

How can new strategies foster the air cargo sector in the Lisbon airport, while dealing with the limited capacity and inadequacy of the air cargo infrastructures?

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Abstract

Air cargo in Portugal, despite its undeniable importance for the Portuguese economy, is still seen by some agents as a poor relative of passenger transportation, as a by-product, not as a product that, *per se* has tremendous potential for wealth generation. It is of fundamental importance, that the Lisbon airport and all its stakeholders are aware of this reality, under the risk of losing an important lever of economic growth, and this research is expected to contribute to this intent. Within this setting, this thesis aims to improve the operational performance within the airfreight sector in Lisbon, proposing new strategies to increase efficiency, while dealing with the limited capacity and inadequacy of the current air cargo infrastructures. By initially characterizing the sector, and subsequently identifying the main causes for the problem of limited capacity, a direct comparison can be made with the reality of some key industry European airports. Hence, allowing the finding of solutions for solving the identified causes to the main problem, and thereby uncovering the winning strategies to face possible constraints to a greater vitality of the air cargo sector in Lisbon.

Keywords: Air cargo, Lisbon airport, Operational performance, Process improvements, Best practices

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Resumo

A carga aérea em Portugal, apesar da sua inegável importância para a economia Portuguesa, é ainda olhada por alguns agentes como um parente pobre do transporte de passageiros, como um sub-produto, e não como um produto que por si mesmo possui um potencial tremendo de geração de riqueza. É de fundamental importância, que o Aeroporto de Lisboa e todos os seus stakeholders estejam cientes desta realidade, sob pena de se perder uma importante alavanca de crescimento económico, e esperamos, com esta investigação, contribuir para esse desígnio. Dentro deste quadro, esta tese tem como objetivo melhorar a performance operacional do sector da carga aérea em Lisboa, propondo novas estratégias para aumentar a eficiência operacional, simultaneamente lidando com a capacidade limitada e a inadequação das infraestruturas de carga aérea actuais. Ao inicialmente caracterizar o sector, e posteriormente identificando as principais causas para o problema da capacidade limitada, poder-se-á finalmente fazer uma comparação direta com a realidade em alguns dos principais aeroportos Europeus. Desta forma, torna-se possível encontrar soluções para resolver as causas identificadas para o problema central, simultaneamente revelando as estratégias mais adequadas para fazer face a possíveis constrangimentos a uma maior vitalidade do sector da carga aérea em Lisboa.

Palavras-chave: Carga aérea, Aeroporto de Lisboa, Performance operacional, Melhoria de processos, Melhores práticas

List of abbreviations

ACN- Air cargo Netherlands

ANA- Aeroportos e Navegação aérea

ANAC- Autoridade Nacional de Aviação Civil

APAT- Associação dos Transitários de Portugal

AWB- Airway-bill

CEIV- Center of excellence for independent validators

CTT- Correios, telefones e telégrafos

EP- Empresa pública

GDP- Gross domestic product

IATA- International air transport association

ICAO- International civil aviation organization

INAC- Instituto Nacional de Aviação civil

JIT- Just in time

NAV- Navegação aérea

OPEC- Organization of petroleum exporting countries

PESTEL- Political, Economical, Social, Technological, Environmental, Legal

SITA- Société internationale de telecommunications aéronautiques

SWOT- Strengths, weaknesses, oportunities, threats

TAAG- Transportes aéreos de Angola/ Linhas aéreas de Angola

TAP- Transportes Aéreos Portugueses

ULD- Unit load device

USD- United states Dollar

TAAG- Transportes aéreos de Angola/ Linhas aéreas de Angola

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“Remember to look up at the stars and not down at your feet. Try to make sense of what you see and wonder about what makes the Universe exist. Be curious. And however difficult life may seem, there is always something you can do and viucceed at. It matters that you don’t just give up”.

- Stephen Hawking

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First and foremost in honor of my grandfather, José Quintela (*in memoriam*), who has always loved me unconditionally, and to whom I think I have not shown how much I loved him, especially in last few months, because of the difficulty in dealing with the pain that was to see him leaving us. Thank you for being one of the best people I have ever met, and this project is also due to you for always teaching me the values of persistence and hard work. *बाँस चांगला नाही* but had a big heart.

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1. Introduction

1.1. Context

In a period of economic recovery of the Portuguese economy, the portuguese airports have been a bulwark of this progress. With record growths in recent years, the infrastructures to process passengers begin to reach their limits, thus requiring solutions.

Lisbon is a paradigmatic case, with the anual traffic reports issued by ANA, showing an anual percentage growth of passengers always in the two digits (2014-13,3%, 2015- 10,8%, 2016-11,7% e 2017-18,8%) leading to the record numbers of 26,6 million passengers, and over 200 thousand aircraft movements a year.

With all the conditions, referred by Ministry of Finance (2018), necessary to find an alternative to the current Lisbon airport, exceeded, being them: 22 million passengers/ year 185 thousand movements/ year, 80 thousand passengers at the thirtieth day and 585 movements /day. The Montijo alternative appears in the nearest horizon (2021/22) as a viable alternative for the resolution of these constraints. It is considered, that the Lisbon and Montijo combined solution grants the necessary relief (and with a relatively small investment) for the resolution of the passenger congestion problem.

Nevertheless, the topic of air cargo, whose processing infrastructure was created in 2008, assumes diferente contours. It is verified that the sector's expression is still relatively low, with average growths in the last five years of 0.5% in Lisbon and 0.6% in Oporto (till 2016) and with the values of cargo processed up to 2016, similar to those processed in 2012. This duality, between a record passenger growth, and near-stagnation of air cargo, is due to a myriad of factors, including:

- i. The limited dimension of the portuguese economy (Worldwide), which leads to a reduced expression in the World air cargo market, leading to the absence of cargo freight aircrafts, and therefore, the majority of cargo being transported via truck to the European hubs (Costa, 2017).
- ii. The stagnation of the Portuguese economy, following the European debt crisis, with a reducing of imports, resulting from a strong decrease in consumption and investment (Exame, 2012).
- iii. Country's geographical position in an extreme of the European Continent, causes significant time delays in the flows (especially to Central Europe) that would be expected to be faster and truly of a fast air cargo processing, but in reality, are not (Costa, 2017).

Thus, in spite of small increases in recent year (until 2016), the recent increase in the processing of cargo of 25,5% in 2017, to more than 115 thousand tons (ANA, 2017), represents the only significant growth in the last decade in Lisbon. Some reasons might arise to explain it, being the most important, the highest yearly economic growth of the XXI century (in 2017), leading to the acceleration of investment and imports (Costa, 2018).

It is difficult to predict if this growth will be sustainable, and if it represents an inversion in the cycle of stagnation. Moreover, if this growth persists for the coming years, the current cargo infrastructure capacity of the Lisbon airport might be exceeded. In fact, it should be noted that, for the first time, the theoretical limit of the current infrastructure was exceeded (100 thousand tons / year), which might result in possible future losses of operational efficiency and quality of service.

The medium-term solution found by the Government and ANA Aeroportos de Portugal, for solving the passenger constraints problem in Lisbon, includes the simultaneous operation of two airports in the Lisbon region (Humberto Delgado and Montijo).

Nonetheless, it does not entail any kind of solution for possible constraints in the air cargo sector, since no additional cargo processing infrastructures are foreseen in the new Montijo terminal. Moreover, although a 50% increase in the capacity of the current terminal (to 150 thousand tons / year), is possible, implying a considerable investment, ANA argues that there will be no significant investments in infrastructures in the sector in the short / medium term (Costa, 2017).

Thus, the cargo terminal in Lisbon will have to process possible increases in the annual processed cargo, with the current infrastructures, and different operational difficulties may arise as a consequence of such a lack of processing capacity.

Still, although the possible increase in the processed air cargo may represent a key reason for the lack of capacity, and inadequacy of cargo infrastructures in the Lisbon airport, there are many other reasons for that. Accordingly, there is clearly the need to explore which are the key causes for such a lack of capacity and inadequacy of infrastructures, and then find strategies to deal with those causes, while avoiding as much as possible the operational difficulties that may arise as a result of inadequate air cargo infrastructures.

1.2. Research question

The research question to be answered is as follows: How can new strategies foster the air cargo sector in the Lisbon airport, while dealing with the limited capacity and inadequacy of the air cargo infrastructures?

1.3. Objectives

From a general point of view, this thesis aims to propose strategies to improve the operational performance of the air cargo sector in the Lisbon airport, while dealing with the limited capacity and inadequacy of the air cargo infrastructures. To achieve this general objective, several specific objectives are defined:

- i) Characterizing the air cargo sector in Portugal, with a special focus in the reality of the Lisbon Airport, trying to understand how the Portuguese reality approaches the best international practices in the sector;
- ii) Identifying the difficulties in the airfreight sector in Lisbon, and even more importantly the causes for the limited capacity of the air cargo infrastructures;
- iii) Identification of potential strategies to solve the problems related to each of the identified causes, based on the best practices in another European major cargo Hub;
- iv) Final recommendations.

1.4. Methodology

In order to be able to fulfill the above-mentioned objectives, we need an adequate methodology. This thesis is a project based on a case study, as according to Yin (2018) case studies strategy is the preferred when “how” or “why” questions are being posed, when the investigator has low control over events and when the focus is in a contemporary phenomenon. All those suits perfectly our project. Four key stages are thus followed in this project.

In the first stage of the research, the characterization of the cargo sector at Lisbon Airport is necessary. For that, tools that enable the reading of the external and internal environment are necessary. With this information, we can raise the potential causes to the main problem in the airfreight sector at Lisbon.

This is followed by a second stage in which the causes are revealed, through the use of strategic planning tools.,

In the third stage, the causes identified as the most relevant, and the processes and practices related to those, will be compared with the best practices at competing airports. This will enable to raise strategies to address the causes.

The fourth and final stage, contains final recommendations on strategies for mitigation / resolution of the causes revealed during the research.

1.5. Scope

Taking into account the objectives proposed to be achieved, it was verified that the scope of this research is limited to the operational and business development / marketing areas at the Lisbon airport. Circumscribing the scope in this way, allows to be more focused and pragmatic, while also more aligned with the objective to achieve within this investigation.

1.6. Thesis structure

The dissertation will be organized and structured in the following chapters:

Introduction: that will subdivide itself in context, research question, objectives, methodology and scope. In this first chapter of the dissertation, the context will be introduced and widely and thoroughly approached. Thus, contextualizing the problem first, then understanding the objectives of this research, and the summary of the methodology being used in order to achieve the objectives

Literature review: review of the existing literature on the subject that will support the research and the analysis to be explored.

Methodology: Presentation of the methodology and research steps.

Case study: Company and sector presentation and application of the investigation stages proposed in the previous chapter, with analysis and discussion of the obtained results.

Conclusions- Response to the research question and further work proposals, in the form of final recommendations on strategies for the the resolution of the causes revealed during the research.

2. Literature review

In this chapter, it is first reviewed the importance of operations management in services, defining them and acknowledging their relationship.

Next, studies focusing on operations management in airports are explored, as well as the main difficulties of operational management in airports.

The next section deals with capacity management in airports and what are the most commonly used tools for linking the two concepts.

Finally, in a final section, the use of the benchmarking tool in the operational management of capacity at airports is reviewed, trying naturally to realize the validity of this tool for the improvement of the air cargo sector.

2.1. Operations management in services

Before grasping the link between operations management and services it is undoubtedly important to first define services and operations management.

According to Kotler (1990: 467) services are, "Any act or performance that one party can offer to another that is essentially intangible and does not result in ownership of anything. Its production may or may not be tied to a physical product".

While according to Pawe (1995: 6) "A service is an activity which has some element of intangibility associated with it, which involves some interaction with customers or with property in their possession, and does not result in a transfer of ownership. A change in condition may occur and production of service may or may not be closely associated with a physical product."

On the other hand, differently from services, a product is manufactured to meet a need or desire of a client or a market, being essentially tangible, perishable, transferable and being possible to be stored (Kotler 2000)

What the above definitions shows, is that the most important characteristics of services are essentially its intangible nature, and the lack of ownership of the the end customer. Reinforcing this idea, Kotler (1994) describes services as having some basic characteristics – intangibility, heterogeneity, inseparability and perishability. In fact, a service provided to a client will not be exactly the same provided to another client.

On the other hand, according to Slack et al (2013), operations management is the activity of managing the resources that create and deliver services and products.

While according to Lee (2018), operations are responsible for generating products and services based on customer needs.

The above definitions show that operations are crucial to the generation of products and services. Reinforcing this idea, Lee (2018: 1) declares that “All organizations need operations to produce some mix of services and products. In any organization, three core functions are the marketing function, product/service development function and operations function”.

This, naturally means that operations play a very important role in any organization, albeit, a clear division between those three functions does not exist. In an holistic perspective operations management inside any organization, needs to interact with all other departments, thus creating all the organizational predicates needed to meet customer needs (Lee, 2018).

Thus, it’s clear that operations management are of major importance in the generation and creation of services, and a core function of any service organization.

2.2. Operations management in Airports

Having understood the relevance of operations management in the generation of services, the focus is now on the operations management in the airport context.

According to Wilke (2016), air transportation has seen its demand increase intensely in the last few years and is essential for the economic growth. Meanwhile, Kolisch et al (2016), states that not only the airline industry is relevant for the Global economy, but essentially airports are the backbone of the industry. The concept of the airport as an essential part of the Airport industry, begins to emerge. Reinforcing this idea, Wilke (2014), says that airports are a vital element in the Air industry. We see, therefore, that airports are central, and of prime importance, an essential condition for the existence of the industry itself.

However, Wilke (2014: 18) states that not only are they important, but also that the “Airport’s main function is the provision of a safe and efficient transition of passengers and goods between the ground and airspace”. In a clear allusion to the safe and efficient traffic not only of passengers, but also of cargo. And it’s here that “operations on the airport surface (i.e. runways and taxiways) are crucial to the achievement of this function. From an operational perspective, airport surface operations require the interaction of five main stakeholders, airport authority (i.e. airport operator), pilots, air traffic control (ATC), ground handling and regulator, both to facilitate the ground movement of aircraft and vehicles, and to maintain the surface in a working condition”.

Nevertheless, the concept airport surface operations, seems simplistic to explain the complexity of Airport operations. Diving deeper into the operational subject, and when referring to airport operations itself, Price (2016: 62) says, “the core functions of Airport Operations are communication, notification, and operational coordination of the airport’s assets, equipment, and personnel to ensure the safe, secure, and efficient movement of passengers, cargo, and aircraft”. While Jacquillat (2016: 171) states that “Airport operations involve a range of consecutive processes, from passenger and cargo operations in terminal buildings to aircraft operations at the gates, on the aprons, on the taxiways, on the runways, and in the terminal airspace”.

Moreover, Airport operations staff is needed to keep the airport running smoothly and safely. This includes improving efficiency of the passenger and cargo processing and solving operational problems. Losses of efficiency in either flight operations or passenger processing will lead to a reducing operational capacity of the airport, which will itself create an impact on the airport revenue flux (Price 2016). The coordination, and operational management of airport resources are, therefore, of crucial significance to an airport with direct impact in its capacity.

According to Marcos et al (2015), the term capacity generally refers to a quantitative value indicating the supply of a service for a certain period. The capacity of an airport can be studied to measure the relationship between demand and capacity; to raise investment needs in airport facilities; to objectively measure the operational capability of the various components of the airport system; for the treatment of projected passengers and aircraft flows; and to estimate the delays and other manifestations of capacity constraints, experienced in the system at different levels of demand. Kolisch (2016) states, that effective departure and landing procedures adding to efficient ground processes are key to increasing the capacity of an airport.

While Jacquillat (2018: 182) says that “Airport capacity depends on available infrastructure and air traffic operating procedures. It is primarily driven by the size and the physical layout of the runway system. All else being equal, the more extensive the runway system, the greater the capacity. In addition, for any given state of the infrastructure, airport capacity depends on air traffic handling policies (e.g., on separation requirements between consecutive aircraft) and procedures (e.g., those aimed at optimizing aircraft sequencing and spacing),”

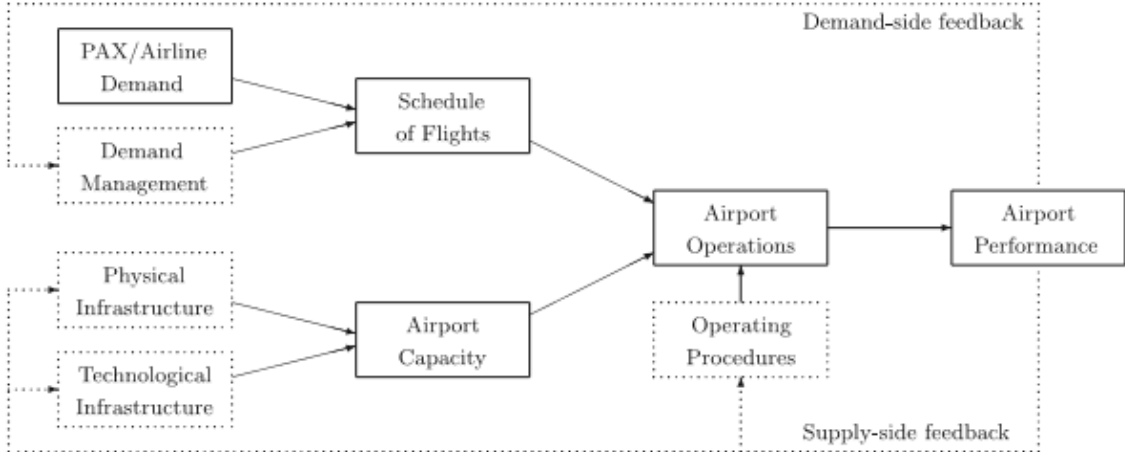
Similarly, Marcos et al (2015) says that, the capacity of an airport is related to the capacity of its respective subsystems, i.e., it depends on the capacity of the passenger terminal, the runway and taxiways, and the aircraft parking platforms (aprons).

By the same token, according to Jacquillat (2018) Airport performance depends on three major factors: Airport capacity, Operations management and Flight scheduling. Demand and capacity management interventions can be grouped into three categories:

- i. Infrastructure expansion-through constructing new airports or expanding the existent;
- ii. Operational enhancements- enhancing efficiency and sustainability of airport operations, in the available infrastructures while complying with safety measures;
- iii. Demand management – through incentives to stimulate demand at off-peak hours or through access regulation that defines peak-hours.

Although connected, these decisions are habitually taken in sequence. The author summarizes this idea, through the scheme below, showing the impact of the above decisions on demand and capacity and therefore performance.

Fig. 1- Schematic representation of airport planning, management and operations



Source: Jacquillat, 2018

What this study shows, is that airport capacity is related to the problem under study in the present project. A clear example of the need for efficient operational management to the infrastructure capacity, not only in the runways and taxiways, but also in the ground processes is the operational management of aircraft parking stands. Flights are usually assigned to an arrival stand/gate at their destination airport well in advance, habitually prior to the departure from their airport of origin. Nevertheless, despite the gate being planned ahead (so that when the flight arrives the stand is available), in practice that is not always the case. The intense variability in departure and flight times, so characteristic of the industry entails frequent gate blockages. Furthermore, gate blockages can trigger tremendous negative impacts, such as passenger delays, increased consumption of fuel, and missed connections (Kolisch et al, 2016).

