fund actions or projects among member states of the EU in favor of social welfare or economic development. In Greece, General Secretariat for Investments and Development (NSRF) includes the Public Investments Program. As Public Investments are all the fixed and intangible investment activities of the State, which, in the context of the investment and economic development policy in general, aim to redistribute national income for the benefit of the society. The Public Investment Program is the country's most important development policy tool contributing to further convergence of regions, strengthening social congestion through targeted actions and interventions to stimulate active demand, promoting sustainable development, enhancing employment, enhancing economic and social justice and supporting competitiveness. Investments included in the Public Investment Program and their expenditure are covered by the Public Investment Budget and concern –among others- constructions, reconstructions and expansions of installations or projects (NSRF, 2019).

2.2 Funding and Investments for Tourism Development

Tourism is an important sector of economy and its development is heavily related to the funding and investments on the fundamental aspects of tourism industry. Hospitality, transportation, promotion and distribution often need to be funded by public and private sectors in order to ensure quality of tourism products or services offered by the destinations. Investments on information and communications technology, infrastructure, education and energy may prove necessary for the future of tourism sector in continuously changing and high demanding consumption patterns. In the Guide on EU Funding for the Tourism Sector

(2014-2020), European Commission has released the types of support to the member states via several direct and indirect funding schemes, such as European Fund for Strategic Investments (EFSI), European Regional Development Fund (ERDF), Horizon, Employment and Social Innovation (EASI) among others, highlighting the tourism related actions eligible for funding, defining the ability of application and the level of funding and illustrating examples of selected projects. Especially, when it comes to EFSI, strategic infrastructure including digital (investment platforms dedicated to tourism), energy (energy efficiency of hotels and tourism resorts)and transport (travel infrastructures such as regional airports and ports) may be supported by such funding scheme (European Commission, 2016). In particular, the latter is indeed considered as very significant to the tourism development of a destination since it is highly related to its accessibility degree since destination's connectivity and tourism mobility is heavily dependent on it. Admittedly, air transport is the favorite transport mode for international tourism, since in 2017 the 57% of inbound tourists has been arrived in the destinations by air (Lock, 2019), while the increase of international tourist arrivals in 2018 is partially driven from improved air connectivity (UNWTO, 2019). Undoubtedly, air transport contributes to tourism development and reasonably, member states invest to the optimization of air transport networks via EU or national funds.

2.3 The contribution of Air Transport to Tourism Development

Mobility entails overcoming a distance from the origin to the destination requires time and cost. Thus, accessibility can be measured as the time and the cost an individual need to spend to access a destination. Economic geographers advocate the significance of the accessibility degree for a place towards its economic development and abundance. Being part of a transport hub-and-spoke network that ensures accessibility to a city or town is essential for the economic activity of a place as very significant due to enormous consequences for its economic prosperity (Poulaki and Papatheodorou, 2011; Ayoama et al., 2011).

On the other hand, according to International Civil Aviation Organization (ICAO, 2019) connectivity is based in the concept where "movement of passengers, mail and cargo involving the minimum of transit points which makes the trip as short as possible with optimal user satisfaction at the minimum price possible". Air transport connectivity is a catalyst to the economic development (ICAO, 2015), the employment, the trade and the mobility in Europe. Therefore, European Union aims to ensure connectivity of its remote regions with urban centers in each country. Local economies of remote regions are more attractive to business activity when they enjoy sufficient connectivity and mobility expansion. A good means of

tackling this problem is the imposition of a public service obligation (PSO) that ensures the interconnection between Europe's outermost regions and urban centers (Hromadka, 2017).

Accessibility depends on various factors in addition to the availability of transport modes and related infrastructure such as frequency of services and fare levels. (Papatheodorou 2002). Increased levels of accessibility may enhance the tourism flows that lead local governments to implement tourism development strategies that usually include transport infrastructure improvement or even construction. On the other hand, when the demand for a tourist destination increases, current infrastructure should be improved to meet it and enhance destination competitiveness (Crouch, 2011). Crouch and Ritchie (1999) advocate that the success of tourism is intertwined with the performance of sectors such as transportation, contributing to the prosperity and quality of life of the local community too. Consequently, air transport may prove very significant for the tourism development in a destination and for this reason governments ensure funding schemes to facilitate air transport services in regions with low accessibility degree. Besides, after air transport liberalization, low cost carriers penetration were characterized as market generators for many undiscovered destinations due to new routes launched by them with low fare availability (Pender and Baum, 2000). Facilitating accessibility of a tourist destination results in its development. Areas characterized by geographic discontinuity and deprived of infrastructure are subject to Public Service Obligation (PSO) regime in order the state government to ensure, via subsidies, the potential of transferring passengers to and from urban areas. This is a global practice and is frequently met in the literature, mainly regarding the islands, where traffic experiences an increase generating so from local residents' transfers, as from tourists that tend to explore accessible destinations. Consequently, air transport contribution to tourism development is obvious in such destinations.

2.4 The Public Service Obligation Regime

A public service obligation hereinafter referred to as a PSO is defined as "a form of service of general interest in which a State may subsidize (fund) a service to ensure adequate provision of scheduled air services to a regional or developing region or to any regional airport considered vital for economic development but it is not commercially viable" (Hromadka, 2017: 6). The state intervenes, with the obligation of public service, a form of state funding intended to ensure for these services the determination of regular air service, with continuity and pricing or minimum capacity. In Europe, Public Service Obligations (PSOs) is a documented policy

(concerning services, frequencies, scheduling and fares) aiming to provide air connectivity to places that under normal circumstances would have lacked them (Fageda et al., 2018).

European PSO routes are characterized by high heterogeneity and discretional criteria among countries in terms of subsidization and market protection. In order not to affect competition (Merkert and Williams, 2010), public service obligations in the EU are allowed only under very specific conditions laid down in Articles 16-18 of the Air Service Regulation (European Commission, 2008) No. 1008/2008 concerning the rules for the operation of airline services in the community.

Public Service Obligations are developed within the legal framework of the European Union. In practice, however, the choice of reserved routes, the decision on the amount of subsidies, the fixing of fares and levels of service, etc. is done by national governments of Member states (European Commission, 2019).A variety of policies have been implemented to support airline services on non-viable routes. Although they share a similar philosophy they have remarkable differences and implications from a public policy perspective, so according to Fageda et al., (2018) grouped these policies into specific categories: a. Route based funding policy, b. Passenger based funding policy, c. Airline based funding policy and d. Airport based funding policy.

In Greece, Public Service Obligation regime concerns route based policy, where the national government via the ministry of transport and Hellenic Civil Aviation Authority subsidize 28 routes upon airline bidding contest, following Commission's criteria on non-viable air connections that need to be operated for social welfare and economic development (European Commission, 2017). However, such markets are protected by the entrance of other carriers during the contract time, since the air carriers bidding to operate the routes.

3. EMPIRICAL CONTRIBUTION

3.1 Paros as a study case

Paros is the third largest among Cyclades Islands complex located in the center of the Aegean Sea, with area of almost 200 square kilometers and 120 kilometers coastline. As a tourism destination, Paros is very popular, not only due to the beautiful beaches but also due to marvelous sightseeing. Regarding Paros transport system, a sufficient road network ensures accessibility across the island, a port located in Parikia -the capital of the island, which offers

ferry connections to Piraeus, the Greek main port close to Athens, and to Lavrio in the southeastern Attica region. Paros also has a local national airport. Before the summer of 2016, the runway was the shortest one in Greece with 800 meters length, i.e. only specific aircraft type could operate there. More specifically, small turboprops of less than 50 seats connected Paros with Athens International Airport. For this reason route was not considered as viable since airline operations used to be extremely limited and given the tourism demand of the island, air services were considered to be insufficient to meet it and the flights that connect Paros with Athens are under Public Service Obligation regime usually operated by the fleet of Olympic Air as the appropriate one for the airport's restrictions in payload. Therefore, in July 2016 the effort of expanding air transport system in Paros was completed. It started in 2012 and its budget reached 15.2 million Euros (Naftemporiki, 2016). Project completion was achieved in two main axes. Initially, local airport was expanded with funding coming from the state through the Public Investment Program (HCAA, 2016) and partially from the private sector investments (Olympic Air - Aegean Airlines' subsidy). Further to the improvement of the airport (no longer such payload restrictions), in the last PSO contest in July 2016 as well, 8 among 28 PSO routes had been handled differently to be operated by two or even more airlines if the financial compensation was null, i.e. without being funded but under the market protection of PSO regime, when the annual funding used to be more than 4 million Euros (HCAA, 2016). Thus, the route is now being served by two airlines that operate with bigger aircraft types due to longer runway. International commercial flights have been launched as well. Consequently, Paros Island is now more accessible by air and arrivals have been increased. For these reasons, Paros is an exceptional paradigm to be investigated in terms of funding and investments in air services towards tourism development.

3.2 Methodology

Empirical methodology includes an extended secondary research data analysis with regards to passenger traffic evolution and seasonality, accommodation units and beds annual change. Data has been collected from various sources. Furthermore a primary research is undertaken and concerns personal interviews with representatives of bodies and institutions involved in tourism and air transport of Paros Island, to extract qualitative data, developed via open-ended questions on air transport latest changes in Paros Island and their contribution to the destination tourism development, adjusted each time to each representative. Interviews were further supported by open discussion on the research hypothesis, since each participant, apart from their point of view, developed additional information based on the institution they represented. Furthermore, secondary data were extracted from the websites of tourism

institutions such as INSETE, Hotel Chamber of Hotels, Hellenic Statistical Authority etc.) as well as from the Hellenic Civil Aviation Authority where, after personal contact, the information on Paros airport improvements were provided along with passenger traffic statistics.

Regarding interviews, representatives participated in the research were:

a. the President of Paros' Municipality Tourism Committee
b. the Head of Network Planning and Scheduling of Aegean Airlines
c. the Airport Manager of Paros National Airport
d. the President of Paros' Hotel Association

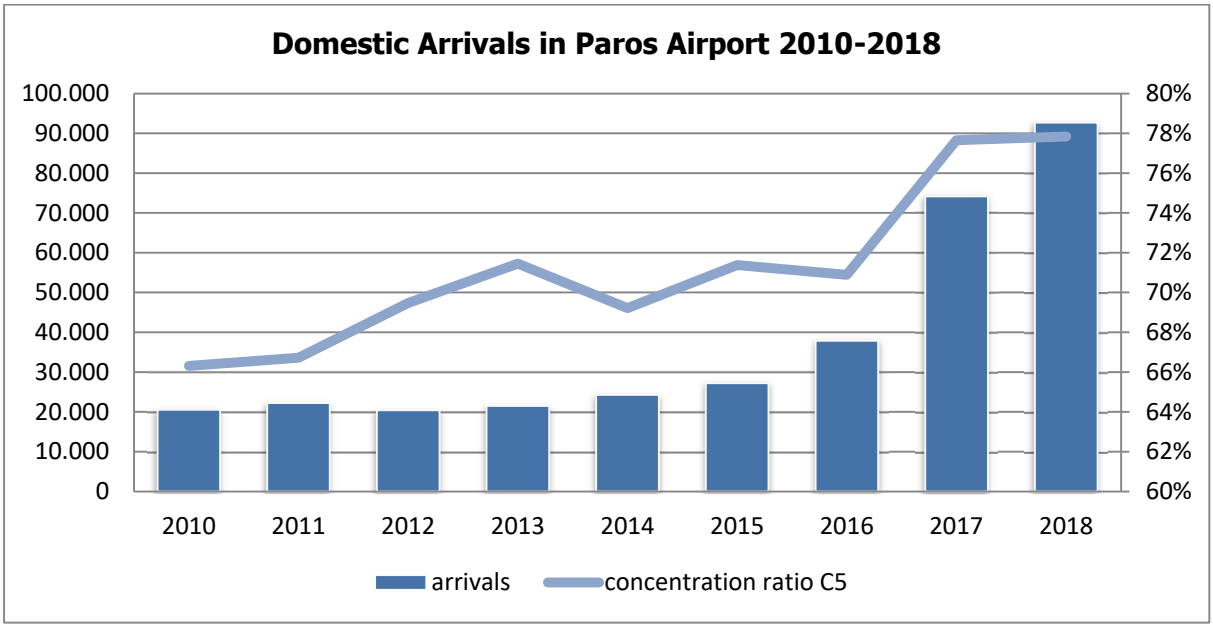
An effort to access Sky Express, the other airline that operates Athens-Paros PSO route, was made but without response. Admittedly, the participants covered all aspects of the research hypothesis providing with insights the issue of funding and investments for tourism development focusing on air services.

4. SUMMARY OF FINDINGS

4.1 Quantitative Data Analysis

Figure 1 indicates than since 2016 there is a significant increase in domestic passenger traffic. Given that improved airport infrastructure was released by July 2016 as well as the changes in PSO regime of route Athens-Paros by then, reasonably such increase is lower for this year (half period). On the other hand, full years 2017 and 2018 highlight the contribution of the evolution in air transport services of Paros Island. More specifically, inn 2017 the domestic passenger traffic has been doubled compared to the previous year, while in 2018 the increase reached the 25%. Additionally, as per Figure 2, international passenger traffic started to appear in Paros National Airport by 2017, that such operations were enabled, contributing with more than 1500 passengers, while such figure was doubled in 2018. Thus, the expectations of both flows (domestic and international passengers) are high for the future of tourism in Paros. It is worth mentioning that concentration ratio C5, ie traffic concentration in months May-September has been dramatically increased lately, indicating that the traffic difference in 2017 and 2018 concerns mainly leisure tourism activity.

Figure 1. Domestic Arrivals in Paros National Airport 2010-2018



Source: Hellenic Civil Aviation Authority, 2019 – processed by authors

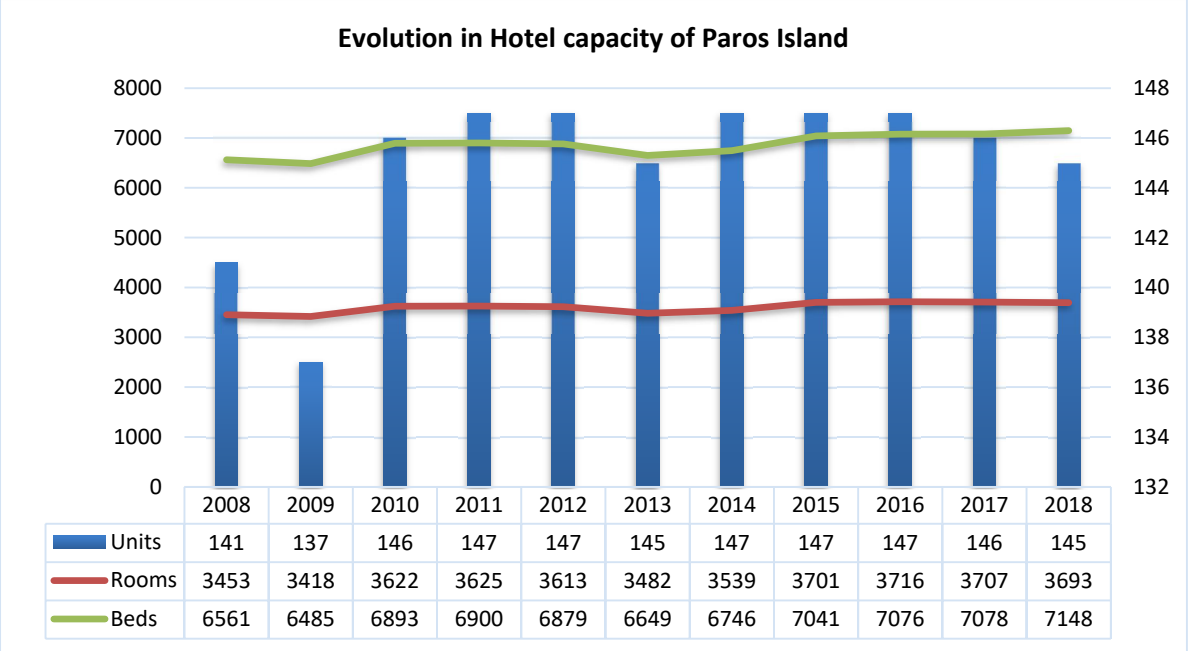
Figure 2. International Arrivals in Paros National Airport 2010-2018

Source: Hellenic Civil Aviation Authority, 2019 – processed by authors

Interestingly, hotel capacity in Paros Island has been differentiated for the period 2016-2018, when the air passenger traffic has been dramatically increased (Figure 3). However, this is not happening for the rooms to let capacity that has been increased by 26% in terms of beds (Figure 4). It seems that the booming in tourism flows has led to this direction, following the trend of the latest years where many underutilized private properties have been transformed

into accommodation units to meet the tourist demand in urban centers and tourist destinations.

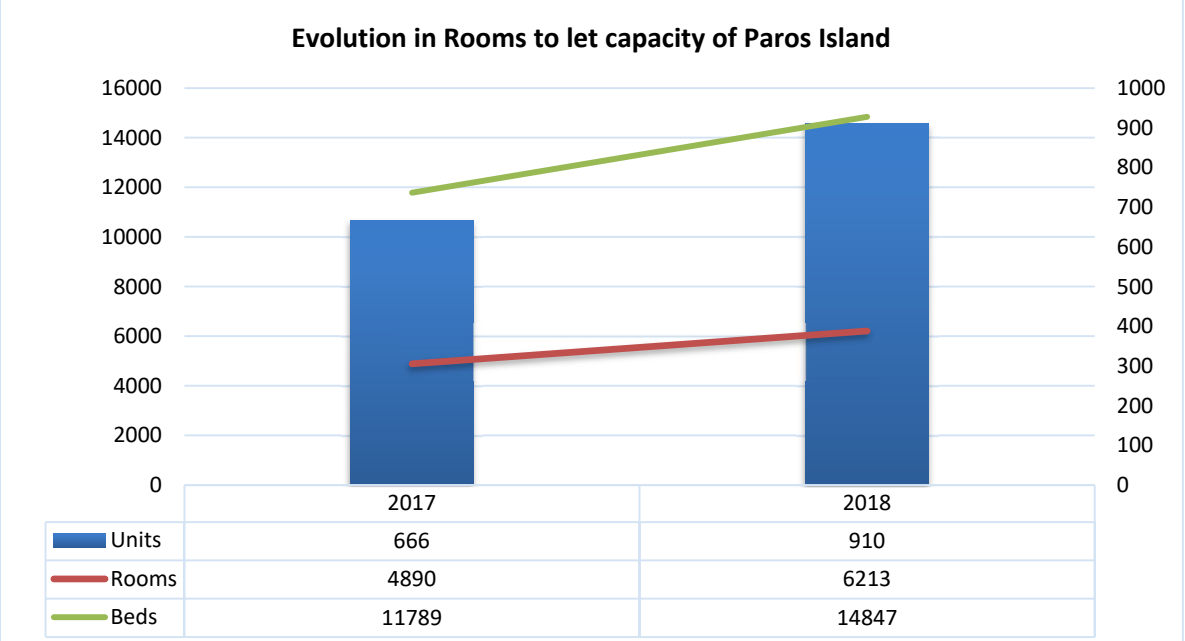
Figure 3. Evolution in Hotel capacity of Paros Island 2008-2018



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Units	141	137	146	147	147	145	147	147	147	146	145
Rooms	3453	3418	3622	3625	3613	3482	3539	3701	3716	3707	3693
Beds	6561	6485	6893	6900	6879	6649	6746	7041	7076	7078	7148

Source: Hellenic Chamber of Hotels, 2019 – processed by authors

Figure 4. Evolution in Rooms to let capacity of Paros Island 2017-2018



	2017	2018
Units	666	910
Rooms	4890	6213
Beds	11789	14847

Source: Register of Tourism Enterprises, 2019 – processed by authors

4.2 Qualitative Data Analysis

Interview with the President of Paros' Municipality Tourism Committee

The President of Paros Municipality Tourism Committee was referred to airport's further expansion when it comes to runway (initially 1800 and later 2200 square meters) and terminal station, highlighting that international flights require custom services which have not yet been implemented in Paros national airport but there is a plan for it. Moreover, he stated that Paros' Municipality has conducted an environmental study related to airport operations and expansion to limit the effect towards the island and its residents. Regarding Athens-Paros PSO route, he argued that as long as the airport permits limited operations in terms of capacity, tourism is not particularly enhanced solely by it. However, after airport's expansion arrivals have been significantly increased, while the expectations are even more optimistic with current situation in air services to permit a more intensive promotion of Paros as a tourism destination in national and international tourism related exhibitions. Finally, the President of Paros' Municipality Tourism Committee stated that indeed, there are additional infrastructure projects that need to accompany such tourism figures' increase. Some of them have already started and other have been planned to, concerning mainly port infrastructure improvements, water infrastructure, waste management that will help to rebuild and protect the existing ecosystem and to upgrading and further development and competitiveness of the island of Paros, and will improve the day-to-day and quality of life of the island's residents and visitors.

Interview with the Head of Network Planning and Scheduling of Aegean Airlines

Paros airport improvement have been partially funded by private sector upon initiative of Olympic Air, which have been operating for many years the route Athens-Paros with small turboprops, aiming to expedite capacity increase for the summer season of 2017. Hellenic Ministry of Transport approved the fund and Olympic Air contributed to the first phase of passenger terminal as well as to the surrounding area of the airport. In question regarding Olympic Air's potential funding for other airports, the Head of Network Planning and Scheduling stated that at the moment there are no plans for such action but due to the strong sense of responsibility towards airline's passengers and Greek people as the major carrier in Greece, Olympic Air would not hesitate to repeat it. Moreover, in the crucial question of the research regarding the contribution of PSO route towards tourism development of the island, he argued that such context assures the minimum service an airline should offer as it initially serves local residents optimizing their accessibility to the urban centers contributing in the economic and social development, while it mitigates seasonality phenomenon in tourism destinations. Olympic Air serves fifteen PSO routes and the Head of its Network Planning and

Scheduling stated that the subsidy does not cover the real operational cost of the route. However, for the case of the islands with payload restrictions due to small runways, it is evident that the fewer seats an airplane has, the higher cost per available seat kilometer (CASK) for the airline. Nonetheless, PSO routes are quite significant in an airline's network due to hub and spoke system efficiency optimization.

Interview with the Airport Manager of Paros National Airport

The most responsible for the new airport of Paros, it manager, stated that the changes in the infrastructure concern mainly the bigger aircraft type that may operate in the island. That does not mean only more people and more tourists but also less flight cancellations due to weather conditions which are equally very important. Moreover, regarding the changes in the PSO regime, he argued that competition has led to fare drop and more frequencies even for the winter season, while currently there is business activity in the airport (airline offices, car rentals, ground handling companies, restaurants and this is predicted to be enhanced in the future. General Aviation is also more active since the airport schedule has been extended. Nevertheless, a twenty four hour operation needs to be done including terminal and runway further expansion, customs and passport control. Paros airport manager advocates that PSO regime has contributed to the tourism development of all routes involved as initially it benefits the local residents. The change of this regime has definitely led to the enormous traffic increase with future potentials.

