

## **Sao Tome International Airport: Performance Benchmarking and Recommendations for a Renewed Business Model**

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## LIST OF ABBREVIATIONS

<b>ACI</b>	Airports Council International
<b>IATA</b>	International Air Transport Association
<b>ICAO</b>	International Civil Aviation Organization
<b>KPI</b>	Key Performance Indicator
<b>MRO</b>	Maintenance, Repair and Overhaul Facility
<b>PAX</b>	Passenger
<b>SBU</b>	Strategic Business Unit
<b>STIA</b>	Sao Tome International Airport
<b>STP</b>	Sao Tome and Principe
<b>TMS</b>	Sao Tome International Airport (IATA airport code)
<b>WTTC</b>	World Travel and Tourism Organization

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## 1. Introduction

Aviation connects the world. The importance of the air transport system is widely recognized not only as a way to quickly cover long distances, but also as an economic engine for all communities. Airports are an essential part of the air transport system because they play a vital role not only within the macro environment of transportation, but also in the process of increasing the quality of life of their regional economies, directly participating in wealth creation and indirectly in social development. Jarach [1] defends that they can be considered as leading players regarding economic, productive, tourist and commercial upgrades of a territory, thanks to the number of potential business transactions that they may stimulate.

But while aviation helps to bridge cultures and support business, trade and tourism, in some places it plays a much more fundamental role – connectivity. The existence of an airport is decisive in the case of islands because they are the main points of departure and arrival, allowing a faster inter-island connection, which is essential for the population (health, studies, commerce, leisure, etc.). Airports are an essential part of the air transport system and they support most islands' major source of income: tourism, a vital source of foreign revenue for islands.

The airport industry has been facing unprecedented challenges in recent years as a result of deregulation of air transport, increased competition and tighter security [2]. The increasing competition in particular has led to the introduction of commercial and private ownership of airports around the world. Airports have therefore evolved gradually from just service providers to competitive business entities. With the introduction of this new operational context, airport authorities have come under pressure to adopt innovative management practices in order to become more efficient and competitive.

Nevertheless, for small regional airports like Sao Tome International Airport (STIA), the object of study of this master thesis, the lack of competitive pressure often leads to inefficiencies in the provision of airport services. Especially at state-managed airports, incentives for efficient operation can be particularly weak if losses can be covered by public funds. This is the reason why the adoption a systematic performance measurement system has the potential to give airport authorities a better understanding of how they can improve their financial, operational, and environmental performance.

## **2. Objective**

As airports evolve gradually from just service providers to competitive business entities, airport authorities are under pressure to adopt innovative management practices in order to become more efficient and competitive. Performance measurement of airport operation is an innovative practice that managers are adopting in the pursuit of efficiency and competitive advantage because it provides data that can be used to make strategic decisions, to correct dysfunctions and improve activity.

It is under this context that the present study arises, with the main objective of benchmarking Sao Tome International Airport's current operational performance; and secondly, of proposing measures to improve its economic and productive performance, based on more efficient procedures and a new marketing approach.

The aforementioned objectives make sense in a context of change in the airport management ideal in Sao Tome and Principe (STP) and in the world: in addition to the traditional purpose of providing a public utility service, generally financially supported by the government, the management of airports is working towards generation of profits and the creation of financial independence. The achievement of such ambitions greatly depends on an efficient utilization available operational resources.

The need for high output levels (of passengers) for airports to be able to achieve cost-efficient operations has always been a challenging issue for airport managers and authorities, as well as the political decision makers. Airports serving a higher number of passengers are able to distribute the fixed costs over a larger output, achieving therefore a cost advantage. For small and regional airports like STIA, however, it is not possible to reach the minimum scale for which the generated revenues would cover the fixed and operational costs. A small catchment area and insufficient inbound traffic at such airports can be considered as the most important reasons for such low output levels.

The problem this paper wants to solve is how to manage a small airport in order for it to operate efficiently and, eventually, start being able to finance itself.

### **3. Motivation**

My first contact with air transport management was through my bachelor's degree's elective courses. At the time, studying airport management seemed like the most logical solution for the internal conflict I felt due to wanting to live and work in the island state of Sao Tome and Principe, my home country, where there isn't a developed air transport industry, while holding a Bachelor of Aerospace Engineering. The present document is the final work of the master's degree in Aeronautical Management I later started so to fill the demand gap that exists in STP for specialized air transport workforce, as well as to somehow give my contribution to the existing literature about the African air transport industry.

After announcing a deal to build an \$800 million port in its naturally deep coastal waters with the help of a Chinese conglomerate in 2015, Africa's second-smallest country is making an audacious bid to become the "Dubai of Africa", working to become a crucial trans-shipment point for large vessels carrying goods going to and from oil-rich but infrastructure-poor neighbors such as Nigeria and Angola [3].

The launch of the Sao Tome International Airport Free Zone project back in 2006 was aligned with these aspirations of becoming a service platform. Nevertheless, since the early termination of the concession contract for the airport free zone between the Santomean government and the private company SDSTP in 2008 [4], the modernization of the airport became a vague idea that is repeatedly mentioned in the national and international authorities' strategy and investment reports, without further supporting studies, or future planning.

On the other hand, the importance of tourism for the socio-economic development of STP has been recognized in several reports released by the Santomean authorities, as well as in the strategic programs of the country's multiple governments [4]. According to the World Travel and Tourism Council [5], travel and tourism had a 10.8% direct contribution to the country's GDP in 2017, and a total contribution of 23,4%, as can be seen on table 3-1 [5]. This is forecast to rise by 3.5% and 4.5% respectively in 2018. These data demonstrate that STP is heavily dependent on tourism as a contributor to economic growth, especially when compared to other regions (7.1% for Sub-Saharan Africa and 10.4% for the World).

Tourism thus assumes a preponderant role in the very few exports of the country, reason why the government has defined it as a priority area of investment and development [6].

**Table 3-1 - Relative contribution of travel and tourism to GDP in Sao Tome and Principe in 2017**

TRAVEL & TOURISM'S TOTAL CONTRIBUTION TO GDP		2017 % share
11	Cape Verde	44.9
28	Sao Tome and Principe	24.3
37	Gambia	20.1
85	Senegal	10.4
	World	10.4
110	Togo	8.7
113	Ivory Coast	8.3
	Sub-Saharan Africa	7.1
145	Ghana	6.2
154	Benin	5.7
178	Burkina Faso	3.9
181	Gabon	2.9

Despite this recognition, and despite one of the recommendations of the 1st Conference on Air Transport Economy in Sao Tome and Principe being “Tourism must go hand in hand with air transport” [7], [8] in reality, because of economic and financial incapacity, the state of Sao Tome has repeatedly planned but failed to complete projects that would allow the improvement of the air transport system [4]. One of them being the project to modernize Sao Tome International Airport in partnership with Sonangol, an Angolan oil company [9].

Under this context of expected growth in demand for air travel due to tourism, together with STP’s difficulty to invest in the international airport’s modernization and/or increase of capacity, I see performance benchmarking as an important tool for identifying excess use of resources and potential areas for improvement within the airport. The results of the analysis can then be used to tackle inefficiencies in the airport’s management, allowing the creation of strategies to reduce operating costs and increasing revenues, which for an organization with reduced investment capacity is undeniably advantageous.

Another reason for choice of this topic comes from the fact that, while there exists a large amount of research on the efficiency of airports and while these studies are useful in advancing our understanding of the operations of airports, they have mainly been focused on European and American continental airports. There is limited research on the management of airports with special operational characteristics, as are island airports. The focus on an African island’s airport thus represents an innovative approach in this type of analysis.

In conclusion, this thesis is motivated by the need to determine and improve the performance of an airport that most likely isn’t going to receive a large amount of investment in the next years, alongside a wish to mitigate the literature gap that exists in the African air transportation industry.



## 4. Methodology

In order to formulate strategies to improve STIA's productivity and market positioning, we will compare the airport's passenger throughput unit, charges and distribution of revenues, against those of a group of airports with similar traffic characteristics. The data to be compared will be selected in accordance to indicators commonly used in the performance benchmarking literature, and in accordance with the availability of data in the operational and economic reports of the peer group.

After this introductory section, the present study is structured in five additional chapters: in chapter 5 a literature review supporting the research objectives identified above is developed; in chapter 6, in order to support the recommendations, an overview of STIA's background will be made, describing the airport's history, evolution of traffic, current operational capacity, safety issues, as well as ownership and management; the seventh chapter is where the performance analysis will be presented; in chapter 8 recommendations for a more efficient operation are formulated upon the airport's background and results of the analysis; finally, in chapter 9 conclusions will be presented, with suggestions for some possible future studies.

Among all the bibliographical resources to be consulted and referred throughout the work, the following books should be noted as the ones which will give theoretical support to the formulation of the recommendations: Airport Marketing by David Jarach[1]; Managing Airports by Anne Graham [10] and Gestión Aeroportuaria by Álvaro de la Rica Aspiunza [11]. In addition to these books, most of the support papers and studies to be taken as an example in this thesis will be consulted via the Journal of Air Transport Management.

The operational data relative to STIA used in this paper comes from STP's Aeronautical Information Publication (AIP), and the National Civil Aviation Institute's (INAC) Regular Air Transport Yearbook. Data regarding the remaining airports used in the benchmarking will, likewise, come from economic reports from their respective national aeronautical authorities. And finally, the overview chapter will be built upon consultation of newspapers, official published reports and inquiries to STP's aeronautical authority.

## 5. Literature Review

### 5.1. The Airport Enterprise

The air transport business is a very complex macro-industry. Within this industry, a variety of activities are carried out by a complementary and combined network of actors: passenger and cargo airlines, integrators, airport authorities, handling agents, catering companies, general sales agents, car rental, aircraft manufacturers and airlines, tour operators and travel agents, and all of them struggle to meet, at least partially, the needs of the final demand [1].

Airports are the part of the system that provides physical support on land to air transport: on the one hand, commercial relations, customs and security controls are carried out; and on the other, operations are planned to facilitate air navigation.

In recent years the nature of airports has changed vastly. Traditionally airports were regarded as a part of transport infrastructure by providing airlines with the necessary resources to conduct their business. In other words, they were a facilitator of airline operation, not especially concerned with pursuing other revenue sources. Consequently, aviation related revenues used to be the most important source of revenue [12]. In times of regulated air travel, with dominant national carriers, the environment of operation was less driven by the kind of market forces we observe today.