This is just one example of the challenges facing the management of the capacity of the airport infrastructures. In fact, a lot might go wrong, as airport infrastructures are subject to unpredictable problems caused by a myriad of problems from bad weather to natural disasters, or labor disputes, etc. From these, results disruptions, causing excessive transportation costs, but also huge economical impacts as customers initially served by one facility must now change airport (Kolisch et al, 2016). Additionally, “the throughput at any individual airport is sensitive to operating factors, such as weather variability and severity, the mix of arrivals and departures, the runway configuration in use, and the mix of aircraft at the airport. Detailed understanding of airport operating capabilities thus requires the estimation of airport capacity under a broad range of operating scenarios” (Jacquillat, 2018: 182).

Thus, the subject of airport capacity management needs to be treated with high priority, both by the managers of airports, but also by research, as it is one of the great difficulties associated to operations management in airports.

2.3. Capacity management in Airports

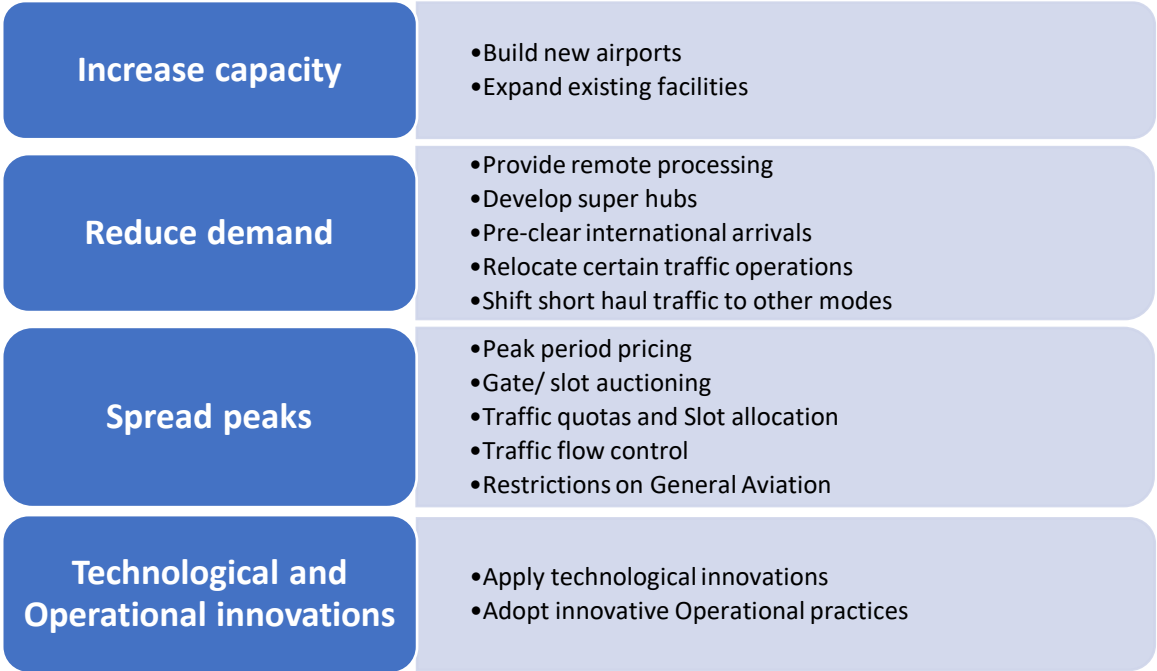
According to Hamzawi, (1992: 47) “The absence of sufficient airport capacity to handle the increasing traffic demands, and the consequent congestion problems and inherent delays, plague the aviation sector at the most important airports around the world.” At the same time Gillen (2016), says that the significant increase in the air industry is leading to increasing congestion in air traffic, causing delays and inefficiencies that lead to rampant costs. Hamzawi (1992), adds that the biggest airports in the World, have been seeing its operations obstructed by ever increasing volumes of air traffic, and with infrastructures being strained to their limits. While, reinforcing this idea Jacquillat (2016), says that despite the steady growth of the increase of air traffic, airport capacity has as its main limitations the operational capacity of the current infrastructures. In the World’s biggest airports the demand has often surpassed the capacity, in spite of many capacity enlargement projects.

Nevertheless, according to Ferruli (2016: 3783), Europe faces a different and “particular challenge in respect of its airport infrastructure. This is mainly due to the dense urbanisation of the continent and the complex system of rules and planning regulations that have arisen as a result and opposition from local residents and their politicians to airport growth. Increasingly, it is not the availability of land or finance that constrains airport development, but rather the environmental consequences of the construction itself or the resultant aviation growth that would arise from it”. Moreover, a wide range of impacts on local communities and the natural

environment can constrain the operation of airports and restrict their ability to secure planning approval for future growth (Upham et al, 2003).

Nonetheless, strategies for solving the problems and constraints in the air transport industry must be a priority, and airports should be looked upon as major infrastructures of the country and as major economic developers (Ferruli, 2016). Bearing that in mind, Hamzawi (1992), states that the first step while searching for a solution is to identify what are the causes of the problem, and that delays happen when the available capacity of the system cannot keep up with the demand for the service. Therefore, the airport saturation solution, lies on reducing the ratio of demand to capacity, which can be done by diminishing the demand, enhancing the capacity, or both. For that he suggests, in his framework, a myriad of solutions to balance airport capacity and demand, described in the figure below.

Fig. 2- Options for balancing airport capacity and demand



Source: Adapted from Hamzawi, 1992

Ferruli (2016: 3785), points to different directions, declaring that “Environmental and operational capacity can be maximized through a long-term planning ensuring an effective environmental management that compensates for growth through the introduction of eco-efficient infrastructure, technological, and operating strategies”. In the same study the author states that environmental impact is a central point on the capacity management of an airport. The absence of an effective environmental management, including eco-friendly infrastructures,

management models and the use eco-efficient technologies, will lead to operations and growth restrictions. For this, in the same study the author decided to apply environmental sustainability criteria in airport design utilizing the support of a tool called GrADE (green airport design evaluation), which aims helping airports to identify and select the best sustainable practices.

Jacquillat (2018), presents us a roadmap for the type of analysis a developing major airport, in its diverse stages of maturity, should adopt in terms of demand and capacity. The most important inlet into this planning process is a long-term traffic forecast. After the traffic forecasts executed, there are four types of analysis, that should be carried over time:

- i. Planning for airport infrastructure: With the ideal outcome, that in any moment of an airport lifetime, its runway systems can deal with peak-hour demand.
- ii. Optimizing air traffic handling policies and procedures: With the ideal level of infrastructure, the efficiency of airport operations is dependent on effective air traffic management systems (such as facilities and equipment, trained personnel and an efficient set of rules and procedures)
- iii. Setting on-time performance objectives: by computing the magnitude and variability of arrival and departure delays over an entire day of operations and defining the acceptable levels of congestion.
- iv. Establishing demand management rules: it works as an additional level of analysis, to be used as a last resource, when forecasts and planning are not in line with reality, or the operational reality at capacity level cannot be changed. In this situation, measures must be taken to manage the demand either through financial incentives (slot auctions or congestion pricing), or non-financial stimulus (schedule coordination).

Therefore, this type of analysis, can be applied on one hand to airports under construction or to airports whose operational capacity is far from exhausted (and which only intend to adopt preventing measures), or on the other hand to airports that are close to, or at the limit of their operational capacity.

Another path to choose in the operational capacity management of airports, is benchmarking. According to Bromiley (2016), the research on benchmarking, i.e modifying practices by imitation, is something to be truly considered in the operations management area. Spendolini (1992: 9) adds that "Benchmarking is a continuous, systematic process for evaluating the products, services and work processes of organizations that are recognized as representing best practices for the purpose of organizational improvement". By the same token, Maclean (2016: 349) says that "Benchmarking is a standard method of assessing performance

by comparison of processes with similar operations at a target or ideal site, to identify gaps on a variety of measures.”

Still according to Bromiley (2016), benchmarking studies tried to identify the conditions (i.e. best practices) within key industry companies, with the underlying idea that firms can mimic practices associated to quality management, therefore leading to manufacturing excellence.

Some other authors refer to benchmarking specifically in airports, according to Francis (2002: 241), “Airports have traditionally monitored their own performance against budgets, but some have now started to recognize the potential for comparing their performance to benchmarks set against other airports in order to improve their competitive position through the identification and adoption of best practices.” By the same token, Merkert (2014: 30), says that “Measuring and benchmarking of airports has in the recent past seen an increased interest from practitioners, regulators and academics alike. One reason for this is the constant drive to improve efficiency of airports either to please private investors or public authorities particularly during the period of austerity that many governments around the globe are currently experiencing.” Due to this and to the defiances faced by airports, benchmarking seems to be an important performance increasing tool (Francis, 2002).

As slots, i.e. airport air company’s use permits, become scarce, efficiency begins to be looked at, as a way to increase capacity. In this sense, benchmarking is used to make the most of the infrastructures that already exist, before taking any decision on new infrastructures. Airports can thus, use not only the efficiency analysis (already referred to in previous studies) but also link it with benchmarking, to identify and learn from industry best practices (Merkert, 2014).

According to the reviewed literature studies or investigations were identified proposing the use of benchmarking for addressing capacity management problems. In terms of air cargo infrastructures, all the studies found were broader and referred to the capacity of an airport as total capacity (passenger and cargo processing included). For that reason, it is considered that benchmarking has also potential to be used for finding best practices for the air cargo infrastructure management.

2.4. Benchmarking in Airports

As stated by some authors referred to in this research, the benchmarking process has been used frequently in the airport industry. Some reasons may arise to justify it, being one of them

the dynamism of the industry, as according to Francis (2002: 239) “Airport privatization, commercialization, congestion of airport infrastructure, rapid growth of traffic, the formation of global airport groups, airline market de-regulation and alliances have combined to create a dynamic and challenging market for airports and their managers. Within the context of such a dynamic market environment, benchmarking has become an increasingly important performance management tool that can be used to enable managers to both monitor and improve aspects of their own operational performance by reference to, and learning from, other organizations”.

Thus, it was decided to search for studies or investigations in which benchmarking is used as a tool for the operational management of airport capacity. The search has revealed some interesting studies, allowing to understand that benchmarking can be applied to many of the elements necessary to the global management of airport capacity.

According to Merkert (2014), in Airport benchmarking studies, the most commonly aspects of airport efficiency are the management structure and the economies of scale concept. Nevertheless, there are a myriad of many other subjects that can and should be studied in airport benchmarking, and that can have a direct influence on the efficient and effective operation of an airport. One of them is the influence of airport competitor’s performance. In the authors study, some relevant and interesting conclusions are taken as he concludes on the existence of a very strong correlation between airport’s efficiency and higher levels of competition between airports (for a detailed review see, Merkert, 2014).

In another benchmarking study Maclean (2016: 349) says that “For airports the Air Transport Research Society produces an annual Global Airport Benchmarking Report, which compares a wide selection of international airports based on Financial, traffic and capacity data. Airport safety measures are not included in that analysis”.

With this gap opportunity, Maclean (for more details see: Maclean, 2016) undertakes a research in which it harnesses the record of incidents and accidents reported to Transport Canada, with an ordering of safety measures and processes, and with the final objective of providing airports the best practices, in what safety measures for airports is concerned.

By the same token, Francis (2002: 246) says that “Benchmarking is one performance management technique that might be used by managers to meet the diverse challenges that they face from the dynamic industry context. Performance improvement can create competitive advantage and can offer potential to improve the efficiency and effectiveness of airport management across the range of challenges, from coping with increased pressure of traffic growth on terminal facilities to managing community relations”. Francis (2002), in its research

concludes using questionnaire surveys, that about 72 per cent of airports reported to be involved in some type of benchmarking, which reinforces the idea of the wide use of this tool in the industry.

None of the studies shown till now, had a unique focus on air cargo benchmarking. In fact, studies that address the topics “benchmarking” and “air cargo” are scarce, but not inexistent. A very good example comes from the study of Chung (2015), who had, as one of the primary objectives the suggestion of making Incheon airport in South Korea, one of the main cargo hubs in the Asia Pacific region, through a benchmarking process. The purpose of the study is to first compare the operational efficiency of airports located in the same area of the World, through comparison of management strategies and cargo handling facilities. The initial part of the research allowed to cluster and order airports through levels of efficiency. The best positioned airport in the Incheon cluster should be the one to be benchmarked. The conclusions are somewhat interesting and revealing. Firstly, the author concludes that Hong Kong was the best rated airport, and therefore, the one to be benchmarked in terms of operational efficiency. Nevertheless, the author ends the study with an interesting paragraph, which at the same time reveals the importance of benchmarking results. Chung (2015: 103) states that “the performance improvement of air cargo facilities can create competitive advantage. It can also offer potential to improve the efficiency of airport operations across the range of challenges on cargo terminal handling issues”

As seen above, much has been studied about the implementation of benchmarking in airport management, but there are few studies that refer to the use of the tool in the air cargo subsector. It was not possible to find more studies in which the benchmarking was used, but the one presented. Hereupon, the present project is also intended to fill this gap in the literature.

2.5) Chapter conclusions

In this literature review, it was possible to comprehend what services and operations management are, and how the two concepts relate.

It was also acknowledge that, one of the major difficulties in operations management in airports is connected to capacity management, and that this subject needs to be relevantly addressed. In this sense, it was displayed a series of studies which presented different proposals for the improvement of the operational capacity management in airports. From tools for capacity management and demand, to measures to increase environmental efficiency at airports.

Moreover, it was also evident that benchmarking is not only a valid tool, but also widely used in improving the operational management of airport capacity.

Thus, the literature review has brought an enormous academic contribution from all the above topics, as studies on the use of benchmarking in the air cargo sector are scarce, though as intelligible, perfectly achievable and valid. This translates into a gap in the literature that is intended to be filled by this project. At the same time, there is a practical contribution to the entire air cargo sector in Lisbon and Portugal, presenting a new vision and the consequent recommendations (resulting from the implementation of the benchmarking tool), for solving the problem already mentioned in this research.

3. Methodology

In this chapter, firstly it will be explained the type of research strategy and design selected to this research. Secondly the actual methodology, to be used throughout the research is revealed, describing the different stages of the research, as well as all the different tools used to collect the data needed to this investigation.

3.1. Case study approach

According to Yin (2018), there are a myriad of ways of doing research, and each strategy has its own advantages and disadvantages depending on the type of research question, the control the investigator has over behavioral events and the focus on contemporary events as opposed to historical phenomena. We already seen that according to this author, case studies strategy should be selected when it answers “how” questions, in the case of low influence over the operation activity and when the center of attention is in a contemporary phenomenon. Possessing no doubts, that the research has all the predicates mentioned above by Yin, a case study analysis is followed in order to answer pragmatically and consistently to the question: *How can new strategies foster the air cargo sector in the Lisbon airport while dealing with the limited capacity and inadequacy of the air cargo infrastructures?*

Supporting this choice “case studies typically combine data collection methods such as archives, interviews, questionnaires and direct observations” (Eisenhardt, 2007: 534-535), and with the exception of questionnaires all of them are widely used in this research.

Still, according to Yin (2018), different types of case studies exist: descriptive, exploratory and explanatory. For the particular case of this project, this case study can be defined as both descriptive and exploratory, as explained below:

- **Descriptive** strategy: with the description of the *modus operandi* within the sector and its difficulties and challenges.
- **Exploratory** strategy: as alternatives will be explored to improve the operation performance within the sector.

3.2 Case study design

In relation to the case study and the specific type of a case study to implement, there are different paths to choose from: the single case study, or the multiple case study on one hand

and the holistic and embedded on the other. Thus, we may have: A single case holistic design, single case embedded design, multiple case holistic design and a multiple case embedded design.

With some ease, it was deduced that the single case study with an embedded approach is what best applies to our research. Firstly, because it represents a unique case (Yin, 2003), with the reality and solutions to be applied in the Lisbon airport, to be in some sense probably not replicable, due to its unique features as location and operations characteristics. Another rationale for this option, is the “revelatory case, this situation occurs when an investigator has an opportunity to observe and analyze a phenomenon previously inaccessible to scientific investigation” (Yin, 2003: 40), as understood due to the absence of relevant literature related to the topic. Thus, this research allows to explore this significant reality in rare circumstances (Eisenhardt, 1989), which might contribute greatly to scientific literature.

Afterwards, while looking at the depth of the research the embedded approach is the one that best applies to this case, because it will allow to focus on the different sub-units of the air cargo sector (all the stakeholders), putting into perspective the holistic idea of the air cargo sector. Moreover, confronting rival interpretations of the real problems/ causes in the sector, which will finally lead to strengthen the conclusions of the research, making them more coherent.

3.3. Research stages

So as to ensure that the above-mentioned objectives can be fulfilled, an adequate methodology is needed. Accordingly, this research will be divided into four distinct stages, described and represented below.

Stage one –Sector characterization- In this stage, the objective is to identify the potential causes of the main problem being studied throughout this project. For that, it is necessary an internal and external analysis of the sector, to understand which internal and external factors might create the problem. For that, the following tools are used:

- i) PESTEL- to characterize the external environment of the air cargo sector;
- ii) Porter’s value chain analysis- identification of the capacities and resources that add value, the strengths and weaknesses of the sector, based in the analysis of the support activities and primary activities;
- iii) SWOT analysis- to synthesized conclusions taken in the PESTEL and the value chain analysis.

For the application of each one of the tools, field direct observation, documentation, semi-structured and structured interviews, and a focus group should be used. To the interviews and focus group, the target groups should be the stakeholders of the air cargo sector. With the individual semi-structured and structured interviews, the objective is to get the individualized vision of each one of the stakeholders, while at the same time obtaining the maximum of information and knowledge. The focus group has a distinct purpose, rather than collecting the maximum amount of information is to standardize what already exists, as different opinions and conflicting informations might arise from the interviews. Therefore, joint discussions of the topics might be necessary to generate consensus.