Interview with the President of Paros' Hotel Association

According to the President of Paros' Hotel Association, airport expansion enhanced the international profile of the island when it comes to the tourism markets of Europe. Despite the mode of transport when accessing Paros, income flows have been increased due to the internationalization of the island by the new airport infrastructure. However, runway and terminal expansion are required for the future, while customs and ground handling services should operate to substantially accept international flights. He stated that indeed the contribution of the changes in air services of Paros island have contributed to the tourist traffic increase which is obvious mainly from May to September. Hotel capacity has also been increased with a new big five-star hotel unit to operate in June 2019. Nonetheless, he postulated that further tourism development requires additional infrastructure projects like new accommodation units. Peak period is characterized by issues regarding water supply, drainage system, road network and port congestion and there is a need for project to facilitate the hospitality for the increased number of tourists on the island. It is important, however,

that there are accommodation units not certified for their quality with the deadline to breathe out by the end of 2019.The president of Paros hotel association finds seasonality extension more feasible now with improved local airport, highlighting the need for an integrated cooperation between the responsible institutions of the island towards sustainable tourism development and natural resources protection from over-tourism. He finally stated that Paros Island as a destination is targeting higher education and income level of tourists and for this reason, alternative forms of tourism such as religious tourism and gastronomic tourism, among others, are also being developed aiming to extend the tourist season.

5. CONCLUSIONS

The development of a tourist destination is heavily affected by a wide range of factors that differentiate the supply and influence the demand that depend on the continuous changes in consumption patterns. The air transport sector is a prerequisite for the very existence of the tourism industry and its development. Therefore, funding and investment schemes are provided towards air transport services enhancement to increase accessibility degree of tourist destinations.

As far as the island of Paros is concerned, Public Service Obligations funding scheme by the European Union has benefited the island ensuring air connectivity of the Island in an evolving regime in favor of service optimization to meet the high tourist demand before and after the airport's expansion upon investment actions by Public Investment Program and private sector (Olympic Air) as well that permitted the airline operations without payload restrictions and bigger aircraft types. Consequently, domestic traffic has significantly increased, and international traffic appeared in Paros National Airport. Private sector investment has been driven by the increased demand for the popular tourist destination that may be translated to higher connectivity flows in the Aegean Airlines –Olympic Air hub-and-spoke network. Admittedly, funding and investments in air services of Paros Island has contributed to the tourism development of the destination as quantitative data analysis has shown, with rooms-to-let capacity to have been significantly increased.

Nonetheless, it is generally accepted by all interviewees that the island in its peak months with existing infrastructure cannot accommodate more visitors. As mentioned in the qualitative data analysis, peak period is characterized by issues regarding water supply, drainage system, road network and port congestion and there is a need for project to facilitate the hospitality

for the increased number of tourists on the island, especially upon the airport expansion. Once the above projects are done Paros Island, as a tourist destination will be able to expand into new markets without dealing with the threat of over-tourism having significant potential for further development and, at the same time, the character of the island along with the quality of life of the inhabitants will not be altered. Furthermore, the projects that are or will be implemented are based on and are part of the strategic plan of the Municipality of Paros for the sustainable development of the island with the aim of improving the quality of life of the islanders taking advantage of the existing financial opportunities.

Paros is a popular tourist destination with high quality of tourist product provided. It covers a wide range of requirements for visitors whether they want a quiet family holiday or a vacation with intense fun and nightlife. Alternative forms of tourism such as religious tourism and gastronomic tourism, among others, are also being developed aiming to extend the tourist season. Suggested further research concerns 2019 as a key year to compare with previous ones, in terms of hotel capacity, as it is expected to experience an increase. Moreover, it would be essential to study if the carrying capacity of the island is exceeded in peak period, following destination life cycle concept.

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AIR CARGO AND AIRPORT COMPETITIVENESS

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ABSTRACT

Historically, airlines and airports considered air cargo as a by-product. However, by looking for additional sources of revenue, airlines and airports became aware of the potential of air cargo. In this study, the competitiveness of European airports with respect to air cargo will be discussed. The relevant characteristics determining the competitiveness of an airport with respect to air cargo are identified by an extensive literature review and by interviews with industry-specialists. These characteristics can be divided into four different components: territory, air cargo marketplace, airport operations and product differentiation. Each component consists of several factors affecting airport competitiveness for cargo. This study can be used by airports to help assessing and enhancing its air cargo strategy, whereas (potential) shareholders are given an additional instrument to check whether an investment in an airport makes would be viable or not.

KEYWORDS

air cargo; airport strategy; airport competitiveness

1. INTRODUCTION

For a long time, air cargo was considered a by-product of passenger services in air transport; airlines and airports paid little attention to the air cargo segment. However, things changed considerably during the last decade and most airlines and airports have created their own cargo strategy as both were looking for additional sources of revenue. Declining yields in the passenger segment, as well as improved cargo payload capacity of new aircraft types have led air cargo to become a logical way for traditional airlines to expand their portfolios. For many airlines, cargo nowadays makes an important contribution to the profitability of the long-distance passenger routes offered (Amaruchkul and Lorchirachoonkul, 2011; Zhang, 2003; Zhang and Zhang, 2002). While air cargo accounts for only 1% to 2% of total freight by weight transported globally, it represents 35% of trade expressed in value (ATAG, 2018). Because of its speed and reliability, typical air cargo goods include pharmaceutical products, electronics, perishable goods (e.g. flowers and fruit), urgent shipments, valuable goods and e-commerce (Alkaabi and Debbage, 2011). Air cargo transport is predicted to grow 3.51% until 2022 (Kupfer et al., 2017), whereas Boeing (2018 and 2016) forecasted a yearly growth rate of between 2.3% to 4.9% until 2035. These growth numbers are primarily driven by the growing Asian market and the flourishing e-commerce segment.

Macário (2008) defined the role of airports as: "*(…) providers of a high technological demanding infrastructure, of national strategic interest, for very sophisticated operations where safety played both a very distinguished and distinct role*". Historically, airports were state-owned entities, especially because of the large investment costs. Adler and Liebert (2014) confirmed the widely adopted idea of airports facing significant economies of scale. Airport competition has been considered as non-existing for a long time and airports were viewed as natural monopolies. However, since two decades, the situation has changed and the idea of airports being monopolies lost its support. Adler and Berechman (2001) mentioned that "*airports can be regarded as organizations that make decisions about how to use their inputs (e.g. number of runways) to produce specific outputs (e.g. service satisfaction)*". This does not mean that all airports take the same strategic decisions. On the contrary, depending on the airport characteristics, different strategies can be observed. Therefore, an analysis of the cargo characteristics of an airport and its impact on airport strategy can give important insights for future development and growth of the airport, especially because of the increasing focus on carrying goods by air in today's globalized economy.

Although interest in air cargo has increased, limited academic literature is available on the competitiveness of airports with respect to cargo. Studies about the role of the freight forwarder in the business (e.g. Adenigbo, 2016) were found in the literature as was research on the role of integrators at an airport (e.g. Malighetti et al., 2016). The impact of full freighters at an airport (e.g. Budd and Ison, 2017) and the issue of night curfews (e.g. Oosterlynck and Swyngedouw, 2010) have also already been discussed in the literature. However, no single study is known which focuses on airport competitiveness with respect to cargo from the strategic perspective of the airport. This study aims to fill this research gap. More specifically, this study will focus on the different factors that contribute to the competitiveness of an airport with respect to air cargo. To capture the myriad of factors that play a role, an extensive literature review was performed and was supported by additional semi-structured interviews with industry representatives[1]. With this, we attempt to identify which factors determine the competitiveness of an airport with respect to air cargo. The remainder of this study is structured as follows: the next section will give a general introduction into airport competition. Section three will present the relevant factors for airport competitiveness in the cargo segment and the last section will discuss the results and conclude.

2. AIRPORT COMPETITION

In the mid-eighties, the European aviation market was described as "a world of non-competing airlines [that] has been mirrored by a world of non-competing airports" (Barrett, 2000). Since then, things have changed dramatically. Airline deregulation initiated competition between airlines and airline alliances, and subsequently led to (some) competition between (hub) airports (Starkie, 2002). Moreover, the privatization and commercialization of airports made airport competition an increasingly important issue. Forsyth (2006) indicated that airports under public ownership were perceived as natural monopolies that were not competing with each other. The commercialization and privatization trend that took place in the aviation industry could not completely neutralize this monopoly power and the author sees this as a good reason to justify price regulation on airports. Graham (2014) confirmed this view on

[1] Semi-structured interviews were conducted with several different airports within Europe. Furthermore, representatives from integrators, freight forwarders, NPO's, last-mile delivery companies, airlines and customs were also interviewed about their opinion on the output of the literature review. Basically, most industry-specialists agreed with the output and only minor changes were made on the airport competition components. The identity of the interviewees is confidential and known by the supervisors.

airport competition but added that both the formation of global alliances and the emergence of the low-cost market segment further opened up competition between airports. Copenhagen Economics (2012) found some additional reasons for the changed business environment in which airports are competing nowadays. Next to the development of low-cost airlines, commercial and technological changes, for example, growing incomes in combination with lower airfares meant that passengers could more easily spend money at airports and make more trips by air. Also, the fact that more people have internet access means that better and more accurate information is available to passengers concerning different airline and airport options (Copenhagen Economics, 2012; Forsyth, 2006; Graham, 2014).

Airports can compete with each other in different ways, and therefore, airport competition can have several forms (Forsyth, 2006). First, airports are in competition with each other for a particular type of traffic, e.g. low-cost traffic or cargo. Next, airports are in competition with each other to attract hub carriers and – closely related to this – also to attract home carriers. The location of the airport is highly influential in the competition between airports, though not necessarily only in the catchment area. Also, competition for concession revenue is seen as important by Forsyth (2006). Graham (2014) revealed that if airports are located in the same catchment area, there is often one dominant player and one secondary airport. Whereas the dominant player can be seen as a major airport, the latter could be an overspill airport, focusing on a particular traffic segment (e.g. short-haul business flights, low-cost flights or cargo). In assessing the competitiveness of an airport, the substitution possibilities also have to be considered. The threat of a new airport is often perceived to be quite low; however, the competition from other transport modes is apparent. High-speed railways are not only a viable alternative for short-haul, but possibly also for medium-haul passenger flights. Better road and railway infrastructure, in general, makes it more convenient to reach major airports. This lowers, for example, the need for feeder services from regional airports. Substitution is clearly highly dependent on the type of traffic one takes into account. However, airfreight, using air transport for its speedy and reliable service, often has a very limited number of alternatives available (Graham, 2014).

Competition between airports is further intensified due to three typical characteristics of the airport industry. Airports are largely fixed costs businesses which are active in a two-sided market and are geographically fixed, a fact confirmed by Starkie (2002). Another important competitive pressure for airports is the threat of airlines switching between airports, as was

found by Copenhagen Economics (2012). However, a study by IATA refuted that airlines can easily switch between airports (IATA, 2013).

The previous paragraphs show that the argument of airports being monopolies has lost most of its support; however, airports still have some locational monopolistic power. Airports are located in a specific area and it is often difficult to add new capacity in that area. Forsyth (2006) verified a (limited) locational natural monopoly for two or more airports in the same city. Even in an oligopolistic market with limited capacity, competition is imperfect. Furthermore, airports realize scale economies and new airports face entry barriers such as the unavailability of land and opposition from politicians and people for environmental reasons. Another barrier for competition is the excess demand and subsequent congestion of some major airports. On the one hand, major airports are often negatively impacted by congestion. However, it is unlikely that a new airport can take advantage of this situation because passengers and airlines do not see the new airport as a viable substitute but rather as an inferior product (for example, the lack of connections). However, those airports are often preferred by freight carriers because some of these carriers traditionally prefer to fly into secondary airports as do low-cost carriers. The impact of the government (be it by regulation or subsidies) is also hampering smooth competition between airports.

Airport competitiveness with respect to cargo is a very specific research area and limited academic research has been undertaken in this domain. The next section will introduce the relevant factors that determine the competitiveness of an airport within the cargo segment. Section three will start with a global overview of the factors taken into account in this study, with a further elaboration of each.

3. FACTORS DETERMINING THE AIRPORT COMPETITIVENESS FOR AIR FREIGHT

An extensive literature review was performed to identify the various factors determining the competitiveness of an airport with respect to air cargo. The identified factors will be explained in detail in the following paragraphs. It is important to keep in mind that linkages between the defined components exist and that all components have to be considered holistically if the overall competitiveness of an airport is to be assessed. Moreover, shareholders' objectives are essential. Depending on the shareholders' objectives, airport management will take different

strategic actions and make different decisions. Figure 1 summarizes the identified factors within the four major components noted previously.

Figure 1. Components of Airport Competition

Source: own composition

Figure 1 is based upon the overview of the academic research summarised in Table 1. It has to be kept in mind, however, that not all of the factors in Figure 1 can be influenced by airport management (e.g. territory block) and are thus rather exogenous. However, others are in direct or indirect control of airport managers (e.g. costs, reputation, presence of freight forwarders) and could be used to shape and or adjust the airport strategy for air cargo.

Table 1. Literature Overview

TERRITORY	
Location	Fuerst and Gross, 2018; Mayer, 2016; Wong et al., 2016; Bowen, 2012; Boquet, 2009; Gardiner and Ison, 2008; Gardiner et al., 2005a; Gardiner et al., 2005b; Zhang, 2003; Air Transport World, 2002; Noviello et al., 1996; Dennis, 1994; Schwieterman, 1994; O'Kelly, 1986; Harris, 1954
Local O-D demand	Boonekamp and Burghouwt, 2017; Kupfer et al., 2016; Bowen, 2012; Alkaabi and Debbage, 2011; Gardiner and Ison, 2008; Cosmas and Martini, 2007; Zhang, 2003; Hall, 2002; Zhang and Zhang, 2002
Capacity	Adenigbo, 2016; Magalhães et al., 2015; Basso and Zhang, 2010; Madas ans Zografos, 2008; Neiberger, 2008
CARGO MARKET PLACE	
Presence of freight forwarders	Boonekamp and Burghouwt, 2017; Kupfer et al., 2016; Burghouwt et al., 2014; Chu, 2014; Li et al., 2012; Rodrigue, 2012; Tretheway and Andriulaitis, 2010; Yuan et al., 2010; Air Cargo World, 2001
Presence of integrators	Malighetti et al., 2016; Struyf, 2016; Onghena, 2013; Bowen, 2012; Alkaabi and Debbage, 2011; Lafaye, 2007; Gardiner, 2006; Bowen, 2004; Zhang and Zhang, 2002
Presence of wide-body capacity	Lange, 2019; Boeing, 2018; Boonekamp and Burghouwt, 2017; Budd and Ison, 2017; de Wit et al., 2017; Kupfer et al., 2017; Kupfer et al., 2016; Mayer, 2016; Merkert and Ploix, 2014; Hsu et al., 2009; Bowen, 2004
Presence of full freighter capacity	Boonekamp and Burghouwt, 2017; Budd and Ison, 2017; Kupfer et al., 2017; Airbus, 2015; Gardiner et al., 2005a; Bowen, 2004; Zhang and Zhang, 2002
AIRPORT OPERATIONS	
Operational time	Kupfer et al., 2016; Chao and Yu, 2013; Oosterlynck and Swyngedouw, 2010; Tretheway and Andriulaitis, 2010; Gardiner et al., 2005b; Delve, 2001; Shaw, 1993
Costs	Yuen et al., 2017; Adenigbo, 2016; Fichert and Klophaus, 2011; Kupfer et al., 2011a; Tretheway and Andriulaitis, 2010; Gardiner et al., 2005b; Zhang, 2003; Adler and Berechman, 2001; Barrett, 2000
Connectivity – network	Boonekamp and Burghouwt, 2017; Ben-Akiva et al., 2013; Chao and Yu, 2013; Chung and Han, 2013; Kim and Park, 2012; Kupfer et al., 2011b; Heinitz and Meincke, 2009; Malighetti et al., 2009; OSC et al., 2009; Ohashi et al., 2005
Accessibility	Boonekamp and Burghouwt, 2017; Struyf et al., 2016; Heinitz et al., 2013; Bowen, 2012; Schramm, 2012; Kupfer et al., 2011a; Tretheway and Andriulaitis, 2010; Gardiner et al., 2005b; Hall, 2001
PRODUCT DIFFERENTIATION	
Reputation	Kupfer et al., 2016; Hwang and Shiao, 2011; Gardiner and Ison, 2008; Gardiner et al., 2005b; Ohashi et al., 2005; Zhang, 2003; Adler and Berechman, 2001; Murphy et al., 1989
Marketing & business development	Fichert and Klophaus, 2011; Yuan et al., 2010; Gardiner and Ison, 2008; Macário, 2008; Gardiner et al., 2005a; Lee and Yang, 2003
Specialized supra-structure	Elliott and Bonsignori, 2019; Graham, 2014; Tretheway and Andriulaitis, 2010; Gardiner et al., 2005b; Kasarda and Green, 2005; Page, 2003; Zhang, 2003; Zhang and Zhang, 2002; Kingsley-Jones, 2000

Source: own composition

3.1 Component 1: Territory

The Territory component contains factors related to the geographical location of the airport. Different studies have mentioned the importance of location and see it as a crucial factor in the assessment of the competitiveness of an airport. However, other factors that are closely linked to location are also relevant; origin-destination (O-D) demand in the catchment area of the airport is a good example. The third major factor taken into consideration is airport capacity. Especially in Europe, capacity seems to be a very relevant issue, as is evidenced by the number of airports operating at almost full capacity such as London Heathrow (LHR) and Amsterdam Airport Schiphol (AMS).

Location

The two main advantages of air cargo transport compared to other transport modes are speed and reliability. Therefore, air cargo is usually used for time-sensitive goods (e.g. e-commerce and pharmaceuticals), valuable items and perishables. Zhang (2003) indicated that if "all other factors equal, the ideal hub location is one that minimizes the total flight kilometres within a network and allows services with larger aircraft". This illustrates the relevance of a central location of an airport for hub activities: minimizing flying time and costs (Air Transport World, 2002; Dennis, 1994; Schwieterman, 1994). By doing a k-means cluster analysis, Wong et al. (2016) confirmed a study by Zhang (2003) that Hong Kong is the most competitive airport for cargo in the Asia-Pacific region because of its central location. However, as Dennis (1994) clearly mentioned in his study of passenger airline hub operations in Europe, the ideal location of a hub depends on the markets one wants to serve. The same is valid for cargo operations. Studies by – amongst others – Harris (1954), Noviello et al. (1996), and O'Kelly (1986) looked for the most appropriate national cargo hub in the US: All studies revealed that the area around Southern Ohio was the best choice due to its central location. Bowen (2012) mentioned the superior location of Louisville compared to Chicago for the US activities of UPS. Boquet (2009) found that airports with a strategic location – like Anchorage, Doha, Abu Dhabi and Dubai – can focus more easily on transshipment cargo activities. A study by Schwieterman (1994) looked for the most attractive air cargo hub in the Pacific Rim by considering 15 major Asian cargo centres. The preferred hub location was South China, and more specifically, the airports in Hong Kong, Taiwan, Manila, Guangzhou and Shenzhen.

A study about non-aeronautical passenger revenues by Fuerst and Gross (2018) used airport location as a proxy for economic development in the surrounding area of the airport. For the cargo segment, Gardiner et al. (2005a, 2005b) and Gardiner and Ison (2008) conducted several interviews with non-integrated cargo operators to shed light on their airport decision process. An important conclusion of these studies is that in the first stage of the airport choice

process, carriers look for an appropriate location or region. Once the location has been chosen, the airport with the highest financial return potential will be chosen. That return depends not only on the costs of operating at the airport but also on the local air cargo demand. Gardiner and Ison (2008) and Mayer (2016) also noted a correlation between the focus of an airport on cargo and – amongst others – its geographical location, manufacturing base and the airlines operating at the airport.

It may be clear that airports with a favourable location have an absolute competitive advantage over other airports. However, defining 'a favourable location' is a case-by-case issue that depends heavily on the type of activities one wants to develop at the airport.

Origin – Destination Demand

Especially for origin-destination (O-D) airports (e.g. Milan Malpensa Airport), local O-D demand is a top-level factor to consider. These airports do not act as hubs and are, therefore, almost fully dependent on the local market. Gardiner and Ison (2008) found that it is important for these airports to be located close to an economic cluster because it is an indication of higher demand. A study by Zhang and Zhang (2002) stated that freighter operations will be located where sufficient local demand is generated. Zhang (2003) divided the markets relevant to Hong Kong Airport into three different parts: local traffic, gateway traffic, and hub traffic. Generally, an airport faces very little competition for local traffic, whereas the competition for gateway cargo is rather fierce between airports in the same catchment area (Boonekamp and Burghouwt, 2017; Kupfer et al., 2016; Zhang, 2003). Regarding hub traffic, airports face competition from other hub airports which are not necessarily in close proximity of the airport. LHR and Dubai International Airport are for instance close competitors of each other on most Europe-Asia routes.

Besides the different types of airports, there are also different types of carriers serving the cargo market. Whereas combination carriers prefer to co-locate cargo and passenger services at their hub airports (Hall, 2002), all-cargo carriers are more likely to choose O-D airports (comparable to low-cost carriers in the passenger segment). The latter are 100% focused on transporting cargo, whereas for most combination carriers, cargo is not the main focus of their business and their airport choice is mainly dependent on their passenger routes. The airport choice for passenger activities will not be elaborated further upon in this paper. For readers that are interested in the airport choice of passenger airlines, a wide range of papers can be found in the literature, e.g. Shaw (1993), Rodríguez-Déniz et al. (2013), etc.

The combination of a good location and local O-D demand is probably of greatest importance for the integrators (DHL, FedEx and UPS), as studies by Alkaabi and Debbage (2011), Bowen

(2012), Cosmas and Martini (2007) and Hall (2002) show. These companies guarantee fast delivery times for which a close location to the market is key; in addition, sufficient local demand gives security to their business.

Airport Capacity

Assessing airport capacity is not just limited to slot allocations and or/restrictions. However, almost all academic research dealing with capacity issues at airports concerns 'slots' (e.g. Adenigbo, 2016; Madas and Zografos, 2008). Slot allocation is a major issue at the vast majority of major airports. Most of these airports try to allocate slots as much as possible to passenger flights because they generate higher income (Basso and Zhang, 2010). Such an allocation policy, together with the unpredictability of air cargo, and therefore, their need for flexible slots, makes it difficult for cargo carriers and/or cargo flights to set up activities at these airports as has been seen at AMS. In 2019, the Dutch government decided against an increase in the number of flight movements at AMS (currently set at 500,000). Because intercontinental passenger flights are financially more beneficial for the airport, as many slots as possible are allocated to such flights. As a result, full freighter airlines experience particular difficulties operating at AMS, and the first signs of negative growth in the cargo segment at the airport can already be observed[2].

However, more factors regarding capacity need to be considered, especially if air cargo is taken into account. A study by Magalhães et al. (2015) touched very briefly upon expansion on the landside for future developments. The potential for expansion at an airport can be high relevant for the air cargo segment, especially because the industry is consistently growing every year. In particular, cross-border e-commerce logistics generates high growth figures and companies active in the e-commerce segment are continuously evaluating possibilities for further expansion to optimize their business. DHL, for example, recently opened a new sorting hub at BRU as a response to the booming cross-border e-commerce market (Air Cargo World, 2018). Such investments are beneficial for the whole airport community because of – amongst others – the additional added value and employment that is created (Neiberger, 2008).

3.2 Component 2: Cargo Market Place

The second component – the cargo market place – includes factors related to the different actors in the air cargo transport/delivery chain. As freight forwarders still control a large share of the air cargo customer front end, the presence of these companies at an airport is highly appreciated by other actors in the transport chain. Furthermore, the enormous growth of

[2] Kalitta Air, for example, has lost slots at AMS in 2019, forcing it to redirect its flights to other airports, including OST and BRU in Belgium (Nieuwsblad Transport, 2019).

Asian and Middle Eastern carriers in the last two decades occurred in tandem with a strong increase in the number of wide-body aircraft. These aircraft are exceptionally well designed to carry cargo in the belly space. A good mix of wide-bodies and full freighter aircraft at an airport is, therefore, a precondition to establish a competitive position in the market.