Several drivers of change have created various imperatives to which the industry reacted implementing a commercialization process. As pointed out by Zenglein and Muller [12], first, increased competition between airlines resulted in lower airfares and increasing passenger numbers; at the same time airlines had to cut costs and attempted to operate on limited margins, while regulated aviation charges had a propensity to remain stagnant, mostly in order for airports to remain competitive. Second, privatization efforts and a decline in state control have also amplified pressure on airports to identify other revenue sources ensuring continued revenue growth and maintaining or increasing profitability.

In light of the aforementioned changes, we may look at airports as real enterprises, their goal being long-term profit generation that can both sustain independent development and reward stakeholders. Table 5-1 [11] briefly explains seven economical characteristics of the aeronautical infrastructure.

**Table 5-1 – Airport economical characteristics**

<b>Characteristics</b>	<b>Explanation</b>
Multiproduct nature of the airport activity	Airport activity involves the provision of essential operational services, handling services and commercial services.
Generated revenue	The revenues generated by the above activities are usually classified as aeronautical and non-aeronautical.
Demand for airport services	The demand is directly conditioned by the air transport market. It can be considered as an inelastic demand or little sensitive to the price since local competition between airports is almost inexistent.
Capacity restrictions at airports	The capacity of airports is usually determined by the possibilities of the runway system. This depends on the demand, weather conditions, air traffic control and the configuration of the runways; only the last two are controllable.
Airport costs	The airport costs are allocated to the terminal building (depend on the flow of passengers) and the runway system (depend on the number of aircraft operated).
Externalities in the airport system	The externality of airports is usually copied in the effect of noise, pollution and congestion.
Coordination of air traffic control activities	The importance of safety in air traffic requires thorough coordination.

## **5.2. The Airport Product**

The transition from airport platform, acting as a mere passive actor in the market, to airport enterprise, implies that the airport administration becomes a manager of the various technical sub-activities hosted within its boundaries. In this case, the goal of airport management becomes profit maximization from whatever source of business derived from a broader concept of “flight experience”, whether it be strictly related to aircraft services, or to more diversified value objectives [1].

The airport product consists of a supply of services, both tangible and intangible, to meet the needs of different market segments. Each market segment will perceive these products levels very differently. For the airline, the core ability is to land and to take off an aircraft,

whereas for the passenger it will be the ability to board and disembark an aircraft. For freight forwarders it will be the ability to load and unload the freight on the aircraft.

Table 5-2 [1] presents the two main strategic business units (SBUs) managed by an airport enterprise, known as the “aviation-related” and “non-aviation related” businesses. A market-oriented airport enterprise would consider the management of these businesses as separate, with the goal of specializing on each of them and maximizing profits.

**Table 5-2 – The two main SBUs of the airport enterprise**

Aviation-related activities	Non-aviation related activities
Landing fees Passenger and cargo boarding fees Air traffic control fees Meteorology information fees Security fees Ground handling and fuel fees Government taxes. Other charges (e.g. parking)	Rents from additional spaces to: airlines, general sales agents, catering firms, forwarders, cargo operators, tour operators, travel agents;  Rents and commissions from various commercial ventures (boutiques, duty free shops, banks, parking sites, etc.);  Direct sales arising from shops owned or managed directly by the airport authority;  Other complementary activities

In light of changing airport economics, non-aeronautical revenues have become an important component of revenue generation for modern airports, inducing a new value proposition. Thus, airports that practically lived off airport taxes changed their approach on management and business opportunities. Aviation charges still are an important revenue source, but they are no longer the nucleus.

It is recognized that passengers are the centerpiece of non-aviation activity, however, at this point, it should be emphasized that they are not the only potential customers of an airport. As illustrated in figures 5-3 and 5-4 [13], there are the other market segments such as non-traveling local residents and service providers whose needs must also be met.

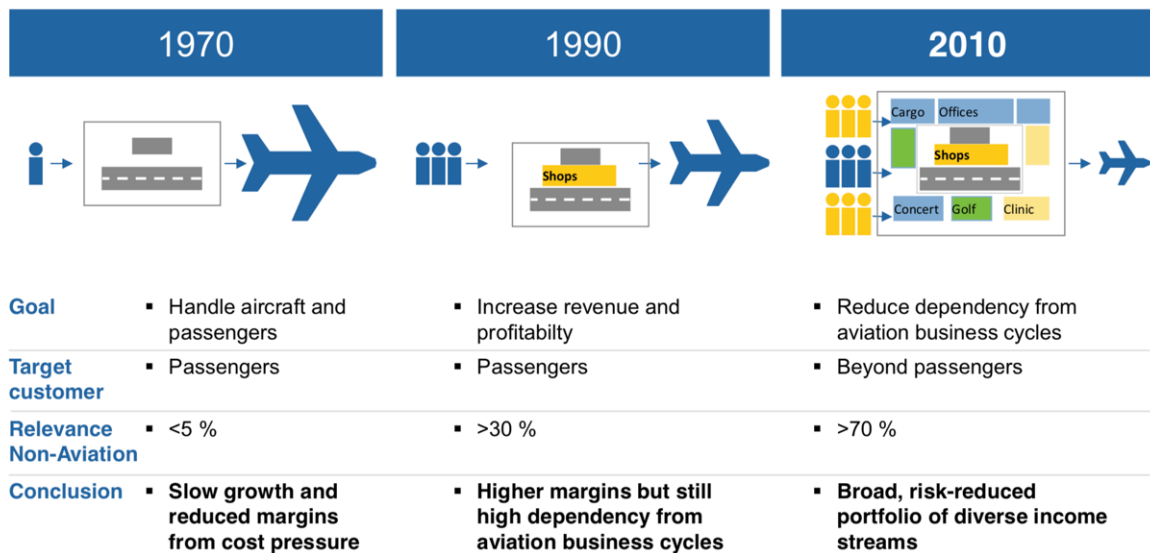


Figure 5-3 - Evolution of the airport business.

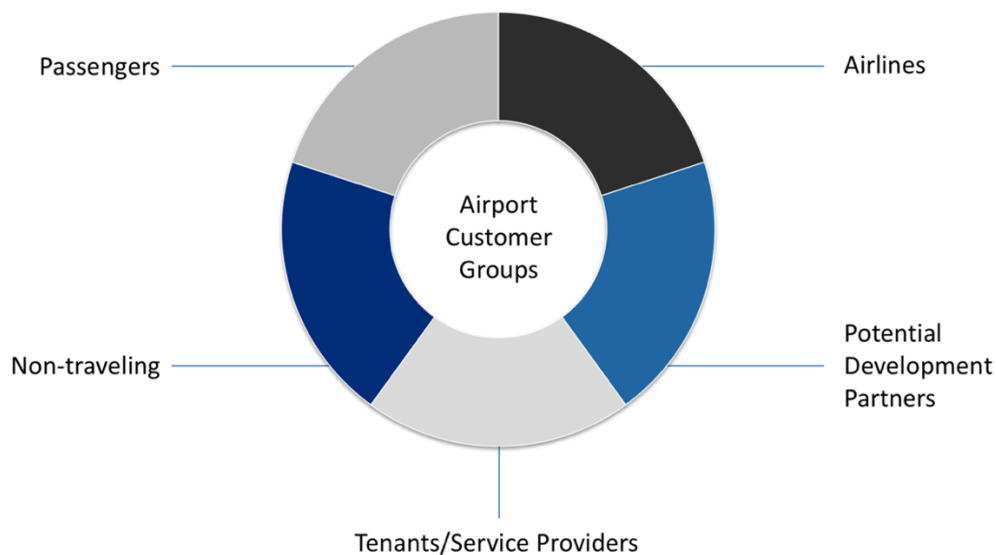


Figure 5-4 - Airport customer groups.

An example given by Zenglein and Muller [12] is that airports can be very attractive locations for a variety of companies. Being near the airport and benefiting directly from its operation can attract further corporate customers which can benefit by locating in the vicinity of the airport. On the other hand, there are companies that benefit from the associated traffic volume. Their operations, therefore, become not only easily accessible but also highly visible, since few locations have as much circulation of people as an airport does.

Figure 5-5 [13] illustrates how passengers and airlines contribute to airport revenues. Passenger related airport charges are paid by the passenger via the airline ticket to the airport; then there is non-aeronautical revenue which results from the passenger's passage through the airport; lastly, aircraft related charges are paid by the airlines to the airport. Furthermore, there are commercial relations with the retail outlets or other operators at the airport, which are not shown in the figure.

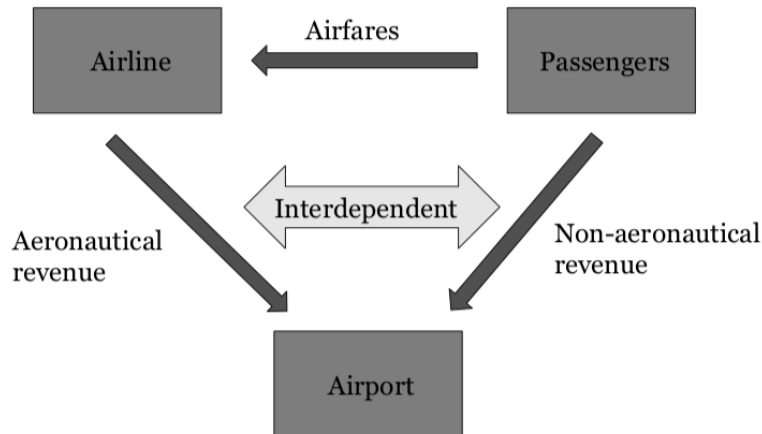


Figure 5-5 - Airports as a two-sided platform

In conclusion, this new commercial approach is creating a complex non-aeronautical sector. At the broadest level, the airport product can now be considered to be a large commercial center, which meets the needs of travelers, visitors and residents. In this case the airport can be defined as an “Airport City” [10], [14]. Successful airport marketing involves focusing on understanding and responding to the needs of the various customer segments.

### 5.3. Airport Performance Measures

Airports have traditionally been considered public monopolies that are financially supported by central and local government. Under such operating environment, they faced no or minimal competition, and as a result there was less incentive for them to be efficient and innovative. A number of studies have examined how airports are changing their performance measurement practices within the context of this dynamic and challenging environment [15]. These studies have generally concluded that airports are gradually adopting innovative performance measurement systems that combine both financial and nonfinancial measures in order to assess performance along the dimensions of economic efficiency, quality of service, and the environment. Table 5-6 [15] presents possible purposes of performance data and its different dimensions are briefly discussed next.

