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NAV PORTUGAL'S PERFORMANCE WITHIN THE SINGLE EUROPEAN SKY INITIATIVE

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ABSTRACT

NAV PORTUGAL'S PERFORMANCE WITHIN THE SINGLE EUROPEAN SKY INITIATIVE

NAV Portugal is the Air Navigation Service Provider in Portugal, providing air traffic control services in the airspace under the country's responsibility. Recently, the company has been included in an initiative launched by the European Commission, called the Single European Sky. This aims for a unification of the European airspace, improving it in four main pillars: safety, capacity, environment, and cost-efficiency. To each of them, Key Performance Indicators need to be computed and monitored, all having pre-defined targets. The presented work project will be analyzing how NAV Portugal is doing in the pillar of capacity, proving suggestions if needed.

Keywords

Capacity	Flights
Arrivals	Delays

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INTRODUCTION

We live in a globalized world, where people are frequently travelling to other parts of the planet, whether due to professional issues, or just because they are on vacation. With the introduction of the first low-cost airline in 1973[1], air travelling has become a growing market, and nowadays people tend to fly more and more often, sometimes at cheaper prices than before. There are 867[2] airline companies all over the world, and the air traffic has even reached 31,116,727.0 registered departures worldwide in 2013[3].

Europe has one of the busiest air spaces (see Appendix 1), reaching over 27.000[4] flights per day. The European sky is organized in Flight Information Regions (FIR), each of them having an Air Navigation Service Provider (from now on mentioned as ANSP) responsible for it. However, having such burden of air traffic every day calls for the need of having the European air space organized in the best way possible, making its management more effective and avoiding its own overload. To work on this, the European Commission launched in the late 90s a project called Single European Sky. As the name suggests, this project would take all the divided FIRs in Europe and turn it into only one but more “efficient, competitive, safer”[5] and environmental-friendly sky. Participating in this initiative, each European country has been introducing the required Key Performance Indicators (KPIs) that will allow monitoring and evaluating these four pillars in each country’s air space, and that will have to meet previously specified targets, that may be flexible and customized to each country, within reasonable limits

[1] http://www.budgetairlineguide.com/
[2] http://www.flightradar24.com/
[3] http://www.worldbank.org/
[4] http://www.europarl.europa.eu/news/pt/news-room/content/20140129STO34174/html/O-que-%C3%A9-o-C%C3%A9u-%C3%9Anico-Europeu
[5] http://www.europarl.europa.eu/news/pt/news-room/content/20140129STO34174/html/O-que-%C3%A9-o-C%C3%A9u-%C3%9Anico-Europeu

and subject to acceptance of such modifications by the European Commission. These required KPIs then cover four areas: safety, environment, capacity, and cost-efficiency. The first one has to do with the incidents and accidents that may occur throughout the years, incidents being defined as safety rules that have been infringed but haven't resulted in any accident. The second area involves analyzing the efficiency per flight, taking into account the distance achieved and the fuel consumption and CO_2 emissions. As for the capacity area, the issue analyzed has to do with the time of the delays, whether it is on route or on arrival. At last, the cost-efficiency area approaches the relationship between costs and efficiency. This attempts to guarantee that the targets in the remaining three areas are met, without having excessive costs that would turn the company inefficient.

One of the countries that are currently participating in the Single European Sky initiative is Portugal, with NAV Portugal. The company is responsible for the Portuguese air traffic control; it has two FIRs under its responsibility, Lisboa and Santa Maria, which are able to cover the sky above the continental territory and the islands.[6] This service is provided in compliance with both national and international regulations, therefore assuring "the best safety conditions, optimizing capacities, and emphasizing efficiency while not neglecting environmental concerns"[7]. Just like the other European ANSPs, NAV Portugal will also be responsible for introducing the required KPIs for the four previously defined pillars of the project, monitoring them, and making sure they will meet the previously specified targets for each – if the company fails to meet the target, it will be penalized, but if it does even better than the required, it receives a bonus.