Freight Forwarders' Presence

Contrary to the maritime industry, freight forwarders (logistics service companies arranging the transport of goods from origin to final destination) and integrators such as DHL and FedEx still control the majority of the air cargo transport chain (Air Cargo World, 2001; Tretheway and Andriulaitis, 2010). Kupfer et al. (2016) stressed the important role of freight forwarders in the air cargo market. Having a wide range of freight forwarding companies present at the airport is said to be beneficial for the airport to attract cargo business (Kupfer et al., 2016; Tretheway and Andriulaitis, 2010). Airlines that fly to long-haul destinations (and thus have a significant amount of belly space available) from a particular airport, benefit from the presence of a wide range of freight forwarders at that airport because these carriers try to optimize their bellyhold capacity via the spot market. The freight forwarding business mainly revolves around the consolidation of smaller shipments from different shippers into larger consignments. (Boonekamp and Burghouwt, 2017; Burghouwt et al., 2014; Chu, 2014; Li et al., 2012) The non-integrated airlines also rely heavily on the freight forwarding business. These airlines see the presence of a wide range of freight forwarders at an airport as an indication of enough local volume (i.e. demand) for the development of a sustainable cargo service. Freight forwarders on their part cluster together in the proximity of an airport in order to optimise their operations because of the time-sensitivity of air cargo (Rodrigue, 2012) and do not want to fragment their flows from different airports within the same catchment area (Yuan et al., 2010). Moreover, these companies prefer airports which can offer a broad range of long-haul destinations to ensure that their cargo can reach a wide range of destinations in a fast and efficient way.

Integrators' Presence

At times, the presence of an integrator can also be beneficial in attracting airlines (Gardiner, 2006) and, therefore, enhance the competitiveness of an airport. Onghena (2013) looked into the business of integrators at the largest airports for cargo in Europe. The same is done in Table 2, although updated with more recent numbers.

Table 2. Top-10 European airports for cargo throughput (in tonnes)

European rank	Worldwide rank	Airport	Tonnage 2017	% change 2016 / 2017	Main cargo carriers at the airport
1	10	CDG	2.195.229	2.8	**FedEx** (main European hub) Air France – KLM (main hub)
2	11	FRA	2.194.058	3.8	**DHL** Lufthansa (main hub)
3	17	LHR	1.794.276	9.4	IAG Cargo (main hub)
4	18	AMS	1.778.382	4.9	Air France – KLM (main hub) AirBridgeCargo, Cathay Pacific
5	25	LEJ	1.131.382	8.0	**DHL** (main hub) Aerologic
6	26	IST	1.095.518	16.2	Turkish Airlines (main hub) MNG Airlines
7	32	CGN	897.132	12.0	**UPS** (main European hub) **FedEx** (hub) **DHL**, Lufthansa
8	34	LUX	822.330	6.7	Cargolux (main hub) Panalpina
9	39	LGG	716.894	8.5	**FedEx/TNT** (main hub) Ethiopian Cargo, El Al Cargo, Kalitta Air, Icelandair
10	46	MXP	589.719	7.5	Cargolux Italia (main hub) **DHL**, **FedEx**, AirBridgeCargo

Source: own composition based on WATS (2017) and Onghena (2013)

Table 2 reveals some interesting facts. Almost all of the top cargo airports in Europe have an integrator as one of their major cargo carriers. Integrators – DHL, FedEx and UPS – are fully integrated logistics service providers that operate their own or wet-leased aircraft. These companies – originally focusing on the fast delivery of small shipments – are an important driver of the growing e-commerce market (Bowen, 2004; Malighetti et al., 2016; Zhang and Zhang, 2002).

The idea that cargo attracts cargo is also supported by Struyf (2016). She found that larger airports in terms of cargo have developed economies of scale in the cargo segment, whereas small airports with limited cargo activities face diseconomies of scale. This means that airports with well-established cargo activities are more competitive in attracting new cargo services. Furthermore, cargo is concentrated in a number of areas around the world, as was shown by Alkaabi and Debbage (2011) for the US market and by Bowen (2012) regarding the cargo

hubs for FedEx and UPS. The presence of an integrator is positive for the cargo development at an airport as the integrator already provides a certain cargo volume (because these companies require large operations for both: market presence on the demand size and economic reasons on the cost side) (Lafaye, 2007).

Presence of Wide-body Capacity

In today's air cargo market, belly space capacity plays a major role. Approximately 50% of airfreight is carried via the bellyhold of wide-body aircraft, and this share will probably increase further in the future (Boeing, 2018; Boonekamp and Burghouwt, 2017; Kupfer et al., 2016). Narrow-body aircraft, on the other hand, play a negligible role in the air cargo business due to their limited availability of space for air cargo (Boonekamp and Burghouwt, 2017; Lange, 2019).

Wide-body aircraft are exceptionally well designed to carry cargo in the bellyhold. Since the economic and financial crisis of 2008-2009, a number of legacy carriers – foremost the European carriers – are struggling with their cargo divisions (Budd and Ison, 2017). Many of these airlines shifted their focus from carrying cargo in full freighters to the belly space of their passenger aircraft (Boonekamp and Burghouwt, 2017). Wide-body aircraft have also become increasingly important for the air cargo market in the last couple of years as the new wide-body aircraft built by Boeing and Airbus, e.g. B777 or A350, are better designed to carry a larger amount of cargo in their bellies (Boonekamp and Burghouwt, 2017; Budd and Ison, 2017; de Wit et al., 2017; Mayer, 2016). Contrary to full freighter capacity, bellyhold capacity can be used at marginal cost. The direct operating costs of a wide-body flight can mainly be allocated to the passengers on that particular flight, meaning that the incremental costs of transporting cargo in the belly are limited to cargo-handling, additional fuel consumption and some administrative costs (Budd and Ison, 2017; de Wit et al., 2017; Kupfer et al., 2017; Lange, 2019).

Moreover, an airport with a fair amount of wide-body services can give flexibility on the timing and the network. Passenger aircraft can fly into destinations which would not have been viable for full freighters and can serve some destinations more frequently (Boeing, 2018; Bowen, 2004; Hsu et al., 2009). Moreover, these wide-body aircraft can feed the full freighter operations at a particular airport (Boeing, 2018; Hsu et al., 2009; Merkert and Ploix, 2014). However, some limitations have to be taken into account when transporting cargo in a passenger aircraft such as security regulations, cargo dimensions, etc. (Budd and Ison, 2017; Kupfer et al., 2017).

Presence of Full Freighter Capacity

Even though a broad range of wide-body capacity is important, it should also be supported by full freighter activities as freight forwarders and shippers tend to move away to other airports in the event that full freighter activities are absent at an airport (Boonekamp and Burghouwt, 2017). However, all-cargo airlines have difficulties in obtaining slots at major gateways such as LHR (Gardiner et al., 2005a) and more recently also at AMS. A study by Airbus (2015) mentioned the strategic advantages for freight forwarders and shippers of full freighter capacity at an airport: greater control over schedules, volumes and routes; broader network (e.g. airports that are not served by passenger flights); ability to transport hazardous and outsized loads which cannot be flown in the belly of passenger aircraft.

On some air routes, the belly capacity of wide-body aircraft does not match the demand and full freighters could cater for this additional demand (Kupfer et al., 2017). Furthermore, some cargo can or may only be shipped by freighters due to its size or hazardous characteristics (Kupfer et al., 2017). These aircraft are also able to carry larger volumes in one single flight and are, therefore, useful to create a larger throughput at the airport (Bowen, 2004). But contrary to passenger flights, full freighters have to deal with unbalanced cargo flows and, therefore, often operate triangular routes (Budd and Ison, 2017; Kupfer et al., 2017; Zhang and Zhang, 2002). Such routings can be a disadvantage for time-sensitive commodities like perishables, pharmaceuticals or e-commerce; in addition, the price of belly capacity is often much cheaper than full freighter capacity.

Next to the integrators, some other carriers are exclusively flying freighters. Kalitta Air, AirBridgeCargo, Nippon Cargo Airlines and Cargolux are some well-known examples (Bowen, 2004). Contrary to most American and European carriers, the Asia-Pacific and Middle Eastern carriers have often well-developed cargo divisions with their own full freighter subdivisions (Budd and Ison, 2017). Budd and Ison (2017) saw two important reasons for this: the strategic geographical location of these countries and the increasing demand for cargo capacity in the emerging economies.

3.3 Component 3: Airport Operations

The third component presented in Figure 1 is called airport operations. As indicated, one of the unique selling positions of air transport is speed and reliability (Dewulf et al., 2014; Lange, 2019). In other words, time-efficient handling of air cargo is essential. Furthermore, the network and connectivity of an airport are vital for shippers and freight forwarders to be able to ship their goods around the world. And since air cargo is by nature multimodal, smooth intermodal operations are fundamental for the cargo market.

Operational Time

The operational time (operating hours) of an airport have always been controversial, demonstrated, for example, by the move of DHL from Brussels to Leipzig in 2003 (Oosterlynck and Swyngedouw, 2010; Tretheway and Andriulaitis, 2010). Gardiner et al. (2005b) explained the importance of night-time operations, especially for integrators. However, the authors also found that night-time operations are less essential for non-integrated carriers as these airlines have to make a trade-off between conducting 24/7 operations on the one hand, and operating from a main gateway airport on the other hand, which traditionally has night-time restrictions. Nevertheless, 82% of the questioned non-integrated carriers operating full freighters valued the possibility to operate at night at an airport as either 'important or extremely important'. Kupfer et al. (2016) confirmed this view and added that especially in the Asian market, night-time operations are a necessity. According to these authors, the main reason for this is that cargo has to leave the Asian continent by night to arrive in Europe in the morning. However, the study by Kupfer et al. (2016) made a clear distinction between major and regional airports. Night-time operations are very important for airlines serving regional airports, whereas airlines active at major European airports are able to schedule their operations around the night-time restrictions.

Delve (2001) considered airports with 24-hour operations as more suitable to attract dedicated cargo traffic and suggested that airports with 24/7 operations have a competitive advantage over others for this type of services. Shaw (1993) clearly indicated that airports should have unrestricted night-time access to attract cargo as well. After reviewing and summarizing the existing literature, Chao and Yu (2013) used the Delphi method to check the relevance of this factor. Airport operational time continues to be seen as an important factor in the assessment of the competitiveness of an airport with respect to cargo. This research approaches the operational time of an airport by examining the night-time restrictions at airports. It is generally accepted that airports that are fully closed at night are less favoured than airports which allow a limited number of night flights or airports without any restrictions.

Airport Costs

Another factor that airlines take into account when choosing a particular airport are the airport costs or airport charges. Fichert and Klophaus (2011) introduced the following definition: "Airport charges are levied on the use of airport facilities and services". Airport charges can further be divided into aeronautical charges (charges directly related to the operations of an aircraft and the respective passenger services) and non-aeronautical charges based on commercial activities.

Adenigbo (2016) found that airport charges – together with airport capacity and customs efficiency – were one of the most significant factors in the choice of cargo agents operating in Abuja Airport; this was supported by Tretheway and Andriulaitis (2010). Barrett (2000) demonstrated that airport charges as such were not seen as determining the airport choice of airlines. A more crucial factor was the total cost of operations, which contains airport charges, but also terminal and ground-handling costs, other operating costs, etc. This view was – amongst others – confirmed by Kupfer et al. (2011a). Whilst minimizing the total cost of operations is very important for cargo operators (Gardiner et al., 2005b), Gardiner et al. (2005b) found that lower airport charges are a common reason for the relocation of full freighter flights. Yuen et al. (2017) confirmed this view stating that an increase in the charges at a particular airport will decrease the cargo output at that airport and increase the cargo output at another airport. In his study about the cargo airlines' choice of an airport, Zhang (2003) revealed that airport charges for Hong Kong's cargo carriers represent only 7% of the airline's total cost, thus illustrating that airport charges are of less importance: However, comparing airport costs is a challenge. This is not only because airports define their 'airport fees' differently, but the costs are also dependent upon other factors such as the type of aircraft, time of the day, the number of passenger and tonnes of cargo carried, etc.

Besides airport charges, other costs are important as well. Adler and Berechman (2001), for example, found that labour costs could also be a factor that has to be taken into account. Kupfer et al. (2011a) mentioned labour costs as well, but also referred to other costs: handling cost, fuel cost, line-haul cost, etc. It must be made clear that the airport costs consist of more than just airport charges. Labour costs – still a major input variable in the aviation industry – could be a relevant factor that many actors in the industry consider when choosing their airport.

Airport Connectivity – Network

Connectivity by air is crucial for regional and economic development, which was confirmed by Boonekamp and Burghouwt (2017). Studies by Kupfer et al. (2011b) and Ben-Akiva et al. (2013) found a positive relationship between freight transport and the economic activity within a region.

Malighetti et al. (2009) examined the connectivity of 467 airports within the European aviation network and classified airports based on connectivity. Eight different clusters were defined, ranging from worldwide major hubs to small airports with only a restricted number of routes. However, no particular attention was paid to the cargo segment. Boonekamp and Burghouwt (2017) concluded that (intercontinental) connectivity is a key element in the airport choice for cargo operations. A study by Chung and Han (2013) indicated that flight frequency and flight

connectivity were almost always mentioned in research about the airport choice for cargo activities, which once again stressed the relevance of both factors. A study by Chao and Yu (2013) mentioned that a wide network of flights goes hand-in-hand with a high availability of cargo transport. To attract transshipment cargo to an airport, Ohashi et al. (2005) also confirmed the importance of an airport's network. Finally, Wong et al. (2016) saw flight frequency and network development as factors in assessing airport competitiveness in the Asian-Pacific air cargo market. The study put Hong Kong and Shanghai Airport as the most suitable to become air cargo hubs in the Asian market, mainly due to their high flight frequency and good network.

As was stated by Boonekamp and Burghouwt (2017), very little literature is available yet on air freight connectivity models. Boonekamp and Burghouwt (2017) described a NetCargo model to benchmark the connectivity of European airports. Kim and Park (2012) used a network quality model for the analysis of cargo transshipments whilst Heinitz and Meincke (2009) on their part built a multi-level air cargo supply-demand interaction model to forecast air freight commodity flows on a global scale. Finally, it is also worth mentioning WorldNet, a freight model developed for the European Commission (OSC et al., 2009).

Airport Accessibility

Air transport has inevitably a multimodal character, most often combined with road transport to and from the airport (Hall, 2001; Kupfer et al., 2011a). Good accessibility by road helps guarantee fast delivery, which is vital for air cargo (Gardiner et al., 2005b; Hall, 2001). Smaller airports specializing in freight should pay particular attention to good road accessibility (Kupfer et al., 2011a). Road haulage is even more crucial for integrators, especially for their next-day deliveries (Bowen, 2012).

Furthermore, it is worth mentioning that especially within Europe and the US, a large amount of freight is trucked (Boonekamp and Burghouwt, 2017; Heinitz et al., 2013; Schramm, 2012; Struyf et al., 2016; Tretheway and Andriulaitis, 2010), often under an airway bill number. The reasons are manifold, but the excellent road network within Europe and the low cost of trucking are important drivers of this trend.

Since very few European airports use railways for their cargo activities, no further attention will be given to railway connections and their impact on the air cargo market.

3.4 Component 4: Product Differentiation

Within the product differentiation component, the focus of airport management with respect to air cargo will be clarified. The reputation of an airport is seen as an important variable by airlines and freight forwarders. Marketing and business development indicate to what extent an airport is engaged in the cargo business. Airports that advertise their cargo facilities and have a good reputation will probably welcome (new) cargo activities. Offering specialized supra-structure, e.g. dedicated warehouses and equipment, to customers will contribute in a positive way in the airport's attempt to attract cargo.

Airport Reputation

Adler and Berechman (2001) found that airport quality levels are important in the airport choice of passenger airlines. A study by Zhang (2003) elaborated on the attention airlines pay to customs efficiency when assessing airport quality, a view confirmed by Ohashi et al. (2005). Ground handling services also contribute to airport quality. Different studies – for example, Gardiner et al. (2005b); Gardiner and Ison (2008); Hwang and Shiao (2011); Kupfer et al. (2016) and Murphy et al. (1989) – revealed the importance of a good reputation with respect to air cargo. Although this factor is rather subjective and perceptual, airlines and freight forwarders consider this as relevant. The study by Kupfer et al. (2016) indicated that a good reputation reduces the uncertainty concerning the quality of collaboration between airline and airport, and is seen as even more important in the long-term than financial incentives offered by the airport or airport marketing. Murphy et al. (1989) clearly stated that the quality of cargo services needs to be checked because goods shipped by air are often of high-value, and damage and loss should be minimized. Gardiner and Ison (2008) found that for all-cargo carriers, reputation and experience in handling freighter flights was one of the most relevant factors in their airport choice process.

Airport Marketing and Business Development

For Gardiner and Ison (2008), an airport is demonstrating its pro-cargo attitude if it is actively promoting its cargo capabilities. The study confirmed a previous one by Lee and Yang (2003) which indicated that airports could attract freighter operators by "intensive competitive strategies and aggressive marketing strategies". In this sense, a study by Macário (2008) is interesting because she found that marketing plays a key role in helping to keep the satisfaction gap as low as possible, meaning that expected and perceived value are matched as closely as possible. Yuan et al. (2010) ascribed the good performance of Hong Kong Airport and Singapore Airport in the cargo segment in 2006 to the fact that both governments listed the development of the logistics industry as one of their top priorities.

In addition, the topic of financial incentives is often included in the discussion on airport marketing and business development. These financial incentives are commonly used by airports to attract business as was studied by amongst others, Fichert and Klophaus (2011). The role of such financial incentives for the cargo segment, however, remains inconclusive as no research has been performed on this topic. Furthermore, only a limited number of airports have incentive schemes specifically for air cargo. Overall, the impact of airport marketing as such remains highly questionable as it is very difficult to quantify the exact results of airport marketing schemes (Gardiner et al., 2005a).

Specialized Cargo Supra-Structure

The last factor that is worth mentioning is the specialized cargo supra-structure, such as specialized handling equipment, storage areas, etc. Gardiner et al. (2005b) used a report by the UK government to highlight the need for good supra-structure for the optimal handling of freighters. Compared to passenger activities, more apron space to load and unload the aircraft is needed. In addition, Graham (2014) highlighted the necessity of specialized loading and transfer equipment to support sustainable cargo activities at an airport. Zhang (2003) found that modern transportation, communication, and logistics systems are essential to become an air cargo hub in China. Kingsley-Jones (2000) and Page (2003) confirmed the importance of sufficient ramps, parking spaces, runways and terminal capacity. Tretheway and Andriulaitis (2010) mentioned the importance of the provision of air cargo facilities for freight forwarders at an airport. The most fundamental aspect, however, is the role of customs. The more efficient customs are, the more efficient the cargo flow will be.

The role of customs can influence airport choice (Zhang and Zhang, 2002), a role which was thoroughly analysed by Elliott and Bonsignori (2019). These authors confirmed that customs restrictions are not only disadvantageous for the air cargo business at the airport but also for the economic development of the wider region. The relevance of customs for air cargo development was also mentioned by Kasarda and Green (2005), although these authors state that there is still some ambiguity in the impact customs have on air cargo operations. Within Europe, the differences between customs reliability are limited, but outside of Europe, some major differences could occur.

4. CONCLUSION

Based on the existing literature, this study presented a structure of factors determining the competitiveness of an airport concerning cargo. The vast majority of research about airport competitiveness is quite general or deals with the passenger segment. However, in the last couple of years, more and more scholars have started to focus on the freight segment as well. As a result, many different factors influencing airport competitiveness could be found in the literature. However, to the best knowledge of the author, there is no study that provides an overall overview of these determining factors. Therefore, this study has addressed this topic. The added value of this study is twofold: first, it analysed airport competitiveness from the perspective of the airport itself, and starting from this perspective, an extensive literature review was carried out. Secondly, a wide range of industry representatives was consulted concerning the preliminary research findings. Based on interviews with different stakeholders, the findings were at first validated, and then adjusted where necessary.

The factors that were identified in the literature were subdivided into four different components: territory, cargo marketplace, airport operations, and product differentiation. Within the territory component, factors related to the location of the airport were included. Not only is the geographical location of the airport relevant, but airport capacity issues are also commonly described as important. The second component, the air cargo market place, assessed the air transport chain and related factors. The most important actors are the freight forwarders, integrators and (cargo) airlines. The way in which operations affect the airport competitiveness for cargo is the subject of the airport operations component. Night-time restrictions are limiting for cargo operations. In addition, airport charges also have to be considered, as these are typically closely monitored by full freighter cargo airlines. The network and connectivity of the airport are another major issue to be assessed in determining airport competitiveness, as smoothly organized intermodality facilitates effective and efficient operations. Finally, the product differentiation component revealed the attitude of the airport towards cargo. Some airports are mainly focused on the passenger segment, whereas others focus on cargo. In between both ends of the spectrum, a wide mix of airport types could be found. Reputation, airport marketing, and specialized supra-structure for air cargo are factors that play a major role within this component.

This study can assist policymakers in drafting their aviation policies. Most European airports are – at least to some extent – publicly owned. Therefore, airports are often used as a tool for regional development. The air cargo segment is still a labour-intensive industry and policymakers may want to boost the cargo market to increase employment in their region. Furthermore, this study suggests which factors public authorities should consider when

attempting to expand air cargo activities at an airport. As it is rather difficult to significantly impact the surrounding region in the short-term, governments can decide upon expansion plans for airports in the longer term, for example, by allowing the construction of new runways. Trying to attract major companies in the air cargo industry (e.g. major freight forwarders, airlines, ground-handlers, e-commerce distributors) is another way to help expand cargo activities at an airport. The role of the government cannot be underestimated in such negotiations, as a supportive government can convince investment from abroad. However, airport operations and product differentiation blocks are also relevant. Labour costs are probably one of the most important cost drivers in the business, so the lower these costs are, the more competitive an airport would be in the industry. Air connections are another key variable, meaning that bilateral agreements with countries that are important freight destinations (e.g. US postal clearance points, major Asian cities like Hong Kong, Seoul, Japan, etc.) are a key element to consider as well. Finally, a good reputation combined with efficient and effective marketing will help to succeed in increasing the air cargo throughput. All these variables should be taken into account by public authorities while drafting their airport policies to support the air cargo market at their airports.

Policymakers that want to examine the potential impact of new aviation policies, can conduct a scenario-analysis based on this study. By developing different scenarios where a set of factors defined in this study are applied, it can be tested whether a new policy will potentially have the desired outcome or not. Not only the potential benefits have to be taken into account, but the (external) costs also have to be considered. If governments want to boost the air cargo market, there will probably be more employment, but also more externalities. Looking to these different aspects from a social welfare economic perspective is crucial.

Regarding future research, the options are broad. This paper will serve as the basic framework for quantitative research in the field of airport competitiveness in regard to cargo. Many different research methodologies could be used to quantify the different factors listed. It could be of interest to limit the number of factors to four or five major ones. In that way, assessing airport competitiveness would be more straight forward. Next, regression models could be developed to assess which factors are of major relevance for airport competitiveness and which only have limited impact. One could also define different types of airports based on the different factors defined. By giving a quite complete overview of factors determining the competitiveness of an airport regarding cargo activities, this study will be a good starting point for such further research.