**Table 5-6 - Examples of different purposes to which performance data may be used.**

<b>Stakeholder</b>	<b>Purpose</b>
Government	For economic and environmental regulation.
Airline	So they can compare costs/performance across airports.
Airports managers	To run their own business.
Passengers	To assess how well they are served as consumers.
Owners/shareholders	To assess business performance and the return on their investment.

### **5.3.1. Service Measures**

Irrespective of which airlines or passengers the airport's services and facilities are designed for, it is very important to measure the quality of service that is provided. Service measures are used to compare performance against service criteria standards defined by IATA in its airport development manual [10]. Quality of service can be measured both objectively and subjectively:

- Objective indicators measure the service delivered and can cover areas such as flight delays, availability of lifts, escalators and trolleys, and operational research survey factors such as queue length, space provision, waiting time, and baggage reclaim time. To be accurate, these measures need to be collected regularly and at varying time periods when different volumes and types of passengers are being processed through the airport.
- Subjective measures involve collecting opinions of users such as passengers through comments cards and surveys. These measures allow the quality of service to be assessed through the eyes of the users rather than the airport management. Respondents are asked to rate their overall satisfaction on signage, cleanliness in terminal, average waiting time and queues, value for money, delays, comfort, friendliness of airport staff, and others.

### **5.3.2. Economic Measures**

Economic performance measures can be used to analyze the relationship between inputs (e.g. labor costs, number of employees, capacity of the system, asset value) and outputs (e.g. quantities of aircrafts, passenger, freight, distribution of revenues and profit) at an airport [2]. These performance indicators can be grouped into categories like cost efficiency, labor or capital productivity, revenue generation, commercial performance and profitability.

Efficiency is defined as the relationship between the quantities of inputs (e.g. labor and materials) used by a company and the quantity of output which it is able to produce using these inputs. Where an enterprise is able to produce the same output using fewer inputs

or produce more output using the same quantity of inputs then it has improved its efficiency. The analysis of airport efficiency can yield significant insights into how efficiently the airport is using its infrastructure and how cost effectively it is doing so.

As with other businesses, labor and capital are the most important inputs of the airport system. To capture the effect of the cost of labor as well as the productivity per head, the labor input can be measured in financial terms, i.e. employee salaries, or physically, through the total number of employees. Capital input can be measured, physically, by the capacity of runways, terminals, and gates; or financially, by asset values. With respect to outputs, they can be measured physically by number of aircraft movements, passengers, and quantity of freight; or financially, by considering total revenues generated [2].

To summarize, economic performance measures are all about relating one or more of the outputs to one or more inputs. By using a number of these indicators, an airport can assess different aspects of its performance and identify where its strengths and weaknesses lie [10].

### **5.3.3. Inter-Airport Benchmarking**

Airports have traditionally been compared to their peers but have now started to recognize the potential of benchmarking against other airports for the improvement of their competitive position. After all, the comparison of airport efficiency can yield significant insights into an airport's potential for increasing productivity and improving use of resources [10]. Nonetheless, producing meaningful inter-airport performance indicators is difficult because ensuring comparability is a complicated task.

One of the major difficulties in comparing airports is the fact that administrations have different roles. There are airports which directly operate the duty free shop stores while others do not, as well as airports which are/are not responsible for handling, for example. Another difficulty is the preparation of annual reports, which has several shortcomings due to the non-standardization of data. Moreover, the importance and weight of certain variables may vary, depending on the airport and its operating environment [12].

To overcome some of these comparability problems, it is recommended to choose a set of airports which are as similar as possible, even though this is probably difficult, given the multi-dimensional nature of airport operations and data limitations [10], [16].

It should be noted that the shift to a more commercial and service-oriented airport management has brought the need for the inclusion of non-aeronautical variables in airport performance evaluation. The omission of non-aeronautical variables in performance studies creates a bias in efficiency results since it underestimates the productivity of airports whose managers focus on the exploration of profit-generating



opportunities from non-aviation activities, especially since there are airports where 70% of total revenues comes from non-aviation activities [17].

The share of revenue from aeronautical sources and the percentage of costs which are allocated to staff have been indicated by Graham [10] as useful to give further insight into comparative performance, and are the indicator that will be later used in the analysis of STIA's performance.

There is a multiplicity of parametric and non-parametric methodologies derived from econometrics and operations research that have been used to evaluate performance in the scope of airport efficiency. However, most of these approaches, especially the parametric ones, have detailed data requirements and strong assumptions have to be made about the type of distribution of error.

The Data Envelopment Analysis (DEA) methodology has been the most widely used benchmarking tool in airport performance studies because it does not require knowledge of production technology or assumptions regarding the type of distribution, and allows to analyze financial and non-financial variables simultaneously [16]–[18]. DEA is a nonparametric linear programming methodology that uses multiple input and output variables to evaluate and compare the relative efficiency of organizational units. However, since it is not a statistical methodology, it has the drawback that any deviation from the efficiency frontier is attributed entirely to inefficiency.

Under this backdrop, we are ready to move onto the next chapters, where a contextualization and analysis of STIA's economical and operational situation will be conducted.

## 6. Overview of Sao Tome International Airport

### 6.1. History

The Democratic Republic of Sao Tome and Principe, a former Portuguese colony, is located in Equatorial Africa. The country is made up of two main islands and several other smaller islets, with a total of 1001 km<sup>2</sup> and 178,739 inhabitants, making it the second smallest African country [19].

Civil aviation begun in the country in 1948 when the Salazar aerodrome was built approximately 5.0 km from the capital of Sao Tome, to serve as a refueling base for the Portuguese Air Force. It was in 1987, after independency, that the National Company of Airports and Air Safety (ENASA) was created with the aim of improving the management and consequent profitability of capital invested in the country's airport infrastructures, and the aerodrome was reformed, becoming today's Sao Tome International Airport.

The exploitation and development of airport services was defined as ENASA's fundamental objectives, with the focus being maintenance of airport safety and security, as well as provision of flight information and air traffic control to ensure the safety of all air navigation in and beyond the Santomean airspace, in accordance with the international standards.

Since ICAO stipulates the separation of regulatory bodies from service providers it became imperative for all affiliates to establish a state organization that will ensure compliance with air navigations. The need to conform to this requirement led to the creation of a fully autonomous National Institute of Civil Aviation (INAC) in 1998 [20].

STP currently has 2 airports, the second one being in Principe island (IATA: PCP, ICAO: FPPR), built in 1968, which only operates domestic regular and charter flights. ENASA previously managed the two airports in the country, but currently Principe's Airport Management is granted to a local administration panel, with ENASA only in charge of its the Air Traffic Services [21].

In 2009 STP's government signed an agreement with Sonangol, an Angolan oil company, to rehabilitate and modernize STIA. This agreement later evolved into a mixed-ownership society between the two entities for the management of the airport, set up on April 2011, of which the Angolan oil company holds 80% of the capital and the STP's State the remaining 20%. After the negotiations, the first batch of renovations took place through the course of 2011, prioritizing the illumination of the runway, acquisition of basic safety equipment and systems, plus a small rehabilitation of the passenger terminal, an investment worth a total of 7 million USD. A future second phase of renovations is supposed to include a runway expansion and restructuring of the terminal [22],[6],[9].

Nevertheless, ever since the 30-year lease contract was signed between the two counterparts and the first batch of rehabilitation took place, Sonangol has not intervened on the airport management's structure. The direction board is still elected politically, and ENASA keeps managing the airport's infrastructures on behalf of the state and the Angolan company. Furthermore, unlike most airports today, economic reports of STIA's administration were never published, which represents a major difficulty in understanding and comparing its performance, specially before and after the concession.

## 6.2. Evolution of Traffic

STIA's regular passenger traffic data provided by INAC (calculated from the sum of embarked and disembarked passengers) shows a continuous growth between 2009 and 2017. As can be seen in figure 6-1 [23], in 2017 there was an increase of 12% (11.440 passengers) compared to 2016, totaling 109.721 passengers, with international regular traffic occupying 84% of market share (92.014 passengers). A rise that can be explained by the increase in occupancy rate and frequencies on the Lisbon – Sao Tome route, as well as by the entry of a new airline, Afrijet, on the Libreville – Sao Tome route.

Domestic traffic, which accounted for 14% of scheduled air traffic, registered 17.707 passengers, a 23% growth over the previous year, which goes hand in hand with the growth of tourism and related economic activities in Principe Island [23], [24].

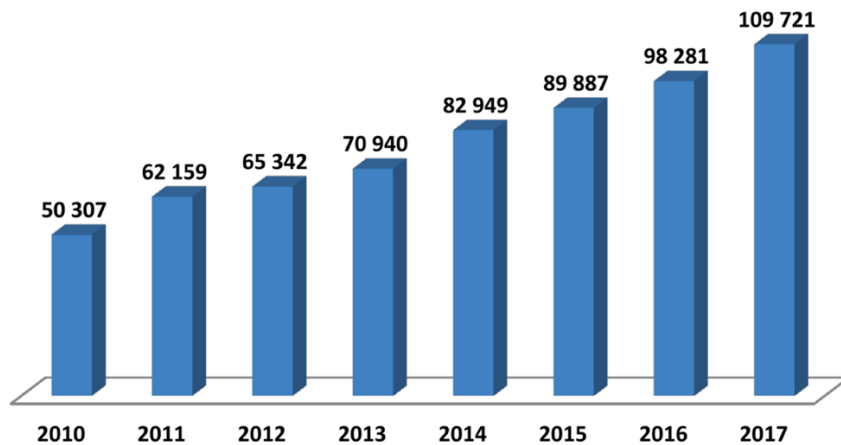


Figure 6-1 - Evolution of passenger traffic at STIA.

Regarding the monthly flow of passengers, there are slight fluctuations but no seasonal spikes. August is the month with the highest number of arrivals, followed by December. March and June, on the other hand, are the months with fewer arrivals to the archipelago.

The noticeable growth in passenger traffic comes as a consequence of the growing importance of tourism in STP, so accentuated that between 2010 and 2016 the number of tourists visiting the destination increased from 8.000 to 29.000, an increase of 263%.

Figure 6-2 [19] illustrates the evolution of international arrivals of tourists. In 2016, tourists represented 59% of the total passenger traffic at STIA.