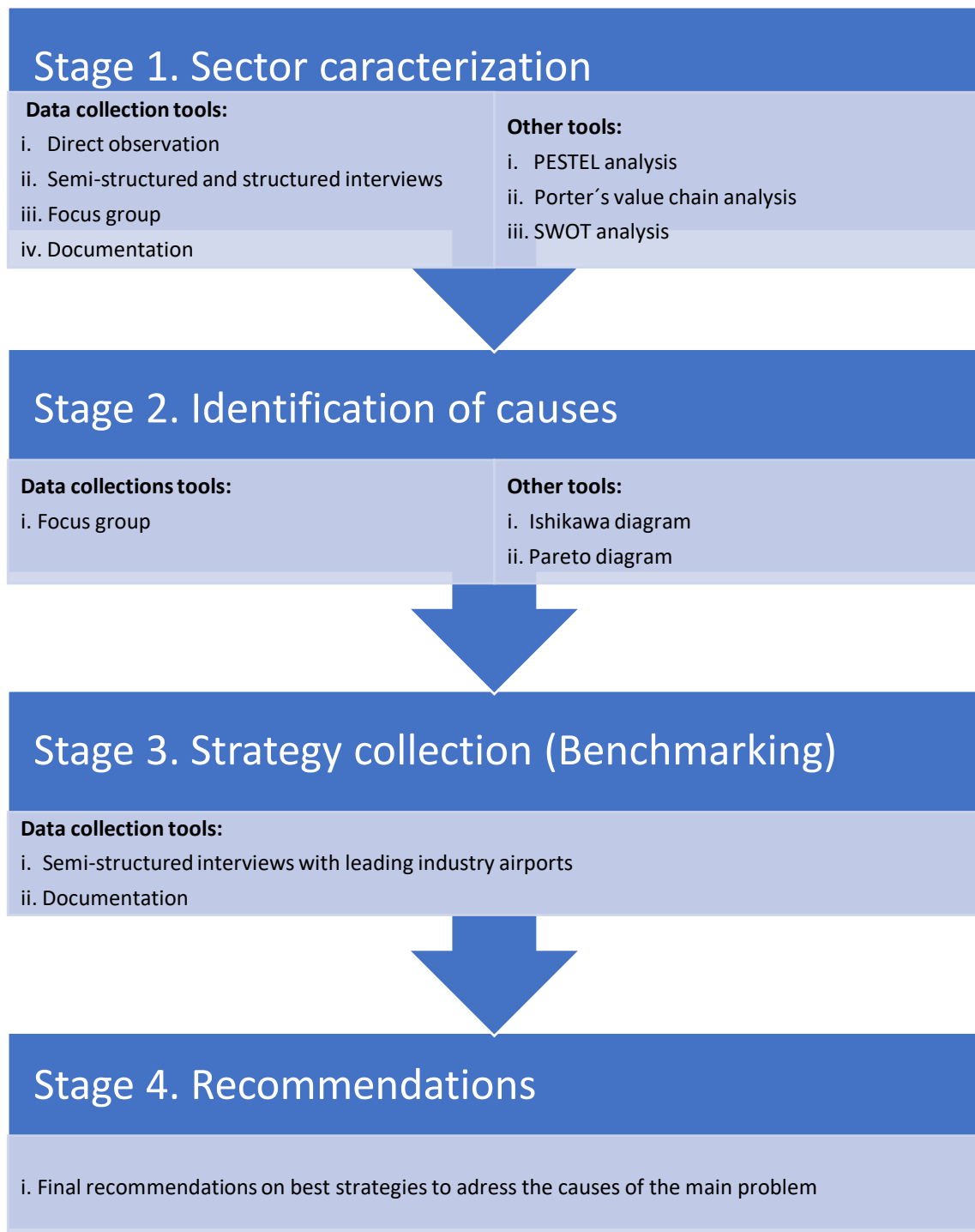
Stage two- Identification of the causes- Throughout this stage, the causes that might be related with the limitation and inadequacy of the cargo infrastructures will be identified, using the Ishikawa and Pareto diagrams. These tools will be presented as an output of the analysis made in stage one. A focus group is used to validate the results of these outputs, being the target groups the stakeholders of the air cargo sector,

Stage three- Collection of strategies with potential to deal with the main causes identified, based on the practices of other European airports- In this stage, key industry European airports will be selected so that a Benchmarking process, can be drawn up. This should be done through semi-structured interviews exposing to the interviewee the causes for the main problem (or problems) and comparing the processes and practices, while identifying the strategies followed by these competing airports, to deal with those issues. The final results will be validated through a focus group, with the target groups being the stakeholders of the air freight sector.

Stage four- Final recommendations- This final stage comprises a chapter with final recommendations on strategies for mitigation / resolution of the causes to the problem revealed during the research.

Figure 3 shown below, depicts the research stages of the project:

Figure 3. - Research stages



4. Case study

In this chapter, the Lisbon air cargo sector is briefly presented including ANA Airports of Portugal (the company that manages the Portuguese airports), the Lisbon airport, the air cargo terminal and an overview of the airfreight sector. Additionally the cargo sector in Lisbon will be characterized, while identifying the potential causes for the main problem in the sector: *the limited capacity and inadequacy of the air cargo infrastructures*.

Finally, after the causes for the main problem identified, a survey of the solutions to mitigate the cause, is done through the benchmark analysis.

4.1. Lisbon air cargo sector presentation

ANA Airports of Portugal

ANA aeroportos de Portugal, SA, as a pure airport management entity was created in 1998, after the division of ANA aeroportos, EP, in ANA aeroportos de Portugal, SA and in NAV, EP (as entity dedicated solely to air navigation). It currently has a network of 10 airports in continental and overseas Portugal, including Porto, Lisbon, Beja, Faro, Madeira, Porto Santo, Ponta Delgada, Horta, Santa Maria and Flores airports (ANA, 2018). The company serves in its airports a total of 73 air companies, and 162 different destinations in 2017. The business volume is of about 710,9 million euros, with a yearly positive variation of 16,8% (ANA, 2018).

Since 2013, ANA airports of Portugal SA, is a private company, on the aegis of the French VINCI group and its subsidiary Vinci airports.

Lisbon Airport

Being, by far the largest airport in the ANA network, Lisbon airport deserves an individualized analysis not only for its size, but also for its complexity. The airport of Lisbon, opened to traffic in 1942, whose current name is Humberto Delgado Airport, is the largest and busiest Portuguese airport.

It serves as the main airport, and air base, for the Portuguese “flag” company, TAP air Portugal, which accounted for 59.8% of movements and 54.2% of passengers in 2017, according to annual data provided by ANA. Moreover, in counter-cycle with what occurs in Porto (where Ryanair dominates) or Faro, with a mix of low cost airlines possessing the bulk

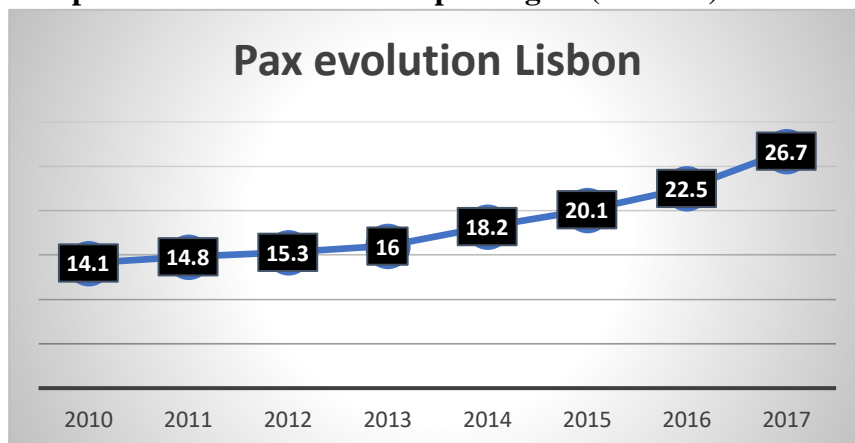
of the number of movements and passengers. This is not to say, that Lisbon is outside this "low-cost wave" (Ryanair, Easyjet, Transavia and Vueling processes more than 25% of Lisbon's total passengers), which sweeps across Europe, but otherwise its presence is mitigated by its operational characteristics, in particular with TAP Portugal.

The most relevant of these unique operational characteristics, is that the Lisbon airport serves as the international Hub for the referred airline. This means, that TAP centralizes the vast majority of its intercontinental connections to America and Africa, in Lisbon, made mainly by its large-dimension aircraft, commonly called wide-bodies such as the Airbus A-340 and A-330 of its fleet. The remaining smaller fleet, and here including the A319 / 320/321 series and more recently Embraer 190 and ATR-72 series, commonly known as narrow bodies (ICAO, 2004), serve not only to transport point to point (in the short and medium distance in Europe), but also to feed the intercontinental connections. We have thus, centralized the intercontinental operations in Lisbon, with all passengers flying to and from America and Africa to pass almost exclusively through Lisbon, from any other Portuguese or European destination.

This HUB system is used by the vast majority of large aviation companies, allowing for interesting economies of scale by pooling demand, generating higher aircraft occupancy rates and cost savings in airline operations, while granting the final customer more available options, destinations and theoretically lower prices (Your Heathrow, 2014). Taking advantage of TAP Portugal's excellent connections, mainly to Brazil and also to Africa, Lisbon airport is considered the largest European Hub for Brazil and one of the most important for Africa. TAP alone, has 10 different destinations for Brazil, some of which are unique in Europe, being the main example Brasília. New destinations in North America have come annually not only from TAP, but also from some North American airlines such as Delta, American Airlines, Air Canada or Air Transat. In addition, some new connections in the Middle East and the rest of Asia have proved to be very successful, with companies such as Emirates and Beijing Capital Airlines as bulwarks.

The growth of Lisbon, however, has brought to the top its structural limitations stemming from its organic growth and the consequent lack of strategy.

Graphic 1- Anual evolution of passengers (millions) in Lisbon



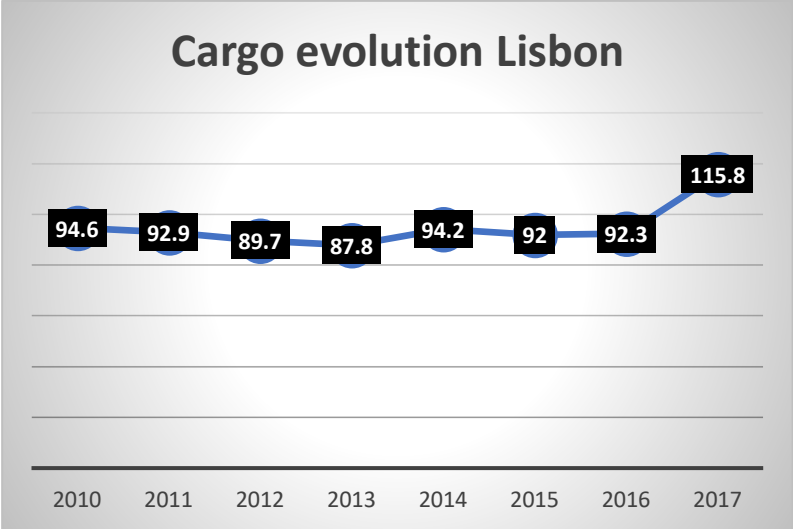
Source: ANA/ PORDATA

Since the beginning of this decade, the growth of passenger processing in Lisbon has skyrocketed since 2014, with the annual growth approaching 20% per year. With a capacity that, in theory was close to 22 million passengers/ year, as referred by Ministry of finance (2018), Lisbon airport in 2017 processed 26.7 million passengers, and with the growth outlook in the foreseeable future, it is not expected that this growth of increase will slow down. The new complementary airport of Montijo, might bring the solutions that the economic agents so long for, but for now with no defined date of opening, these ideas are merely speculative.

Lisbon air cargo sector

Air cargo although often considered a by-product, is unanimously considered of extreme relevance. In fact, in most of the Hub realities, the transportation of cargo is the factor that allows the viability of certain routes (Your Heathrow, 2014).

Graphic 2 - Annual evolution of freight processing (thousand tons) at Lisbon



Source: ANA/Pordata

As opposite, to the number of annual passengers in Lisbon, the observation of the cargo processing since the beginning of this decade, indicates that the annual values of cargo processed in Lisbon have been practically stagnant, since 2010 and until 2016. However, in 2017 the total of processed cargo skyrockets, with an increase of 25,5%. Some possible explanations, might reveals itself very valid, such as the recent positive evolution of the Portuguese economy at the head of the possible causes, the increase of the e-commerce or also a possible increase of transfer cargo (all of which are factors that will be explored in the SWOT analysis later on).

However, despite this apparent sluggishness or lack of vitality in the sector, and excluding the *sui generis* year of 2017, Lisbon airport alone has been responsible for more than 60% of the cargo processed in Portugal in recent years. In 2016 alone, the Lisbon airport processed 92260 tonnes out of the total of 135 440 processed in Portugal, *i.e.* more than 68% of the total (data provided by ANA), which shows the economic importance of the cargo to Lisbon airport, and to the local and national economy.

Taking into account the importance of cargo in Lisbon, the new Lisbon air freight complex was inaugurated at the end of 2008 (investment of 24 million euros), replacing the previous and outdated facilities located in buildings close to the present Terminal 1. Taking advantage of available land westside of the airport's main runway, a complex with a total of 23 thousand square meters is built, with a capacity to process 100 thousand tons of cargo / year, with the possibility of being expanded to a capacity of 150 thousand tons / year (APOE, 2009).

Fig. 4 - Air cargo complex, Groundforce (blue) and Portway (orange) areas, Lisbon



Source: Google maps

The cargo center has two parking lots with a total of 250 places, as well as areas reserved for the possible expansion, in the north and south of the main buildings (left and right of the image). The cargo terminal also has a central building to support the cargo, where customs, forwarder companies, airlines, phytosanitary and veterinary departments are located. The warehouses themselves are granted to the handling companies present in Lisbon, Groundforce (warehouses on the left, marked in blue) and Portway (on the right, marked in orange), with 6 truck parking positions in front of the Portway warehouse and 8 in front of the Groundforce warehouse. The small southern warehouse (right and unmarked side) belongs to CTT Correios de Portugal, and is at service of the air express mail, which will not be object of study in this investigation. The cargo terminal complies with the majority of IATA requirements, including the cargo storage area, the refrigerated area, storage of radioactive products, valuable products (there is a safe for storage of these products) and a specific storage area for dangerous goods.

The cargo warehouses, has different total areas of storage for each of the handlers, but is divided into two areas of equal size. This means that Groundforce (with the biggest total area of storage) will have half of its storage area dedicated to exports and another half dedicated to import. Portway, despite having a lower total storage area, also has an equally divided warehouse, with half for export and half for import.

The import and export processes of both handlers, although similar, have slight distinctions. It should first, be noted that Groundforce processes most of the cargo passing through Lisbon. The figure below depicts the processed cargo by air company in the year of 2017, it shows the total cargo tonnage by airline, while exposing the yearly variation and total percentage of the airline in the Lisbon air freight sector.

Table. 1 – Processed cargo by air company in Lisbon 2017

Airlines	Total cargo tonnage	Variation % 17/16	% Total
TAP Portugal	70 170, 3	27,5 %	60,6 %
Emirates	10 547,8	-7,5 %	9,0 %
TAAG	6 085, 4	47,6 %	5,3 %
European Air	7 756, 3	12,6 %	6,7 %
Azul Linhas Aéreas	4 670, 0	+200 %	4,0 %
ASL Airlines Belgium	2 505, 6	17,9 %	2,2 %
Beijing Capital	670, 3	-	0,6 %
Azores Airlines	2 857, 9	-2,9 %	2,5 %
Swiftair	1 370, 3	59,1 %	1,2 %
Star Air	2 312, 0	0,9 %	2,0 %
Lufthansa	991, 2	27,5 %	0,9 %
Air Canada	287, 0	-	0,2 %
Turkish Airlines	819, 3	60,8 %	0,7 %
United	763, 1	20,4 %	0,7 %
Alitalia	125, 5	-	0,1 %
British Airways	370, 8	-5,5 %	0,3 %
Brussels Airlines	475, 9	42,5 %	0,4 %
Iberia	291, 0	-30,3 %	0,3 %
Air France	302, 1	3,4 %	0,3 %
Air Transat	107, 5	40,5 %	0,1 %
Royal Air Maroc	315, 5	13,3 %	0,3 %
STP Airways	149, 0	-18,0 %	0,1 %
TACV	215, 0	-20,2 %	0,2 %
Euro Atlantic	129, 1	31,4 %	0,1 %
Orbest	7, 3	+200 %	0,0 %

Source: ANA

Groundforce is responsible for handling TAP, which according to the above table, in 2017, processed slightly more than 60% of the total processed cargo in Lisbon. In addition to this, it also processes Azul linhas aéreas cargo, Azores airlines, and some other smaller statistical companies such as Lufthansa, Iberia, Air France, among others. Looking at the picture, it is easy to understand that Groundforce processes between 65 and 70% of the total cargo in Lisbon. This explains the larger size of its storage area, as well as its superior importance when it comes to transfer cargo, a topic that will be studied deeply, later on.

Portway has as main bastions, Emirates and TAAG Angola Airlines. Emirates as a major import and export company, and TAAG as one of the most important companies in Lisbon for export. Portway, however, is processing a number of other companies, including all integrators, such as European Air (on behalf of DHL), ASL airlines (on behalf of Fedex), Star air (on behalf

of UPS) and Swiftair, thus and according to the above table, totaling over 30% of the cargo processed in Lisbon. Integrators are so named, because they integrate every aspect from collecting to delivering parcels and point-to-point cargo (Sales, 2013). However, in the case of Lisbon, these companies also transport freight outside the integrator concept, and work directly with freight forwarders, so that it is possible to make better use of the commercial space of the aircraft. The integrator companies have planes called freighters, which carry only cargo.

However, all other carriers, excluding freight aircraft integrators and / or charters, carry cargo in the bellyholds of passenger aircraft, commonly known as belly freight (Sales, 2013). In the case of Lisbon, this is the predominant mode with 86% of cargo to be transported in the bellyholds of regular passenger aircraft in 2016 (Costa, 2017). This feature of the Lisbon operation will be explored later in the SWOT Analysis, as one of the most important limitations for the development of the Lisbon freight, since, except for the long haul, Lisbon is mostly served by narrow bodies, which are extremely limited for the massive transportation of cargo.

4.2. Stage 1: Sector characterization

The objective in this stage, is to characterize the cargo sector in Lisbon, while identifying the potential causes for the main problem in the sector. For that, an internal and external analysis of the sector is made, allowing to read which internal or external factors are creating the problem. This analysis also allows to identify the opportunities and threats posed by the market that may influence the solutions that may be taken to the problem, and moreover the weaknesses and strengths of the air cargo sector in Lisbon, which also influence these solutions. This is done, not only by analyzing and reading the numbers in documents, but essentially through direct observation and the accumulated experience of professionals in the sector (through semi-structured interviews).

4.2.1. Data collection

Data collection tools, including, direct field observation, documentation, semi-structured interviews and a focus group, were used in this stage.

Direct observation was used, on one hand through my experience and ease to observe an important part of the cargo operation, and on the other hand because of the acquired knowledge as an Airport Operations Officer, in the last 14 years, at the Lisbon airport.