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THE CONTRIBUTION OF REGIONAL AIRPORTS ON TOURISM ENTERPRISES. THE PERSPECTIVE OF TRIPOLI AIRPORT, IN GREECE

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ABSTRACT

Air transport and tourism development are considered to be two closely related concepts. According to international literature, one of the most important modes of passenger transport around the world is air transport, thus affecting the economic development of many areas, especially those isolated geographically and touristically, as well as local tourism businesses. Understanding the scale of these impacts is important not only for the development of tourism businesses and the local economy, but also for policy makers who make strategic decisions. Most studies focus on the impact of large airports on the national and regional economy, while much less attention has been given to the impact of airports on regional destinations. This study, exploring the potential of the Tripoli military airport in Greece as a civilian airport, seeks to analyse the functional relationship between small regional airports and local tourism businesses, the results of which can contribute to the financial planning and organization of a destination.

KEYWORDS

Regional Airports, Low Cost Carriers, Tourism Business, Tripoli Airport – Greece

1. INTRODUCTION

As early as the 1920s, commercial air transport, gained international support because of its ability to interconnect people, places and products. More recently, the various subsidies provided through various programs in the US and Europe aimed at linking remote areas with their countries' main economic centers (Blonigen, Bruceand Anca, 2012). Based on international literature, there are many studies that either focus on large airline facilities or seek to examine broader airport interconnections with dynamic destinations at macroeconomic level. Instead, the present study focuses mainly on the role that smaller regional airlines can play in boosting tourism businesses and local economic prosperity.

It is a micro-economic view of the extent to which a regional airport used by Low Cost Carriers could be enhancing accommodation businesses and complementary tourist services. At the same time, this study can be a useful 'tool' for tourism policy makers and strategic planners of local destinations. One might argue that smaller-regional airports cannot exert significant influence on the local economy, as would be the case with a large conventional airport, and to some extent this may be true (Butler and Kiernan, 1992). However, the traditional challenge with local or regional airports is that while often not economically viable they are considered, at least by local development stakeholders, important for business growth and attracting investors to an area (Van den Berg, Van Klink and Pol, 1996).

Public use of infrastructure, such as airports, is often considered an important component, as many studies have revealed strong correlations, overall, between public spending on infrastructure and productivity growth (Aschauer, 1989). However, there are other international reality studies that have questioned issues such as the viability of some regional airports, the sustainable management of their facilities and whether their results are actually delivering on expectations (Winston, 1991).

2. LITERATURE REVIEW

Kasarda and Lindsay (2011) argue that the existence of airports in different regions signals a new model of regional economic development. Indeed, airports are considered to be the largest infrastructure investment that an area can implement and play a dominant role in interconnecting different places, populations and developing the international economy (Button & Taylor, 2000).

The international dialogue on regional economic development and in particular on the "new development theories" has placed particular emphasis on the importance of information in economic development (Button, 1998). And of course, as people-to-people contacts drive

economic growth, air travel can be considered very important because of the distances they can cover, such as facilitating work, leisure and product movement (Button and Vega, 2008; Button and Yuan, 2013).

The close relationship between airline passengers and the regional increase in human income has been shown by numerous studies (Goetz, 1992; Green, 2007; Button, Doh, and Yuan, 2010; Mukkala and Tervo, 2013; Cidell, 2014;). Brueckner (2003) finds, however, that airports and airline services contribute more to businesses that rely on the provision of services and information than on industrial production.

As Kanafani and Abbas (1987) point out, the success of smaller regional airports largely depends on the location chosen for their operation and whether this option makes them independent of the major central airports.

Neal (2010) argues that airports are an important factor in the "interconnection of cities" as they link key nodes to the global economy. At the same time, they can help to create 'favorite places' in the global market by providing high quality access to the global flow of people, goods, money and information (Bowen, 2002).

On the other hand, Halpern and Brathen (2011) find that the success of regional airports largely depends on the regional size and requirements of passengers at the airport. In the same vein, Blonigen and Cristea (2012) in their studies argue that airline traffic has a significant impact on regional population, income and employment growth, but that their impact varies according to regional size and structure. of the industry. Rosenthal and Strange (2004) point out that airports play an important role in stimulating regional productivity due to the positive external factors that result from the economies of the settlements that develop around these locations.

Many scholars (Audretsch and Feldman, 1996; Gaspar and Glaeser, 1998) also document the importance of face-to-face interactions. Airports, by narrowing long distances, can increase face-to-face interaction by bringing people from different cities and regions closer together. Business-people also often argue that they will consider investing in a relatively small flight radius directly from their office so that they can interact with managers and monitor those investments. Studies by Lian and Ronnevik (2011) show that passengers prefer the large, main airport of the area, as opposed to the smaller local airports, due to the size of the services available.

It is difficult to pinpoint exactly the causality between airports and economic growth. In any case, airports can be added to the overall economic growth, through the movement of goods and people, along with other growth factors in an area. However, airports are also more likely to be located in larger areas with higher levels of economic growth, more people, larger industries and so on, increasing demand for their services. However, the liberalization of the European air transport market in 1997 led to a redesign of the air transport market (Graham, 1997; Papatheodorou and Arvanitis, 2009), providing a particularly strong incentive for the operation of regional airports. To foster competition in the airline market, this reform has created increasing demand for take-off and landing times at airports. Many already established international airports at European level have been unable to meet this growing demand and as a result more airlines have switched to operating from regional airports.

At the same time, there has been significant growth in Low-Cost Carriers, which avoids the higher costs associated with larger airports. Airports specializing in Low Cost Carriers are mainly developed at regional level and are considered of paramount importance for local economic development (Green, 2007; Lei and Papatheodorou, 2010). The basic operating model of Low Cost Carriers is structured into two main pillars: reducing operating costs and increasing the efficiency of available factors (Sorensen, 2005). Consequently, the strategy of operating a Low Cost Carrier is to offer a simplified product that will at the same time ensure the high levels of completeness and profitability of the company (Skeels, 2005). The reduction of operating costs results from maximizing all productive factors, reducing fixed costs and the adjustment of services offered.

Consequently, in the context of increasing its competitiveness, a Low Cost Carrier primarily focuses on maximizing the use of its aircraft, both in terms of completeness and frequency of operation. By maximizing the number of seats available per flight, minimizing aircraft turnaround time and increasing the frequency of flights, Low Cost Carriers achieve density economies that are evaluated as more cost effective to reduce unit costs on air than economies of scale (Pitfield, 2008; Dobruszkes, 2006).

The fixed costs of Low Cost Carriers are essentially the aircraft fleet and the costs of operating the airports. The fleet of Low Cost Carriers is usually homogeneous and consists of medium-sized, new-generation aircraft that are characterized as cost-effective and energy efficient. These homogeneous features give Low Cost Carriers greater flexibility in the employment of available staff as it facilitates staff qualification and minimizes the cost of training (Sorensen, 2005). On the other hand, the use of central airports generates high fees and impedes the basic aspirations of Low Cost Carriers for short boarding and frequent flights (Mason, 2000; De Groote, 2005; Soresen, 2005;).For this reason, Low Cost Carriers are mainly operating out

of regional airports which have only basic infrastructure for handling and managing flights (Hunter, 2006). This strategy facilitates the maximization of frequencies, minimizing boarding /landing delays and making the aircraft more time-consuming on point-to-point routes (Lawton, 2000; Mason, 2000).

At the same time, it is found that there is a two-way relationship between Low Cost Carriers and regional airports in addition to the multiple benefits that Low Cost Carriers have from using regional airports, regional airports often approach Low Cost Carriers in order to enhance their connectivity to other destinations and thus. increase their revenues from increased passenger traffic (Francis et al., 2004; Zenelis, and Papatheodorou, 2008).

European experience has shown that many small regional airports find it difficult to make a profit and many rely on subsidies (Barrett, 2000). However, a dialogue on the operation and development of regional airports should extend beyond profit or loss conditions. It should take into account the importance of regional airports for many economically and touristically isolated areas where they have a catalytic effect by improving productivity, attracting economic and tourist activity, boosting local income and employment.

3. METHODOLOGY

3.1 Purpose of the research

The purpose of this empirical research is to investigate the prospective use of Tripoli Military Airport and as a civilian airport for Low-Cost Carriers and to evaluate its contribution to the local tourism business in the region.

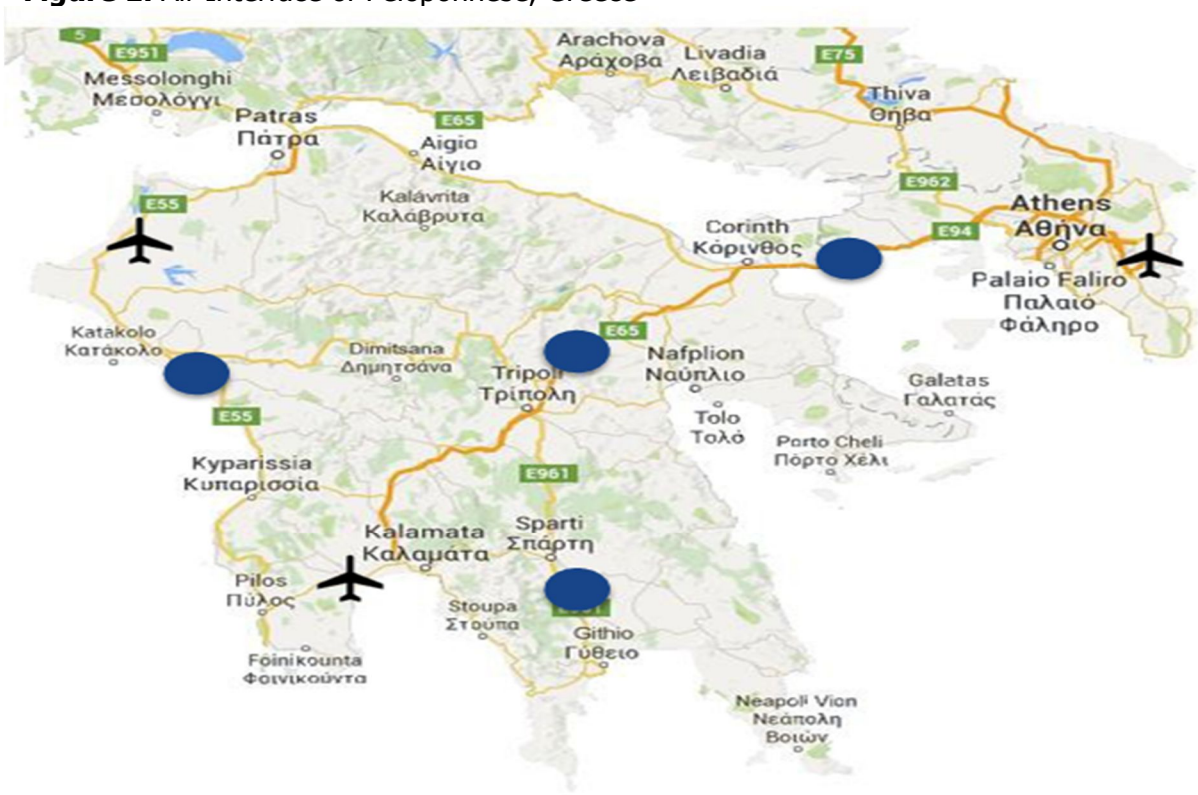
3.2 General characteristics of the study area.

The Peloponnese has a particularly important and diverse cultural heritage, comprising historical sites and monuments, folklore wealth, cultural infrastructures, as well as morals, customs and various cultural events. The Peloponnese region consists of five regional units: Argolida, Arcadia, Corinthia, Laconia and Messinia, of which only the regional unit of Messinia is adequately served by the existing airport of Kalamata, while the remaining are from the Kalamata airport, between two and four hours, and are primarily served by Athens International Airport (AIA) (SETE, 2018).

The prospect of the Tripoli Military Airport operating as a low-cost passenger airline through Low Cost Carriers is likely to significantly boost local tourism business, due to its geographical location and low costs in airport taxes and air fares.

The total area of the Peloponnese is 21,379 square kilometers and covers 16.2% of the country's geographical area. Two-thirds of the Peloponnese consists of mountainous or semi-mountainous areas. The climate of the region varies depending on the altitude and is characterized as Mediterranean in coastal areas and temperate within the Peloponnese. The sectors involved in primary production and processing of agricultural products are dynamic, in contrast to the tourism sector which shows a decline in turnover (Rural Development Program, 2014-2020).The Peloponnese connects with the rest of Greece mainly through the Corinthian isthmus, which connects it with Attica, and via the Rio-Antirio bridge, which connects it with western and northern Greece. It is accessible by air through the airports of Araxos and Kalamata, as well as Athens (Figure 1), while it is accessible mainly by ferry to Patras (EYSSAAP, 2014).

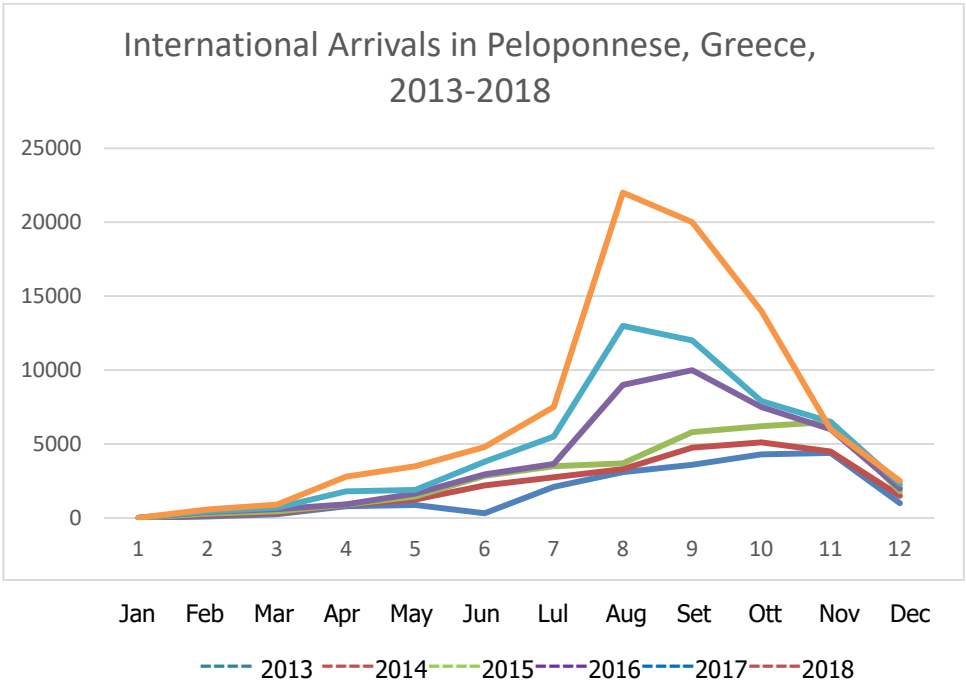
Figure 1. Air Interface of Peloponnese, Greece



Source: Civil Aviation Authority, 2018

Germany was the main market for the Peloponnese, with international arrivals in 2018 at the Kalamata airport, followed by the United Kingdom. These two markets accounted for 53% of all international arrivals in the study area, 68% of international arrivals in 2018 occurred between June and September (Figure 2), (CAA, 2018).

Figure 2. International Arrivals in Peloponnese, Greece, 2013-2018



Source: SETE Intelligence, 2019

Most international arrivals take place in the Argolida regional unit, followed by the Corinthian regional unit. In addition, most of the hotel units have the Regional Unit of Argolida followed by the Regional Unit of Laconia (Table 1).

Table 1. Arrivals and Capacity of Tourist Accommodation in Argolis, Korinthia, Laconia, Arcadia

Regional Unit	Argolida	Korinthia	Lakonia	Arkadia
Arrivals in Hotels 2018	**94,063**	**78,752**	**27,246**	**4,328**
%Greeks	**64%**	**66%**	**24%**	**91%**
%Foreign	36%	34%	76%	9%
Number of hotels (2018)	**147**	**103**	**139**	**106**
4–5stars	29	16	30	27
3 stars	28	31	63	36
1–2 stars	90	56	46	43
Supplementary tourist accommodation	**269**	**75**	**186**	**203**

Source: CAA, 2018; Hellenic Chamber of Hotels, 2018

3.3 Perspective of using Tripoli military airport in Greece and as a policy to service Low Cost Carriers - Technical Study Data

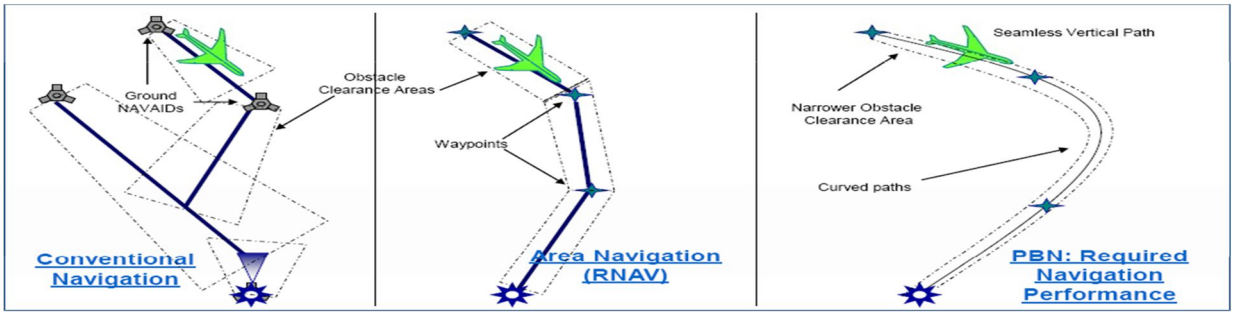
As part of its investigation into the use and development of the Tripoli military airport for low-cost civil aviation flights, it has been a constant demand of tourism companies in Central and Southeastern Peloponnese. The main reasons pushing in this direction are the time distance from the AIA to the regions of SE Peloponnese, the high charges of the AIA and the time distance from the airport of Kalamata.

According to the results of a technical study conducted on behalf of local professional tourism operators in Greece, the IBI Group Hellas SA technical consulting firm on the possibility of using the existing Tripoli military airport and as a civilian airport for Low Cost Carriers, the following interesting facts emerge (Efstathopoulos, Richetta & MacKinnon, 2014):

Modern market trends and the ever-increasing need for more regional airports to use in many tourist destinations, and even with strong geomorphic terrain, such as the case study of the Tripoli Airport in Greece, necessitate the gradual withdrawal of many old technology airports and with new processes based on new Global Navigation Satellite System (GNSS) technologies and in particular Performance Based Navigation (PBN) technologies, compared to ground based auxiliary technologies (e.g. VOR / DME) (ICAO, 2019).

Key benefits of GNSS technology are security (vertical guidance), cost / efficiency, greater airspace capacity, less impact on the environment (emissions, noise) and is suitable for airports in highlands with high terrain & numerous obstacles (mountains, etc.) as it provides significant flexibility in the course of aircraft (Figure 3)

Figure 3. Summary of GNSS Technologies for Developing Instrumental Processes



Source: Efstathopoulos, Richetta & MacKinnon, 2014

The initial technical study of the suitability of the Tripoli Military Airport for its use and as a civilian airport, had been carried out in 2003, during which technical barriers were identified, including extensive obstructions with ICAO Annex 14 surfaces, inaccurate ground-based

instrumentation procedures. (VOR / DME) and the ability to approach aircraft only from the North. These barriers after 2011 were finally overcome with the help of new technologies (GNSS-PBN), coupled with the need to extend and slightly change the landing and take-off runway of the aircraft (Figure 4). Over the years, the application of new technologies for instrumental processes is a one-way street for Greek airports as it appears to be supported by all market players.

Figure 4. Military Airport of Tripoli, Greece: Extend and Change Route Airfield

Source: Efstathopoulos, Richetta & MacKinnon, 2014

3.4 Method of Data Collection – Sampling

The questionnaire was selected as the 'tool' for gathering research data, which is considered the most widespread research tool. The structure of the questionnaire was carefully designed to meet specific qualitative and quantitative standards for evaluating the characteristics of the tourists who were the sample of the survey. For the purposes of the survey, a questionnaire was developed in two languages, English and German, since these two nationalities, which constituted both major categories of the survey population, constitute the major bulk of tourists choosing the wider region as their holiday destination.

The first section informs the subjects of the research of its purpose and observes the anonymity of the data to be reported. At the same time, it is requested to initially fill in some of the individual-demographic and social characteristics of the subjects (country of origin, gender, age category, educational level, employment status, income level) which constituted the identity of the research.

Specifically, for the main questionnaire, the questions were aimed at gathering data on the following individual issues: Basic traffic sizes (number of nights, purpose of travel, repeatability, travel time, etc.):

- Reservation details (means and method of reservation, travel package or not, etc.)

- Airport and Carrier Selection Criteria
- Expenditure breakdown analysis (air freight allocation, accommodation, entertainment, other tourism businesses, overheads)

Regarding the sample collection process, the questionnaires were distributed and completed in writing by a random sample of passengers, focusing mainly on the two nationalities (British and German), who resided in hotels in the Regional Units of Arcadia, Argolis, Korinthia and Lakonia travel to Greece by air. The sample of the individual categories of research subjects collected after evaluating the validity of the answers was digitized through SPSS Statistics 24. In terms of the sample of the survey, the initial target population was a total of 300 questionnaires with the main volume coming from the two main categories of nationalities (British and German). In the final sample, after examining the questionnaires for their validity and completeness, 252 questionnaires were included, a number which is considered satisfactory for the needs of the analysis of this research study.

3.5 Demographic Characteristics of the Sample

Based on the questionnaires answered, an even distribution of the sample was found between the two main nationalities (British 40.2% and German 43.3%), with a small percentage coming from other countries (16.5%).Focusing on the individual samples, we could comment that 92% of the visitors of the destinations under study, regardless of nationality and country of origin, use the Athens International Airport (AIA) to move from the country of origin to the individual destinations. The main reason is that there is no nearer regional airport capable of supporting low cost direct flights other than Kalamata, which is considered quite distant compared to the destinations chosen for vacation.

The majority of respondents belong to the age group of 26-35 years (32.65%), followed by the age groups of 19-25 years and 36-45 years (26.32% and 24.3% respectively), while the lowest rates are followed by the age groups of 46-55 years and over 56 years (10.4% and 6.33% respectively). In terms of education the overwhelming majority of respondents are university graduates (42%) or Masters' degree holders (28.2%) and in combination with the following airport and air carrier selection questions, there is a positive conclusion correlation between higher education level and proximity to airport - fare. Employment status and income level are important indicators for determining the economic profile of visitors as their financial ability determines the level of expenditure in the local economy. The majority of survey participants (62.3%) are financially independent while the vast majority fall into the income categories of € 0-12,000 and € 12,001 to € 30,000 (35.2% and 38.6% respectively) while much smaller percentages are in the income categories of EUR 30,001-50,000 and over EUR 50,001 (18.5% and 7.7% respectively).

Combined with the questions raised below, it appears that the income categories that would choose a regional airport that can support LCCs (Tripoli airport type) are mainly the low income categories (65.4%). It is also noteworthy that a significant percentage (34.6%) of high income categories would make a similar choice. Moreover, in the case of a regional airport that would support LCCs, the overwhelming majority of respondents said that they would choose their destination more regularly because of the low cost of air fare.

4. RESULTS AND DISCUSSION

Of the traffic sizes, the main indicator for the purposes of this analysis is the length of stay since it reflects the magnitude of the potential tourist expenditure of visitors. In both main categories of research, the average stay in a destination is quite high and ranges between 6 and 7 nights. As for passengers of choice beyond Athens International Airport, a nearer regional airport such as Tripoli, which could accommodate low-cost carriers, the vast majority of both major nationalities (British and Germany) at 72.3% and 66.8% respectively, stated that they would choose it on the most basic criteria the closest distance to the destination of their choice and the lowest fare.