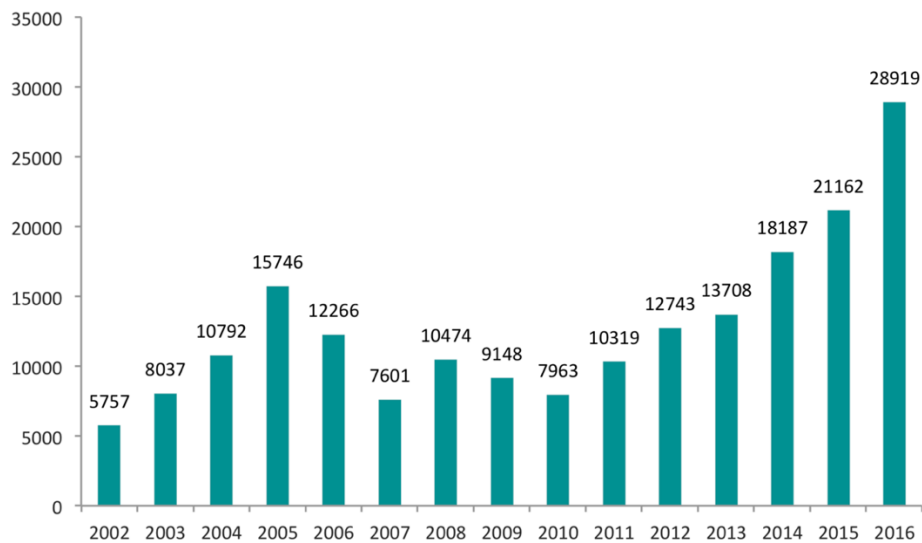


Figure 6-2 – International arrival of tourists to STP between 2002 and 2016.

Costa [19] explains that the atypical trend in the chart on international tourist arrivals was due to the emergence of a new airline, Air Luxor, which linked Sao Tome to Lisbon, and which presented more competitive prices than TAP. It started operations in 2003 and ceased operating in 2006. Air Luxor’s operation increased the volume of passengers and, consequently, the arrival of tourists to STP. It should also be noted that with the departure of Air Luxor from this route, the price of air tickets rose up again.

The downfall in growth between 2005 and 2010, with growth in 2008, when it registered growth, a period corresponding to the economic and financial crisis in Europe and the world. In 2008, an agreement between several private partners and the State gave birth to STP Airways, a new airline connecting the country to Europe. It started with one weekly flight, but for the last two years the frequency of flights during the high season (usually from July) increases to two per week [19].

The continued growth between 2010 and 2016, reaching almost 29.000 arrivals, corresponds to the recovery period of the main world economies and markets emitting to the destination. Regarding the main emitting markets to the country, discriminated in figure 6-3 [23], it is important to highlight the importance and the weight of the Portuguese market, which accounts for 43% of the total number of international arrivals to the archipelago. Angola leads the list of non-European issuing markets, with a significant share of 15.3%. France is the other European country comprising the top-5 emitting markets in 2016, with a market share of 6.2%. The United States and the United Kingdom complete the ranking of nationalities arriving in São Tomé and Príncipe for tourism.

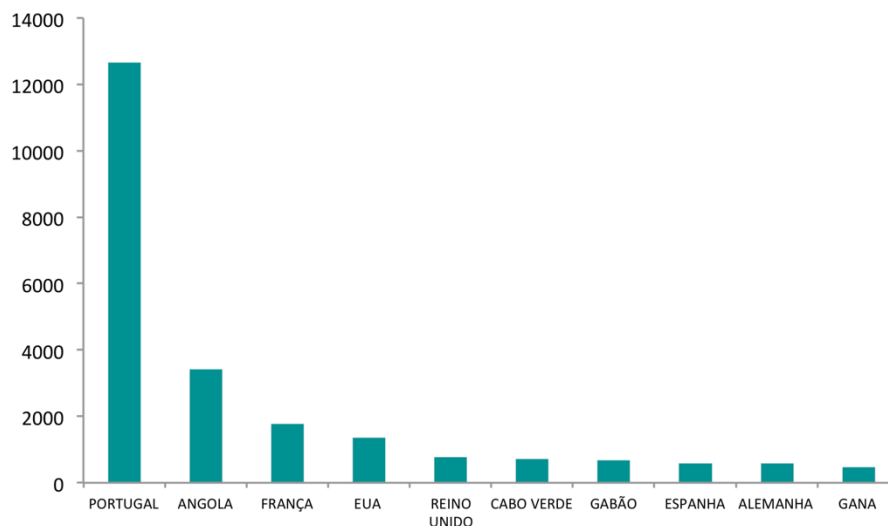


Figure 6-3 – International arrival of tourists to STP by nationality.

Despite the significant and encouraging growth, exploration of the tourism potential of STP’s natural, historical and cultural resources is still taking baby steps. The shortage of flights to/from Europe and the African coast can be pointed out as one of the major challenges. According to data from INAC for Winter 2017/2018, there were 7 companies operating regular flights from STIA [19]. Table 6-4 [23] compiles the market share of each airline and the routes they operated in 2017. In figure 6-5 [23] it can be seen that Sao Tome – Lisbon – Sao Tome is the busiest air route, followed by Sao Tome – Luanda – Sao Tome.

**Table 6-4 – Market share and routes operated by scheduled airlines at STIA in 2017.**

Airline	Operated Routes	Market Share (% total passengers transported in 2017)
TAP	Lisbon – Accra – Sao Tome Sao Tome – Accra – Lisbon	35,36%
TAAG	Luanda – Sao Tome Sao Tome – Luanda	19,04%
CEIBA	Malabo – Sao Tome – Libreville Libreville - Sao Tome – Malabo	2,77%
Afrijet	Libreville – Sao Tome Sao Tome – Libreville	3,91%
Afric Aviation	Libreville – Sao Tome Sao Tome – Libreville	1,15%
STP Airways	Lisbon – Sao Tome Sao Tome – Lisbon	35,56%
	Sao Tome – Principe Island Principe Island – Sao Tome	
Africa’s Connection	Sao Tome – Principe Island Principe Island – Sao Tome	2,21%

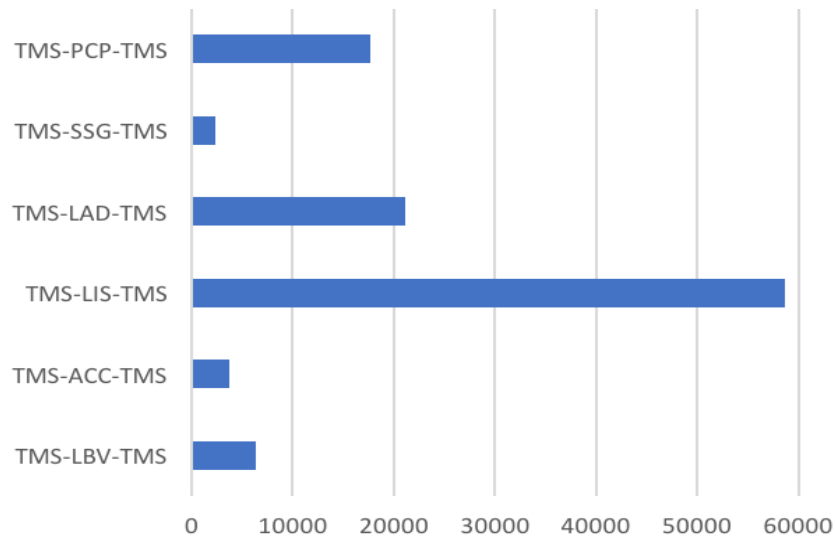


Figure 6-5 – Distribution of passengers per air route operated at STIA in 2017

Until 2016 TAAG operated one flight to Praia (Cape Verde) from STIA, but this connection was discontinued due to insufficient passenger demand. Before exploring the Lisbon – Accra – Sao Tome route, TAP Portugal used to operate via Sal (Cape Verde). Another extinct route is Lagos – Sao Tome, operated by the former Air Nigeria.

With respect to the non-scheduled share of traffic, besides sporadic charter cargo flights operated by foreign companies, there's Africa's Connection commonly operating charter flights to Douala and secondary airports in Gabon [25].

At this point it is worth mentioning the airport's annual traffic report makes no reference to the market share of charter flights, private aviation, nor the segmentation of passengers (transit, VFR, business travelers, etc.), which could give a great insight into existing marketing opportunities. In the case of VFR passengers, for instance, while official statistics do not capture this particular sub-class of traveler, one can glean some indication of the growth in the share of traffic [19]. Record keeping and analysis of this data is essential for the airport to understand its market positioning and to formulate new strategies based on the tendencies of the traffic.

### Cargo Data

Despite the growth in passenger numbers and aircraft movements, in 2017 cargo and mail transport decreased by 16% and 56%, respectively. Regarding the cargo transported to / from STIA, we can see on figure 6-6 [23] that there are fluctuations, with a downward tendency. These fluctuations can be explained by an unstable import/export activity in the country, or by a lack of methodical collection of data. For example, we see that between 2014 and 2015 the difference is of more than 120.000 kilograms transported, growing back again 66.851 kilograms in the next year, which leads us to consider two scenarios: the airport is experiencing a decline of this type of services, or the facilitation of this type of data by companies to the airport authority is deficient.

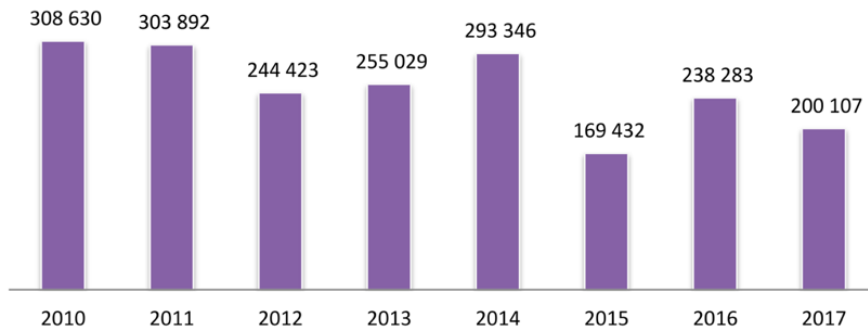


Figure 6-6 – Evolution of cargo transport (in kilograms) at STIA.

### 6.3. Current Operational Capacity

After the brief history and traffic overview of the airport, its current state, facilities and capacities will be described below.

STIA currently provides immigration and customs services, meteorological information, fuel supply, ground assistance, and airport security. One of the measures taken by the airport administration to cope with the growing level of demand for these services was to increase operations to a full 24-hour service, for departments with air navigation responsibilities (i.e. the control tower, the aeronautical information service, as well as security, electrical/electronic and firefighting departments). The airport's administration, the fueling service, the customs and the immigration operate Monday to Friday from 0070-1600 UTC and from 1600-0700 on request (with 2h prior notice).