Thus, the cargo terminal at Lisbon airport was visited several times, where guided tours and explanations of the complete point-to-point air cargo processes were provided. Portway

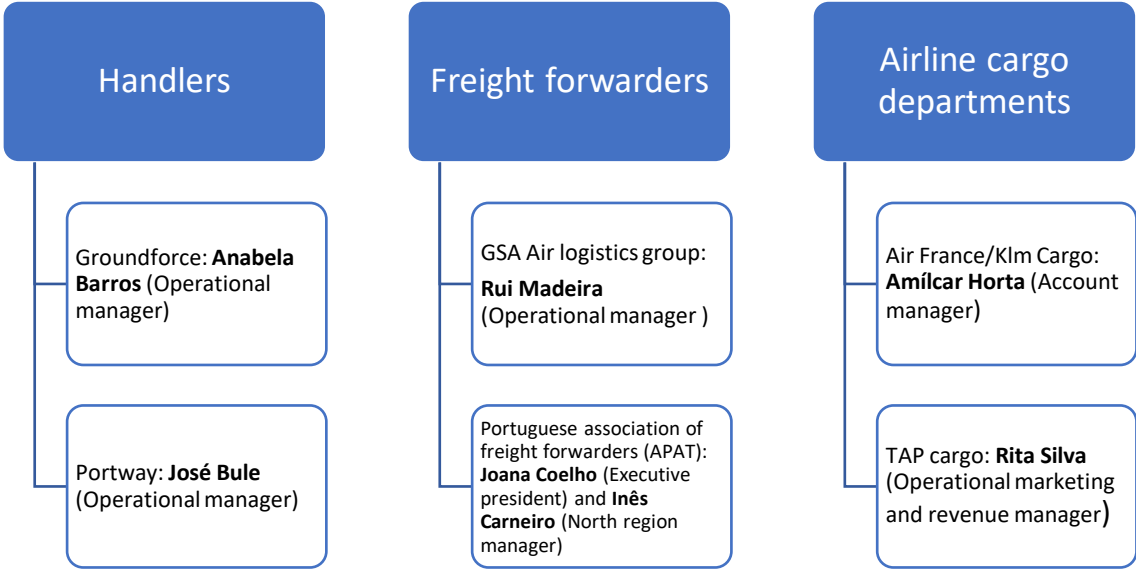
infrastructures were observed in the first place, being received by Mr. José Bule (Portway Cargo Operation manager), who explained Portway's import and export processes of cargo, while at the same time observing this whole process *in loco*.

Secondly, Groundforce infrastructures were presented by Mrs. Anabela Barros (Groundforce's Cargo and Mail Operator), who also explained the import and export processes for the Groundforce cargo, while observing the entire process in place.

The transportation of cargo, from and to the airplanes using tractors, was observed, and the process of loading and unloading of the aircraft, while performing the tasks as an Airport Operations Officer. This enabled to, not only supplement the information, that was kindly provided, by the operational managers of Portway and Groundforce, but also to integrate additional information, to be used in the other strategic planning, throughout the research.

Documentation provided by ANA was also used, including all cargo statistics for the years 2015, 2016, 2017 and January 2018, besides extra literature. Finally, semi-structured interviews, with all air cargo stakeholders in Lisbon were performed. Figure 5 below, shows the interviewees according to each stakeholder.

Fig. 5- Semi-structured stakeholder interviews



In these interviews, it was created and open-flow communication, so that it was possible to obtain the largest amount of information, from all the knowledge that each of the interlocutors had to offer. Only four points of mandatory passage were defined, in all these semi-structured

interviews, which are published as I. In Appendix with the interview scripts. Additionally, as shown in Figure 6:

Fig. 6 - Structured stakeholder interview



ANA Aeroportos de Portugal, in the name of Francisco Pita, asked for a fully structured interview script, which is published as II. in Appendix. A focus group, to gather as many stakeholders as possible was also planned. However, it was not possible to meet with more than one element responsible for each stakeholder, at a time, due to the unavailability of interviewee's time.

The information collected with all these data collection tools has allowed to evaluate the internal and external environment of the entire sector in Lisbon, and especially to obtain the necessary information to apply out all the other strategic planning tools.

4.2.2. Characterization of the air cargo sector: External Environment Analysis using PESTEL

PESTEL Anaysis

The PESTEL analysis is based on the identification of Political, Economical, Social Technological, Ecological and Legal factors, and is used to track the environment in which a company/sector operates. PESTEL is seen as a structured way to arrange the external environmental factors, this tool is also used to analyze and chart the external environment inducing an industry. The tool grants an overview of the macro-external environment elements needed to be considered in every decision-making process (Sandberg et al, 2016, Song et al, 2017). The results are summarized in the Figure 7, below, and in detail afterwards.

Fig. 7 - PESTEL analysis



Political

Growing protectionist in World trade

Despite the growth in world trade, there is a resurgence of protectionist measures in some of the biggest players in world trade. China was, in recent history, one of the most closed players, despite its enormous relevance in the world economy. But the new political reality in the United States of America is potentially explosive and is been leading to the imposition of import tariffs (especially in raw materials) and retaliation by other major economies like China or European Union, that might trigger a crisis in world trade representing a significant risk to global growth (Look, 2018), also with obvious negative consequences in the air cargo sector.

Increasing airport fees

After the entry of Vinci Airports into the management of ANA airports (privatization in 2011), airport charges increased several times, with increases between 28% and 167%. At the same time, air traffic has also risen by about 70%, (Relvas, 2018), which means that Lisbon remains a competitive destination, at least when it comes to passenger tourism. The majority of cargo is carried on the belly of passenger aircraft, that land and take off in Lisbon, therefore, the charges increase does not have a direct impact on this type of cargo. However, when thinking about full cargo freighters, integrators, or exclusive cargo companies the reality may already be different. Taking into account the huge intra-European competition for cargo, the economic factor of airport charges, can easily remove competition from Lisbon and cause freight companies to fly far from Lisbon.

Security concerns might lead to stricter rules and therefore inefficiencies and rising costs

Security at airports is a concept that, almost all aircraft passenger has already dealt with, in a more or less comfortable way. In freight transportation, reality is at least as complex, as all cargo has to be controlled, via x-ray screening or using some other method, before entering an aircraft, and this can lead to significant challenges, such as with very large cargo, explosives or flammable liquids. The reality is becoming more complex, as threats to aviation security are constantly increasing, and the geopolitical reality is becoming more and more unstable. It is expected that new security measures will become increasingly restrictive, to which the air cargo sector will inevitably have to respond with investments, which will naturally have an impact on the final consumer.

Economical

Portugal economic recovery

The economic recovery of Portugal is clearly an opportunity, not only at the level of an increase in investment and therefore imports, but also in an increase of exports. The year 2017, brought a sui generis growth in air cargo, with the 25.5% growth of cargo processed in Lisbon, to exceed all the projections and clearly in countercurrent, with the reality of portuguese air cargo, in the last few years. This might be a consequence of the economic recovery of Portugal and the Portuguese companies, that naturally took advantage of the portuguese economy growth of 2,7% in 2017, to increase investment in a + 8,4% rate, the highest since 2008, and after consecutive years of financial restrictions. At the same time the 7,9% increase in exports, the highest since 2010, might also had an important role in this equation (Aníbal, 2018). These

facts seem to be very plausible to have direct consequences on the exponential growth of air cargo traffic. It remains to be seen, though, whether economic growth is an important condition for the growth of the processing of cargo in the coming years, or whether it will only be a cyclical phenomenon of business investment readjustment. This is, however, an opportunity to observe attentively.

Portuguese economy recovery might not be sustainable in the long term.

The Portuguese economic recovery of the last years, possibly one of the main causes for the positive air cargo evolution in the last year, may not be sustainable in the coming years. After a series of years, of severe economic crisis in Portugal, the doubt about the sustained evolution of the Portuguese economy still arises throughout all the economic agents. With a very high level of public debt, and with a high possibility of bad credit standing in the bank, any shock outside the real economy can easily direct the Portuguese economy into a new recession (Aguiar, 2017). Air freight is no exception, and a new recession could easily take air cargo numbers to much lower figures.

Portugal's small economy

The Portuguese economy and market in the European and World context are of modest size. When looking at the capturing potential of the Portuguese air cargo market, it is also quite modest. In order to acknowledge the current size of the air cargo sector in Portugal, the information gathered through the interviews showed us that the whole national market is of the same size as the first agent in Spain. It is true that 70 to 80% of the cargo processed in Lisbon is transfer cargo, whose destination is not Lisbon, so the growth potential is naturally less dependent on the size of the Portuguese market. However, this limitation will always have to be taken into account, when considering the creation of a Hub in Lisbon, with a European dimension.

Slow down of World economy

After the economic crisis of 2008, whose echoes were still heard in the following years and the crisis of the European debts (from 2010 onwards), the World economy has been living with relevant growths. Nonetheless, the ageing populations, (in developed and developing countries), the low investment, slowing in productivity gains and tightening monetary policy is showing limits in the world economic expansion (Donnan, 2018). Although there is no direct link, world trade usually follows the growth of economies. This slow growth of the World economy is therefore expected to have possible negative effects on world trade and, consequently, on air cargo.

Economic downturn in some Portuguese speaking countries like Brazil, Angola and Mozambique

The excellent commercial relationship and excellence of connections with the former colonies of Brazil, Angola and Mozambique, is a two-pronged stick. This is because the intercontinental cargo connections, are essentially with these 3 countries (despite some relevance in the connections with the United states of America and other African countries) which makes the cargo sector in Lisbon somewhat dependent of the economic variations, in such countries. Recent crises, especially in Angola and Brazil, can easily lead to a decrease in external trade (especially imports) as consumption declines with the economic breakdown (Miranda, 2018). This immediately translates into a decrease in cargo imports, and the air sector will not be spared to this decrease. Thus, the dependence on international exports of air cargo to these countries, makes the sector also dependent on the economic fluctuations of these economies, with recent crises leading to a high possibility of decreasing exports of air cargo.

Rising oil prices

Rising oil prices are also a factor of extreme relevance. With oil reserves far from finished, but still finite, the time of cheap oil has long gone. The outlook is for a sustained price increase in the coming years, and recent cuts in production by OPEC, high demand, and a drop-in dollar's value, have shown oil prices hitting maximums of four years (Amadeo, 2018). Despite this, the aviation industry has flourished in the last years. Nonetheless, in an industry fully dependent on oil and its derivatives, an increase in oil prices above the adaptive and competitive capacity of the different players, might easily lead to disastrous results. It is not a matter of if, but of when, thus, the air cargo industry will have to prepare properly for this expected change. The questions are somewhat philosophical and go beyond the scope of this investigation, but is it worth investing in a sector whose survival is highly endangered in the long term? It is undoubtedly a relevant question to be answered by all those in charge of the sector in Portugal.

E-commerce

The growth of e-commerce is also a reality to which no business segment can be extraneous. The numbers skyrocket day after day, and in all types of business, and the total online sales are expected to reach 3,5 trillion USD in 2019. The current customer does not just want home delivery, but speed is essential. Only air freight, which is the fastest mean of transporting goods / merchandise, has the predicates to respond to these new online customers desires (IATA, 2018). The growth of this market is expected to be exponential in the coming years, and the opportunities for air cargo are also tremendous.

Strong competition from Spanish airports, specially Madrid in Exports

Spanish airports, especially Madrid, present themselves as the main competitors in this "race" for increasing the air cargo processing. Its geographical position, right in the center of the Iberian Peninsula (therefore with better and faster access to any corner of the Peninsula), a better elaborated terminal, simpler, with some expansion capacity, and especially bigger and more efficient screening facilities, are positively differentiating factors. According to some freight forwarders and handlers, the limitations of Lisbon's x-ray screening often lead to cargo being transported to Madrid and then being shipped to destinations also served by Lisbon. The operators also take advantage of the faster and simpler expedition, to often opt for Madrid, instead of Lisbon, even if this decision involves a journey of 600 km. Market and revenues are lost, which would otherwise remain in Lisbon.

Strong competition from road and maritime cargo.

The strong competition of the road and maritime transport service is also a factor to be taken into account. Usually much cheaper (but also slower), there are a number of constraints with which air travel can not compete. The lowest price, especially from maritime shipping, is something the airline industry can not (and should not) compete with. Flexibility in deliveries from road transportation, is something the air cargo sector can not (and should not) compete with. But speed, must clearly be the bulwark of the airline industry, and the customer is willing to pay for that speed. Therefore, with lengthy processes of screening or documentation, the great advantage of air transport can be easily lost, due to the simplicity of the processes of both shipping and road transport. It is important to simplify and adapt the equipment so that the processes of preparation of cargo are as fast as possible, thus maintaining the great virtue of the sector, the speed of transportation.

Social

Pressure from community to lessen night operations due to noise and proximity to city.

The successive years of increases in aircraft movements at the Lisbon Airport are beginning to leave marks, as far as noise is concerned. With an airport literally in the urban mesh of the city, the conflict between aircrafts and residents, dormant for many years, is now beginning to emerge. A 2012 study by ANA (Mapa de ruído, Aeroporto de Lisboa) indicates that about 19% of the Portuguese population is exposed to noise levels above 65 db (threshold of fatigue), but in Lisbon this figure is around 50%. With the increase of close to 70% of traffic in Lisbon since 2011, it is expected that these values will still be of a higher order. The presence of the airport

in the urban area means, that not only the surrounding areas of the airport, are exposed to high noise levels, but also the approaches and departures corridors are next to densely populated areas. The pressure to mitigate this noise begins to emerge, and the Lisbon Chamber has already publicly assumed that it is against any measure to increase the number of flights during the night period between 00h and 06h (Gordo, 2018).

The pressures of the groups of residents are understandable, but in the same way are the difficulties of the Lisbon Airport in dealing with the demand that is being targeted. Taking into account that (as far as freight is concerned) night time is clearly the most favorable period for companies, it is easy to understand the difficulties that a large number of cargo operations may be subject in Lisbon.

Technological

More efficient aircrafts

Successive increases in oil prices and total dependence on oil industry, have driven the industry to a new mindset, a new reality, the one of efficiency. With total dependency of petroleum (at least in the nearer horizon), the only alternative is to consume less. Since in this industry, the main variable for the reduction of consumption is weight, the new generations of airplanes, are taking advantage of this new mindset, and are built essentially in composites that include fiberglass, carbon, aluminium, among others. Moreover, the engines are now more efficient, and lighter in construction due to the lower overload they are exposed to. The savings coming from this new technology could reach the 100 billion dollars, not only by the greater efficiency in fuel consumption, but also because this (thouger and lighter) materials are also more resistant, therefore, requiring less maintenance and a less expensive construction (Delft University, 2007).

Bridging to air cargo, it can be easily understood that a considerable reduction in fuel costs and aircraft maintenance will result in a decrease in aircraft operating costs. Consequently, and potentially, the prices to be charged by the air cargo companies, may also be lower, leading to an increase in service, due to the higher demand. The conditions for an even greater increase in airborne cargo are thus met.

Ecological

Airport proximity to city and Tagus estuary.

Cities tend to be highly polluted environments, with polluted water lines, high air pollution and often, infertile and polluted soils. Since cities alone are polluted, therefore a city with an

airport within its urban network will potentially be even more polluted. Several hazards appear from fuel spills, oil in soils and / or groundwater and sewage, high atmospheric pollution located due to the polluting emissions of aircraft, to the extremely high noise, all of this characterizes an airport environment. In the specific case of Lisbon, the proximity to the Tagus estuary ("sanctuary" of a large number of bird species), and the proximity to migratory bird routes, makes especially foreseeable collisions between aircraft and birds. This is a particularly dangerous aspect, not only for the fauna of the Tagus, but of relevant importance for the safety of civil aeronautics. An increase in Lisbon airport movements is thus, an important obstacle to the coexistence between the airport and the environment.

CO2 emission limits, footprint and quotes

The air industry is one of the fastest growing sources of greenhouse gas emissions, and this is a fact that cannot be denied. In order to get an idea of the magnitude of the emissions from the industry, if it was a country, it would be in the top 10 of the largest emitters of greenhouse gas emission, and on an individual level, a person who goes between New York and London and returns, produces the same level of emissions needed to heat a house, for a whole year. At the same time, if nothing is done, the growth of gas emissions in the industry is expected to reach values between 300 and 700%. Thus, there is a problem at hand, economic vitality in the sector is wanted, but at the same time guarantee environmental sustainability. The European Union has implemented accountability measures for all European companies, while modernizing procedures and aircrafts to ensure greater efficiency (European commission). However, these measures are not sufficient to mitigate the rampant demand for the airline industry, and no measures are envisaged that could lessen the predictable emission overload that the growth in industry could bring. Once again, the question of awareness and sustainability of a highly polluting industry rises. Solutions do not glimpse in the short term, and this adds to the penumbra over the future horizon of the airfreight industry.

Legal

Night noise restriction laws

In terms of structural and strategic weaknesses, one of the ways to overcome some of the congestion would be to operate at the airport when there are night noise restrictions (between 00h and 06h). In this period, there are a limited number of 91 weekly movements in Lisbon, according to the Ministry of public works (2005), which is quite castrating at the operational level. Rumors have surfaced that ANA airports, was preparing to ask for the reduction of this

period to be between 01h00 and 05h, allowing two additional hours of normal operation. However, this possibility, is in direct conflict with the interests of the Lisbon chamber and government, which showed total unavailability for any change in this reality, making it impossible to open night periods for normal operation. Taking into account, that the operation of aircraft dedicated to cargo is essentially nocturnal (due to the need for the operation itself), we find that the possibilities of an increase of movements, in the hours still available, is practically inexistent. Highly congested periods during the day are highly restrictive in terms of options, and outside the needs of the air cargo sector.

4.2.3. Characterization of the air cargo sector: Internal Environment analysis using Value Chain Analysis

The Value Chain Analysis is used for the internal analysis of the air cargo sector in Lisbon. With this analysis the capabilities and resources that can add value (the strong points), to the sector are presented, together with the weak points. This analysis is, based on the assesment of the support activities and the primary activities. In this analysis, the value chain analysis framework proposed by Porter (1985) is used, which comprises in the value chain, primary activities and support activities. The primary activites include: Inbound logistics, Operations, Outbound logistics, Marketing, Sales and Service. The support activities include: Procurement, Human resources management, Technological development and Infrastructure. Nevertheless, only the topics identified during the interviews and in the analyzed documentation are taken into account. This means, there are some activities that are not identified as key in this sector (and therefore not identified in figures 8 and 9 below), such as the item *Procurement* in support activities and item *services* in primary activities. In the figures below, each topic identified is associated with each value chain activity.