In addition, the analysis of the allocation of individual costs of visitors to a destination determines the characteristics of the visitors' consumer profile and the range of sectors and economic activities that benefit locally. Consumer preferences and priorities set during their stay at a destination shape the level of individual costs and therefore determine the economic benefits of visiting a local / regional economy. A visitor's basic consumables are related to air fare costs and a range of services including expenses for holiday packages, accommodation, dining, transportation, entertainment, cultural activities, shopping and a range of individual support services.

According to the respondents, a very small percentage (4.2% for British and 3.6% for German nationality) chose to purchase a travel package with an average cost per tourist package of € 820 for the British market and € 1060 for the German market respectively. For those who did not choose to buy a tourist package, the estimated average cost of purchasing the air fare was € 216.40 for the UK market and € 203.5 for the German market while the average of the sample spend airfare purchase was € 209.96 and prevailing price € 230. In terms of how the accommodation was booked in the two main categories of the sample the rates were similar 34.3% of British and 37.4% of Germans visitors used the accommodation website or an intermediary's website respectively to book their rooms. The cost of accommodation was calculated as the total cost per person for the whole period of their stay in the area. As a result, the average per capita expenditure on accommodation for British was € 267.4 while for Germans € 366.3 respectively.

The higher average per capita spending for Germans is related to their length of stay and the choice of accommodation they have, which is probably of a higher class and quality of service provided.

4.1 Comparative Analysis of Expenditure based on the Demographic Characteristics of the Subjects Surveyed

The qualitative analysis has found that the profile of the main categories of research subjects participating in the sample under study have a great deal of similarities irrespective of nationality. However, the consumer behavior of visitors is not solely influenced by the country of origin of the visitors. The prospect of operating a nearer civilian airport, such as the Tripoli airport under consideration, which can accommodate mainly Low Cost Carriers, also specifies a variety of passengers, with different demographic and socio-economic characteristics.

The potential difference in consumer preferences involving a similar passenger audience should be considered in order to draw useful conclusions about the economic impact that the operation of a corresponding regional airport will have on local businesses and the local economy. Therefore, it is necessary to determine the consumer patterns of each individual demographic category, which may constitute the Low-Cost Carriers passenger community. Individual demographic categories, by attributing most or a small part of their spending to local businesses, at the same time formulate the pricing policy and profile of tourism companies and affiliated airlines in order to maximize their revenue. Therefore, in order to determine which consumer profile would be most effective, the fluctuations of average expenses by demographic category should be investigated.

As noted above, the cost of purchasing airfare constitutes a large part of the total travel expense of the visitors. Although such expenditure as a cash inflow does not directly affect the local economy, a similar expenditure may determine the amount of money spent on staying at a destination (Table 2).

Examining the costs of direct inputs into the real economy of the regional units of the Peloponnese concerned, the fluctuations of accommodation and other activities were analyzed using the following procedure:

The regularity of the distributions of the responses to each individual variable of demographic and socio-economic characteristics was initially tested by means of the Kolmogorov-Smirnov statistical test. Observing that there is no normal distribution of the sample data, the non-parametric Kruskal-Wallis test was applied for each individual demographic category. The

results showed that only two variables were statistically significant in terms of their subgroup's average cost of accommodation (Table 3)

Table 2. Correlation between Air Ticket Expense and Accommodation, General Tourist Services Expenses

Correlation		**p-value**	**Spearman Correlation**
Air ticket expense	Accommodation expense	0.000	0.403
	General tourist services expense	0.000	0.413
The correlation in significant at the 0.01 level			

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Table 3. Kruskal-Wallis Test for Accommodation Expenses

Demographic characteristics	**Kruskal-Wallis test**
Nationality – Country of origin	0.000
Age category	0.075
Educational level	0.073
Employment status	0.063
Income category	0.001
The difference is significant at the 0.05 level	

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Based on the data in Table 3, a significant variation in the range of accommodation expenses is identified in the demographic characteristics of "nationality-country of origin" and "income category".

Table 4. Accommodation Expenditure by Nationality-Country of Origin (in € per person)

Nationality - Country of origin	**N**	**Average**	**Minimum**	**Maximum**	**Range**	**Standard deviation**
British	103	267.40	24.00	1,840.00	1,816.00	245.62
Germany	105	366.30	25.00	2,100.00	2,075.00	377.20
Other	44	208.62	11.00	920.00	909.00	221.52

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Based on the fluctuation of accommodation expenses compared to these two sub-categories of demographic characteristics it is observed (Table 4) that visitors from Germany spent more money on their stay than visitors from Britain. It is therefore found that German tourists bring more benefits to local hotel companies than British tourists, while the expense of spending on both nationalities reveals a wide variety of accommodation prices.

Table 5. Accommodation Expenses by Income Category (in € per person)

Income category	N	Average	Minimum	Maximum	Range	Standard deviation
Under 12,000 €	86	152.46	19.00	820.00	801.00	202.36
12,001-30,000 €	98	207.47	30.00	1,020.00	990.00	248.83
30,001-50,000 €	57	292.24	28.00	1,400.00	1,372.00	389.61
Over 50,001 €	11	407.67	40.00	2,200.00	2,160.00	492.39

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Based on the income category of the visitors, there is a very interesting consumer trend, since in combination with the data from the air freight expense, the money that would save visitors from choosing a low cost carrier would be transferred would be transferred to the cost of accommodation. Indeed, as can be seen from the data analysis (Table 5), with the exception of the two extreme income categories (under € 12,000 and over € 50,001), the middle income categories show a range of costs ranging between € 1,000 and € 1,400 with expenditure accommodation to be determined between 200 and 300 €.

On the other hand, spending on general services (catering, leisure, transport, commerce, etc.), in addition to accommodation, reflects the expenditure incurred on all businesses, other than the hotel industry, during the stay of visitors to a destination. In order to evaluate visitors who are considered to be most cost-effective for local businesses and to assess their demographic characteristics, the same statistical tests were used which were also used for past expenditure. In this case too, the sample irregularity was detected and Kruskal-Wallis statistical test was used. Expenditure findings for general services (Table 6) showed statistical significance based on demographic characteristics of "nationality-country of origin", "educational level" and "income category".

Table 6. Kruskal-Wallis Test for General Service Expenses

Demographic characteristics	Kruskal-Wallis test
Nationality – Country of origin	0.000
Age category	0.067
Educational level	0.048
Employment status	0.068
Income category	0.000
The difference is significant at the 0.05 level	

Processing: authors

According to the analysis data (Table 7), in this case too, visitors from Germany spent more money on general services than visitors from Britain, which means that they bring greater benefits to all local businesses than British tourists.

Table 7. Expenses on General Services by Nationality-Country of Origin (in € per person)

Nationality - Country of origin	N	Average	Minimum	Maximum	Range	Standard deviation
British	103	207.40	10.00	1,800.00	1,790	215.62
Germany	105	343.30	15.00	2,300.00	2,285	377.20
Other	44	200.62	20.00	1.020,00	1,000	201.52

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Concerning the expenditure on general services in relation to education level (Table 8), it is observed that visitors who are more supportive of the local economy have a postgraduate degree, as opposed to those with lower education which result in lower spending.

Table 8. Expenses on general services by education level (in € per person)

Educational level	N	Average	Minimum	Maximum	Range	Standard deviation
Basic education	25	170.86	30	300	522	115.31
Secondary Education	58	296.11	30	700	670	232.22
University graduate	103	295.85	20	1,300	1,280	216.80
Postgraduate studies	66	320.83	30	2,200	2,170	405.61

Processing: authors

Finally, with regard to the expenditure on general services compared to the 'income level' (Table 9), it is observed that the middle income categories have similar consumption habits in terms of the level of expenditure on general services. On the other hand, the two extreme income categories cause the lowest and highest costs for general services while staying at a destination.

Table 9. Expenses on general services by income category (in € per person)

Income category	N	Average	Minimum	Maximum	Range	Standard deviation
Under 12,000 €	86	151.15	20	800	780	163.18
12,001-30,000 €	98	263.15	15	2,200	2,185	303.15
30,001-50,000 €	57	265.78	20	850	830	201.58
Over 50,001 €	11	411.10	30	2,200	2,170	412.22

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5. CONCLUSIONS

Based on international literature and the findings of the present study, a strong interdependence relationship between air transport and the economy at national and local level is confirmed, with the overwhelming majority of tourists, especially in Greece, choosing airplane as the main means of transport (SETE Intelligence, 2019). In particular, in isolated geographical or tourist areas it is very interesting to clearly determine the extent to which regional airports have an impact on local economic development.

It is a fact that the liberalization of air transport that has led to increased competition and the emergence of Low Cost Carriers has brought new opportunities to the transport sector, passenger transport, the organization and management of regional airports, but has also created the need to assess the impact of many regional airports on the local economy. As identified in the international literature, the main effects of utilizing regional airports are on increasing the traffic and recognition of destinations and on the multiplier economic benefits they bring to local business and the economy.

In the Peloponnese, which is the study area of the present research work, there is a strong seasonality in tourism activity and a high degree of dependence on the domestic market. Consequently, the development of an airport like that of Tripoli, proximity to all central and southeastern Peloponnese would constitute an essential infrastructure project crucial to the economic development of the wider region.

Concerning the effects that the operation of a regional airport such as Tripoli could have on hotels and supplementary tourism businesses, the findings of the primary research are very interesting. In particular, having a closer and cheaper airline connection with the tourist destinations under study seems to attract a much higher number of visitors to the wider area. According to survey data, visitors who would choose an airport closer to their destination of choice, such as Tripoli Airport in Greece, which could support Low Cost Carriers, are in the majority of highly educated, well-informed people with high demands on infrastructure and social services, elements which should be taken into account by the development stakeholders involved in the tourist strategic planning of the area.

The fact that the majority of the guests who would choose a low cost regional airport supported by Low Cost Carriers is a reflection on the amount of total costs to be incurred. But a similar consumer behaviour is offset by the fact that cheap airfare has a high traffic and repeatability in the region, with multiplier benefits for tourism businesses and the local economy.

From a comparative analysis of expenses based on demographic characteristics, some source-markets for Greece, such as the German market, appear to be more interesting than others, because of their higher spending, so they should be further approached with more active promotional policies of the tourist product of the Peloponnese. At the same time, the extent of the cost of accommodation, regardless of nationality, shows that the economic benefits are evenly distributed across almost all categories of tourist accommodation, regardless of the price and quality of service provided.

Interestingly, the low-cost savings on air fare through Low Cost Carriers, primarily favor tourist accommodation, compared to other tourism businesses, since most of the total cost appears to be transferred to the cost of accommodation. On the other hand, high-educated people spend much of their total spending on one destination in general services, beyond accommodation and fares, thereby significantly boosting the local economy as a whole, against lower education categories level.

On the demand side, the middle income categories appear to have similar preferences and consumer behavior, at least in terms of spending on more general services. On the supply side, such a conclusion can be attributed to the level of prices and services of existing destinations businesses, which are priced in these income categories.

According to the data provided, it is found that, at least in the short term, the operation of a regional airport such as that of Tripoli, along with the development of Low Cost Carriers, which have been the catalysts of aviation growth over the last ten years in Europe and Greece in particular, it will contribute to the development of entrepreneurship and the economy of the Peloponnese. It will also strengthen existing target markets and open new ones, increase business and price competitiveness, lengthen the tourist season, and develop new products and services.

Finally, in the long run, in order to maintain and further develop the tourism capital of the Peloponnese, there must be adequate tourism strategic planning, a sustained program of public investment in infrastructure projects and special tourist facilities and a continuous upgrade of tourism services. In any case, specifically, how an airport such as Tripoli, in addition to its importance for local development, can be economically viable should be the subject of further research.

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SPATIAL PATTERNS OF DOMESTIC AIR PASSENGER TRAFFIC GENERATION IN NIGERIA

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ABSTRACT

This study aims at analyzing the spatial patterns of domestic air passenger traffic generated by the interacting city-pairs in Nigeria's air transportation system at five points in time – 2003, 2006, 2010, 2014 and 2018 to establish the spatial and temporal changes that have taken place over time. It also examined the relationships between the populations of the cities and the volumes of domestic air passenger traffic generated by the cities to establish the impact of population on the traffic generating capacity of the cities. The volumes of domestic air passengers handled by each city, the percentage share of total traffic, the populations of the cities, the Pearson's Product Moment Correlation Coefficient and the student's 't' test were used for the analyses. The study revealed that Lagos was the dominant domestic air passenger traffic generation centre. It established that few centres generated most of the domestic air passenger traffic in Nigeria and that the spatial pattern of traffic generation tended more towards concentration than dispersal. The study also found that there were statistically positive relationships between the populations of the cities and the volumes of traffic generated by the cities. Balanced regional development is recommended, among others, to help redistribute population among the cities in the air transportation system in Nigeria so as to increase their air passenger traffic generating capacity.

KEYWORDS

Domestic air passenger traffic, Traffic Generation, Concentration, Population, Generating Capacity, Balanced Regional development

1. INTRODUCTION

Transportation involves the movement of people, goods, services and information between points in space. It helps in creating useful links between regions and economic activities; between people and the rest of the world (Rodigue et al, 2006). Air transportation is the use of aircraft in moving people, goods and information from one point to another. The development of air transportation in Nigeria started after the World War 11 and it has since then, like other transportation modes, contributed to the socio – economic development of Nigeria, especially in areas of movement of people and goods within the country and across international borders, generation of revenue and employment.

Air traffic is classified into passenger, freight and mail. In Nigeria, domestic air traffic is classified into passenger, cargo, mail and excess luggage. Cargo and excess luggage constitute freight traffic (Filani, 1975). Domestic air passenger traffic is the air passenger traffic exchanged by the city-pairs within the air transportation system in any country, including Nigeria. Domestic air passenger traffic pre-dominated the air transport system in Nigeria. It accounted for 71.73% in 2003, 72.80% in 2004, 72.13% in 2014 and 74.24% in 2018 (NCAA, 2003, 2004, 2014 and NBS, 2018). The number of domestic air passengers lifted in Nigeria increased to over 8,000,000 in 2007 (Abioye, 2009), over 11,700,000 in 2014 (NCAA, 2014) and over 12,000,000 in 2018 (NBS, 2018).

Nigeria is a relatively large country where population and economic activities are concentrated in certain points, both far from and near to each other. This spatial arrangement generates spatial interaction between various points of concentration of population, economic, socio-cultural and political activities within the country.

Early research works on spatial interaction have identified population as a primary factor that determined airline passenger traffic patterns. Harvey (1951) examined the factors determining the airline passenger traffic pattern within the United States and identified population of the communities in a pair as well as the distances between them as the primary factors affecting traffic flow. In a similar study, Taaffe (1956) has shown that urban population is a dominant factor affecting concentration of air passenger traffic in the United States.

More recent studies on traffic interaction have incorporated additional factors – attractive forces such as Gross Domestic Product (GDP), employment, per capita income, percentage of employees and frictional forces including travel time, travel cost and scheduled frequency. The outcome of the studies still identified population as a prominent factor affecting concentration of air passenger traffic. Alam and Karim (1997) developed city-pair demand

models for the analysis of domestic air transportation in Bangladesh using demand and supply variables of population, employment, Gross Domestic Product (GDP), dummy, travel time, travel cost and distance. The study indicated that population was a dominant and highly significant variable affecting domestic air traffic, followed by GDP and employment. This result was supported by the findings of the research by Masumoto (2005) on the hubness of Asian major cities in terms of air traffic patterns. The result of his study indicated that population was more important in explaining air traffic flows than GDP. Sivrikaya and Tunç (2013) also indicated that urban population, distance, and number of beds in tourism facility were found to have significantly boosted domestic air transport demand by city-pair level in Turkey. Cohen (2016), in his explanation of global city-pair air travel demand and forecasting of air traffic flows found, among other things, that population and income (measured as GDP) were very important drivers of travel demand. Bardi (2017) also examined the effect of population variable on domestic air passenger traffic flow in Nigeria and established that population had significant positive influence on domestic air passenger traffic flow in Nigeria during the 2003, 2006, 2010 and 2014 periods.

A lot of changes have taken place over the years in the domestic air transport arena in Nigeria. The Nigerian government has formally liberalized the air transport sector since 2001 and as at 2018, many private airlines, among which were Aero Contractors, Arik Airlines, First Nation Airlines, Dana Airlines, Peace Airlines, Medview Airlines, Overland Airways, Azman Airlines and Max Airlines participated in the provision of domestic air passenger services to take care of the increasing air passenger traffic. The situation has, therefore, changed and the new characteristics and pattern of generation of domestic air passenger traffic need to be established to ascertain the spatial and temporal changes that have taken place over time. This study was, therefore, conceived to analyze the spatial pattern of domestic air passenger traffic generation in Nigeria and since population had been identified as a prominent factor affecting air passenger traffic pattern it would, in addition, establish the relationship between the populations of the interacting city-pairs in Nigeria and the domestic air passenger traffic generated by the cities to ascertain the impact of population on the generating capacity of the cities.

2. THE STUDY AREA

This study focused mainly on Nigeria, which lies between Longitudes 3^0 and 15^0 east of the Greenwich Meridian and between Latitudes 4^0 and 14^0 north of the Equator. It covers an area of 923,769km^2. Nigeria is a relatively very populous country. The official census of 1963 put the population figure at 55,600,000 while that of 1991 was put at 88,500,000. The results of the 2006 census put the total population of Nigeria at over 140,000,000 and the density of

the population was 139 persons/km^2 ((NPC 2007). In 2014 the population of Nigeria was estimated to be 177,500,000 and according to World Population Review, (2019), Nigeria's population is estimated at 200,963,599 in July 2019, with estimated density of 212.04 persons/km^2 and growth rate of 2.62%.

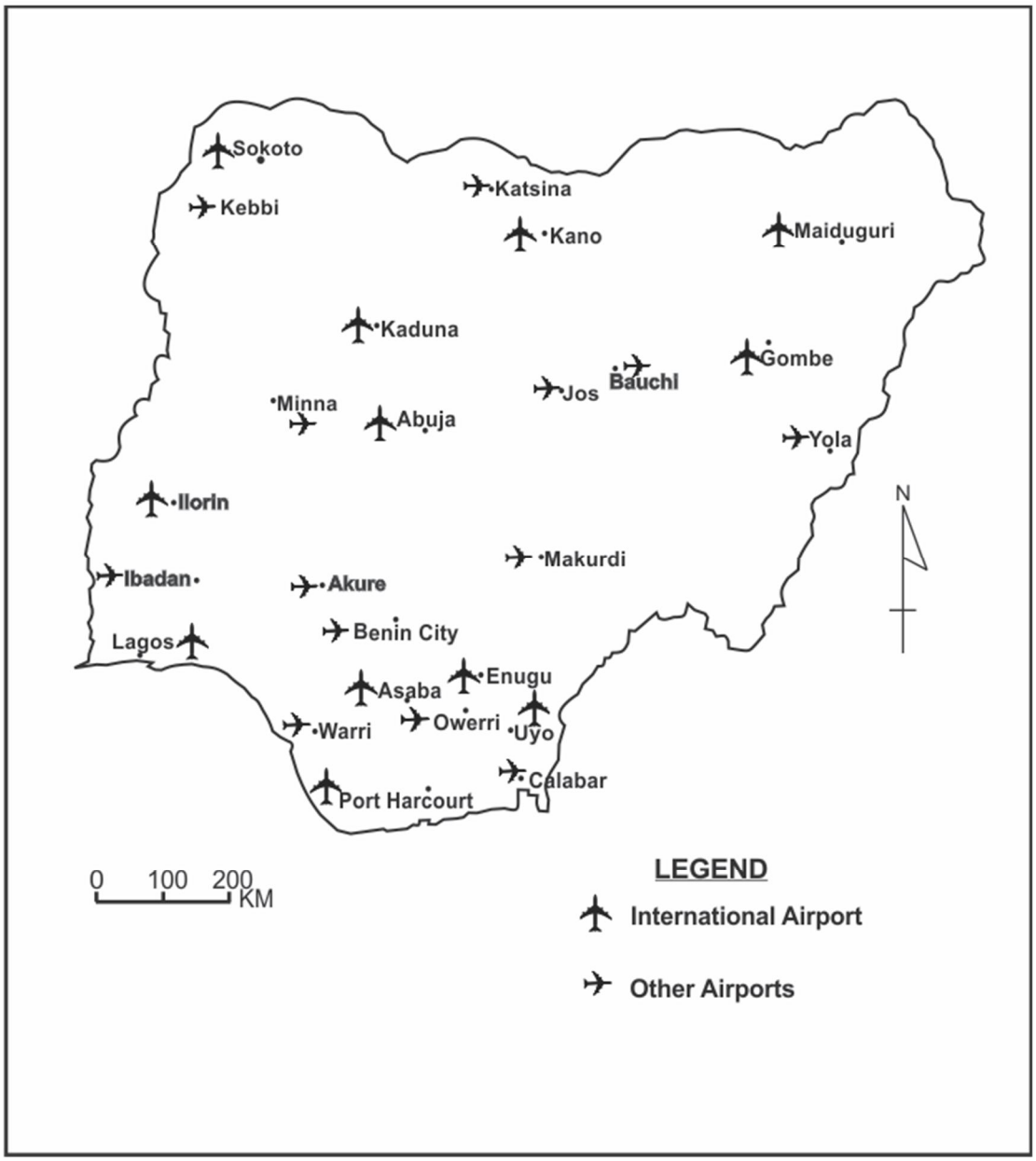
The level of urbanization i.e. the proportion of the population living in the urban centres in Nigeria in 2006 was 45% and the results of the 2006 census estimated the rate of urbanization in Nigeria to be 5.3% /year (Federal Republic of Nigeria, 2008). The Federal Capital Territory, Abuja and all the state capitals are urban centres and all the Local Government Area Headquarters were given urban status during the 1976 Local Government Reforms and this increased the number of urban centres within the country. This increase in urbanization intensified the drift of population from the surrounding rural areas to the urban centres in order to explore the opportunities in them, thereby leading to concentration of population at specific points in the country. This concentration of population at specific points, the distances separating them and the various socio-economic activities going on in them increased the demand for transportation for effective interaction.

The expanding transportation systems in Nigeria provide the infrastructural basis that facilitates socio-economic development. The earliest form of transport in Nigeria is water transport and the other modes of transport are road, rail, pipeline, air and rope/cableways. Water transport dominated the transport system until 1912 when the first railway from Lagos to Kano was completed. Road transport was developed when motor vehicle was introduced in 1920s and in the 1940s air transport was developed.

The history of air transport dates back to the end of the World War 11 in 1945, and since its inception there has been a tremendous increase in the volume of air traffic. Over 450 scheduled flights were handled every day through domestic and international flights in 2007 (Abioye, 2008) and the number increased to 724 in 2008 (Abioye, 2009). In 2014 the total scheduled domestic aircraft movement in Nigeria was 137,927 (NCAA, 2014) and the number increased to 234,367 in 2018 (NBS, 2018).The Federal Government of Nigeria has been spending huge capital on the aviation sector. In 2004 Appropriation Act a total of ₦4,620,700,000 was allocated to the aviation sector and this jumped to ₦21,711,466,589 in 2007 and further increased to ₦36,579,702,475 in 2008 Appropriation Act (Federal Republic of Nigeria, 2004, 2007 and 2008). However, the total allocation to the aviation sector decreased to ₦34,829,565,713 in the 2011 budget and to ₦32,308,750,792 in the 2014 budget (Federal Republic of Nigeria, 2011 and 2014).

As at 1986 there were 16 government-owned airports controlled by the Nigeria Airports Authority. The number increased to 25 in 2014 as can be seen in Figure 1. In addition, there were many public and private landing strips located at places approved by the government.