The airport can only be accessed by road (personal vehicle, hotel bus, or taxi), and there is a free open sky parking space for users, located a few meters from the passenger terminal. Since the rehabilitation of the airport by Sonangol in 2011, STIA covers a total area of 1500m<sup>2</sup> [22].

The runway, 2.160 m long and 45 m wide, has often been pointed out as weakness as it is unable to accommodate stopovers of wide body aircrafts meant for transatlantic connections (between Johannesburg and New York, for example). Nonetheless, it is enough to receive medium range, wide body aircrafts with up to 260 seats, like the Boeing 767 or the Airbus 310.

Figure 6-7 [26] illustrates the range of an Airbus A320<sup>1</sup> which departs from STIA. With a runway length requirement that is met by STIA, the area covered in blue represents all possible destinations within the aircraft's typical range.

<sup>1</sup> Take-off distance at MTOW of 2090 meters.

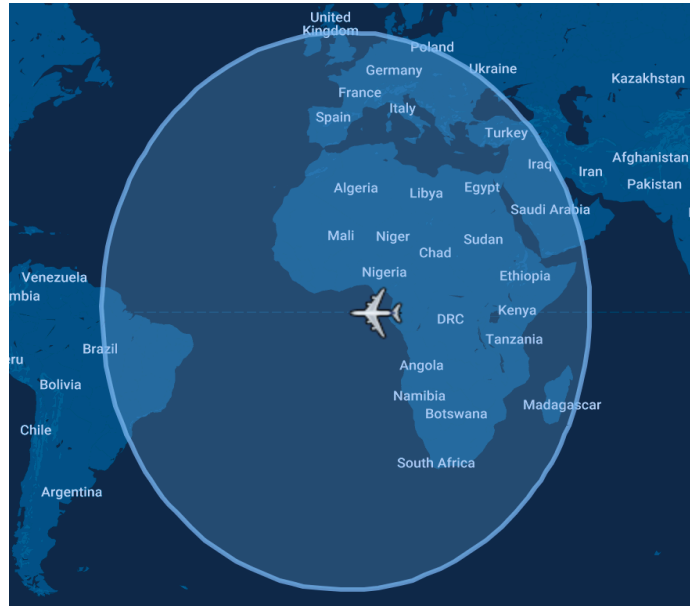


Figure 6-7- Representation of an Airbus A320's range from STIA

The check-in area currently has 4 counters, the security check has 1 x-ray machine and the arrivals area has 1 luggage belt. The boarding area, with capacity to process one flight at a time, has a cafeteria and a small souvenir shop. On arrival, passengers must undergo passport, vaccine and border control, to then get to the baggage claim area, and exit after going through customs.

Nearby the apron we can find a fire truck and 2 small fueling trucks. Ground handling services are subcontracted to STP Airways, being available within ENASA's operating hours or by arrangement. In a phone interview with a flight dispatcher who works at the airport, he reported that baggage loading and offloading faces major difficulties due to outdated equipment and personnel incoordination, causing long waiting times for baggage claim.

The airport administration's offices are on the Control Tower building, near the small cargo terminal where STP Airways and Africa's Connection have their offices, which also serves as a maintenance hangar for the small aircrafts operated by Africa's Connection. The hangar's capacity is of 1 medium aircraft.

Figure 6-8 [27] schematizes the airport's infrastructures and runway characteristics. Table 6-9, elaborated with data from [21], [23], [27], [28] compiles the major operational characteristics of the airport.



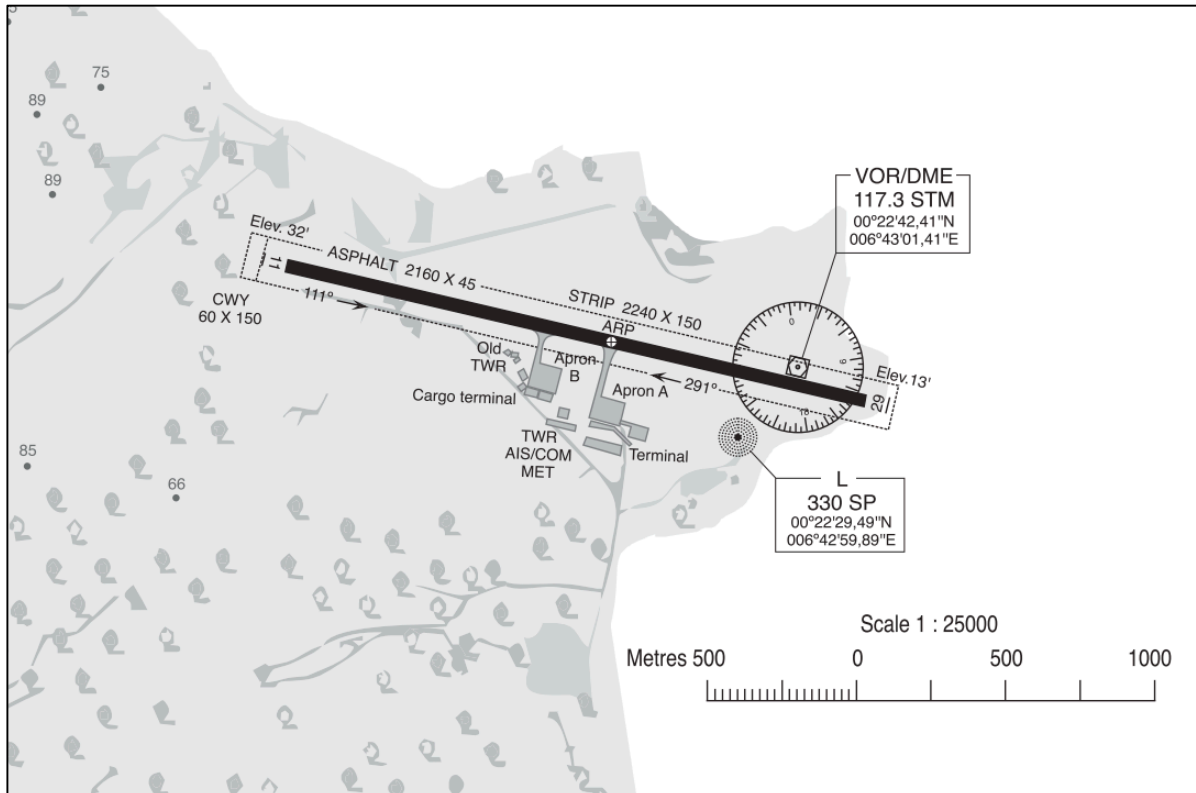


Figure 6-8 –STIA’s Visual Approach Chart

**Table 6-9 – Operational Specifications of Sao Tome International Airport**

Airport operator	ENASA
ICAO code	FPST
IATA code	TMS
Type of airport	Public/Civil, International
Types of traffic allowed	IFR/VFR
Capacity of fuel supply facilities	2 small trucks (400 liters per minute)
Number of runways and taxiways	1 runway
Runway dimensions	(11/19) 2160 m x 45m (asphalt) 4D ICAO aerodrome reference code
Platform capacity	3 medium aircrafts + 4 small aircrafts
Aircraft maintenance infrastructures	1 small hangar
Terminals	1 passenger terminal 1 cargo terminal
Firefighting and extinguishing	Category 5
Facilities	4 check-in counters 1 boarding gate 1 baggage claim belt

## 6.4. Safety Issues

Sao Tome and Principe continues to face challenges in the implementation of the ICAO Standards and Recommended Practices (SARPs). Safety-related deficiencies including Significant Safety Concerns (SSCs) have been identified by ICAO in 2014 through the Universal Safety Oversight Audit Program (USOAP). The existence of SSCs does not necessarily indicate a particular safety deficiency in the air navigation service providers, airlines (air operators), aircraft or aerodrome; but, rather, indicates that the State is not providing sufficient safety oversight to ensure the effective implementation of applicable ICAO Standards [29], [30].

The three SCCs pointed by ICAO were:

- crossing of the airport's runway by residents of neighboring towns;
- manual security checks made on arriving and departing passengers' luggage;
- the inexistence of an X-ray machine in the airport's VIP lounge.

Following the audit, the Government embarked on the modernization of airport facilities with financial and technical support from Angola to address the above-mentioned weaknesses. ICAO undertook assistance activities related to the implementation of a Plan of Action developed for STP, giving priority to the resolution of SSCs in the short-term and medium-term, and to building the capacity to effectively implement safety requirements in the long-term.

Improvements in air surveillance and safety allowed STP to be taken off ICAO's blacklist in May 2017, when ENASA solved all SSCs identified on the previous ICAO audits. This certification, which came for the first time in the history of civil aviation in Sao Tome and Principe, was a joint effort between INAC, ENASA, as well as other stakeholders like local flight operators [20].

Nevertheless, SSCs aside, a lot of work still needs to be done with respect to safety. As can be seen on figure 6-10 [31], which represents STP's percentage of Effective Implementation for the various categories covered under ICAO's Universal Safety Oversight Audit Program, all aspects were below the global average. As of 2014, STP's overall Effective Implementation was of 18.17%.

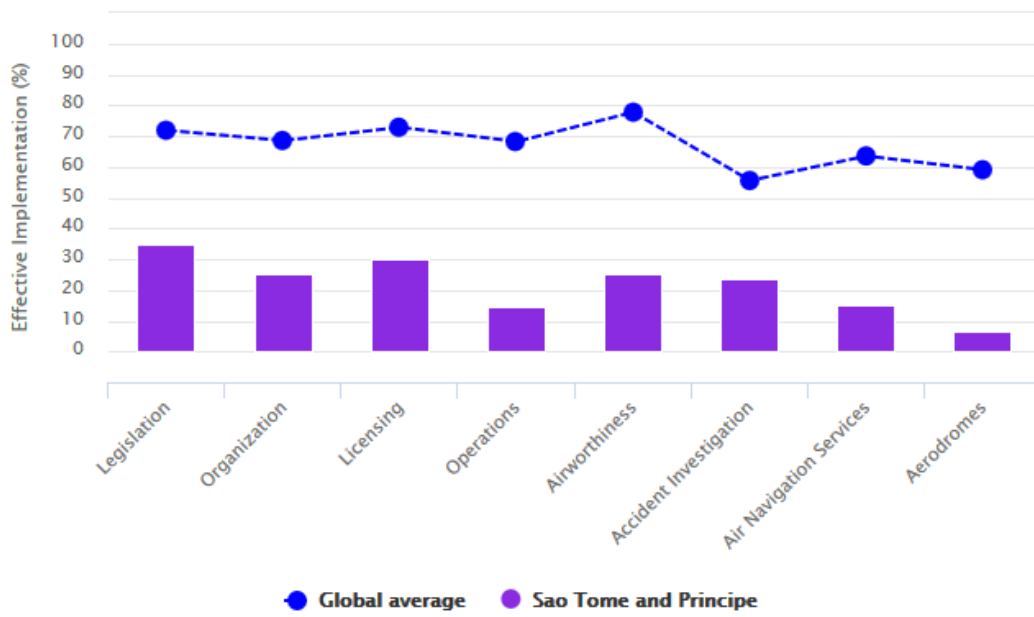


Figure 6-10 – STP's Effective Implementation of safety oversight versus global average.