Fig. 8- Value chain support activities analysis

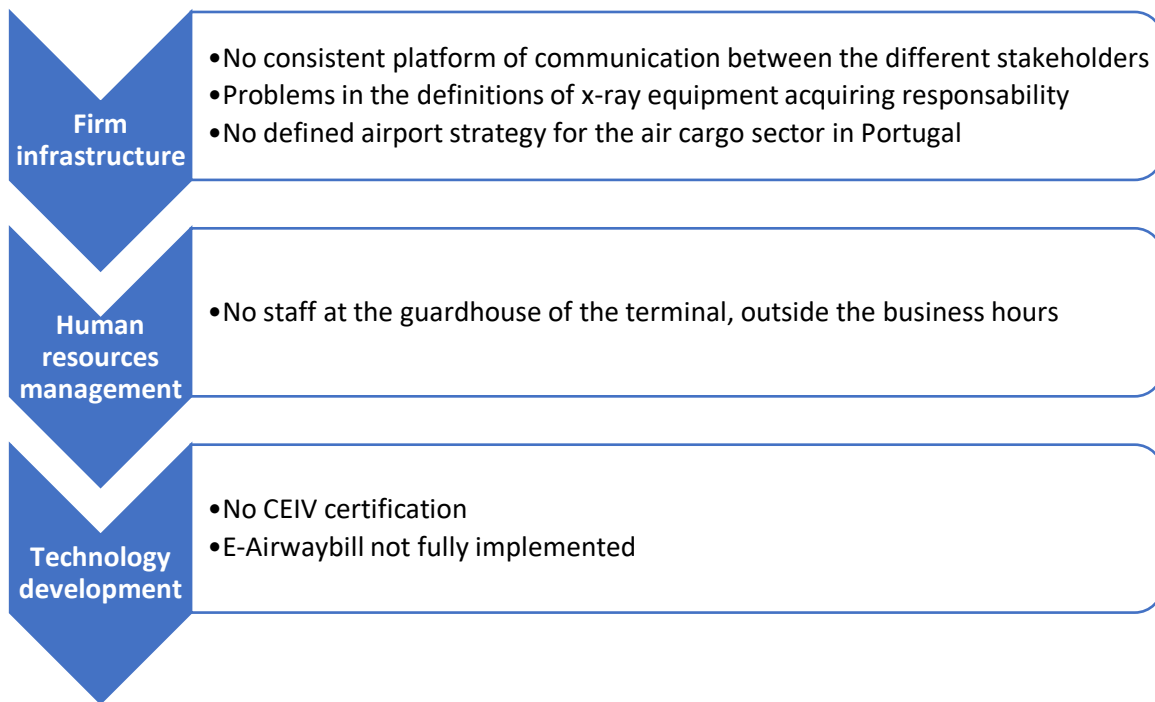
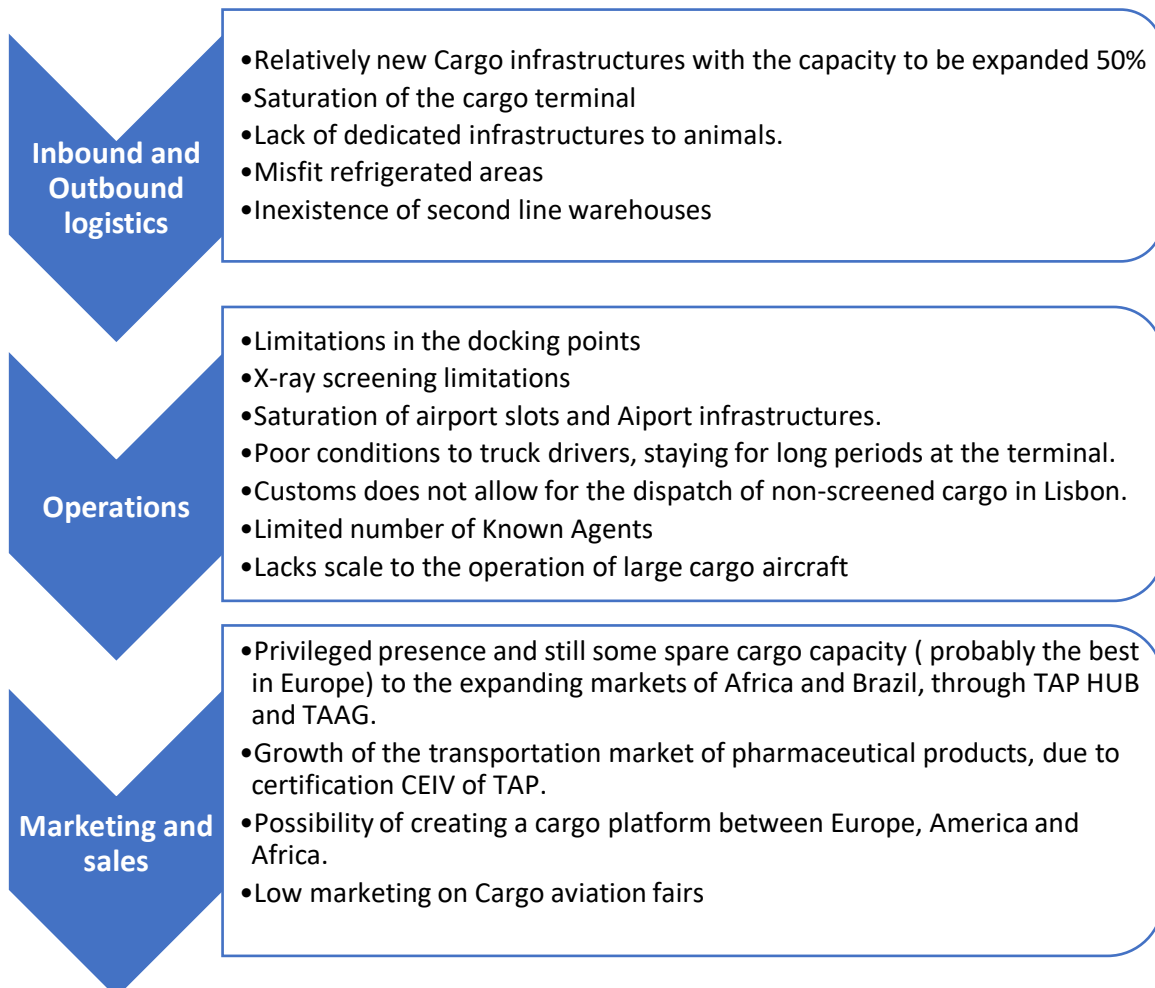


Fig. 9- Value chain primary activities analysis



With the exception of topics: *Privileged presence and still some spare cargo capacity (probably the best in Europe) to the expanding markets of Africa (Portuguese speaking countries) and Brazil, through TAP HUB and TAAG and also New Cargo infrastructures with the capacity to be expanded 50%*, The remaining topics refer to weaknesses or points that can be improved. The detailed explanation of each topic is done separately, hereafter.

Value Chain support activities

Firm infrastructure

No consistent platform of communication between the different stakeholders

It was verified the existence of monthly meetings between handlers and airport, quarterly between APAT, freight forwarders and handlers. However, while thinking of the sector as a whole, the existent air cargo community (which brings together all stakeholders in the sector has not met for 3 years. Thus, there is no communication platform between all the different stakeholders, absolutely necessary for the communication and resolution of the needs of the sector.

No defined airport strategy for the air cargo sector in Portugal

This lack of communication between stakeholders leads to an unclear strategy for the air cargo. The ideas that might exist seem to be misaligned from one stakeholder to the other, which then leads to a lack of a joint strategy for the air cargo sector in Portugal

Problems in the definitions of x-ray equipment acquiring responsibility

Current screening equipment is acquired and managed by handlers (GF and Portway), but according to some stakeholders such as APAT, the airport should provide larger screening facilities, as is the case of Portuguese national ports.

Human resources management

No staff at the guardhouse of the terminal, outside the business hours

The lack of staff outside office hours, in the security cabin at the entrance of the terminal area, is often a factor that also hinders the operation of trucks. The absence of someone who can conveniently navigate the drivers (usually unaware of the terminal lay-out) within the air cargo terminal areas, could be extremely beneficial to the image and quick operation at the Lisbon freight terminal, at a very low cost.

Technology development

No CEIV certification

The transportation of pharmaceutical products by air, implies the compliance with strict standards of temperature maintenance, among others. In order to respond to customer concerns, IATA has created the CEIV pharma certification which ensures that the infrastructure, operations, and staff, comply with all the standards and master lines expected by the manufacturers of pharmaceuticals (IATA, 2017). The airport and other stakeholders do not currently have this certification, which leads to loss of market in this important and valuable air cargo niche. Although TAP Cargo, is currently preparing for certification (topic to be developed in the opportunities conclusions), group certification (Groundforce, Portway, freight forwarders and ANA) allows not only to cost-sharing, but also to the certification of the supply-chain as a whole, which then permits greater efficiency and moreover, the end of the obligatoriness to audit the transportation of these goods.

E-AWB not fully implemented

The documentation required to export or import cargo, is highly complex and the process tends to be very bureaucratic. Worldwide, the air cargo industry has more than 30 different paper documents, being the Airway bill, the most relevant. The digitalization of documentation presents itself as the natural pathway for a facilitation process, that is needed. The e-airway bill (or e-AWB), or e-freight, or electronic bill, is the digital version of the airway bill version, and represents the natural evolution that will have to exist in the sector (ACN). The implementation process in Portugal is still slow, while in Asia there are already exclusive e-freight stations (Revista cargo, 2018), and some European airports are also using it massively.

The process in Portugal, was blocked due to bureaucratic issues with the Tax Authority, however the process is now underway. It is seen as essential, by all stakeholders, therefore its non-implementation would be seen as an obstacle to the facilitation and growth of the air cargo sector.

Value Chain primary activities

Inbound and Outbound logistics

Relatively new Cargo infrastructures with the capacity to be expanded 50%

Despite the current facilities of the Lisbon freight terminal, already showing signs of overload, there is still capacity to be increased 50%, obviously after a significant investment

from the Lisbon Airport. In addition, the facilities are relatively new (inaugurated in 2009), so it is not to expect short / medium term modernization work, which could further limit the normal cargo operations.

Saturation of the cargo terminal

With the Lisbon airport, exceeding year after year, the declared capacity, it is no wonder the saturation in the infrastructure. The cargo terminal is a paradigmatic example of this reality, being 2017, the first year in which the theoretical capacity of the infrastructure (100 thousand tons) is exceeded. The consequences of that can already be seen, with the lack of space to the storage of cargo, but also with an evident lack of space in the refrigerated areas (topic to be developed ahead). Despite the capacity of expansion referred to, as strength, the truth is that in the short term, there are no plans to expand the cargo terminal, therefore operational problems are to be expected as the cargo processing increases.

Lack of dedicated infrastructures to animals

There is also a lack of dedicated infrastructures, for animals staying for longer periods in the terminal. At the moment, there is no infrastructure prepared for animals to stay for long periods, in comfort conditions, at the terminal. The current solution is to keep them in an isolated area inside the terminal, but in conditions of temperature and noise, exactly the same as the rest of the cargo shipped, which is far from optimal.

Misfit refrigerated areas

Despite the existence of areas with different temperatures, varying between extremely negative temperatures (-25°C) to 15-25°C (temperature of conservation of the pharmaceutical products, which are the most profitable market), it is verified that the refrigeration chambers, are of small dimension and are not enough for the needs of the market.

The doors of these cold rooms do not have space for pallets and containers. Moreover, there is a manifest lack of space, especially in the market for pharmaceuticals, which usually have to be kept between 15 and 25°C. The exponential growth of this market in the Lisbon airport, entails important operational limitations, that need to be overcome. Once again, the creativity of handlers and freight forwarders arose, and it was decided to use a large container with a controlled temperature (15 to 25°C inside). This solution rises to overcome the problem of space for this growing market, however, the absence of space inside the terminal for this container, requires its placement outside the terminal area. This, obviously, implies loss of operational efficiency with a greater amount of time to move the loads between the different areas of the terminal. Moreover, this creative solution does not guarantee an absolute maintenance of constant controlled temperatures, as a normal cargo terminal coolroom possess, therefore

deviations of temperature occur frequently, which will lead to loss of the cargo, and subsequently market loss.

Inexistence of second line warehouses

In terms of the inadequacies, it is still notorious that there are no second line warehouses, i.e. warehouses that can be managed by other handling companies, logistics operators and forwarders. In such places, it would be possible to receive the cargo and prepare it to be delivered directly to the airline, already prepared. This would entail the storage of the cargo, preparation through palletizing and documentation dispatch.

Operations

Limitations in the docking points

According to handlers and freight forwarders, the docking place is an important limitation. Firstly, due to the fact that the height of the docking place is not the most suitable for the unloading / loading of goods, and secondly because it only has one docking point for import and another one for export, to each of the handlers (Portway and Groundforce).

The fact that the docking place is not at standard height, leads to a decrease in productivity and a longer time in the unloading of trucks. According to the handlers, the recurrent inability to use the docking equipment itself, due to the difference in height for a truck, leads to the use of more "creative", but less effective unloading processes, since they are more prone to work accidents, and lower productivity.

On the other hand, the existence of only a docking point for import or export, leads to over-usage, creating recurring malfunctions. More importantly, with the arrival of several airplane trucks from central Europe (either to unload cargo to be exported, or to unload cargo that arrives for import), the process becomes especially slow and inefficient. The impossibility of unloading more than one truck at a time, strongly limits the operation of airplane trucks, at the Lisbon cargo terminal. A normal unloading operation of a truck will take close to one hour. Bearing in mind, that the number of trucks between Friday and Monday morning, only at the Groundforce terminal, varies between 40 and 60, it is easy to understand that the process will be clearly inefficient and especially time consuming. According to Groundforce officials, it is perfectly normal for a truck to get 3 days to unload at the terminal.

X-ray screening limitations

The absence of large x-ray screening facilities leads to efficiency limitations, but also to the impossibility of x-ray screening at certain loads (such as very dense cargo). According to

handlers and freight forwarders, triple screening devices and higher payloads are required. These limitations lead to market loss, with large cargo, or special features cargo being transported to other airports (such as Madrid or other airports in the Central Europe) due to the impossibility of being screened in Lisbon. Efficiency and market share are lost, within this reality.

Saturation of airport slots and Airport infrastructures

At the same time, there is also a saturation in the airport slots (time periods available for arrival / departure from the airport, since the airport is coordinated), which causes serious restrictions for the operation of the several companies that operate in the airport. The absence of available slots, at certain periods of the day, may cause a certain company to be unable to perform an operation, despite having market and operational conditions for doing so. This factor is seriously restrictive by forcing companies to use slots that are uncompetitive, or even unable to fly to or from Lisbon.

Poor conditions to truck drivers, staying for long periods at the terminal

The prolonged wait for truckers, to unload at the terminal, raises other types of problems. In this case, the inexistence of any types of bathhouses or toilets that guarantees the minimum conditions of insalubrity for the truckers, to whom is usual to stay during consecutive days, waiting for their turn to unload, is a major problem.

Customs does not allow for the dispatch of non-screened cargo in Lisbon

Customs does not allow the dispatch of unscreened cargo by airplane truck, which would then be transported and dispatched to airports with larger screening facilities (Madrid, Amsterdam, Paris, etc.) where subsequent screening and shipment would be carried out to the final destination.

Limited number of Known Agents

As the name implies, these are agents recognized by the national aviation authority (in this case ANAC), as safe in their handling and preparation of cargo until shipped. This fact implies that the cargo has already been screened at the Cargo agent's premises before arriving at the terminal (INAC, 2008). APAT indicates that this process should be further explored and improved in Portugal, since the number of agents recognized is small, and the process of the ANAC is slow and complex.

Lacks scale to the operation of large cargo aircraft

At the structural level, Lisbon airport has no scale for the operation of large cargo aircrafts, with the majority of the cargo operation being done as the belly freight (in the belly of passenger aircrafts), which is essentially, in the case of Lisbon, done by narrow body aircrafts (especially

in the short to medium haul, inside Europe). This is not to say, that part of the cargo is not transported by freighters or integrators, but just that most of the cargo is carried by belly freighters. Obviously, these restrictions on the transportation of high-volume cargo, lead to the transportation of an increasing amount of cargo by airplane trucks to / from the largest hub airports at central Europe, served by a large freighter aircraft network.

Marketing and Sales

Privileged presence and still some spare cargo capacity (probably the best in Europe) to the expanding markets of Africa (Portuguese speaking countries) and Brazil, through TAP HUB and TAAG

One of the main competitive factors of the industry in Lisbon, is precisely the strong link between Portugal, South America, and Africa. There are several reasons behind this reality, whether historical or economic, but this is undoubtedly one of the key factors, that can be capitalized as one of the main competitive advantages of the air cargo sector in Lisbon.

TAP with its hub in Lisbon, is the main responsible for the privileged connections, and probably the most complete ones, at the European level. For Brazil alone, there are 10 connections with spare space for cargo on most connections, except for Rio de Janeiro and São Paulo. In addition, the connection to Brasília, is unique amongst European companies and is especially advantageous for the transport of cargo (especially pharmaceutical products), as it is the main country's gate to the import of public health goods. The hub in Lisbon, allows TAP to centralize departures and arrivals to Brazil, allowing passengers to be transhipped to other European destinations, creating a more efficient operation. The reality is the same in the cargo sector, despite some difficulties in making high volume bulk cargo transfer due to the use of narrow bodies (small/ medium size aircrafts) for European destinations. At the European level, TAP connections to Brazil, are the only ones with some spare space for freight, and therefore represent an interesting (and often unique) alternative for freight transportation between the European Continent and Brazil. The connections with the African continent, are also of particular relevance, particularly for the Portuguese-speaking countries, and emerging markets of Angola and Mozambique. Here, TAP has the main role, but also TAAG with one or two daily connections, is an important player. Moreover, at the export level, Luanda is one of the main markets. In addition, it appears that this market is being used to gain access to South Africa, with some cargo being sent from Lisbon to South Africa, via Luanda or Maputo.

Growth of the transportation market of pharmaceutical products, due to certification

CEIV of TAP

In a period of significant growth in the market, for the transport of pharmaceuticals in a controlled environment (15 to 25°C), and with the market growing from 8,36 billion dollars to 10,28 billion in 2018, air cargo share decreased from 17% in the year 2000 to 11% in 2013. This is mainly due to the lack of compliance, standardization, accountability and transparency throughout the air transport supply chain, which entails heavy losses for the pharmaceutical industry, due to temperature deviations occurring in the process and consequent degradation of the product. To address this problem, IATA has created a certification CEIV, that guarantees the necessary conditions for the transport in safety conditions and ensuring the quality of the service (IATA, 2017). None of the stakeholders in the air cargo sector in Lisbon, has CEIV IATA certification for the transport of pharmaceutical products at controlled temperatures. However, TAP Cargo is now in the process of obtaining this IATA certification, in a process, however, isolated from other entities in the sector. A group certification that included ANA, handlers, freight forwarders and companies would bring cost sharing, but essentially a more efficient and more attractive supply chain for the pharmaceutical industry. Thus, TAP Cargo's certification is an important step in the right direction and will certainly bring significant growth in the transport of controlled-temperature pharmaceuticals. Firstly, because it is the guarantee of a safer transportation, and secondly because it dispenses constant quality audits, which of course make the process more efficient and profitable.

Possibility of creating a cargo platform between Europe, America and Africa

Thus, the network and excellent connections from Lisbon to America and Africa, join together to a geographical position, that although peripheral in the context of central Europe is clearly the closest, while thinking of the triangle Europe, America, Africa. The conditions for a Hub platform between three continents are thus, met. Adding to the excellent connections, spare freight capacity, and increasing freight numbers in transfer, an advantageous geographic position (saves about three hours on an America-Europe trip, relatively to Frankfurt) and we have gathered important predicates for the establishment of an important cargo platform.

Low marketing on Cargo aviation fairs

Some stakeholders indicate that Lisbon Airport, and what its cargo terminal offers is not well marketed, especially in aviation fairs.