Figure 1. Airports in Nigeria



Source: Produced from the Data obtained from the NCAA

3. DATA AND METHODS

This study was based on domestic air passenger traffic data from all airlines that provided scheduled domestic air passenger services in Nigeria at five points in time – 2003, 2006, 2010, 2014 and 2018; the volumes of traffic generated by each city in the domestic air network;

their percentage share of total domestic air passenger traffic, and the population of each city. All the cities in the domestic air network and the volume of domestic air passenger traffic generated by each city, which included the outgoing (departure) and incoming (arrival) traffic, were obtained from the Nigerian Civil Aviation Authority (NCAA). The population figures for the cities were obtained from the Nigerian Population Commission (NPC). The volumes of traffic generated by each city and their percentage share of total traffic from all airports, as given by the NCAA, were used for the analyses.

The 1991 population census figures were used for the projection of the population of cities within the air transport system during the study periods. The 1991 census population figures for the cities were projected to the figures for 2003, 2006, 2010, 2014 and 2018, using the growth rates of 9.3% for Abuja, 4.7% for Lagos and 3.2% for other cities, and the formula –

$$P_1 = P_0 e^{r.t}$$

Where P_1 is the projected population, P_0 is the base population; r is the rate of population growth; t is the time interval; e is the exponential of the product of r and t.

It would have been ideal to use the 2006 population census figures (the most recent then) for the projection but the 2006 figures were rendered in national, state and local government levels and did not record the population of the individual cities. The 1991 population census figures recorded the population of the individual cities hence the 1991 figures were used for the projection. The relationship between the populations of the cities and the volumes of traffic generated by each city was established, using the Pearson's Product Moment Correlation Coefficient and the significance of the relationship was tested using the Student's 't' test.

4. RESULTS AND DISCUSSION

4.1 Spatial patterns of Domestic Air Passenger Traffic Concentration

The volume of domestic air passenger traffic handled by each city within Nigeria's domestic air transportation system during the five time periods – 2003, 2006, 2010, 2014 and 2018 and their percentage share of total domestic air passenger traffic are shown in Tables 1, 2, 3, 4 and 5. Table 1 shows that in 2003, Lagos played a dominant role in traffic generation. It accounted for 39.09% of Nigeria's total domestic air passenger traffic. Other centres that generated heavy traffic in 2003 were Abuja (23.98%), Port Harcourt (14. 44%), Warri (6.64%), Enugu (3.45%) and Kano (2.83%). These six centres – Lagos, Abuja, Port Harcourt, Warri, Enugu and Kano generated 90.43% of the total domestic air passenger traffic in 2003.

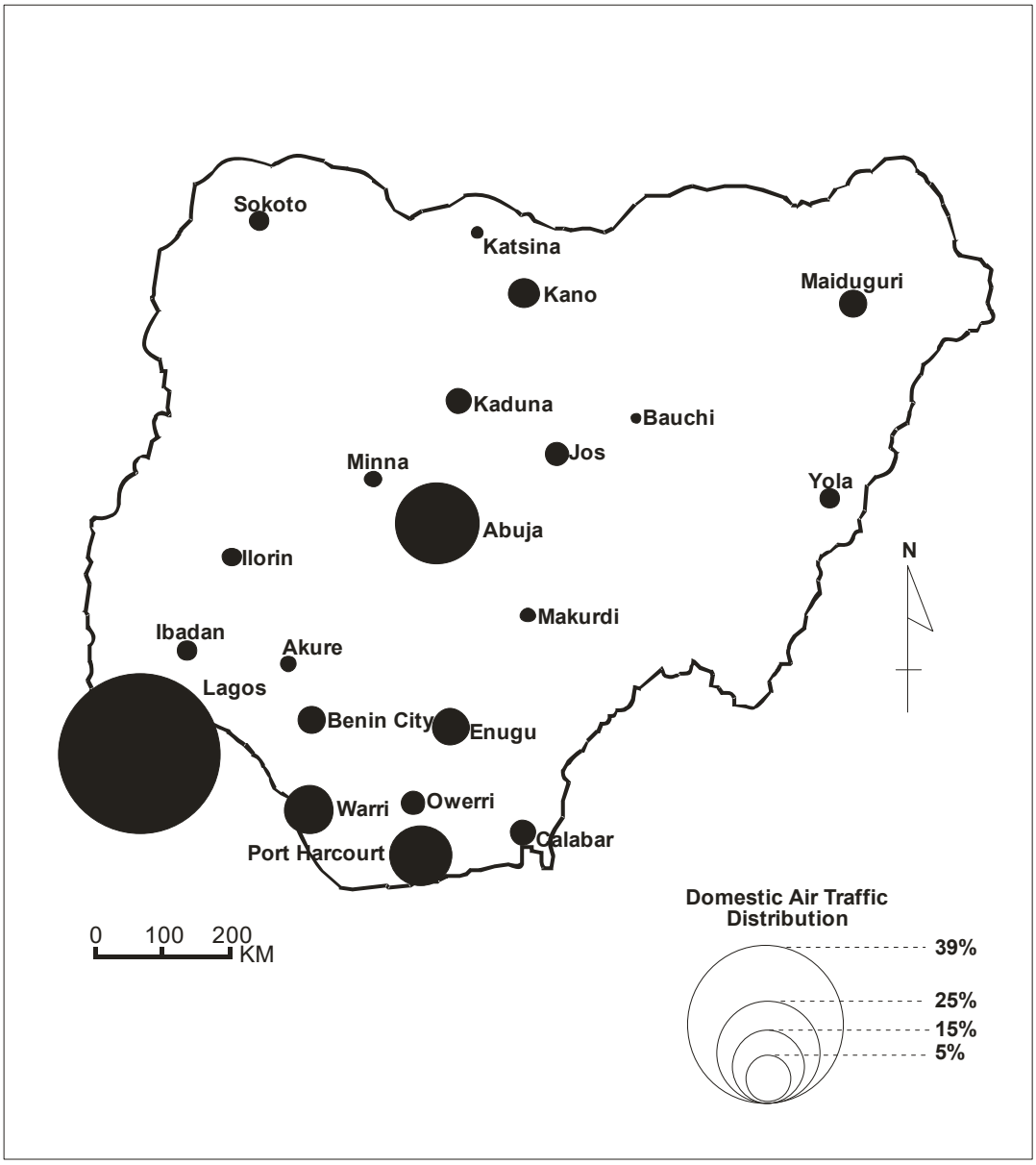
The pattern of distribution of the total domestic air passengers handled at each airport in 2003 is illustrated in Figure 2.

Table 1. Total Domestic Air Passengers Handled by the Nigerian Airports in 2003 and their Percentage share of traffic

S/NO.	PASSENGER		MOVEMENT	TOTAL	PERCENTAGE SHARE OF TRAFFIC
	AIRPORT	ARRIVAL	DEPARTURE		
1.	ABUJA	709,251	706,755	1,416,006	23.98
2.	AKURE	1,615	1,422	3,037	0.05
3.	BAUCHI	895	864	1,759	0.03
4.	BENIN	35,695	35,038	70,733	1.20
5.	CALABAR	60,577	61,362	121,939	2.07
6.	ENUGU	99,216	104,800	204,016	3.45
7.	IBADAN	2,574	2,486	5,060	0.09
8.	ILORIN	3,022	2866	5,888	0.10
9.	JOS	23,142	20,937	44,079	0.75
10.	KADUNA	62,979	60,435	123,414	2.09
11.	KANO	84,646	82,414	167,069	2.83
12.	KATSINA	869	888	1,757	0.03
13.	LAGOS	1,150,013	1,158,757	2,308,770	39.09
14.	MADUGURI	35,094	34,399	69,493	1.18
15.	MAKURDI	984	1525	2509	0.04
16.	MINNA	2,329	2,492	4,821	0.08
17.	OWERRI	25,011	20,093	45,104	0.76
18.	PORT HARCOURT	451,638	400,883	852,521	14.44
19.	SOKOTO	10,234	11,550	21,784	0.37
20.	WARRI	197,639	194,276	391,915	6.64
21.	YOLA	22,602	23,313	45,915	0.77
TOTAL		**2,979,041**	**2,926,030**	**5,905,071**	**100**

Source: Nigerian Civil Aviation Authority (NCAA) Statistical Data, 2003

Figure 2. Per Cent Distribution of Domestic Air Passenger Traffic Handled By Each City, 2003.



Source: Produced from NCAA Statistical Data for 2003

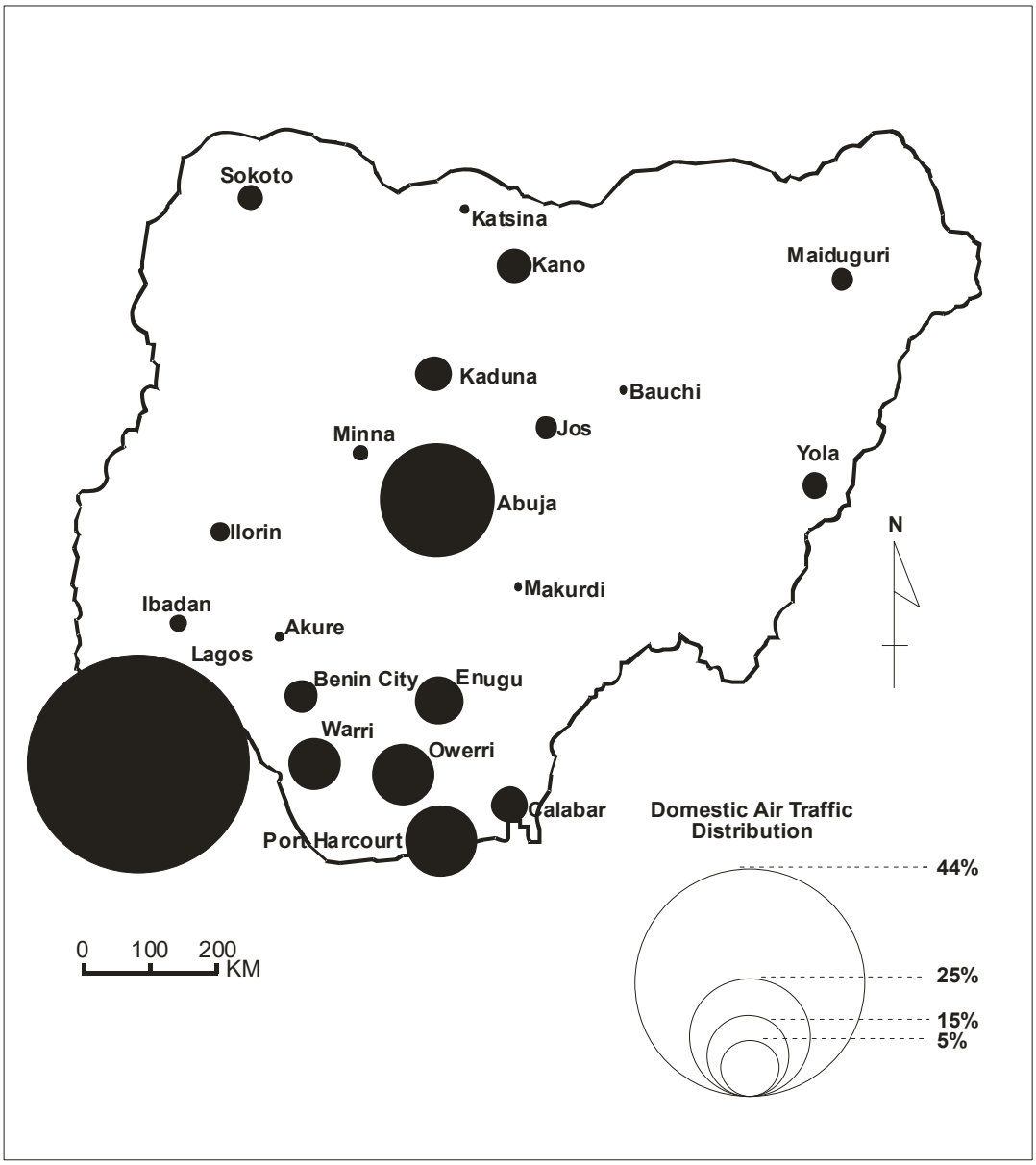
Table 2 shows that in 2006, Lagos dominated the generation of domestic air passenger traffic as it accounted for 43.75% of the total domestic air passenger traffic generated in Nigeria. The six - heavy traffic generating centres - Lagos (43.75%), Abuja (24.68%), Port Harcourt (8.81%), Owerri (4.85%), Warri (3.82%) and Enugu (2.94%) generated 80.1% of the total domestic air passenger traffic in Nigeria. The pattern of traffic generation in 2006 is shown in Figure 3.

Table 2. Total Domestic Air Passengers Handled by the Nigerian Airports in 2006 and their percentage share of traffic

S/NO.	PASSENGER		MOVEMENT	TOTAL	PERCENTAGE SHARE
	AIRPORT	ARRIVAL	DEPARTURE		OF TRAFFIC
1.	ABUJA	802,571	804,850	1,607,421	24.68
2.	AKURE	1,548	1,488	3,036	0.05
3.	BAUCHI	527	625	1,152	0.02
4.	BENIN	45,532	45,924	91,456	1.40
5.	CALABAR	83,123	83,631	166,754	2.56
6.	ENUGU	97,883	93,558	191,441	2.94
7.	IBADAN	5,646	6,596	12,242	0.19
8.	ILORIN	10,159	9,064	19,223	0.30
9.	JOS	16,304	14,454	30,758	0.47
10.	KADUNA	54,749	54,412	109,161	1.68
11.	KANO	80,361	74,306	154,657	2.37
12.	KATSINA	216	189	405	0.01
13.	LAGOS	1,415,605	1,434,155	2,849,760	43.75
14.	MADUGURI	14,965	15,717	30,682	0.47
15.	MAKURDI	120	122	242	0.004
16.	MINNA	4,277	3,219	7,496	0.12
17.	OWERRI	168,568	147,031	315,599	4.85
18.	PORT HARCOURT	278,110	295,697	573,807	8.81
19.	SOKOTO	17,820	28,109	45,929	0.71
20.	WARRI	128,456	120,281	248,737	3.82
21.	YOLA	26,453	27,094	53,547	0.82
TOTAL		**3,252,983**	**3,260,522**	**6,513,505**	**100**

Source: NCAA Statistical Data, 2006

Figure 3. Per Cent Distribution of Domestic Air Passenger Traffic Handled By Each City, 2006.



Source: Produced from NCAA Statistical Data for 2006

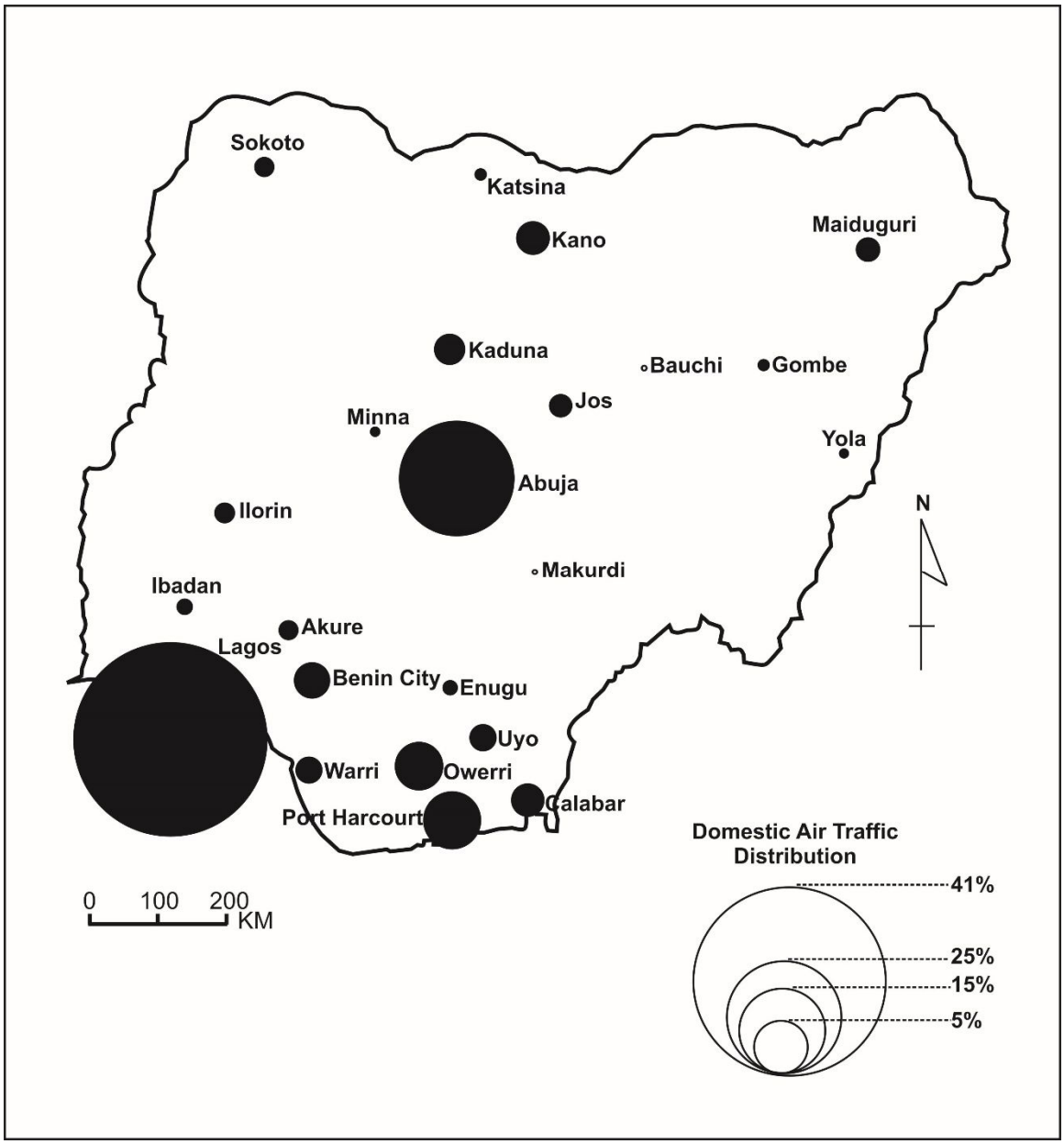
In 2010, Lagos dominated the air passenger traffic generation in Nigeria. As can be seen from Table 3, Lagos accounted for 40.60% of the total domestic air passengers. As in other years, there were six heavy traffic generating centres in 2010, namely Lagos (40.60%), Abuja (30.88%), Port Harcourt (8.73%), Owerri (3.91%), Benin (2.90%), and Calabar (2.36%). These six centres generated 89.3% of the total domestic air passenger traffic generated in 2010. This pattern of traffic generation is illustrated in Figure 4.

Table 3. Total Domestic Air Passengers Handled by the Nigerian Airports in 2010 and their Percentage Share of Traffic

S/NO.	AIRPORT	TOTAL PASSENGER	PERCENTAGE SHARE OF TRAFFIC
1.	ABUJA	1,643,838	30.88
2.	AKURE	2,766	0.52
3.	BAUCHI	00000	0.00
4.	BENIN	154,558	2.90
5.	CALABAR	125,418	2.36
6.	ENUGU	11,875	0.22
7.	IBADAN	17,976	0.34
8.	ILORIN	23,714	0.45
9.	JOS	37,064	0.70
10.	KADUNA	83,931	1.58
11.	KANO	124,963	2.35
12.	KATSINA	5,262	0.10
13.	LAGOS	2,161,264	40.60
14.	MADUGURI	47,301	0.89
15.	MAKURDI	0000	0.00
16.	MINNA	950	0.02
17.	OWERRI	208,267	3.91
18.	PORT HARCOURT	464,945	8.73
19.	SOKOTO	29,188	0.55
20.	WARRI	69,894	1.31
21.	YOLA	51,440	0.97
22.	GOMBE	5,224	0.10
23.	UYO	53,199	1.00
TOTAL		**5,323,035**	**100**

Source: Computed from the NCAA Statistical Data, 2010

Figure 4. Per Cent Distribution of Domestic Air Passenger Traffic Handled by Each City, 2010.



Source: Produced from NCAA Statistical Data for 2010

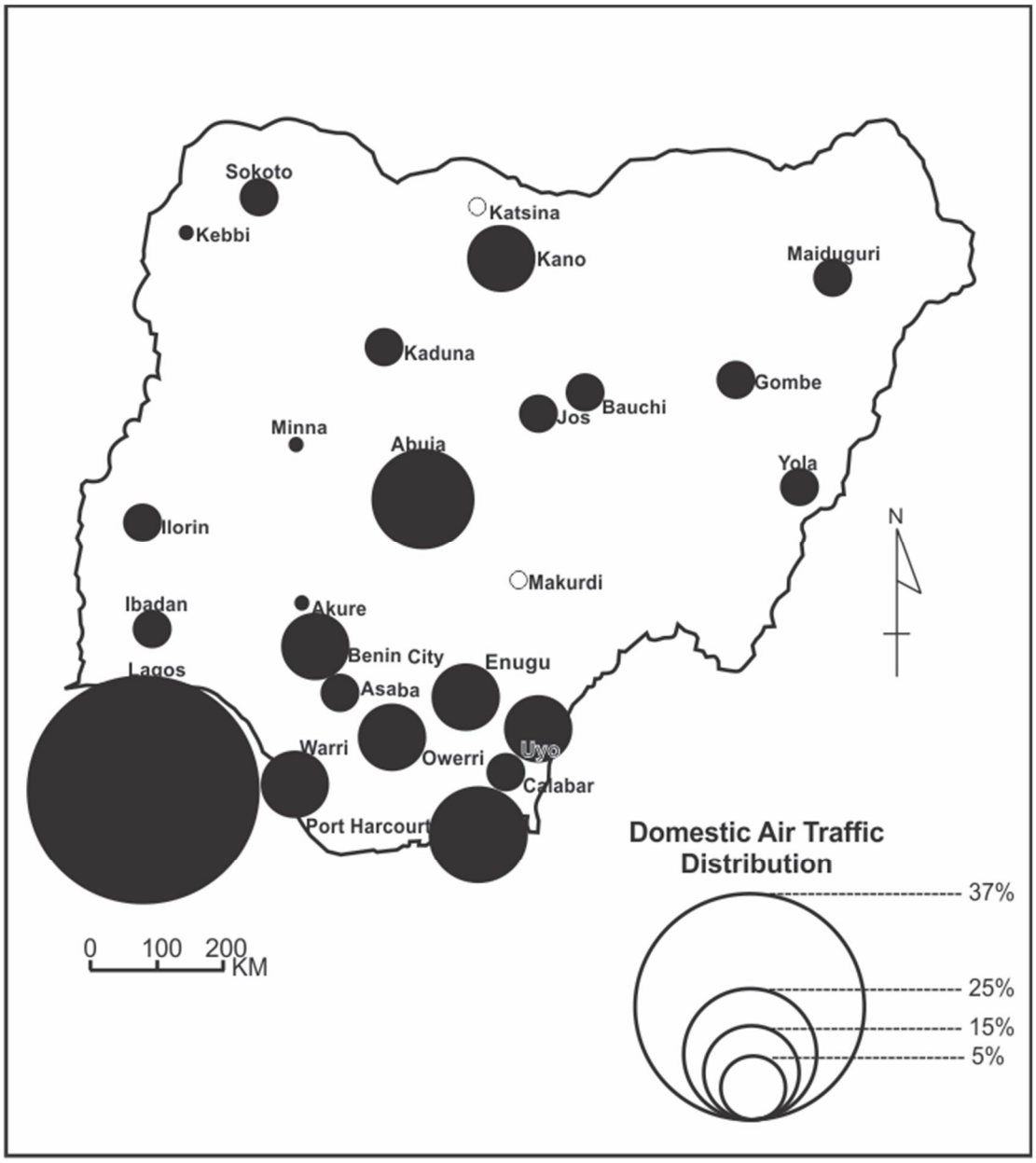
In 2014, Lagos continued to dominate the domestic air passenger traffic generation in Nigeria. It generated 37.13% of the total traffic. Lagos and the other five heavy traffic generating centres generated 84.08% of the total domestic air passenger traffic, viz – Lagos (37.13%), Abuja (28.75%), Port Harcourt (10.46%), Owerri (2.74%), Uyo (2.5%) and Kano (2.5%). The pattern of distribution of the traffic in 2014 is shown in Table 4 and Figure 5.