## **7. Performance Benchmarking**

As explained in the literature review chapter, performance measures analyze the relationship between inputs and outputs at an airport. This relationship can be expressed in both financial and physical terms [10] and there are several econometrics and operations research methods that can be employed in order to thoroughly study the efficiency of a group of airports. Nonetheless, due to the requirements regarding quality of data in order to obtain accurate results, the analysis that will be performed in this chapter does not resort to these benchmarking tools.

### **7.1. Productive Performance**

In order to study STIA's productivity, we will compare performance indicators of 6 island airports, 5 of them processing fewer than 200.000 passengers, and 1 of them processing fewer than 500.000 passengers in the year the data was recorded. Choosing airports with similar number of passengers was imperative since it is directly related to the importance of tourism and socioeconomic status of the regions adjacent to the airport [32]. Three indicators were used for the analysis:

1. Number of passenger per airport authority employee;
2. Number of aircraft movements per airport authority employee;
3. Labor share of operating costs (%).

The airports used in this analysis are managed by Cape Verde's ASA (ICAO Codes: BVC, RAI, VXE) and by Portugal's ANA (ICAO codes: PXO, SMA, HOR), two entities which administrate airport networks. In the case of ANA's airports, the number of employees and the labor share of costs of each airport doesn't normally come discriminated on the annual reports of the airport network, as this information is considered sensible. To overcome this obstacle, Ramos' 2009 study of Cape Verdean Airports' Administrative Efficiency [32] was used as a reference, providing employee data of ANA's and ASA's airports in 2008. The following table puts together the data and the calculation of performance indicator, which will be examined next.

**Table 7-1 – Comparison of productivity indicators of the peer group**

<b>Airport (ICAO Code)</b>	<b>Year of Data</b>	<b>Pax</b>	<b>Mov</b>	<b>Total AAE</b>	<b>Pax/AAE<sup>1</sup></b>	<b>Mov/AAE<sup>2</sup></b>	<b>LSC<sup>3</sup> (%)</b>
<b>Porto Santo (PXO)</b>	2008	130.537	3.017	78	1.674	39	62
<b>Santa Maria (SMA)</b>	2008	103.960	3.663	64	1.624	57	65
<b>Horta (HOR)</b>	2008	196.433	4.799	36	5.456	133	41
<b>Boa Vista (BVC)</b>	2008	100.800	1.808	22	4.582	82	5
<b>Praia (RAI)</b>	2008	420.524	9.639	81	5.192	119	20
<b>Sao Vicente (VXE)</b>	2008	165.015	4.575	37	4.460	124	24
<b>Sao Tome (TMS)</b>	2017	109.721	2.509	190	577	13	68
<b>Mean</b>		<b>175.284</b>	<b>4.287</b>	<b>73</b>	<b>3.366</b>	<b>81</b>	<b>41</b>

<sup>1</sup> Total handled passengers per airport authority employees

<sup>2</sup> Total aircraft movements per airport authority employee

<sup>3</sup> Labor share of total costs

Table 7-1, elaborated from [23] and [32], is revealing in several ways. First, we can see that amongst the 7 airports STIA has the largest number of employees, 190, followed by Praia's Airport with 81. These two airports have 160% and 11%, respectively, more employees than the total average of the airports analyzed. In the case of Praia's Airport, however, this high number is consistent with its passenger traffic, the group's largest.

Secondly, despite the 9 years of difference in data, which implies major differences in infrastructure, technology and even market environment, STIA is the least efficient airport, both in terms of total handled passengers and movements per AAE. With 577 passengers per employee, STIA's performance is far away from the average of 3.366 passengers per employee, and even further from Horta's 5.456 passengers per employee, the best performance.

With respect to aircraft movements per AAE, Horta's Airport is still the most productive, with 133 movements per employee, followed by S. Vicente's, with 124 movements per employee. STIA has a ratio of 13 movements per employee, more than six times less than the average, 81 movements per employee.

Regarding labor share of total expenses, in 2008 all Cape Verdean airports were below the average of all analyzed airports, 41%. Porto Santo, Santa Maria and S. Tome Airports on the other hand, all with relatively similar traffic, were above average. In this field S. Tome was also the least efficient, with 68% of the expenses applied in the payment of employees.

As noted before, one of the limitations of this type of analysis is that different airports have different management schemes. The data doesn't allow us to conclude how each airport allocates its workforce, for example. In the case of ENASA, since handling is contracted to STP Airways, ramp agents and check-in clerks are not considered employees of the airport administration.

Through this comparison we can understand that for the traffic level which is currently handled at STIA, it is possible to use much less resources, both in terms of employee number, and of labor costs. STIA's overstaffing is directly and negatively reflected in this performance benchmarking.

## 7.2. Airport Charges and Non-Aeronautical Revenue

There are many factors that affect an airport's level and structure of costs and revenues. Some of these are more easily influenced by an airport's management than others. First, the volume and nature of the traffic, which the airport operator has limited control over, can have a major impact on the airport's economic performance [10]. Table 7-2 [20], [27] lists all the sources of revenue, both aeronautical and non-aeronautical, currently explored by STIA's administration.

**Table 7-2 – STIA's Revenue Sources**

<b>Aeronautical Revenue</b>	<b>Non-Aeronautical Revenue</b>
Passenger service charge Landing charge Lighting aids charge Air navigation charge Parking Cargo tax Fuel	Rent Consumer articles Service provision Equipment rental

Sao Tome and Principe’s airport fees and charges were regulated for the first time by law in 1999, and then readjusted again in 2005 [21], [27]. Although ICAO recommends that these rates should be denominated in local currency, the charges to access STIA’s facilities are denominated in US Dollars, which, due to exchange rate variations, can result in extraordinary gains or losses [33].

From table 7-3 [27], [34]–[36] we can see that the rate paid per passenger embarked on international flights at STIA is about 54% higher than that charged at Cape Verdean Airports and almost 4 times the fee paid in The Canary’s El Hierro Airport, also an airport with less than 200.000 passengers traffic. At the Portuguese airports there is an additional charge, the passenger processing equipment charge, which is not applied at any of the other airports analyzed. It further increases the amount paid by the passengers at those airports, but still remains below the amount paid at STIA.

**Table 7-3 - Comparison of international passenger charges in different airports for 2018.**

	<b>Cape Verde Airports</b>	<b>El Hierro Airport</b>	<b>Azores Airports</b>	<b>Madeira Airports</b>	<b>Sao Tome</b>
International passenger service charges	15,81 EUR	3,67 EUR	16,71 EUR	24,57 EUR	24,20 EUR
Security charges	2,73 EUR	3,50 EUR	1,94 EUR	1,94 EUR	4,37 EUR
Passenger processing equipment charges	-	-	0,188 EUR	0,188 EUR	-
Total payable per departing passenger	18,54 EUR	7,17 EUR	18,838 EUR	26,838 EUR	28,57 EUR

Looking at 7-4 [37], which compares fuel prices at all the airports which can be flown to from STIA (plus Cape Verde’s most important airport, Sal’s Amilcar Cabral Airport (SID)), it can be seen that STIA provides one of the most expensive refueling services. After Malabo International Airport (SSG), comes STIA with a price 27% higher than the average, more expensive than all the other Gulf of Guinea airports, i.e. Luanda (LAD), Accra (ACC), Libreville (LBV).

The relative level of charges currently applied in STP does not go along with the global trend in major airport administrations, where one of the objectives is to reduce the rates to be paid by airlines in order to attract more flights and thus increase the number of passengers and potential customers, achieving balance of accounts with the increase of non-aeronautical revenues. This trend is observable in the case of Spain’s AENA, which

allows incentives and discounts on small airports, like The Canary’s El Hierro, which had the lowest international passenger service charge in the previous analysis.

**Table 7-4 – Comparison of fuel prices as of September 2018**

<b>Airport (ICAO Code)<sup>2</sup></b>	<b>Fuel Price Jet A1 (USD/usg)</b>
SID	2,62
ACC	2,87
LAD	2,87
TMS	4,13
LBV	3,92
SSG	4,53
LIS	2,77
<b>Mean</b>	<b>3,39</b>

Ramos [32] points out that trying to recover losses while maintaining high airport charges is to have a short-term vision, as it leaves great risks in future development. A better alternative would be to lower airport charges and to have losses in the short term, to wait for the recovery of demand and losses, and to recover costs in the long term through the surplus of traffic induced by the lower fees.

Although airport charges are defined by law, ENASA and INAC could collaborate in the sense of revising or turning it into a flexible process where fees can be defined according to the type of traffic the airport wants to attract.

### **7.2.1. Non-Aeronautical Revenue**

With regards to non-aeronautical revenues, Graham [10] explains that larger airports are normally in a better position to provide a greater range of commercial facilities for passengers and other consumers and therefore tend to have a greater reliance on non-aeronautical revenues. However, there is no “typical” airport when it comes to looking at the services and facilities that an airport provides. Beyond the basic operational functions, different airports have little in common.

Naturally, the weight of commercial revenues varies on the different regions of the globe. In 2006, for example, average non-aeronautical revenues in the Middle East / Africa and North America region accounted for about 53%, while in Europe the average was 48% and the Asia / Pacific region was almost 46% , as seen in table 7-5 [38].

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<sup>2</sup> SID: Amílcar Cabral International Airport; ACC: Kokota International Airport; LAD: Quatro de Fevereiro International Airport; TMS: Sao Tome International Airport; LBV: Léon-Mba International Airport; SSG: Malabo International Airport; LIS: Humberto Delgado International Airport



**Table 7-5 - Non-aeronautical revenues per region in 2006**

<b>Region</b>	<b>Non-aeronautical revenues (\$ billions)</b>	<b>% Non-aeronautical revenues from total revenues</b>	<b>Non-aeronautical revenues per Passenger (\$)</b>
Africa/Middle East	1,8	52,9	8,00
Asia/Pacific	6,92	45,7	7,06
Europe	16,61	48,1	12,15
Latin America/Caribbean	0,85	29,0	3,13
North America	9,05	52,6	5,92
Total	35,23	48,1	8,06

According to INAC, the non-aeronautical revenues achieved by STIA in 2017 were 15,4% of total revenues, falling far short of the world's average of 39,8% [39]. These figures presented by STIA naturally reflect the poor commercial productivity of the airport, even though it stayed within the ICAO's assumptions of the relation between the volume of passengers transported and non-aeronautical revenues, depicted in table 7-6 [33].