4.2.4. Characterization of the air cargo sector: External and Internal analysis using SWOT Analysis

According to Streuli et al (2018:173), “SWOT is an acronym of strengths, weaknesses, opportunities and threats and is a structured planning method that evaluates the internal and external factors that are favourable or not in a project”. While using SWOT analysis as a tool it is intended to evaluate, but also indicate possible strategic focus drivers, since when assessing the external and internal environment with the tool, it will lead to the reflection on the best use of resources but also the strategy in the sector. Thus, investing in opportunities or defending itself against threats, through the potentialization of forces and improving weaknesses. Khatir et al (2018), says that, resorting to SWOT analysis, an organization is capable of identifying factors that play major roles in both its success, but also failures, and then modulate strategies to shield and adjust these factors. Hence, with this tool managers might elaborate proper strategies by comparing both internal and external factors. The SWOT analysis is presented below as a matrix (Table 2) and is the joint output of PESTEL and Porter’s value Chain analysis.

Table 2. SWOT Analysis

SWOT Analysis		
	Strengths	Weaknesses
Internal	<p><u>-Privileged presence and still some spare cargo capacity (probably the best in Europe) to the expanding markets of Africa (Portuguese speaking countries) and Brazil</u></p> <p><u>-Relatively new Cargo infrastructures with the capacity to be expanded 50%</u></p>	<p><u>- Saturation of airport slots and Aiport infrastructures</u></p> <p><u>- Saturation of the cargo terminal</u></p> <p><u>- Limitations in the docking points</u></p> <p><u>- Poor conditions to truck drivers</u></p> <p><u>- No staff at the guardhouse of the terminal</u></p> <p><u>- X-ray screening limitations</u></p> <p><u>- Customs does not allow for the dispatch of non-screened cargo</u></p> <p><u>-Problems in the definitions of x-ray equipment acquiring responsibility.</u></p> <p><u>- Limited number of Known Agents</u></p> <p><u>- Misfit refrigerated areas</u></p> <p><u>- Lack of dedicated infrastructures to animals</u></p> <p><u>-Inexistence of second line warehouses</u></p> <p><u>- Lacks scale to the operation of large cargo aircraft.</u></p> <p><u>-European periphery- less suited for multimodal cargo trucking</u></p> <p><u>-No CEIV certification</u></p> <p><u>-E- Awb not fully implemented</u></p> <p><u>-Low marketing in cargo aviation fairs</u></p> <p><u>- No platform of communication between stakeholders</u></p> <p><u>- No defined strategy for the air cargo sector in Portugal</u></p>
	Opportunities	Threats
External	<p><u>-Portugal economic recovery</u></p> <p><u>-E- commerce</u></p> <p><u>-Growth of the transportation market of pharmaceutical products, due to certification CEIV of TAP.</u></p> <p><u>-Saturation of cargo capacity in other European airports to South America and Africa</u></p> <p><u>-Possibility of creating a cargo platform between Europe, America and Africa.</u></p>	<p><u>-Economic downturn in some Portuguese speaking countries like Brazil, Angola and Mozambique</u></p> <p><u>-Strong competition from Spanish airports, specially Madrid in Exports</u></p> <p><u>-Portuguese economy recovery might not be sustainable in the long term</u></p> <p><u>-Strong competition from road and maritime cargo.</u></p>

4.2.5. Stage conclusions

To summarize this stage, it became even clearer the central problem of the air cargo sector in Lisbon. The limited capacity and inadequacy of the infrastructures and the consequent inability of the entire supply chain to deal with a possible and expected increase in air cargo processing in Lisbon, is in fact a real problem and jumps to the eyes of any external and internal observer.

At the same time, as we embarked on this phase of the investigation, it was also clear that some mechanisms could be adopted to further promote the growth of air cargo sector at the Lisbon Airport. However, any measures taken that can improve the attractiveness of Lisbon airport, and thus increase air cargo processing, will go head-on with the various limitations that already jam the sector nowadays. The reality is that the Lisbon cargo terminal, and the Lisbon airport itself, are already highly congested and with very little maneuverability for large increases in cargo processing.

In the next section the focus will be on identifying the main causes for the problem that has been identified during the investigation: *The limited and inadequate air cargo infrastructure capacity*. However, as it has often seemed that this problem was entangled with the relative stagnation (low growth) of the sector, the causes of the lack of vitality of the sector in the last decade in Lisbon, will be looked upon, complementing the research.

4.3. Stage 2- Identification of causes

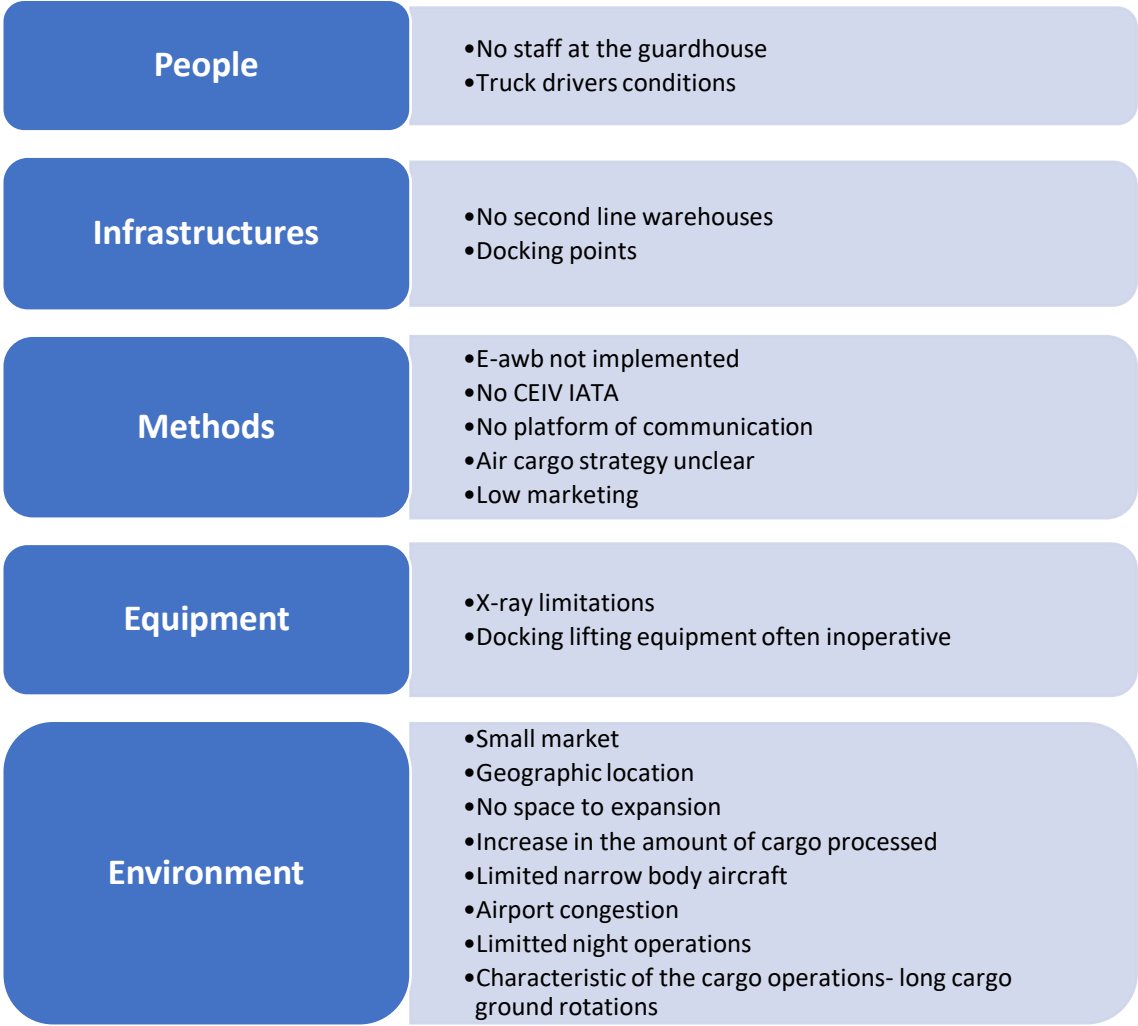
This chapter will serve to identify the causes of the problem, based on the analysis presented previously. Accordingly, these causes will be made visible and easily understandable. In this sense it will be firstly used the Ishikawa diagram to identify the causes and group them by major categories. Secondly, the Pareto diagram allows to understand which causes were referred often in the interviews, and therefore to define the most relevant causes

4.3.1. Ishikawa Diagram

This tool is constituted by a causal diagram, showing the causes for a certain problem. At the right end of the diagram lies the central problem, and then the causes are grouped into major categories, in each diagonal line, representing the fish bones. Ishikawa diagram is usually used “as a model for better understanding of the likely causes and effects of an event” (Jayaprasad et al, 2018: 196).

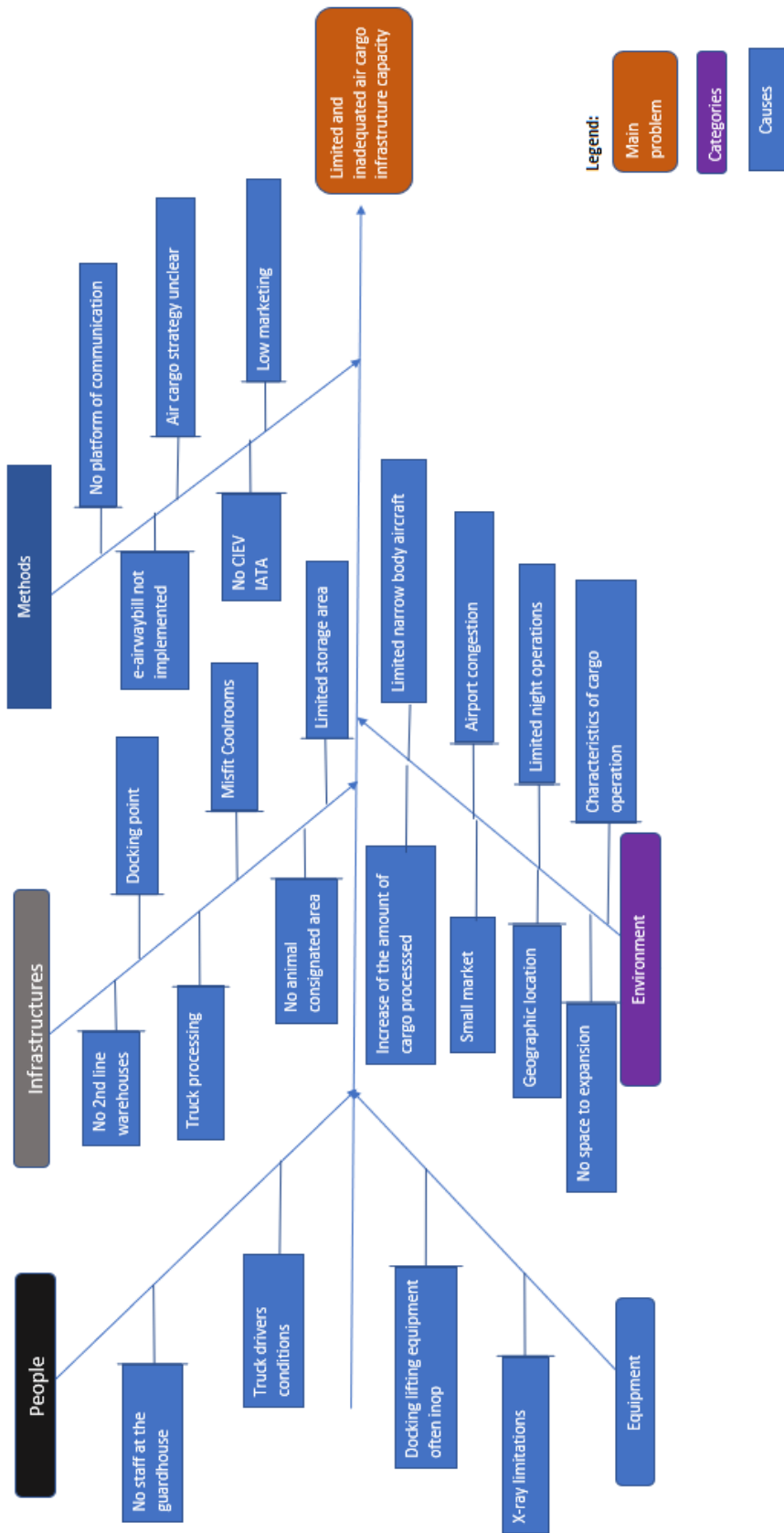
In the diagram constructed, the central problem previously defined (Limited and inadequate air cargo infrastructure capacity), is at the extreme right of the diagram. In addition, the five major categories of the tool are used to group the different verified causes: People, infrastructures, methods, equipment and environment. Figure 10 depicts the causes grouped in the different categories.

Fig. 10- Ishikawa causes grouped by categories



Due to the need to simplify the diagram, short descriptions for each problem, are used, to briefly describe all the identified causes. The causes chosen, are identified based on the analysis presented above and can be easily identified in the SWOT analysis. The detailed explanation of each cause is found in the previous chapters. The Figure 11 below, depicts the final results of the ishikawa diagram

Fig. 11- Ishikawa Diagram

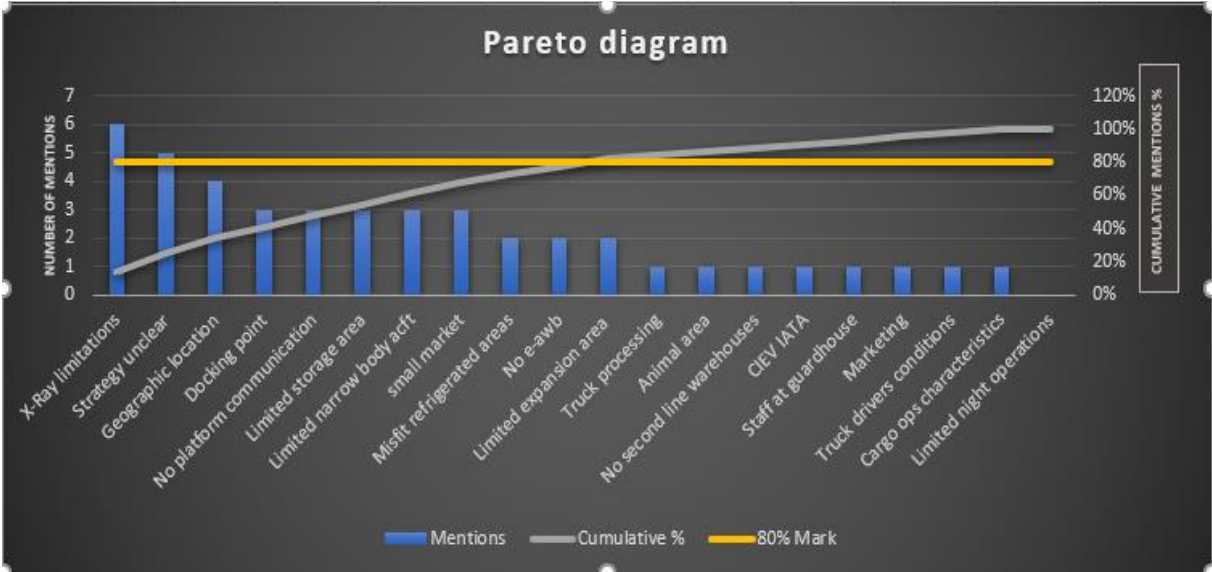


Pareto diagram

The second tool to be utilized is the Pareto diagram. This tool seeks to carry out the Pareto principle, according to which 80% of the consequences come from 20% of the causes. The Pareto diagram uses a column chart, that orders the frequency of occurrence from the highest to the lowest, thus allowing prioritizing problems. This tool is expected to make it easier to identify the main causes for the problem found, as it would be probably impossible to work all the identified causes.

In the diagram, all the causes identified were discriminated and the frequency of occurrences translates the number of interviewees who referred those causes during the interviews. A line representing the 80% mark of references, was defined, symbolizing the border between the most relevant causes. Graphic 3 below, represents the Pareto diagram.

Graphic 3 – Pareto Diagram



At the left of the graphic, is represented the range of the number of mentions in the interviews, the gray line represents the cumulative curve in percentage, with the scale. By reading the graphic, the "No e-AWB" cause marks the 80% border, which means that all the causes at the left, are within 80% of occurrences and that the causes to the right, are in the remaining 20%.

4.3.3. Stage conclusion

The most important causes for the identified problem are now more noticeable. These two tools allowed for a more objective and pragmatic view of the problem. In the next stage, these causes will be picked upon, and through interviews understand how have other airports dealt with these issues.

4.4. Stage 3- Strategy collection (Benchmarking)

The objective in this stage, is to contact a leading European airport in the cargo industry, therefore enabling to compare the current processes and practices in those airports with the current practices in the air cargo sector in Lisbon, giving special emphasis on how those airports dealt with similar problems (and underlying causes) as the one identified in Lisbon. Through this comparison, it is to observe if this selected airport, has encountered similar problems, and their strategies to deal or mitigate them. This comparison, allows to compare the reality of Lisbon with the best international practices in the industry, enabling to identify winning strategies that can be followed by the air cargo sector in Lisbon.

4.4.1. Data collection

In order to achieve the above objectives, it was necessary first to select an airport that could serve as benchmark in this process. Schipol airport in Amsterdam, ended up being selected.

It was selected, not only because it is one of the biggest European hubs of passengers (third at European level), but essentially because it is one of the biggest European hubs of cargo (the third at European level, just behind Frankfurt and Paris Charles de Gaulle). Airports in France and Germany were also considered, but, because of the size of the French and German economies, it seemed that it would make little sense to compare any airport in these countries, with Lisbon. Obviously, the Netherlands is also on a different level, and Amsterdam is right at the European center, but in any case, taking into account the major European hubs, it seemed that the reality of Amsterdam compared to Frankfurt or Paris, would be the closest to Lisbon.

The possibility of using more than one airport for this investigation, was considered, and Brussels airport was also a strong possibility, but the difficulties in finding an experienced professional in the cargo business, willing to be interviewed forced this possibility to be rejected in favor of just Amsterdam.

In addition, Schipol airport is only 9 kms from the city, so it may also be interesting to understand how the authorities deal with possible traffic restrictions due to noise or limitations in the expansion of the infrastructures, aspects that mark the current reality in Lisbon.

In order to make possible these comparisons and perceptions of best practices, data collection tools were required, so it was opted first to do a semi-structured interview with an experienced Air France-KLM professional (Mr. Van Rijn Walter), who is the current manager of operations and sales manager at Benelux for Air France-Klm cargo and Martinair and has more than 20 years of experience in the sector, with an extremely interesting and rich professional past, which we transcribe in the Appendix (as III) .

In order to make the interview more effective, previous contacts with the interviewee were made to validate the topics to be included. It was decided to consider all the topics and not only consider the causes within the 80% mark of the Pareto diagram, since valuable information could be lost in this way.