[6] http://www.nav.pt/
[7] http://www.nav.pt/

METHODOLOGY

The methodology followed along this thesis fits a case study model. “In general, case studies are the preferred strategy when "how" or "why" questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context.” (Yin, 1989). In fact, the goal of this work project is to analyze how NAV Portugal is doing in terms of the required yearly indicators and whether or not the company will be meeting the targets defined by the Single European Sky initiative, in the reference period that starts in 2015 and ends in 2019. Due to data availability and confidentiality concerns of the company, this analysis focuses only on the indicators that refer to capacity. In this framework, there are two required KPIs[8]:

1. The average minutes of *en route* ATFM (Air Traffic Flow Management) delay per flight attributable to air navigation services, which has a target of 0,12 minutes of delay per flight;
2. The average minutes of arrival ATFM delay per flight attributable to terminal and airport air navigation services and caused by landing restrictions at the destination airport, which has a target of 0,6 minutes of delay per arrival.

Besides the main goal of understanding whether the company will be achieving the defined targets, this developed works aims to answer questions such as: how does the organization of the airspace impacts the results of KPI 1; and how does weather impact the company’s performance in KPI 2.

[8] **COMMISSION IMPLEMENTING REGULATION (EU) No 390/2013 of 3 May 2013** laying down a performance scheme for air navigation services and network functions

At this point, it has become clear that this work project will focus mostly on quantitative data. As stated by Woodside and Wilson (2003), “While case study research is associated often in the literature with using qualitative research methods, we advocate viewing case study research as *not* being restricted to one set of research methods. Quantitative methods (…) are appropriate for many case study research studies.”. The first phase involves “gathering a considerable volume of data from within an organization to develop the clearest possible picture of the phenomenon” (McCutcheon and Meredith, 1993). According to the same authors, it is also important to notice that in the situation of case studies like this one, “the researcher usually has little or no capability of manipulating events”.

For the first KPI, the data collected includes the total number of flights, the number of delayed flights, and the minutes of delay, all per month and summed per year, from 2010 to the end of the first trimester of 2015 (Extra File 1). For the second KPI, the registered information records the minutes of delay caused by restrictions to landing, and the number of arrivals per airport, all per month and again summed per year, ranging from January 2008 to December 2014 (Extra File 3). However, this information does not include the movements in the islands, since that to participate in this initiative a minimal record of movements per day in a FIR is mandatory, and the islands do not correspond to such requirement.

Once having the historical data needed to compute each indicator, I needed to make some kind of approximation for future values of this information, given that the Single European Sky initiative’s reference period was defined to be up to 2019, and until then future values to calculate the indicators remain unknown. For this, I computed linear regressions that would explain in the best way possible the variance of the data, and was able to compute an estimation of the upcoming values (Extra Files 2 and 4).

"The case study's purpose may be strictly to describe a situation but, more often, it is to understand how or why events occur" (McCutcheon and Meredith, 1993). Hence, once I had both historical and estimation of future data, both indicators were calculated for each possible year until the end of 2019. Afterwards, the computed values were used to plot graphs showing the indicators' progress to better understand what their trend is looking like. Besides this, by plotting as well the line that corresponds to the target set for NAV Portugal for each indicator, I was able to analyze whether or not the company was evolving to meet the objectives in each year of the reference period. Before drawing any conclusions, I also plotted a few variants of the indicators (e.g., excluding variables or analyzing the monthly data instead of annual) that allowed me as well to explore the reasons that may be causing the presented trends of the indicators.

As for the final part of the work project, a more qualitative process was followed, considering that "(…) the researcher may take an interpretive approach in understanding and explaining the data (…)" (McCutcheon and Meredith, 1993). As a consequence of the results found, I was able to make comments regarding the outcomes and provide recommendations for the company to meet the targets set within the project. This allowed me to discuss and answer the research questions that I previously defined, drawing actual conclusions for the carried work project.