**Table 7-6 - Passenger volume and non-aeronautical revenue relationship**

<b>Annual Passenger Volume</b>	<b>% Non-aeronautical revenues share of total revenues</b>
Up to 500.000	11%
From 500.000 to 2.000.000	26%
From 2.000.000 to 5.000.000	29%
Above 5.000.000	36%

It is clear that STIA could increase the percentage of gains from the non-aeronautical component, which would contribute not only to the increase in total revenues but also the number of employees and taxes paid to the government. Since the commercial component is little used, it is a possibility which could be analyzed by STIA's administration.

### 7.3.SWOT

After going through STIA's history, activity, operational constraints, benchmarking its productivity, level of charges, and revenue sources, next a SWOT analysis will be carried out. This is a useful tool to grasp a company's real situation, and to plan future strategies, especially when the intention is promoting structural transformations [40].

#### STRENGTHS

- Proximity to the capital;
- Available space for constructions and concessions;
- Uncongested traffic;
- Administrative autonomy;
- Monopoly (only international airport in the country);
- Strategic geographical position;
- Visa exemptions.

#### WEAKNESSES

- Outdated airport infrastructure;
- Lack of financial transparency;
- Difficulties to record and analyse traffic data;
- Direction board elected politically;
- Non-liberalized air transport market;
- Expensive charges;
- Overstaffing;
- Difficulties in implementing ICAO's standards.

#### THREATS

- Increase in international tourism competition;
- World economy's fluctuations;
- Small number of low-cost airlines operating in West Africa;
- Competition from other West African airports, with better financing, to become regional hubs.

#### OPPORTUNITIES

- Growth of tourism and business markets on the Gulf of Guinea;
- STP tourism demand's steady growth;
- Transatlantic connections between Southern Africa and America that need to stopover;
- International events hosted by STP;
- Emerging middle-class with purchasing power;
- Good country relations with Angola and Portugal;
- Demand for MRO in West Africa.

## **8. Recommendations for a Renewed Business Model**

Construction of terminal buildings and infrastructures alone doesn't automatically imply that an airport will be on the right track for success. In the absence of serious managerial efforts, some traffic volumes will probably be achieved by chance, but this volatile performance will not provide long-term economic viability for the airport enterprise.

Efficiency is a word that means different things to different people. There are various notions of efficiency. Productive efficiency, for example, refers to producing a given output by using the minimum possible amounts of inputs, or, producing the maximum possible output using a given amount of inputs. Another notion of efficiency is related to costs of production and in this case cost efficiency may be thought of as producing a given output at the minimum possible cost, given the prices of factors of production.

As a result of what was seen during the development of this work, this section will try to give light to alternatives and possible future actions aimed at improving STIA's productive efficiency. The recommendations are divided in two sets:

- one set aims at increasing the operational outputs (passenger traffic and non-aeronautical revenues);
- the other set aims at reducing the operational inputs (number of employees/labor costs, operational costs)

The formulated recommendations are meant to bring small but long-term improvements in economic performance, allowing the airport to gradually move from financial dependence to self-sustainability and, ultimately, to being able to finance infrastructural upgrades like runway expansions or construction of new hangars.

### **8.1. Increasing Revenue**

Marketing has become a core activity at many airports, and one that is considered to be vital for success [41]. On the basis of the distinctive features of each individual airport, a consistent positioning strategy is a crucial preliminary step in the design of all operational and airport marketing tools.

In order to achieve the correct market positioning, an airport-enterprise will need to conduct a market research study, aimed at understanding both the quantity/quality of current traffic values, identifying missing or underdeveloped services, potential for a new type of traffic, analyzing the flow at competing airports, as well as drawing data for future developments.

Thus, with the goal of creating new and enhancing existing revenue streams, an extensive market research needs to be done by STIA's administration. On the basis of this analysis, the airport can define the desired airline profile as a customer, and change its facilities and/or services based on the type of traffic that is wanted. Furthermore, this market research would be an advantageous asset because it could be presented directly to target airlines, in the route development efforts of the airport. The cost of this market research will be discussed next.

### **8.1.1. Route Development**

The focal point of any marketing system is always the consumer of the services. An airport has many customers but two of the most important are airlines and passengers, and the marketing techniques used for the two types of customer differ greatly [10].

The extent to which an airport operator by itself can influence a passenger's choice is limited as their decision is primarily determined by the airline services being offered and the location of the airport. This is why STIA's administration should direct their attention towards marketing to airlines:

- **Creating incentive schemes and discounts for new routes.**

An airport's charging policy has its greatest impact on airline operations when new routes are being considered – especially when being operated by low-cost airlines or on small regional sectors.

A strategy for attracting new routes could be offering low prices through deals negotiated with each airline when trying to create a new route. An example of a deal is giving heavy discounts or eliminating landing and parking charges (imposing charges per passenger only), as long as the airline ensures a guaranteed traffic volume during certain period of time.

Similarly, to incentive the already operating airlines: giving discounts for long-haul routes, routes which contribute to global traffic growth, or with load factors above 80%, for instance.

The initial losses in aeronautical revenue would be short term because, thanks to the surplus of traffic induced by the lower fees and discounts, earnings would grow on the long run, making it possible to recover losses in the long term.

- **Appointing a liaison officer or creating a route development department.**

This department would be in charge of conducting and providing market research to airlines, of promoting the airport in relevant destinations, as well as finding airlines to operate new or existing routes. Besides the salaries, there would be extra expenses to conduct the market research and to run the needed efforts to reach and close deals with airlines. Table 8-1 [41] gives us some light on expenditures on route development (excluding personnel costs). At small airports the costs hover around US\$100.000, a value that can be recovered if the route development is effective. Annex I, elaborated by Halpern and Graham [41], lists measures which airports have used to communicate route development opportunities to airlines.

**Table 8-1 - Expenditure on route development (excluding personnel costs) at airports during 2014 financial year.**

	N	Average expenditure (US\$)	Average expenditure per passenger (US\$)
All airports	69	346,645	.84
By airport size			
Smaller	37	104,400	1.42
Larger	32	626,741	.17
By ownership of the operator			
Public	59	319,585	.88
Private	10	506,299	.63

Finally, at the most basic level, it is important to promote STIA to airlines by producing general publicity information, by placing advertisements in trade journals, and by being represented at exhibitions, tourism seminars and workshops, or similar events. The aim here is to increase awareness amongst airlines.

### **8.1.2. Reassessing Ground Handling and Improving Service Measures**

Speed, efficiency and accuracy are important in all ground handling services provided at an airport in order to minimize the turnaround time, a critical factor in airlines' operation. The existence of only one ground handling service provider at STIA means that there is no competition and, consequently, no encouragement to continuously improve the quality and the price of services provided.

For the amount of traffic that exists, attracting new service providers may be hard, reason why it is crucial that ENASA establishes appropriate monitoring and control systems to ensure the quality of service provided by STP Airways Handling. In this sense, the recommendation is to monitor *Key Performance Indicators* (KPIs) for the check-in and baggage waiting time, to introduce higher quality requirements when prolonging

subcontractor agreements, and to apply sanctions when KPI's are below a minimum level of service. Moreover, in order to attract stopover flights, which possibly land in Libreville, Luanda or Accra due to more competitive servicing rates, fuel price at STIA also needs to be reconsidered.

Without using more money or resources, a more efficient operation can be achieved by STIA's administration through the use of quality management systems, and training of the existing personnel in order to make quality one of the pillars of all operations.

Using the existing workforce to perform daily surveys assessing the level of satisfaction of customers, as well as keeping in touch with airlines to determine their level of satisfaction, are all fundamental actions to know what services/processes need improvement.

Moreover, publishing comprehensive annual performance reports is part of having a commercial mindset. Transparency regarding revenues, costs and productivity, improve the airport's image on the eye of the public, airlines, and of its own employees. Publishing a full annual economic report is more than necessary for possible customers to see growth and willingness to continuously improve service.

### **8.1.3. Increasing Non-Aeronautical Revenues**

Although it is unlikely that STIA will become an Airport City in the short or medium term, it doesn't mean that ENASA can't implement certain methods used in that management model. At this point, since our main goal is to attract more airlines, there is a constraint on the aeronautical charges that can be imposed. Therefore, an alternative to subsidize aeronautical operations and upgrade the airport's infrastructure is by increasing non-aeronautical revenues.

After revising and defining the total amount of space that can be allocated for retailing and other commercial activities, the STIA's administration needs to analyze the segmentation of passengers in order to create services that are catered to their needs.

As seen before, tourists made up more than half the total passenger traffic in Sao Tome in 2016, a fairly homogeneous profile basically related to leisure and other similar guidelines: less preoccupation with travel time to the airport and demanding a series of specific services (e.g., food and beverage due to the scarcity of these in the vicinity of the airport, or because it is not always provided by airlines).

Ramírez [42] elaborated a list of relevant non-aviation services that should be available for passengers' convenience at an airport, of which STIA provides the ones marked in table 8-2. Besides the souvenir shop, the snack-bar, other concessions are needed in the context of a touristic airport.

**Table 8-2 - Non-aeronautical services available at STIA.**

Currency exchange		Snack Bar	X	Charger of electronic devices	
Car rental		Restaurant		Airport-city transport	
Parking	X	Fast Food		Taxi	X
Information		Playground		Medical services	
Showers		Stores	X	Police station	
WIFI	X	Boutique			

Typically, a concessionaire pays a fixed rental plus additional income to the airport once a predetermined profit level has been reached, but a strategy to encourage increased retail presence is to promote concessions entirely based on the profit of the concessionaire. Car rental and currency exchange, for example, are two of the most basic services needed, and which could benefit from being located at the airport.

- **Using the old terminal as a tourism resource**

In order to take advantage of the growth of tourism, a specific tourist product for history and aviation enthusiasts could be created. By partnering up with local tour operators, STIA's administration could create a route exploring the old passenger terminal's modernist architecture, as well as the 2 Lockheed Constellation aircrafts currently parked in the airport's surroundings, which were used for the humanitarian air-corridor based in São Tomé island during the Biafra War in the late 1960's [43].