Thus, a structured interview was drawn, in which 15 different points (reflected in figure 12, below) were discussed based on the causes, identified in the Ishikawa diagram and also identifiable in the Pareto diagram.

Fig. 12- Topics considered to the interview

Topics included	Topics excluded
<ul style="list-style-type: none"> • 1)Air cargo strategy • 2)Platform of communication between stakeholders • 3)X-ray limitations • 4)Second line warehouses • 5)Dedicated infrastructures to animals • 6)Refrigerated areas • 7)CEIV IATA certification • 8)Docking points • 9)Truck drivers conditions • 10)Staff at the guardhouse • 11)e-airwaybill • 12)Marketing • 13)Congestion of the cargo terminal • 14)Cargo operations colliding with airport congestion • 15)Limited night operations 	<ul style="list-style-type: none"> •Geographic location •Small market •Limited expansion area

As referred in Figure 12 above, the topics “geographic location”, “small market” and “limited expansion area”, were left aside, due not only to the limitations of time in the interview, but also because they are exogenous factors, to which the interviewee considered would have

little to add. Moreover, they are tendentiously subjective factors, to which there are not properly measures that can mitigate them, but rather mindsets. However, the topic “limited expansion area” was referred to in point “Congestion of the terminal”.

During the interview with Mr, Walter it was addressed each of the points separately, explaining the reality in Lisbon, and then asked the interviewee to comment and describe the reality in Amsterdam for each of those points.

The information collected with this data collection tool, allows to make a direct comparison between the realities experienced in the air cargo sector in both airports, and thus, obtain the information necessary to synthesize the best practices, and in the final chapter make recommendations of possible strategies to be adopted by the air cargo sector in Lisbon.

4.4.2. Schipol airport presentation

We have decided to undertake a brief presentation of the Amsterdam airport so that an understanding of the results of the interview is facilitated.

Amsterdam Schiphol airport is just 9 kms away from the city of Amsterdam and is the largest airport in the Netherlands and one of the largest European airports. According to the numbers published in Schipol site (Schipol), the numbers for 2017 are:

- i. 68,5 million passengers e 496 748 aircraft movements.
- ii. 1.752 498 tons of processed cargo.

Amsterdam Schipol serves as hub for KLM, KLM Cityhopper, Corendon city Airlines, Martinair, Transavia and TUI Fly Netherlands. Adittionally, serves as the European hub for Jet airways and base to Easyjet and Vueling. These are just some of the 108 airlines that use Amsterdam, offering 322 different destinations.

Its proximity to the city of Amsterdam, implies strong limitations of noise. In addition to having built a new lane in 2003 (18R-36L) further away to mitigate the effects of noise in relation to the nearest localities, annual movement limits were also defined. Its very high number of annual movements, head-on with the comfort of the populations of neighboring localities, so that a maximum number of annual movements of 500,000 till the end of 2020 was defined by the government. The numbers of 2017 point to almost 497 000 movements, i.e, the airport has almost reached its limit of growth (Pieters, 2017).

Amsterdam Schipol Cargo facts

All the below numbers and facts are taken from Schipol cargo site (Schipol).

Of Schipol's more than 496,000 annual movements, about 17,776 are full-freighters (i.e. integrators or cargo flights), representing 3.6% of total movements, transporting 60% of the total cargo processed by Amsterdam. The rest is naturally transported in the "belly" of passenger aircraft. One of the great success factors at Schipol airport is its connectivity, as it is the airport with most direct air routes, with 326 scheduled destinations in 98 countries. In addition to the 104 passenger companies, Schipol also serves 26 scheduled freighter operators, which fly to 160 different destinations.

Most of the cargo that passes through Schipol, however, is in transfer (as in Lisbon), having as destinations other places, which not the Dutch market. The proximity of the Rotterdam harbour (one of the biggest in Europe), makes Amsterdam even more relevant, and reinforces its importance as one of the great European hubs of cargo.

The air cargo market is served by 7 handlers, being: Air France- KLM cargo, DNATA, Menzies aviation, DHL aviation, Swissport, WFS Holland and Freshport.

The numbers of the cargo warehouse are also impressive: a total of 525.000 m² of cargo warehouse space, from which 60% has direct access to the cargo apron. Additionally, there is still room to expansion especially in the Schipol South East zone. All these characteristics make a large number of companies choose the airport area, as a distribution base in Europe, with more than 50% of the Asian and American companies, with European distribution centers in the Netherlands.

4.4.3. Benchmarking (Schipol Amsterdam airport)

It was decided to compare the practices and work processes of Amsterdam, one of the largest European hubs of cargo, with those of Lisbon, in a benchmarking process. It seemed that Schipol Amsterdam, for all of the aforementioned, could represent an example of best practices, and with this to replicate and migrate to Lisbon a series of interesting strategies, with the objective of contributing to the evolution of the entire supply chain of the air cargo sector in Portugal. The points recognized as obstacles, and that jam the sector in Lisbon, were picked up. These too, are referred as the most important causes for the major problem.

In this chapter, each of the points will be analyzed, explaining in as much detail as possible the reality in Amsterdam for each one of them. For this, the information obtained through the interview is used, while complementing with information from extra literature, adding to the reading information suggested by the interviewee.

It was decided to focus on clarifying the reality of Amsterdam in this first chapter of benchmarking, since the limitations of each of these points have already been explained in previous chapters, and the expected impact on the capacity problem will be explained in the next chapter " Recommendations. "

1. Air cargo strategy

The biggest difference between the Portuguese and Dutch realities lies in the existence of an independent organization called ACN (Air cargo Netherlands), which represents and unites all the stakeholders involved in the air cargo sector in Amsterdam, around a common project. In its representation, ACN has the Airport (Schipol group) and the most relevant freight forwarders, airlines, ground handlers, truckers and service providers.

Looking at its mission ACN states that "Our mission is to link the various parties active in the air sector in the Netherlands in order to strengthen the sector's market position." (ACN).

This sector's representativity allows not only for the development of the Dutch air cargo, but also greater relevance when it's necessary to defend mutual interests. Mr. walter declared that one organization as ACN is necessary, as this represents a joint approach, instead of having everyone "fighting" for their own interests. This allows to bring together the best of both worlds, not only because you can support the initiatives of the market which are from the interest of the organization, but especially because of its representativeness and importance, the organization can initiate its own initiatives for the development of the sector.

The lack of clarity, and the lack of a joint strategy bringing together all key stakeholders around a common goal that still exists in Lisbon, is thus resolved.

The result of this strategy followed by Amsterdam is seen through several successful projects headed by this organization, that are now under way, and are described in their site, the most important being "Pharma gateway Amsterdam" (topic to be further addressed in the research).

2. Platform of communication between stakeholders

The creation of an organization like ACN alone, could solve any problems that might exist regarding the majority of communication, for long term strategy. The ACN board has a representative of each stakeholder, from forwarders, airlines, service providers, ground handlers, truckers and Schipol airport group. In this way, any strategic decision in the sector, problems, suggestions or concerns of any order, is guaranteed to be taken to the board and

represented in a fair decision and always taking into account the superior premise of development of the Dutch post industry, in the broadest possible manner.

Additionally, there is also a weekly newsletter issued by ACN, informing all members of the latest developments in the air freight industry. Finally, there is a weekly newspaper (NT, Nieuwsblad transport) for everyone.

3. X-Ray limitations

According to Mr. Walter, KLM Cargo does not X-ray cargo. The X-ray is done by known agents or by the shipper. The majority of cargo is already screened before entering KLM Cargo terminal, as KLM cargo does not possess X-ray equipment. All the control that is necessary to the cargo, is made through a method that uses dogs (by a third company), to verify the existence of explosives. This process can be done in two distinct ways:

- i. Taking an air sample, from inside the truck, and have a dog to sniff it;
- ii. Off load the cargo and use dogs to sniff the cargo.

However, this process is expensive, so most of the cargo is secured, well before being delivered to KLM Cargo. The process is similar with TAP cargo, which also does not screen cargo, but rather uses Groundforce for this process. However, this process in Amsterdam is clearly distinguishable from the reality of Lisbon, since most of the cargo in Lisbon is screened in the terminal via the Groundforce or Portway handlers. The big difference lies in the supply-chain moment in which the cargo is secured, in the final stretch in the case of Lisbon, and early on, in the case of Amsterdam. The small number of known agents in Portugal makes it so, while in Amsterdam most of the cargo comes from known agents. Mr. Walter affirms that he strongly believes that the security of the cargo, in the beginning of the supply-chain, is the way to go, as it allows for a faster and more reliable process.

Adittionally, Customs possesses big screening facilities, but they are only used for their random controls of counterfeit and guns. No customs screening facilities are used to check for explosives.

4. Second line warehouses

According to Schipol internet site, Amsterdam Schipol airport has about 525 000 m² of total cargo warehouse space, of which about about has direct access to the cargo aprons. The 60 % might be defined, as the first-line warehouses, normally occupied by the first line companies of the Airlines and cargo handling agentes, which have a direct access to the airside and will therefore be responsible for taking goods to and from the aircraft. KLM cargo is one of these

companies, and according to Mr. Walter does not possess any second line warehouse, as it only makes sense for palletized cargo, otherwise it would just create an extra step in the supply chain.

Directly behind the handlers and companies first line warehouses, are the ones normally referred as second line warehouses, occupied by the forwarders. As previously mentioned, in these, the cargo is prepared both physically and documentally, and insured the clearance by customs, to deliver the cargo in the dock. In the vicinity, we found several business parks where this work can be done, and in which there is some capacity for expansion.

5. Consignated infrastructures to animals.

Schipol owns an animal hotel, due to the large number of animals that pass by its infrastructures, every year. From horses, animals to zoos, and even pets, the size of this subsector within air cargo is extremely relevant in Amsterdam. Thus, Air France-KLM cargo, decided to create the Schipol KLM cargo animal hotel, especially for animals in transfer (it is also used for animals in export, or import) and which is at present the largest and most modern infrastructure of the sort in the World.

The facilities are separated from the rest of the cargo storage area and are fully dedicated to the treatment and preparation of animals for the flight. The hotel facilities are operational 24 hours a day and have specialized animal stewards trained at the Veterinary University of Utrecht for the treatment of animals. In addition, they have a team of veterinarians available when needed (Air France/KLM cargo). In this facility, animals are kept in exceptional hygienic conditions, in addition to being fed, provided water, exercise and necessary rest before being embarked on a flight, or lifted by their owner. The services offered may include flight stewards, in the case of horses or other large animals, with constant access to the stalls, if necessary. A service that is unique in the industry, is the dog walking service, and also here Schipol Airport is at the forefront (KLM, 2013).

Mr. Walter says that these services make perfect sense at an airport as Schipol, where there are a large number of valuable animals to fly (e.g Horses or Zoo animals). However, he says, it may not make as much sense in the case of just pets.

6. Refrigerated areas

Mr. Walter declares, that, at least when speaking about Air France-KLM there is still available capacity. Air France-KLM has two separated cooling areas: Area for palletized cargo and area for loose cargo. In the Air France-KLM premises, there are 40 rooms for pallets

(especially 15°C to 25°C or 2 to 8°C) with temperatures from -25°C to 25°C, and 40 extra positions for separate cargo, with the same range of temperatures.

It was impossible to know the numbers of total refrigerated area in Amsterdam, nevertheless, in the next topic, it will be shown the numbers of the Project Gateway Amsterdam, which are representative of Amsterdam pharma reality.

7. CEIV IATA certification

All the data below, for the CEIV topic, is taken from ACN site, as a direct result from the results of the interview. One of big projects of ACN is **Pharma Gateway Amsterdam (PGA)**- with the purpose of making Schipol the best European pharma hub, the organization has created a task force, and a project with dedicated elements, which join the Schipol group and 23 pharma logistics companies. The purpose, is to create a closed IATA CEIV certified logistics chain, joining all the positive predicates that Schipol naturally already has, such as its excellent connectivity and efficiency, and uniting unparalleled transparency (with access to 24/7 temperature data).

The Air France KLM Martinair cargo and its entire supply chain are a clear example of the good results of this project with its CEIV IATA certification since February 2016. It is the first major airline group to be certified, which means they are now compliant with the international regulations, surpassing the good distribution practice guidelines by adding explicit air transport requirements, pointing to high-end transportation in the pharmaceutical industry. KLM cargo has an entire dedicated team to pharma products, and people involved with certificates and insurance.

However, there are many other companies that already have this certification, being part of this huge project in the airline industry of Pharma products, some examples are: Yussen Logistics, Cyberfreight pharma logistics, Swissport, Gefco, Nouwens transport Breda, DeJong special services, WFS, Jan de Rijk logistics, AirBridgeCargo, Turkish Cargo, AirChina cargo, Menzies aviation, DHL, China Southern Airlines, or Rhenus logistics.

Additionally, the numbers of project PGA are phenomenal with 16800 m² of first and second line pharma handling capacity and 90 000 tons of pharma cargo handled in 2016. The table 3, below, depicts the cold room facilities available through project Pharma gateway Amsterdam.

Table 3. Pharma gateway Amsterdam cold room facilities

Type	Loose cargo positions		Pallet positions	
	1 st Line	2 nd line	1 st line	2 nd line
-20 degrees	18		10	
2-8 degrees	457	185	302	285
15-25 degrees	3051	9750	2645	9360
Unspecified		3300		2400
Total	3526	13235	2957	9645

Source: Adapted from Pharmagateway.nl

8. Docking points

Naturally, the reality of Lisbon can never be compared to the reality of Amsterdam, and the number of docking points is one of those points where the comparison is practically impossible. Recalling that Lisbon has a total of 4 docking points (2 for Grounforce and 2 for Portway), and while analyzing the reality of Schipol we see that only the Air France KLM cargo warehouse has a total of 20 docking points. Subdivided into 4 inbound docks to palletized cargo and 4 to outbound palletized cargo, and additionally there are 12 docks to loose cargo. We do not possess the total number of docking points in Amsterdam, but naturally with the number of handlers and logistics companies in the air cargo fleet, is to imagine that the number will be as high as a few hundred. Naturally, this reality entails a high fluidity in the loading/unloading of cargo of trucks.

9. Conditions for truck drivers

One of the main differences, lies in the fact that, the majority of the time there are no trucks staying for long periods, as there are enough docking points to unload / load cargo.

The airport, also has several truck parks, including an international lorry park where the drivers can park their vehicles, waiting for loading / unloading of the cargo. There are toilet and bath facilities for drivers, as well as a waiting room and wi-fi. This international park also has capacity for expansion, so it can be expanded in case of increased demand.

10. Staff at the guardhouse of the terminal.

The cargo park in Lisbon, has different characteristics of the cargo park of Amsterdam. While Lisbon has a single, sealed cargo park, which, although public, requires a security check,

Amsterdam has not only one cargo park, but several, especially in the southern area of the airport. All of the parks with access to the tarmac, the premises of every company are secured 24 hours, with 24 hours a day staff. In parks that have second-line stores, there are usually fences, but normally with automatic control, without staff at the checkpoints.

11. E- AWB

Schipol airport is at the forefront of the implementation of the E- AWB, but there are still several airports where, there is no implementation of the digital documentation, and in these cases the paper AWB is still needed. Thus, in a joint project between ACN, 22 airlines and 130 freight forwarders, the e-AWB single process Schipol airport was created. Thus, regardless of whether the place of destination is a station prepared for e-airwaybill, or still requires paper documentation, the shipping party can deliver all documentation in digital format to the airline. The airlines, will then print the documents, whenever necessary. The latest figures point to 63% implementation of e-AWB in Amsterdam. In the case of KLM Cargo, the figures point to close to 100% implementation, and only in the case of stations that need paper, will this be used.

12, Marketing on aviation affairs

KLM cargo has its own marketing campaigns, independent from the ones from Amsterdam Schipol Airport. It was not possible to obtain information on marketing campaigns from Schipol airport, at international fairs.

13. Saturation of the cargo terminal in Lisbon (limited storage area)

According to Mr. Walter in the terminal processing, the infrastructures are sometimes congested in Amsterdam, and they sometimes struggle to deal with loose cargo in the weekend, but there are no problems with the cargo. Nevertheless, the characteristics of the Dutch economy point the workers to a great rotation of labor positions, especially in precarious job, and thus the staff finishes hopping off to other jobs, better paid.

14. Characteristics of cargo operation, colliding with Lisbon airport congestion

This topic is not an issue in Amsterdam according to Mr. Walter

15. Limited night operations (Noise restrictions)

The area around the Amsterdam airport is densely populated, as is the case with the reality of Lisbon. Schipol, thus has a limited number of movements during the night in the period

between 11 pm and 6 am. In addition, only 2 of the 6 runways are operational, with 4 of them closed to traffic, plus extra measures to be taken by airlines to mitigate noise during the landing / take off phase (Wubben, 2004). Amsterdam, also has a limit defined by law, for the maximum number of annual movements of aircraft, and that is 500 thousand movements.

To date, these restrictions have not inhibited the success of Schipol, either in the passenger or freight aspect. The night restrictions have not inhibited the growth and maintenance of Schipol at the forefront of air cargo, but the approach to 500,000 movements could lead to future difficulties.

4.4.4. Stage conclusions

The objectives proposed for this stage were fulfilled. The information obtained from the operational processes towards the topics addressed, were very valuable. It was possible to see that the great majority of the causes identified as the main issues for the problem, identified in the Lisbon airfreight sector - *the limited capacity and inadequacy of the air cargo infrastructures*" were already resolved by Amsterdam Schipol airport, or never existed due to the efficiency of its processes.

The necessary insights are obtained to identify the necessary winning strategies, thus allowing to propose several recommendations that will be elaborated in the next stage.

4.5. Stage 4 – Recommendations

The comparison of the Lisbon air freight sector with Amsterdam Schipol allowed for an understanding of the best international practices in the industry. It is now possible to identify winning strategies to be followed by the air cargo sector in Lisbon, in order to deal with the identified problem. Final recommendations based on the identified best practices in the sector are presented hereafter.

4.5.1. Final recommendations

Creation of an independent organization for the development of air cargo in Portugal

All projects need a foundation, and they need a well-defined vision of a strategy. This might come from the creation of an independent government organization, in which all stakeholders of air cargo in Portugal are included. A national project seems like the best option, firstly because Lisbon has a limited dimension, and secondly because other national airports could complement gaps that may arise from the Lisbon saturation and growing restrictions. Airports such as Beja with a cargo terminal without any use and also without any kind of noise restrictions, or even Porto (with some spare capacity), can in an ambitious, well delineated, but realistic strategy, function as great coadjuvantes, to supply any limitations of Lisbon.

A project that unites, in Portugal, ANA airports, Groundforce and Portway, airlines, Portuguese freight forwarder association, service providers and truckers, could be the starting point for the success of the sector in Portugal. With an objective and credible strategy, and with a well-defined direction, resulting from the exchange of ideas and serving the interests of all stakeholders in the industry, it would naturally be a success.