LITERATURE REVIEW

As mentioned previously, this work project refers to a very specific initiative, the Single European Sky, designed explicitly for the countries within the European Union (EU) and for each of their ANSPs. Because of this extremely precise nature of this plan, there have not been made any papers or studies concerning the Single European Sky initiative. Nonetheless, it is both possible and interesting to find and analyze several studies made concerning the main consequence that I will be examining throughout the present work project: delays in the air travel industry, and what has been happening at this level over time.

To start, it is imperative to understand the importance of this industry. "Mobility of passengers and goods is an essential basis for the development of economic market structures resulting from the spatial dislocation of production facilities and labor in industries as well as in services and retail trade. Adequate systems and capacities are mandatory to serve the demand for transport." (Bubalo and Daduna, 2012).

Precisely due to the remarkable utility of the air travel industry, this one has been growing a lot over the years. In fact, "between 1960 and 2011 worldwide scheduled passenger air travel grew from 109 billion passenger-km traveled to 3.7trillion – an average growth rate of over 7% per year (…). Forecasts for future growth are also high." (Evans and Schäfer, 2014). To go along with such fast growth, "(…) increasingly sophisticated efforts are being made to improve the efficiency of the air transportation system." (Andersson, Hall, Atkins, and Feron, 2003).

However, despite the considerable efforts made, and again according to Evans and Schäfer, "such growth in air traffic would also produce significant impacts, including airport and airspace congestion (…)”. One of these impacts is in fact what will be approached throughout this work project: delays. “Delays at airports have become a very common problem worldwide” and “in 2005 over 20 per cent of all intra-European flights leaving from these airports departed more than 15 min later than their scheduled departure time.” (Santos and Robin, 2010). This problem tends to achieve even bigger proportions considering that airports depend on each other; destination airports depend on origin airports, and so on. Therefore, “Delays at any specific airport may impact delays at other airports in the network, as aircraft execute their daily flight schedules (or “itineraries”) by flying from one airport to another.” (Pyrgiotis, Malon and Odoni, 2013).

Obviously, these increasing delays have financial consequences and have “caused airlines and passengers billions of dollars each year” (Zou and Hansen, 2014). In fact, not only these “flight delays are costly”, but also “(…) like any other form of waiting for service, may negatively affect customers (passengers) in many ways. Delays can increase passengers’ anger, uncertainty, and dissatisfaction provided” (Bishop, Rupp and Zheng, 2011), which is not something that a company wants to have.

We should not forget that due to its dimension, airspace is one extremely difficult task to be competently managed. “Air traffic management fills the real-time role of ensuring that airplanes and passengers travel safely and efficiently from the departure airport, through the airspace, to their destination.” (Sud, Tanino, Wetherly, Brennan, Lehky, Howard and Oiesen, 2009). Although this seems quite simple, there are several components that may interfere within this process along the way, as I will now describe throughout the analysis of this work project.

ANALYSIS

There are several possible reasons that may lead to plane delays, whether at the airport or *en route*.

Weather, per example, is one of them. Although when a plane is already up in the air it is not very likely to be affected by this factor, when it is on the ground waiting to take-off or approaching the airport to land, lack of visibility is not wanted. This means that when there is an extremely rainy or foggy day, planes need to wait for better visibility to take-off or land, therefore consequently causing delays.

Another reason, per example, is **Air Traffic Control (ATC) Capacity**. Due to its importance, the airspace is extremely well structured and organized into sectors.

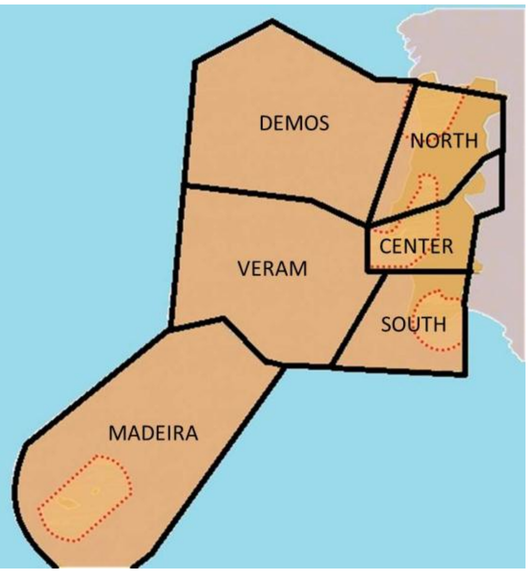


Image 1: NAV Portugal's sectors.