Table 4. Total Domestic Air Passengers Handled by the Nigerian Airports in 2014 and their percentage share of Traffic

S/NO.	PASSENGER		MOVEMENT	TOTAL	PERCENTAGE SHARE
	AIRPORT	ARRIVAL	DEPARTURE		OF TRAFFIC
1.	ABUJA	1,687,312	1,680,657	3,367,969	28.75
2.	AKURE	3,675	3,245	6,920	0.06
3.	ASABA	86,993	83,854	170,847	1.46
4.	BAUCHI	7,786	9,202	16,988	0.15
5.	BENIN	123,691	110,494	234,185	2.0
6.	CALABAR	99,765	101,456	201,221	1.72
7	ENUGU	146,462	141,059	287,521	2.45
8	GOMBE	15,883	15,487	31,370	0.26
9.	IBADAN	38,390	37,074	75,464	0.64
10.	ILORIN	43,137	42,853	85,990	0.73
11.	JOS	34,480	31,955	66,435	0.57
12.	KADUNA	94,212	95,215	192,427	1.64
13.	KANO	153,910	138,391	292,301	2.5
14.	KEBBI	984	1,081	2,065	0.02
15.	LAGOS	2,170,084	2,179,287	4,349,371	37.13
16.	MAIDUGURI	10,695	9,071	19,766	0.17
17.	MINNA	3,475	0	3,475	0.03
18.	OWERRI	161,602	159,079	320,681	2.74
19.	PORT HARCOURT	613,382	611,640	1,225,022	10.46
20.	SOKOTO	49,021	50,624	99,645	0.85
21.	UYO	144,629	147,732	292,361	2.5
22.	WARRI	108,257	109,110	217,367	1.86
23.	YOLA	76,336	76,211	154,547	1.32
TOTAL		**5,879,161**	**5,834,777**	**11,713,938**	**100**

Source: Computed from the NCAA Statistical Data, 2014.

Figure 5. Per Cent Distribution of Domestic Air Passenger Traffic Handled by Each City, 2014.



Source: Produced from NCAA Statistical Data for 2014.

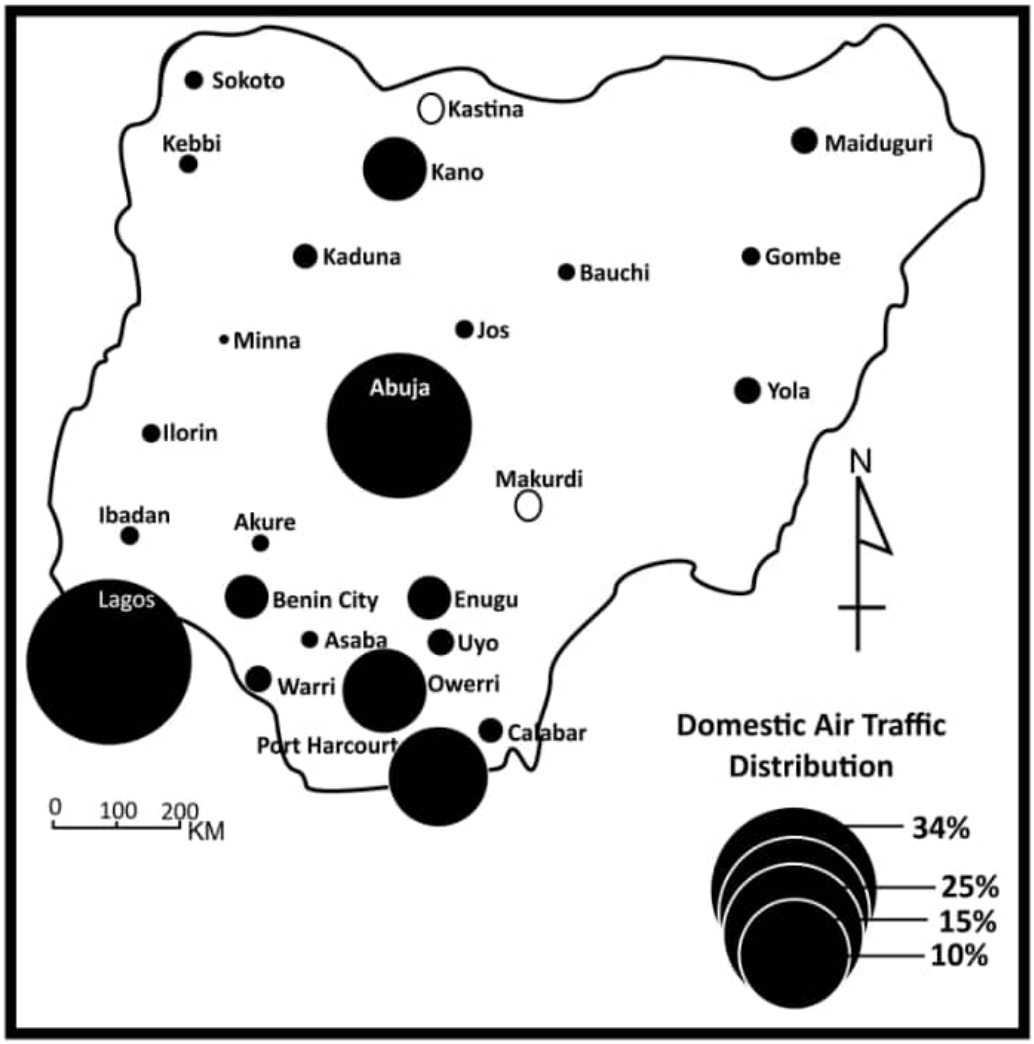
In 2018, Lagos still dominated the domestic air passenger traffic generation in Nigeria. It generated 33.88% of the total domestic air passengers. As shown in Table 5 there were six-heavy traffic generating centres in 2018. The six centres and the percentage of total domestic air passengers generated were Lagos (33.88%), Abuja (30.83%), Port Harcourt (8.56%), Owerri (4.07%), Kano (3.25%) and Enugu (2.72%). These six centres generated 83.31% of the total domestic air passenger traffic in 2018. The pattern of Domestic air passenger traffic generation in 2018 is illustrated in Table 5 and Figure 6.

Table 5. Total Domestic Air Passengers Handled by the Nigerian Airports in 2018 and their percentage share of Traffic

S/NO	PASSENGER		MOVEMENT	TOTAL	PERCENTAGE SHARE
	AIRPORT	ARRIVAL	DEPARTURE		OF TRAFFIC
1.	ABUJA	1,931,295	1,931,788	3,863,083	30.83
2.	AKURE	30,656	31,730	62,386	0.50
3.	ASABA	33,201	32,663	65,864	0.53
4.	BAUCHI	18,191	17,949	36,140	0.29
5.	BENIN	154,277	160,922	320,199	2.56
6.	CALABAR	81,912	84,240	166,152	1.33
7	ENUGU	170,448	170,591	341,039	2.72
8	GOMBE	28,392	28,011	56,403	0.45
9.	IBADAN	46,265	45,835	92,100	0.74
10.	ILORIN	57,276	56,691	113,967	0.91
11.	JOS	38,710	38,240	76,950	0.61
12.	KADUNA	83,667	85,281	168,948	1.35
13.	KANO	205,777	201,615	407,392	3.25
14.	KEBBI	14,928	15,257	30,185	0.24
15.	LAGOS	2,138,146	2,107,001	4,245,147	33.88
16.	MAIDUGURI	100,702	101,238	201,940	1.61
17.	MINNA	1,336	1,362	2,698	0.02
18.	OWERRI	257,880	252,666	510,546	4.07
19.	PORT HARCOURT	538,068	534,910	1,072,978	8.56
20.	SOKOTO	53,608	53,637	107,245	0.86
21.	UYO	116,169	116,658	232,827	1.86
22.	WARRI	87,478	87,594	175,072	1.40
23.	YOLA	89,587	92,423	182,010	1.45
TOTAL		**6,282,969**	**6,248,302**	**12,531,271**	**100.0**

Source: Computed from the NBS Air Transportation Data, 2018.

Figure 6. Per Cent Distribution of Domestic Air Passenger Traffic Handled By Each City, 2018.

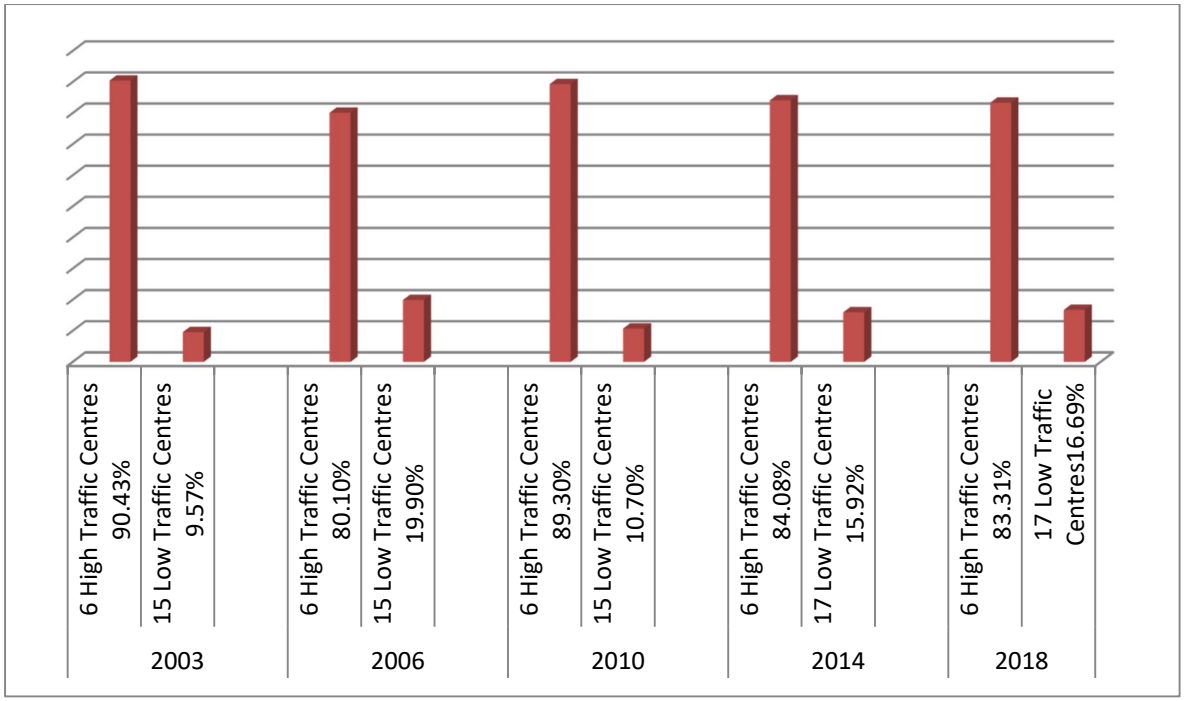


Source: Produced from NBS Air Transportation Data, 2018

A prominent aspect of domestic air passenger traffic generation in Nigeria is the dominance of Lagos during the study periods, as it accounted for 39.09%, 43.75%, 40.60%, 37.3% and 33.88% of the total domestic air passenger traffic in 2003, 2006, 2010, 2014 and 2018 respectively. Lagos is, therefore, the most dominant domestic air passenger traffic generating centre in Nigeria. This finding is similar to the findings by Filani, 1975 and Bardi, 1987. Filani (1975), in his study of the structural characteristics of domestic air transport in Nigeria, found Lagos to be a dominant airport in domestic air passenger traffic generation in 1960/61, 1965/66 and 1971/72 periods, when it accounted for 28.1%, 39.7% and 35.1% of Nigeria's total domestic air passenger traffic respectively. Bardi (1987) also found that Lagos played a dominant role in domestic air passenger traffic generation in 1980, 1983 and 1986, when it accounted for 45%, 46% and 48% of Nigeria's total domestic air passenger traffic respectively.

Another noticeable aspect of domestic air passenger traffic generation in Nigeria is the pattern where the distribution of traffic tended more towards concentration than dispersal. In 2003, the six centres in the category of heavy traffic generation centres handled 90.43% of the total domestic air passenger traffic. The remaining 15 centres handled only 9.57% of the passengers. In 2006, the six-heavy traffic generating centres handled 80.1% of the total domestic air passenger traffic while the remaining 15 centres handled only 19.9%. In 2010, the six-heavy generating centres handled 89.3% of the traffic, leaving only10.7% for the remaining 15 centres. In 2014, the six-heavy traffic generating centres handled 84.08% while the remaining 17 centres handled 15.92% and in 2018 the six centres in the category of heavy traffic generating centres handled 83.31% while the remaining 17 centres handled 16.69%. These patterns of domestic air passenger traffic generation are shown in Figure 7.

Figure 7. Patterns of Domestic Air Passenger Traffic Generation, 2003, 2006, 2010, 2014 and 2018



Source: Produced from NCAA Statistical Data for 2003, 2006, 2010, 2014 and NBS Air Transportation Data, 2018.

It can, therefore, be concluded that domestic air passenger traffic generation concentrated in few centres which generated most of the traffic during the 2003, 2006, 2010, 2014 and 2018 periods; and this suggests that only few airports in Nigeria (the six that generated heavy traffic each year) were viable during the study periods. The few traffic generated by the other airports seemed inadequate to keep them thriving without their operations being subsidized with the revenue from the more viable airports.

Most centres were found to be low traffic generating centres presumably because of their low level of involvement in commercial and industrial activities which could not support high level of spatial interaction among them and other cities in Nigeria. However, Ibadan, with its high population and high level of commercial and industrial activities, generated low domestic air passenger traffic during the study periods (see Tables 1-5). This probably resulted from the 'traffic shadow effect' created by its nearness to Lagos which is a heavy traffic generating centre, and the presence of good network of roads, including the Lagos Ibadan highway that provides competitive alternatives to potential air travelers.

There were spatial and temporal changes in the volumes and patterns of domestic air passenger traffic generation in Nigeria. The volumes of traffic generated by the cities in the domestic air network varied from city to city as can be seen in Tables 1, 2, 3, 4 and 5 and in Figures 2, 3, 4, 5 and 6. However, Lagos retained its 1st position as the most dominant domestic air passenger traffic generating centre throughout the periods of study. The volumes of the total traffic generated by the six-heavy traffic generating centres each year also varied from year to year. There were changes in the list of cities with high traffic generating capacity over the study periods. For example, Kano was listed among the cities with high generating capacity in 2003 and 2006 but was replaced by Calabar in 2010. Warri and Enugu were also among the cities in 2003, 2006 and 2010 but were replaced by Owerri and Uyo in 2014 and in 2018 Uyo was replaced by Enugu. However, the pattern of traffic generation, where few centres generated most of the domestic air passenger traffic remained the same during the study periods.

4.2 Relationship between the Populations of the Interacting Cities and the Volumes of Domestic Air Passenger Traffic Generated by the Cities

The relationships between the population of each city and the total traffic generated by each city within the air transport system in Nigeria in 2003, 2006, 2010, 2014 and 2018 were established using the Pearson's Product Moment Correlation Coefficient (r). The SPSS Version 22 was used for the computation. The population of each city and the total traffic handled by each city for the study periods, as shown in Tables 6, 7, 8, 9 and 10 were used for the analyses. The populations of the cities were represented as independent variable (X) while the volumes of the total traffic handled by the cities were represented as dependent variable (Y).In order to reduce the effects of large ranges in the data set and achieve better linear relationship, the data of both X and Y axes were transformed to logarithms (log X and log Y).

Table 6. Population of the Cities and the Total Traffic Handled by each City within the Domestic Air Transport System in 2003

S/NO	CITY	POPULATION	POPULATION ESTIMATE (X)	TOTAL TRAFFIC HANDLED (Y)	Log X	Log Y
		1991	2003	2003		
1.	ABUJA	371,674	545,671	1,416,006	5.74	6.15
2.	AKURE	239,124	351,069	3,037	5.54	3.48
3.	BAUCHI	206,537	303,226	1,759	5.48	3.25
4.	BENIN	762,719	1,119,782	70,733	6.05	4.85
5.	CALABAR	310,839	456,357	121,939	5.66	5.09
6.	ENUGU	407,756	598,645	204,016	5.78	5.31
7.	IBADAN	1,835,300	2,694,487	5,060	6.43	3.70
8.	ILORIN	532,089	781,184	5,888	5.89	3.77
9.	JOS	510,300	749,195	44,079	5.87	4.64
10.	KADUNA	993,642	1,458,811	123,414	6.16	5.09
11.	KANO	2,166,554	3,180,816	167,060	6.50	5.22
12.	KATSINA	259,315	380,712	1,757	5.58	3.24
13.	LAGOS	5,195,247	9,131,630	2,308,770	6.96	6.36
14.	MAIDUGURI	618,278	907,722	69,493	5.96	4.84
15.	MAKURDI	151,515	222,446	2,509	5.35	3.40
16.	MINNA	189,191	273,724	4,821	5.44	3.68
17.	OWERRI	119,711	175,753	45,104	5.24	4.65
18.	PORT HARCOURT	703,421	1,032,724	852,521	6.01	5.93
19.	SOKOTO	329,639	483,958	21,784	5.68	4.34
20.	WARRI	363,382	533,498	391,915	5.73	5.59
21.	YOLA	54,810	80,469	45,915	4.91	4.67

Source: NCAA Statistical Data, 2003 for the Traffic Data, NPC for the 1991 Census Figures on which the Estimates were based.

Table 7. Population of the Cities and the Total Traffic Handled by each City within the Domestic Air Transport System in 2006

S/NO.	CITY	POPULATION	POPULATION ESTIMATE (X)	TOTAL TRAFFIC HANDLED (Y)	Log X	Log y
		1991	2006	2006		
1.	ABUJA	371,674	1,406,239	1,607,421	6.15	6.21
2.	AKURE	239,124	386,442	3,036	5.59	3.48
3.	BAUCHI	206,537	333,779	1,152	5.52	3.06
4.	BENIN	762,719	1,232,611	91,456	6.01	4.96
5.	CALABAR	310,839	502,339	166,754	5.70	5.22
6.	ENUGU	407,756	658,964	191,441	5.82	5.28
7.	IBADAN	1,835,300	2,965,981	12,242	6.47	4.09
8.	ILORIN	532,089	859,895	19,223	5.93	4.28
9.	JOS	510,300	824,683	30,758	5.92	4.49
10.	KADUNA	993,642	1,605,779	109,161	6.21	5.04
11.	KANO	2,166,554	3,501,315	154,657	6.54	5.19
12.	KATSINA	259,315	419,072	405	5.62	2.61
13.	LAGOS	5,195,247	10,514,383	2,849,760	7.02	6.45
14.	MAIDUGURI	618,278	999,183	30,682	6.00	4.49
15.	MAKURDI	151,515	244,860	242	5.39	2.38
16.	MINNA	189,191	307,747	7,496	5.49	3.87
17.	OWERRI	119,711	193,462	315,599	5.27	5.50
18.	PORT HARCOURT	703,421	1,136,781	573,807	6.06	5.76
19.	SOKOTO	329,639	532,721	45,929	5.73	4.66
20.	WARRI	363,382	587,252	248,737	5.77	5.40
21.	YOLA	54,810	88,577	53,547	4.95	4.73

Source: NCAA Statistical Data, 2006 for the Traffic Data. NPC for the 1991 Census Figures on which the estimates were based.

Table 8. Population of the Cities and the Total Traffic Handled by each City within the Domestic Air Transport System in 2010

S/NO.	CITY	POPULATION	POPULATION ESTIMATE (X)	TOTAL TRAFFIC HANDLED (Y)	Log X	Log y
		1991	2010	2010		
1.	ABUJA	371,674	2,015,604	1,643,838	6.30	6.22
2.	AKURE	239,124	439,212	2,766	5.64	3.44
3.	BENIN	762,719	1,400,927	154,558	6.15	5.19
4.	CALABAR	310,839	570,935	125,418	5.76	5.10
5.	ENUGU	407,756	784,948	11,875	5.89	4.07
6.	IBADAN	1,835,300	3,370,995	17,976	6.53	4.25
7.	ILORIN	532,089	997,317	23,714	6.00	4.38
8.	JOS	510,300	937,296	37,064	5.97	4.57
9.	KADUNA	993,642	1,825,076	83,931	6.26	4.92
10.	KANO	2,166,554	3,979,427	124,963	6.60	5.10
11.	KATSINA	259,315	476,298	5,262	5.68	3.72
12.	LAGOS	5,195,247	12,689,110	2,161,264	7.10	6.33
13.	MAIDUGURI	618,278	1,135,625	47,301	6.06	4.67
14.	MINNA	189,191	347,497	950	5.54	2.98
15.	OWERRI	119,711	219,880	208,267	5.34	5.32
16.	PORT HARCOURT	703,421	1,292,011	464,945	6.11	5.67
17.	SOKOTO	329,639	605,466	29,188	5.78	4.47
18.	WARRI	363,382	667,443	69,894	5.82	4.84
19.	YOLA	54,810	100,672	51,440	5.00	4.71
20.	GOMBE	163,604	300,500	5,224	5.48	3.72
21.	UYO	58,269	107,210	53,199	5.03	4.73

Source: NCAA Statistical Data, 2010 for the Traffic Data. NPC for the 1991 Census Figures on which the Estimates were based.

TABLE 9. Population of the Cities and the Total Traffic Handled by each City within the Domestic Air Transport System in 2014

S/NO.	CITY	POPULATION	POPULATION ESTIMATE (X)	TOTAL TRAFFIC HANDLED (Y)	Log X	Log y
		1991	2014	2014		
1.	ABUJA	371,674	5,424,462	3,367,969	6.73	6.53
2.	AKURE	239,124	499,188	6,920	5.70	3.84
3.	ASABA	49,725	103,804	170,847	5.02	5.23
4.	BAUCHI	206,537	431,160	16,988	5.63	4.23
5.	BENIN	762,719	1,592,229	234,185	6.20	5.37
6.	CALABAR	310,839	648,898	201,221	5.81	5.30
7	ENUGU	407,756	851,314	287,521	5.93	5.46
8	GOMBE	163,604	341,534	31,370	5.53	4.50
9.	IBADAN	1,835,300	3,831,314	75,464	6.58	4.88
10.	ILORIN	532,089	1,110,772	85,990	6.05	4.93
11.	JOS	510,300	1,065,290	66,435	6.03	4.82
12.	KADUNA	993,642	2,074,269	192,427	6.32	5.28
13.	KANO	2,166,554	4,522,829	292,301	6.66	5.47
14.	KEBBI	63,147	131,823	2,065	5.12	3.31
15.	LAGOS	5,195,247	22,452,066	4,349,371	7.35	6.64
16.	MAIDUGURI	618,278	1,290,697	19,766	6.11	4.30

17.	MINNA	189,191	316,299	3,475	5.50	3.54
18.	OWERRI	119,711	249,905	320,681	5.40	5.51
19.	PORT HARCOURT	703,421	1,468,440	1,225,022	6.17	6.09
20.	SOKOTO	329,639	688,144	99,645	5.84	5.00
21.	UYO	58,369	121,848	292,361	5.09	5.47
22.	WARRI	363,382	758,584	217,367	5.88	5.34
23.	YOLA	54,810	114,420	154,547	5.06	5.19

Source: NCAA Statistical Data, 2014 for the Traffic Data. NPC for the 1991 Census Figures on which the Estimates were based.