Implementing this would require an investment of less than 5.000€ for rehabilitation of the building and marketing of the route. The investment would be recovered through the visitor ticket fees.

## **8.2.Reducing Costs**

In order to reduce operating costs, every resource and process at STIA has to be brought into question so to know if there is any possibility to eliminate or at least to simplify it. Every contract with a supplier has to be revised so as to adjust the service to a minimum. The two main areas which can be revised are introduced next.

### **8.2.1. Minimizing the cost of employees**

When it comes to employees, it's not quantity that matters, it is quality. Having 68% of total costs going into labor is a high value for an airport that subcontracts ground handling activities. Employee labor costs can be minimized by means of reducing the number of professional careers and training them to perform different tasks at the same time.

Training, specializing and motivating manpower is more profitable than having a large and inefficient workforce.

Moreover, there are flexible IT solution techniques which enable for evaluating alternative staff planning practices, e.g. by revising shift duties or by cross utilizing staff groups. Such procedural changes can lead to significant savings in staff costs and help the airport to make its operation more efficient.

### **8.2.2. Cutting energy bills**

One way to lower energy costs is by installing an on-site solar photovoltaic system, which gathers solar energy and cuts reliance on power imports from the grid. Solar installation is a long-term investment and its cost depends on how much electricity needs to be generated – a bigger system will cost more, because it needs more equipment as well as more labor to install and maintain it.

The installation of a 30kW solar power system to complement the energy supplied by the local Water and Energy Company (EMAE), for example, can cost around US\$70.000. For 120 to 140 solar panels (1,6 m x 1m each) at least 224 m<sup>2</sup> of space is needed. Depending on the current electricity rates in STP, such a system can save US\$15.000 worth of energy yearly, delivering a full return on investment within about 5 years and providing free electricity for the remainder of their solar panel system's 25+ year lifespan [44].

Aside from financial benefits, utilizing electricity from solar power would result in reduced consumption of fuels, thus reducing greenhouse gas emissions and pollution. By using this alternative source, STIA can express its participation in the battle against global warming and can reduce the country's dependence on foreign resources. Going green would not only reduce operation expenses but would serve as a great marketing tool. Having an environmentally responsible image is good, especially since STP's tourism vision is based on sustainability and ecotourism.

In conclusion, through increasing revenues and reducing costs, STIA would be able to provide a more efficient service at lower prices for airlines, making it possible for the airlines to offer flights also at lower prices, and therefore increasing passenger traffic. Under an efficient operation and a commercial mindset, increasing traffic means generating profits, which are ultimately bound for investing in infrastructure upgrade.



## 9. Conclusions

In light of the expected growth of demand for air travel in Sao Tome and Principe, together with prevailing difficulties to invest in the international airport's infrastructural and technological upgrade, the objective of this thesis was, first, to benchmark STIA's operational performance, in order to identify excess use of resources or potential areas for improvement and, second, to formulate guidelines to improve the airport's economic and productive performance.

Despite difficulties in finding official operational data about the peer group, the objective was met: it was possible to verify that, for the traffic level which is currently handled at STIA, there's room for improvement in terms of employee number, in terms of labor costs, as well as of the development of the non-aeronautical business unit. On the other hand, it was observed that the fuel prices applied are higher than the average of the airports which are part of STIA's route network, and that the international passenger service charge was the highest amongst island airports in Madeira, Azores, Cape Verde and The Canary's El Hierro Airport.

As a result of all that was seen, possible future actions were formulated. In order to obtain optimum efficiency of its small-scale airport installations, the airport's administration should not only rely on attracting new operators to increase air traffic, but also diversify economic activities and innovate in new models to secure new revenue. In what concerns cost reduction, every resource and process at STIA has to be brought into question so to know if there is any possibility to eliminate or simplify it. The recommended areas for revision were workforce and energy bills, for long term cost reduction.

As stressed by ACI [13], successful airports embrace a commercial mindset. A commercial mindset implies not only focus on providing better service at lower costs, but also transparency regarding revenues, costs, and productivity. Unlike major airports today, economic reports of STIA's administration were never published, which represented a major difficulty for the realization of the present work. The unavailability of data hindered a more comprehensive analysis of the airport's economic performance, especially before and after its concession.

Moreover, as noted before, the present work was aimed at bringing small but long-term improvements in managerial practices, allowing the airport to gradually move from financial dependence to self-sustainability and, ultimately, to being able to finance infrastructural upgrades like runway expansions or construction of new hangars. This means that the viability of business opportunities requiring large investment or major infrastructural changes were not in the scope of this thesis. There is still room for research in various areas, e.g. a viability study for the construction of an MRO facility, one of the opportunities identified in the SWOT analysis.

Finally, it cannot be stressed enough that determining the airport's current capacity and conducting a market research is crucial before investing in new infrastructure. What can and should keep receiving investments, however, are safety improvements. In order to evolve into a self-sustainable airport, STIA's connectivity, safety, infrastructure, efficiency will all play a major part.

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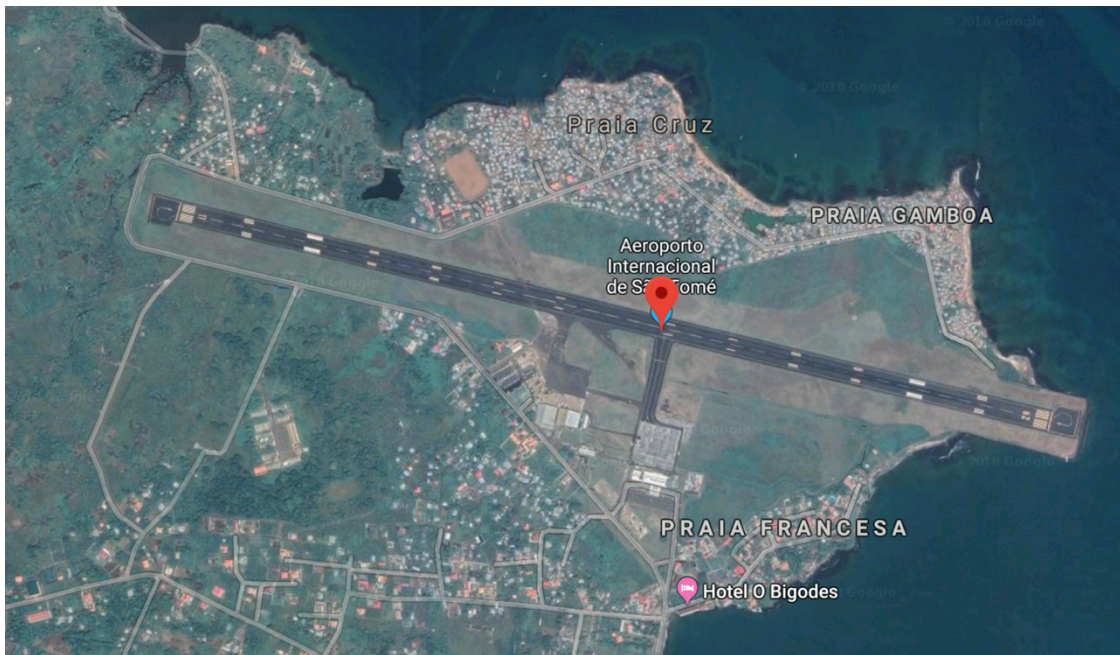
## APPENDIX

**Annex I** – Extent to which airports have used the following ways to communicate route development opportunities to airlines in 2014. Elaborated by Halpern and Graham [41].

	N	% Respondents				Mean	SD	Alpha if deleted
		Great extent	Some extent	Very little	Not at all			
Attend route development networking events	112	64	19	8	10	1.7	.993	.805
Meet airlines in their offices and present to them	112	55	24	12	9	1.8	.989	.799
Target a specific airline with a bespoke report	112	47	25	15	14	2.0	1.089	.797
Send marketing materials to airlines by email	112	32	39	16	13	2.1	.997	.790
Invite target airlines to visit the airport	112	31	42	19	8	2.1	.909	.799
Present itself on route development websites	112	30	22	17	31	2.5	1.230	.808
Hire a consultant to conduct activities	112	24	25	12	39	2.7	1.221	.838
Provide information on the airport website	112	16	26	34	25	2.7	1.017	.804
Send marketing materials to airlines by post/fax	112	6	17	30	47	3.2	.932	.816
Communicate with airlines via social media	112	4	20	22	53	3.2	.923	.799

Mean = 1 'great extent', 2 'some extent', 3 'very little', 4 'not at all'.

**Annex II** – Photos of Sao Tome International Airport. Sources: Google Maps, ENASA.





Carla Rebelo



## **Resum**

A mesura que els aeroports evolucionen de simples proveïdors de serveis aeronàutics a entitats empresarials competitives amb ànim de lucre, el mesurament de l'eficiència de l'operació aeroportuària sorgeix com una pràctica important que proporciona dades per a la identificació de possibles sobreusos de recursos i d'àrees de l'operació que poden millorar-se.

En aquest estudi, el rendiment operacional de l'Aeroport Internacional de São Tomé és comparat amb els d'un grup d'aeroports amb característiques de trànsit similars. Es comparen el nombre de passatgers processats per empleat, les tarifes i la distribució dels ingressos, utilitzant-se els resultats de l'anàlisi per formular estratègies destinades a millorar l'acompliment econòmic i productiu de l'aeroport.

## **Resumen**

A medida que los aeropuertos evolucionan de simples proveedores de servicios aeronáuticos a entidades empresariales competitivas con ánimo de lucro, la medición de la eficiencia de la operación aeroportuaria surge como una práctica importante que proporciona datos para la identificación de posibles sobreusos de recursos y de áreas de la operación que pueden optimizarse.

En este estudio, el desempeño operacional del Aeropuerto Internacional de Santo Tomé es comparado con los de un grupo de aeropuertos con características de tráfico similares. Se comparan el número de pasajeros procesados por empleado, las tarifas y la distribución de los ingresos, utilizándose los resultados del análisis para formular estrategias destinadas a mejorar el desempeño económico y productivo del aeropuerto.

## **Abstract**

As airports evolve from just service providers to competitive business entities, performance measurement of airport operation arises an important practice because it provides data that can be used to identify excess use of resources and potential areas for improvement within the operation.

In this study, Sao Tome International Airport's operational performance is benchmarked against those of a group of airports with similar traffic characteristics. The passenger throughput unit, service charges and distribution of revenues are compared and the results of the analysis are then used to formulate strategies aimed at improving the airport's economic and productive performance.