As represented in Image 1 above, there are six sectors under NAV Portugal's responsibility: sectors DEMOS, VERAM, SUL (South), MADEIRA, NORTE (North) and CENTRO (Center). The last two sectors may also be subdivided into two sectors each, between UPPER (North Upper and Center Upper) and LOWER (North Lower and Center Lower); this distinction is made considering the altitude they cover, meaning that the former covers the air space until 34.500 feet and the ladder covers from there upwards. The controllers have a maximum of planes to control, which depends on the sector they are working on; still, if there is a maximum limit of planes to lookout for, and if there is a higher demand than that limit on certain hours, some of those flights on such hours will have to be delayed to cross the sector when they will not be exceeding the capacity.

ATC Staffing is also a factor for delay; if for some reason there are less air traffic controllers available to work at a certain day (or specific time of the day), it is not possible to overload the ones that are working with the remaining flights, and consequently these will have to be delayed.

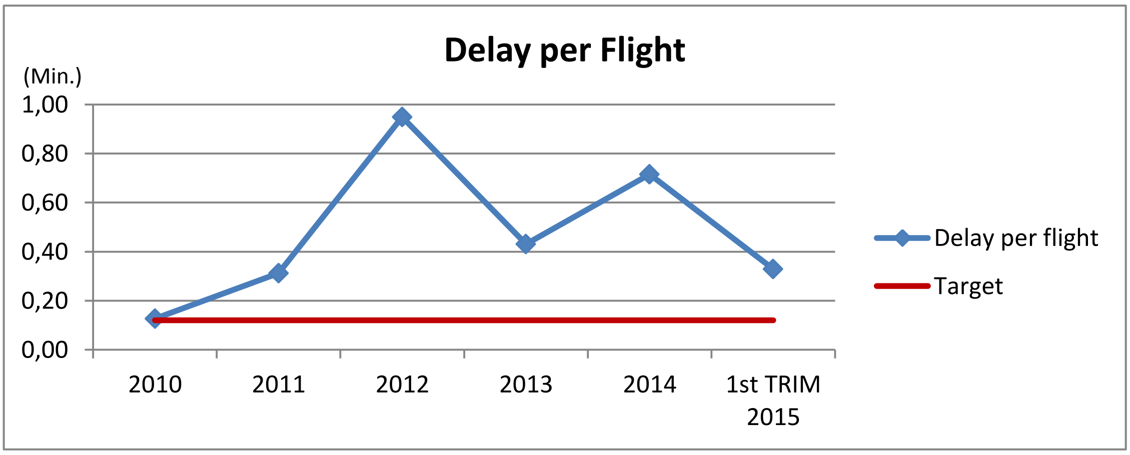
ATC Equipment is as well responsible for causing delays. This is characterized by the equipment needed for air traffic service to be provided, which includes radars, per example; obviously, these are essential materials for a plane to start and end its flight appropriately, thus without them flights need to be delayed.

Construction work on the runway or **systems failure** at the airport are also examples of situations that may also cause delays on arrivals and departures.

Having so many factors contributing for the delays, it becomes important to evaluate and understand how capacity is being affected and if Portugal is being able to meet the targets set by the Single European Sky initiative.

KPI #1

For the first indicator, relevant data was collected since 2010 (excerpt shown in Appendix 2, complete information in Extra File 1 – KPI 1), which includes all information about the number of flights, number of delayed flights, number of minutes of delay, and mean of delay per flight (KPI number 1) – all monthly and annually. Considering that 2015 is not a concluded year, I took into account the first trimester of this year.