Table 10. Population of the Cities and the Total Traffic Handled by each City within the Domestic Air Transport System in 2018

S/NO.	CITY	POPULATION	POPULATION ESTIMATE (X)	TOTAL TRAFFIC HANDLED (Y)	Log X	Log y
		1991	2018	2018		
1.	ABUJA	371,674	4,577,998	3,863,083	6.66	6.59
2.	AKURE	239,124	567,353	62,386	5.75	4.80
3.	ASABA	49,725	117,979	65,864	5.07	4.82
4.	BAUCHI	206,537	490,036	36,140	4.69	4.56
5.	BENIN	762,719	1,809,652	320,199	6.26	5.51
6.	CALABAR	310,839	737,507	166,152	5.87	5.22
7	ENUGU	407,756	967,455	341,039	5.99	5.53
8	GOMBE	163,604	388,172	56,403	5.59	4.75
9.	IBADAN	1,835,300	4,354,492	92,100	6.64	4.96
10.	ILORIN	532,089	1,264,452	113,967	6.10	5.06
11.	JOS	510,300	1,210,754	76,950	7.09	4.89
12.	KADUNA	993,642	2,357,547	168,948	6.37	5.23
13.	KANO	2,166,554	5,140,436	407,392	6.71	5.61
14.	KEBBI	63,147	149,825	30,185	5.18	4.48
15.	LAGOS	5,195,247	18,481,018	4,245,147	7.27	6.63
16.	MAIDUGURI	618,278	1,466,946	201,940	6.17	5.31
17.	MINNA	189,191	448,881	2,698	5.65	3.43
18.	OWERRI	119,711	284,030	510,546	5.45	5.71
19.	PORT HARCOURT	703,421	1,668,959	1,072,978	6.22	6.03
20.	SOKOTO	329,639	782,112	107,245	5.89	5.05
21.	UYO	58,369	138,488	232,827	5.14	5.37
22.	WARRI	363,382	862,172	175,072	5.94	5.24
23.	YOLA	54,810	130,044	182,010	5.11	5.26

Source: NBS Transportation Data, 2018 for the Traffic Data. NPC for the 1991 Census Figures on which the Estimates were based.

The results of the correlation analyses are shown in Table 11.

Table 11. Summary of Correlation Results of the Analysis of the Relationships between the Population of each City and the Traffic Generated by each City

Year	Correlation Coefficient **(r)**	Coefficient of Determination **(r^2)**	Significant at
2003	0.451	0.203	0.020 (1 tailed)
2006	0.480	0.230	0.014 (1 tailed)
2010	0.480	0.230	0.014 (1 tailed)
2014	0.533	0.284	0.004 (1 tailed)
2018	0.506	0.256	0.007 (1 tailed)

A test of significance of the correlation coefficient was made using the Hypotheses below:
Ho: There is no significant relationship between the population of a city in Nigeria and the volume of domestic air passenger traffic generated by the city.
H_I: There is a significant relationship between the population of a city in Nigeria and the volume of domestic air passenger traffic generated by the city.

In testing the significance of the correlation coefficient, a version of the Student's 't' test as given below, and the correlation results for year 2018 – r = 0.506 were used –

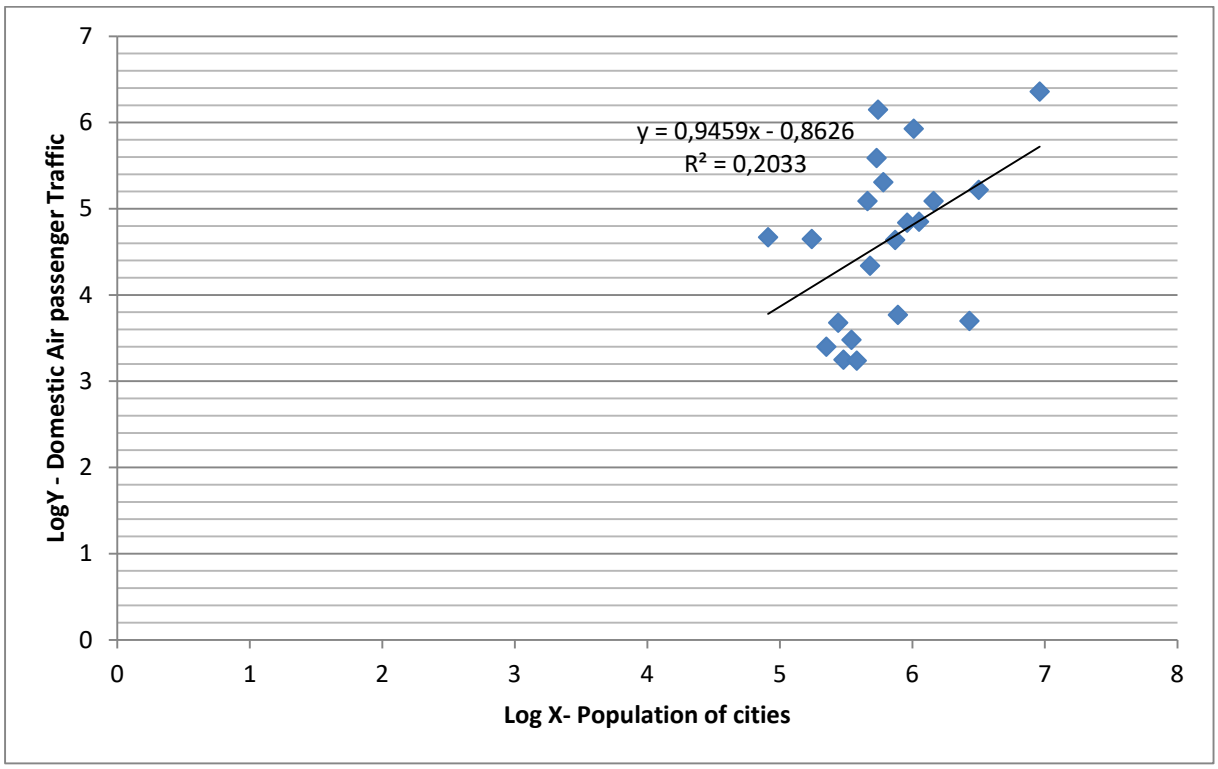
$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} \quad (1)$$

Where r is the value of the correlation coefficient, and n the population size.

The value of the calculated 't' is 2.687. At 0.05 level of significance and 21° of freedom, the critical value of 't' from the table of Student's 't' distribution is 1.72. Since the calculated value of 't' is greater than the value of the table 't' of 1.72 the null hypothesis (Ho) is rejected and the alternate hypothesis (H_I) is accepted. There is, therefore, a significant relationship between the population of a city in Nigeria and the volume of domestic air passenger traffic generated by the city. As can be seen from Table 11, the results of the analyses show that the population of each city correlated positively and significantly with the volume of traffic generated by each city in 2003, 2006, 2010, 2014 and 2018.
The r values of 0.451, 0.480, 0.480, 0.533 and 0.506 for 2003, 2006, 2010, 2014 and 2018 respectively show that there were statistically, weak, positive relationships between the populations of the interacting cities and the volumes of domestic air passenger traffic generated by the cities. Even though the positive relationships were weak, they were

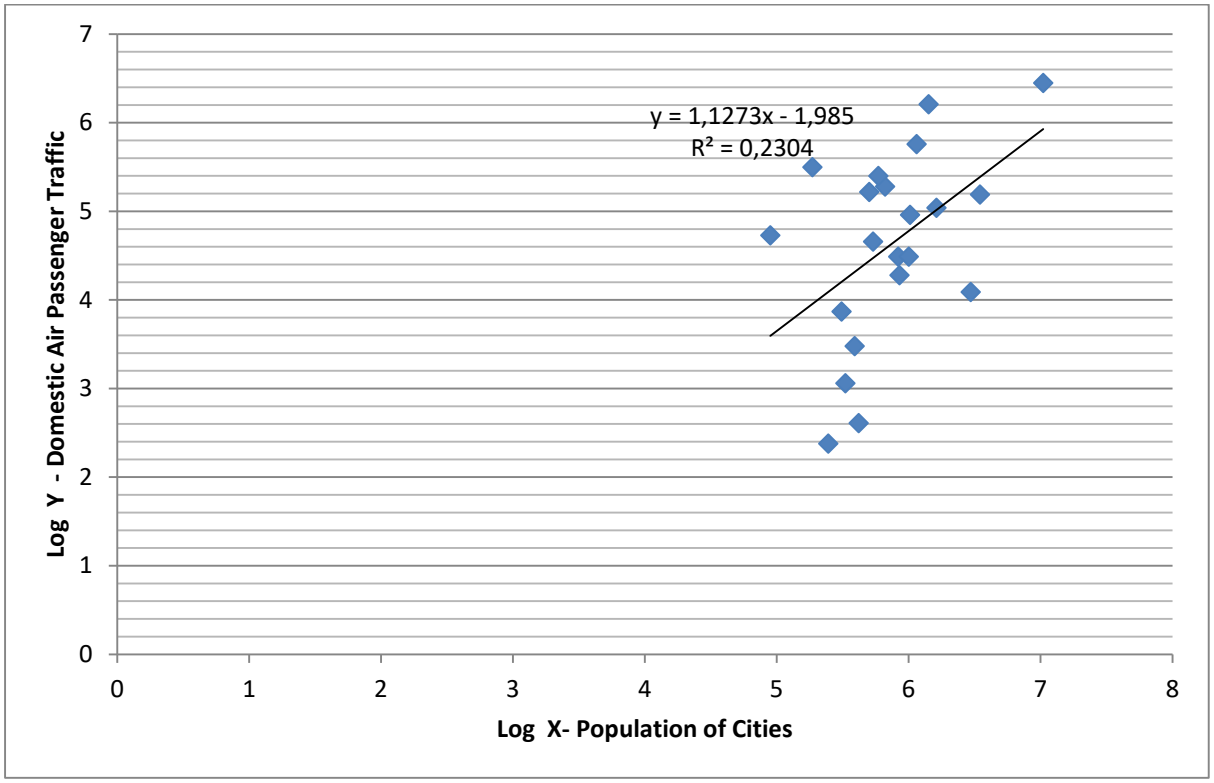
statistically significant. The values of the calculated 't' are 2.202, 2.385, 2.385, 2.888 and 2.687 for 2003, 2006, 2010, 2014 and 2018 respectively. At 0.05 levels of significance and 19° of Freedom for 2003, 2006, and 2010; and 21° of freedom for 2014 and 2018 the critical values of 't' from the Table of Student's 't' Distribution are 1.73 for 2003, 2006 and 2010 and 1.72 for 2014 and 2018. Since the values of the calculated 't' during the study periods are greater than the values of the Table 't' there is a statistically significant relationship between the population of a city in Nigeria and the volume of domestic air passenger traffic generated by the city. These relationships are shown in Figures 8, 9, 10, 11 and 12.

Figure 8. Relationship between the Populations of the Interacting Cities in Nigeria and the Volume of Domestic Air Passenger Traffic Generated by the Cities in 2003.



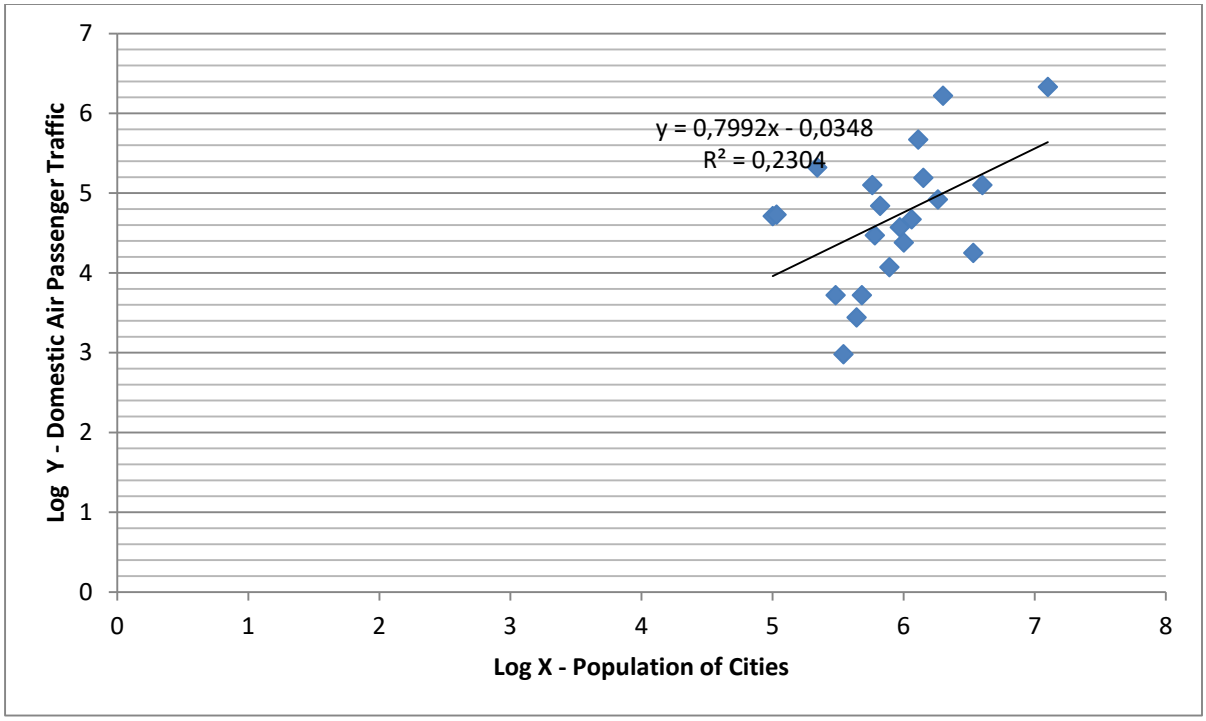
Source: Produced from NCAA Statistical Data for 2003

Figure 9. Relationship between the Populations of the Interacting Cities in Nigeria and the Volumes of Domestic Air Passenger Traffic Generated by the Cities in 2006.



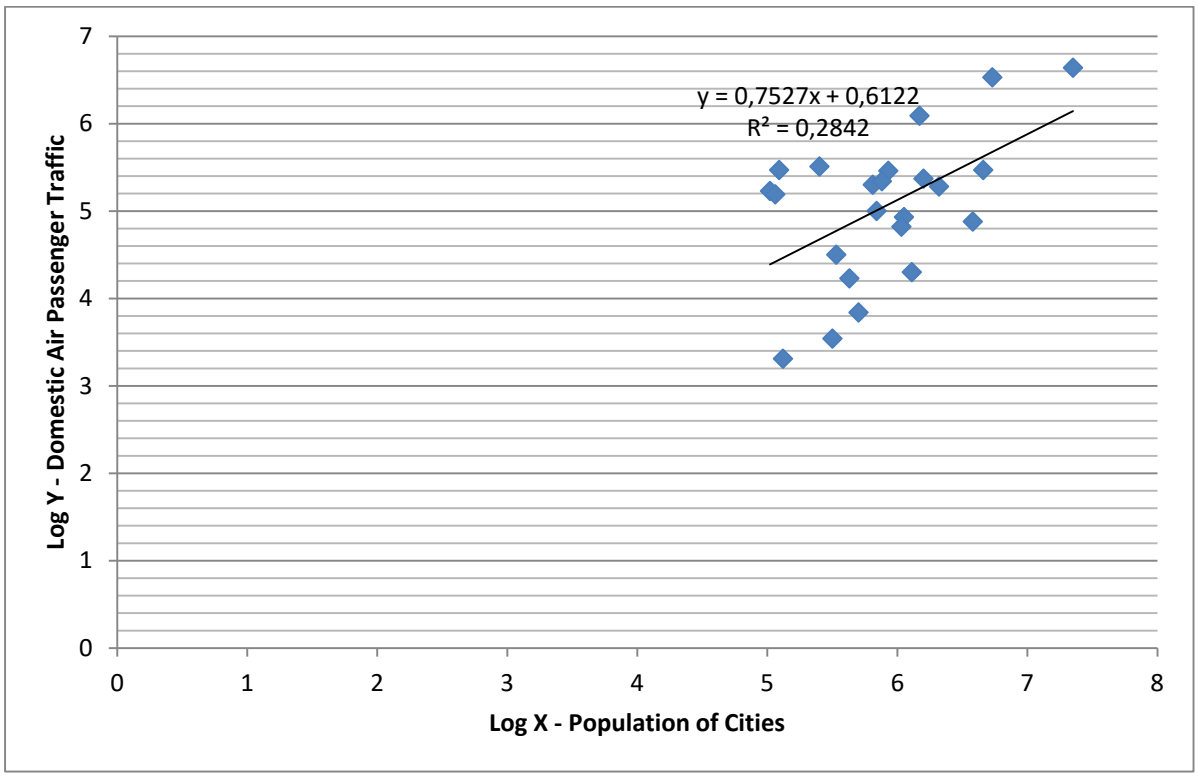
Source: Produced from NCAA Statistical Data for 2006.

Figure 10. Relationship between the Populations of the Interacting Cities in Nigeria and the Volumes of Domestic Air Passenger Traffic Generated by the Cities in 2010.



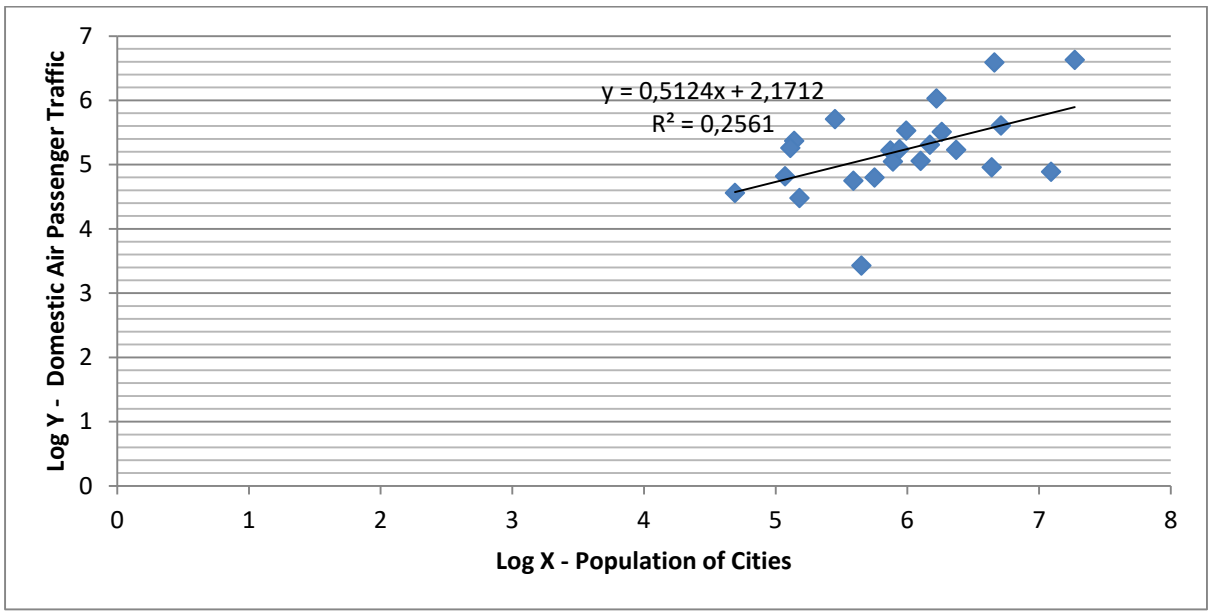
Source: Produced from NCAA Statistical Data for 2010.

Figure 11. Relationship between the Populations of the Interacting Cities in Nigeria and the Volume of Domestic Air Passenger Traffic Generated by the Cities in 2014.



Source: Produced from NCAA Statistical Data for 2014.

Figure 12. Relationship between the Populations of the Interacting Cities in Nigeria and the Volume of Domestic Air Passenger Traffic Generated by the Cities in 2018.



Source: Produced from NBS Air Transportation Data for 2018.

The r^2 values of 0.203, 0.230, 0.230, 0.284 and 0.256 for 2003, 2006, 2010, 2014 and 2018 respectively signifies that the population of the cities accounted for 20.3%, 23%, 23%, 28.4%

and 25.6% of the domestic air passenger traffic in 2003, 2006, 2010, 2014 and 2018 respectively. This indicates that population significantly determined, to some extent, the volume of domestic air passenger traffic generated by the cities in Nigeria during the study periods. The finding of this research supports the findings of Alam and Karim (1997), which indicated among other things, that population was a significant variable in air travel in Bangladesh. The result is also supported by the study by Masumoto (2005), which indicated among others, that population was important in explaining air traffic flows in major Asian cities.

5. CONCLUSION AND POLICY RECOMMENDATIONS

This study analyzed the spatial pattern of domestic air passenger traffic generation in Nigeria and the relationship between the populations of the interacting city-pairs and the volumes of domestic air passenger traffic generated by the cities. The results of the study show that Lagos was the most dominant domestic air passenger traffic generating centre even when the political capital city of Nigeria has been moved from Lagos to Abuja since 1991.

The study also found that the generation of domestic air passenger traffic was concentrated in few centres. These centres in the category of heavy traffic generating centres – Lagos, Abuja, Port Harcourt, Warri, Enugu, Kano, Benin, Calabar and Owerri handled 90.43%, 80.1%, 89.3%, 84.08% and 83.31% in 2003, 2006, 2010, 2014 and 2018 respectively. This implies that only the few airports in the heavy traffic generating category were viable during the study periods. Most centres were found to be low traffic generating centres presumably because of their low level of involvement in commercial and industrial activities which could not support high level of spatial interaction among them and other cities in Nigeria.

The study established that there were spatial and temporal changes in the volumes and patterns of domestic air passenger traffic generation in Nigeria. The study also shows that there were statistically, positive relationships between the populations of the interacting cities and the volumes of domestic air passenger traffic generated by the cities, implying that population significantly determined the volume of domestic air passenger traffic generated by the cities in Nigeria during the study periods.

Since the generation of domestic air passenger traffic concentrated in few centres of high population concentration where administrative, industrial and commercial activities take place, it is pertinent to alter this pattern of traffic generation from concentration to dispersal. This could be achieved through balanced regional development where conscious effort is made to redistribute economic activities within the country. This, would in turn, increase the population of the centres where new economic activities have developed. The rational dispersal of

economic activities and its attendant redistribution of population would help in changing the pattern of domestic air passenger traffic generation from concentration to dispersal and help in increasing the air passenger generating capacity of the cities and the connectivity of domestic air network in Nigeria.

It is not advisable for a country like Nigerian to concession the heavy traffic generating airports in the country to private companies for management as once suggested by some stake holders. If the airports in the heavy traffic generating capacity are concessioned to private companies whose interest is profit maximization, all other airports which apparently survive on the revenues obtained from the concessioned airports would not survive on their own as a result of low passenger traffic generating capacity and low revenue obtainable from their activities. This would then lead to the collapse of the low traffic generating airports and consequent total collapse of domestic air passenger transport in Nigeria if the private companies fail to perform effectively.

Rather than concession the heavy traffic generating airports to private companies, the government of Nigeria should aim at achieving spatial equilibrium in air passenger traffic generation by introducing deliberate policy of industrial dispersion and balanced regional development to stimulate resource development and growth of the low traffic generating cities/airports. This would help in redistribution of population and economic activities in the cities and improve their competitive positions in terms of development, growth and air passenger traffic generating capacity.

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