In the case of ACN, the mission, vision and philosophy are visible to all and are short, assertive, but content ideas. This philosophy seems, the most relevant aspect of an organization of this type. The ACN board has a representative from each of the air cargo sectors, and all decisions are taken with the knowledge and endorsement of all members, yet with a global vision of the sector to overcome any individual need.

Ensuring a collaborative and fair environment is essential if projects are to start to emerge, either through innovation or in the support of external projects of industry interest. ACN supports several innovative projects in the world airfreight sector (some were described during the research) and it is to believe that the creation of a similar project in Portugal, could also open space for support for innovation, in the sector. The idea that arose from this research is that, at least in Portugal, the sector is a bit pond, and averse to change, and that too may explain the stagnation of the sector in the country. The difficulties exist, but also the solutions, it is necessary, nevertheless a forum where they can be expressed. An organization as this, will help solve these issues.

Additionally, the communication difficulties identified as one of the main causes for the state of the sector in Portugal, could then be overcome. First, because each stakeholder is represented and can then report first hand to its different representatives, secondly because they

have an active voice in decisions, thus guaranteeing the necessary transparency. In addition, a weekly newsletter, to be distributed to all members, should be issued informing everything that is related to the organization and the latest news in the sector and in the industry as a whole.

Difficulties such as the growing congestion at Lisbon airport, night noise limitations, limitations to growth due to insufficient infrastructures, or difficulties of expansion due to the location close to the urban nucleus, can thus be looked at directly and sought solutions through a joint strategy. Moreover, opportunities, such as the excellent commercial links and aerial connections with North, South America (especially Brazil), and Africa, and the unmatched spare capacity in European term, could then begin to be explored. At the same time, the geographical position at the vertex of 3 continents could be a motto, a vision of the future, that would have shaped all the decisions of the organization. But for this, it is necessary that all players are in the same boat, not only because it is easier to innovate and / or overcome the challenges that arise, but especially because the sector expresses its needs with just one voice, guaranteeing a greater representativity.

All the recommendations that we will present next, will only make sense after the creation of a forum like this, being a central vector, for the development and progress of this industry.

CEIV certification

Dedicating a chapter, only to this topic could probably be necessary, since the business opportunity is too important, so that Lisbon is left out. The reality of the transportation of pharmaceuticals is changing. First, the pharmaceutical transportation industry is growing at a staggering speed (10.2 billion in 2018), second because the air cargo sector that until now, had been losing market share, re-emerged in force in the race with CEIV certification, and thirdly because the most important European airports have already understood this reality and have joined forces to capture a market of (many) billion euros. We mentioned, that most of the transportation of pharma products is not done by air, because until recently the sector was unable to guarantee that pharma products (which are extremely sensitive to temperature change), were kept at stable temperatures throughout the supply-chain, leading to temperature excursions and tremendous product losses. CEIV certification has brought the necessary tools to solve this problem, ensuring the quality of service required for the safe transport of pharma products.

Companies at airports like: Amsterdam, Athens, Barcelona, Basel, Brussels, Frankfurt, Hong Kong, Liège, Madrid, Paris or Singapore are getting certified as a community. This

means, that the mentioned airports guarantee the safety conditions for the transport throughout the supply-chain, meaning airport, airlines, ground-handlers, shippers, forwarders and trucking companies. In a joint effort, creating a global network of "safe" stations, which will naturally be selected by the most important pharma production laboratories in the world. Thus, conditions are created for an important growth in the transport of pharma, at least in the airports that include this network.

Amsterdam, has several projects and task forces, purely aiming to make Schipol a major European hub in the transport of pharmaceuticals. These projects derive from a common idea, from a vision, and of course this is the first step to be taken.

In Lisbon, the reality is clearly different. In the interactions, it was apparent that for TAP Cargo this was an important goal, and that there was interest in a joint certification including handlers and handling agents and others, something that is absolutely necessary for a close IATA certified logistics chain. However, at no time did this seem like an important goal for any of the other stakeholders in Lisbon. It seems, that this lack of interest or naive behaviour stems from the inefficiencies in the communication between stakeholders and lack of vision that exists in the portuguese cargo sector.

Lisbon, can not, in any way, stay out of this project. Airports, like Madrid or Barcelona, important competitors of Lisbon, are in the vanguard of this project. And in the absence of joint action by the portuguese authorities or organizations, Portugal, and especially Lisbon, will then see (literally) millions of euros on its skies, which would otherwise enter the portuguese economy.

Moreover, it was identified a tremendous potential in Lisbon, with excellent connections to South America. Destinations such as Brasília (gateway for the entrance of all public health goods in Brazil), are unique in the European reality, and the lack of guarantees of quality in the dispatch of pharma products, can sabotage a tremendous potential to make Lisbon the pharma outlet door from Europe to Brazil.

In addition to the loss of market share for other airports, the actual efficiency of the current supply chain could be massively improved. Firstly, because the processes would be homogenized, due to the need to meet the requirements of a closed IATA certified logistics chain. And secondly, because it avoids the need for constant quality audits and surveys that impede the fluidity of the entire supply chain. The creation of a task force is suggested, included within the independent organization for the development of air cargo in Portugal, with the objective of creating the necessary synergies for the development of the pharma products transport business, naturally encompassing CEIV certification.

E-AWB implementation

In a complex industry, with tight security rules and heavy documentation, simplification measures are naturally welcome. The ideology behind the air cargo industry includes speed as a bulwark. The truth is that often, the speed that is characteristic of the aircraft, does not follow up, on the processes until the loading or unloading of the cargo. Excessive documentation and dependence on paper are part of a process, that sometimes blocks the fluidity of the entire supply-chain. Identified by most stakeholders, as one of the most important projects, e-airwaybill represents the future by digitalizing the most important documents, thus creating airwaybill. In a project that essentially includes airlines, freight forwarders and ground handlers, the goal is not only to simplify but also to grant faster, better communication and connectivity in the process of information transfer between stakeholders, required for the shipment of cargo.

In Portugal, the implementation of this project is still low, while in the main European airports, a large part of the cargo shipment is already done using e-airwaybill. The case of Amsterdam is paradigmatic, being a station, whose implementation rate is already close to 100%. However, in the processing of cargo to Lisbon, it is still necessary to print paper documentation, making the process almost archaic and far from the best practices in the sector.

The full implementation of the e-AWB project in Portugal has been hampered by the Tax Authority, but it seems essential that it is unblocked by the competent authorities, otherwise market share will be lost to the competitors. Once again, it seems, that there is a lack of a single and representative voice that can demonstrate the sector's needs towards the Portuguese authorities. In solving this type of constraints, a Portuguese air cargo organization could serve as a deblocker, showing the direction that best serves the portuguese economy and sector.

Terminal improvements

According to the information provided, ANA airports does not expect in the medium term to make large investments in the cargo area. However, the current major needs will be addressed and measures that although large investments are not expected, might be very advantageous.

Docking points

The docking points are seen as one of the main limitations to the efficient use of the current storage capacity. Investments in the terminal, will have to add more docking points, which would mitigate the problem coming from the increasing number of trucks, especially at the weekend, that clog the infrastructure. The current docking points of the terminal are not at the

standard height defined by IATA, so this is a point that naturally needs investment, but that in itself would not add much to the fluidity in the air cargo processing.

The investment in more docking points would lead to a more fluid loading / unloading of trucks, thus, mitigating the health problem that currently exists in the cargo terminal in Lisbon with truck drivers. Prolonged waiting, sometimes for days, is not accompanied by the truckers' minimum conditions of salubrity. It is recommended, the investments in bath facilities and toilets, while the problem of the prolonged wait is maintained.

Refrigerated areas

The size of the refrigerated areas in the Lisbon terminal cargo is clearly reduced and insufficient for the current needs of the sector. Placing a refrigerated outer container is an attempt to mitigate the problem, but that is not, of course, a long-term solution. On one hand due to operational limitations, loss of efficiency and speed in the processing of the load, on the other hand due to the fact that an increase in the quantity pharma products can easily lead to saturation even in the containerized area (15-25 °C) outside the terminal. The existing coolrooms are clearly insufficient, and some of them do not even allow loading pallets. Any investment made at the terminal, needs to necessarily add more refrigerated area, which is a top priority.

Animal consigned area

The absence of a place inside the cargo terminal, dedicated to animals, has been described as an important gap by some of the stakeholders. Not only because the basic conditions of animal survival and safety could clearly be improved if this existed, but also because it ensures more confidence to the shipper, and hence likely to create more business.

In the case of Amsterdam, they possess the largest and most sophisticated Animal Cargo hotel in the World, with regular expedition of animals from Zoos, Horses and pets. There is a strong doubt that Lisbon needed such facilities, even though there are valuable animals being flown, most of them are domestic animals. However, a separate and isolated area of the remaining cargo inside the terminal that would guarantee adequate comfort, temperature, and dedicated staff would be a major improvement. This could be a measure that although, not requiring a great amount of space to be implemented could significantly improve the cargo efficiency process of live animals, reducing the possibility of accidents inside the terminal, a

timely control of the health conditions of the animals, and therefore a smoother live animal supply-chain air cargo processing

Staff at the guardhouse of the terminal

As described, in some interactions there were small changes that could probably suggest small investments, which could however have interesting results. In the case of Amsterdam, most of the first-tier warehouses, ie warehouses with access to tarmac, have enclosed spaces with 24-hour surveillance. But usually each company, has its own warehouse with surveillance, so they are smaller areas where it is easy to navigate the trucks. In the case of the Lisbon terminal, the park has its entire area fenced, but in a single fence for the entire cargo park, making it more difficult to navigate the park due to the larger size. Access to the exterior, only has vigilant staff during office hours. The presence of security staff could be advantageous, not for security reasons (as this is ensured), but because they offer precious help to truckers who arrive at the terminal for the first time, facilitating and speeding up the movement process within the terminal.

X-Ray

The limitations of x-ray equipment were identified as one of the main limitations in the sector, at Lisbon. However, while analyzing the reality of Amsterdam, it was verified that KLM Cargo does not possess x-ray equipment to control explosives. All of the x-ray control is done using sniffing dogs, in an expensive process, but kept as the only one, as a way to encourage the screening of the cargo, at the beginning of the supply chain, and not in the final phase. In the Netherlands, most of the screening is done by what is called "known agents", and the difficulty in implementing this mindset in Portugal has been identified, as one of the most relevant problems by some of the stakeholders. Naturally, this is due to the lack of a joint strategy between all the stakeholders in the supply chain, and the lack of definition of what policy the industry intends to promote, as far as cargo screening is concerned.

In order, to follow the best practices, it is necessary to define the sector's strategy, ensuring that it intends to carry out cargo screening at the beginning of the chain, and then to create facilitative measures so that agents can follow the guidelines. The process in Portugal, mediated by ANAC, is complex and time-consuming, so it has had very little expression. The current Groundforce and Portway equipment has limitations, but it seems that the best strategic solution, lies not in purchasing new equipment or to hold the airport responsible for more

advanced equipment, but to redefine the strategy for fluidity and processing speed, throughout the entire supply-chain.

4.6. Conclusions of the chapter

Throughout this chapter the air cargo sector in Lisbon was characterized, while identifying the potential causes for the main problem in the sector. The characterization of the sector using tools as PESTEL, Porter's Value Chain and SWOT analysis, allowed for the identifications of the causes, revealed through the use of strategic planning tools as Ishikawa and Pareto diagram. With the causes for the main problem identified, a survey of the solutions to mitigate the cause, was done through the benchmark analysis, with Amsterdam Schipol airport. The comparison between the Lisbon air cargo sector, with Amsterdam Schipol allowed for better understanding of the best practices in the Industry. With all this information collected, it was then possible to make recommendations of the best strategies to be followed in Lisbon, thus answering the investigation question.

5. Conclusions

In this final chapter, a synthesis of our understanding of the problem and causes is done. Recommendations were already done, that nonetheless will naturally serve as a reasoned opinion, resulting from a long investigation, joining the ideas and opinions of many of the most influential and knowledgeable professionals in Portugal and even abroad. These responded to the investigation question. It is referred in this chapter, what contributions this research has brought to the literature but also in practice. We will also address the limitations arising from an investigation of this kind and end up exposing future work proposals.

5.1 Answer to the Investigation question

The investigation question was - *How can new strategies foster the air cargo sector in the Lisbon airport, while dealing with the limited capacity and inadequacy of air cargo infrastructures?*

The full answer to this question, came out of the whole outcome of the project and in the form of the final recommendations, which was the final objective of the thesis, as it was naturally a result of the fulfillment of all the other objectives.

Regarding the answer to question itself, it is perceivable, that strategies such as the creation of an independent organization for the development of the air cargo sector in Portugal, are central, and will necessarily serve as a foundation for a change in the direction of the sector, in Portugal. It is only through the effort and the joint union of all stakeholders in the sector, around a common ideal, that the other suggested measures can then be followed.

The implementation of new technologies through, as an example the e-airway bill, is not in Lisbon, being widely used. In a measure that might improve efficiency and speed throughout the process of cargo processing. Moreover, the lack of a joint CEIV IATA airport certification, entails not only the possible loss of market share, for competing airports with this certification, but also a decrease in the efficiency of the current cargo processing of pharma products in Lisbon, as this is subject to unremitting quality audit controls. The efficiency improvements that a homogeneous closed IATA certified chain may entail, should not be ignored.

In the terminal improvements theme, the research has shown that space restrictions were central to the limited capacity and inadequacy of the infrastructures, therefore it was not taken into account recommendations that would have huge requirements of space. Thus, improvements in docking points and refrigerated areas, were pointed out, suggestions that more than requiring extensions in the current terminal, may instead lead to reconfigurations of the

existing facilities. Recommendations of the staff in the guardhouse and of an animal consigned area, which, although may seem less relevant, have the capacity to demonstrate that small changes may be extremely significant in improving the efficiency of the air cargo processing.

The section of recommendations was completed, addressing the topic of X-ray, which has probably been one of the most discussed topics, as a major cause. The investigation has led us to the conclusion, that the best solution to this issue lies more in changes throughout the entire supply chain, than in investments in the just the final phase. The notion that cargo sterilizations should be done at the beginning of the supply chain (by known agents), rather than in the final phase (at the cargo terminal) has proved to be the most effective and efficient practice. Naturally, a change of this caliber in the air cargo sector implies a clear change of strategy, with changes in procedures and policies and significant investment by a relevant part of the stakeholders. Thus, naturally, leading to the need for a joint strategy in the sector, referred to initially.

5.2. Contribution

There were two major contributions of this project. One more practical, in the operational sense and the second to the literature. In the operational sense, the first idea that emerged after this investigation, was that air cargo in Portugal, despite its undeniable importance in the World and Portuguese economy, is still looked upon as the poor relative of aviation, or as a byproduct, not as a relevant product *per se*, despite its enormous potential for wealth generation. This was, after all, the most striking feeling in most of the interviews, the lack of vision, the lack of relevance, the lack of structure and the lack of strategy.

The truth is, that Portugal, and more especially Lisbon, can not be alienated from this industry, otherwise it will lose a fundamental lever in what may be the most relevant period of economic stability and growth in the last two decades.

It seems that in Portugal, all the measures that can be taken without understanding this idea, will be tailored to the failure, and measures were proposed throughout this research, that can reverse this reality in Portugal. As major changes are not expected, as far as airport infrastructures are concerned, measures that allow the use or development of what already exists are absolutely necessary.

Operational recommendations of different measures that can improve significantly the efficiency and effectiveness of the air cargo sector in Lisbon were made in this project. Lisbon

should capitalize on its potential using recommendations of projects like this but also investing in knowledge with new studies or projects intended to develop this industry.

There was also a major contribute to the literature, as research uniting the topics benchmarking and air cargo is significantly reduced, as could be seen from the literature review conducted. Thus, it is expected that this project could contribute not only to fill the gap that was identified in the literature, but also to serve as a lever for the emergence of more studies about these extremely interesting and relevant topics.

5.3. Limitations

Time was clearly a limiting factor for this project. There were clearly difficulties of time management, that prevented doing a more detailed investigation on the various topics. This was especially relevant in the literature review, which prevented doing a more extensive study on the literature already existing on the topics studied.

Secondly, it was expected to obtain more support from the company ANA Aeroportos de Portugal, which was clearly the stakeholder (of the sector) that contributed the least to the investigation, since this was one of the companies that could benefit the most from this research. However, it was the company, with which it was more difficult to get an interview. Forcing me to fulfill bureaucratic procedures, wasting time and resources, which might otherwise have been dedicated to research.

Furthermore, it was extremely difficult to get European airport contacts, and especially to find the right people, with the right knowledge, available for an interview. More contacts and interviews with elements from other airports would clearly be enriching for the investigation, but this was not possible due to the limited resources.

Finally, the visit to Schipol Amsterdam would have clearly been a plus, and would have probably aggregated value to the investigation, but the limited time and financial resources prevented this from happening

5.4. Future work

The contribution of this project is undeniable, but naturally research can dive further in the study on these topics, that are undoubtedly relevant not only to the literature but also to the real economy.

Naturally, in a project with more time and financial resources, some of the limitations that this project may present might be mitigated. Contacts with other airports, may bring to light

some solutions that were not found throughout this project. Using Brussels as a benchmark might reveal itself interesting, as it reflects the reality of what is considered one of the exemplary airports, in what recent measures taken in the air cargo sector is concerned. Additionally, it represents an airport of moderate European dimensions, and probably closer to the Lisbon reality.

Benchmarking with one of the major Spanish airports, Barcelona or especially Madrid, may also bring interesting contributions. As, in fact, these are the main competitors of Lisbon, as far as air cargo is concerned.

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7. Appendix

I. Semi-structured interviews model

- 1) Quais é a sua visão do sector da carga aérea em Portugal/ Lisboa?
- 2) Quais são para si, os maiores problemas/constrangimentos para que exista uma maior vitalidade no sector?
- 3) O que lhe parece que pode ser feito para resolver/ mitigar tais problemas?
- 4) Que oportunidades e ameaças se avizinham no sector, para os próximos anos?

II. Structured interview model, to Francisco Pita, ANA aeroportos

- 1) Qual a política da ANA, perante a carga aérea em Lisboa? Em Portugal?
- 2) Quais as expetativas/ previsões da ANA para o sector, nos próximos anos?
- 3) Que problemas/ constrangimentos a ANA encontra como os mais relevantes para uma maior vitalidade do sector da carga aérea em Portugal/ Lisboa?
- 4) Parece-lhe que existe capacidade nas infraestruturas do Aeroporto de Lisboa, para lidar com futuros aumentos na carga aérea? Se não, como espera mitigá-las/ resolvê-las?
- 5) Estão previstos investimentos nas infraestruturas da carga aérea em Lisboa, ou no Porto?
- 6) Na eventualidade da necessidade de criar mais entendimentos e sinergias no sector da carga aérea em Lisboa/ Portugal, qual o papel da ANA neste processo?
- 7) Que oportunidades se avizinham como as mais relevantes no sector, segundo a ANA?
- 8) O que espera a ANA fazer, para aproveitá-las com a maior eficácia possível?
- 9) Quais são os pontos fortes do sector em Portugal/ Lisboa, segundo a ANA?

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