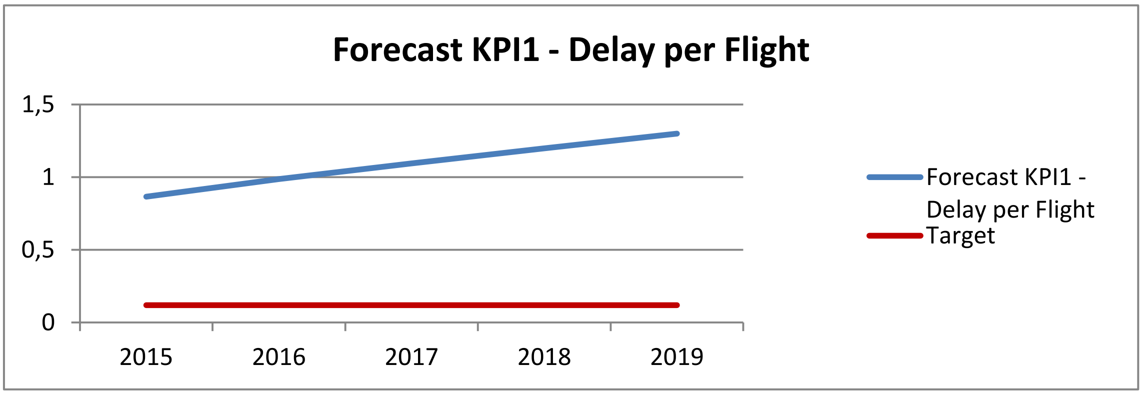
Graphic 1: Delay per Flight, per year.

By plotting the KPI in Graphic 1, we are able to understand that it is a quite oscillating trend – however, it is important to notice that even though this seems an extremely irregular indicator, this oscillation is in a range of one minute only. Nonetheless, if we take an average of all months in the presented years of the KPI, we will reach a value of 0,51 minutes of delay per flight, which is much more than double the target set by the Single European Sky for this indicator in Portugal, of 0,12 minutes of delay per flight, represented by the red line.

To forecast how NAV Portugal's first KPI would evolve until the end of the reference period, I ran regressions. I started by forecasting the minutes of delays, and to do so I tried to run several different regressions. I began with a normal regression using the overall available information per month as a whole, which ultimately had a low explained variance (R^2) of only 14,15%. After this, I tested a seasonal regression by dividing the available data by quarters, which presented the same problem of having a low R^2, 28,60%, although this value was slightly higher than the previous one. Insisting on finding a better R^2, I ran again a seasonal regression, only this time divided by semesters. This resulted in an increase of the R^2 to 34,33%, which, despite having improved, still was not enough. I decided to try a third seasonal regression, only this time I divided the periods in the apparent cyclical logic that was represented over the years (January-May, June-August, September, and October-December). Although this seasonal analysis resulted in an increase of the R^2, this was only a small one to 36,36%. Remaining unsatisfied with these results, I tested another option that consisted on running twelve regressions, one per month. This meant that I would be using a sample size of only 5 months for each monthly regression, considering that the complete data available for all months of the year was from 2010 to 2014. Although this had resulted in months with a very low R^2 (such as May per example, with a variance explained of only 0,70%), this was also the option that presented the best and highest results for other months (February and September, per example, showed an R^2 of 76,96% and 70,68%, respectively). Ultimately, due to the presence of monthly regressions with a much better R^2 than any of the previously ran, I decided that this last one would be the one to use for computing the forecasts of the minutes of delays.

After having this calculation done for the rest of the reference period, I started to run a regression to predict the total number of flights. Again, a normal regression was ran and presented an R^2 of only 11,78%. This being a low value, I ran a second regression, a seasonal one divided by quarters. With an R^2 of 53,89%, I chose to use the second regression to compute the predictions of the number of flights.

Having both predictions for minutes of delays and number of flights, the forecasts for the delay per flight KPI were computed (excerpt shown in Appendix 3, complete information in Extra File 2 – Forecast KPI 1), as presented in the graph below.

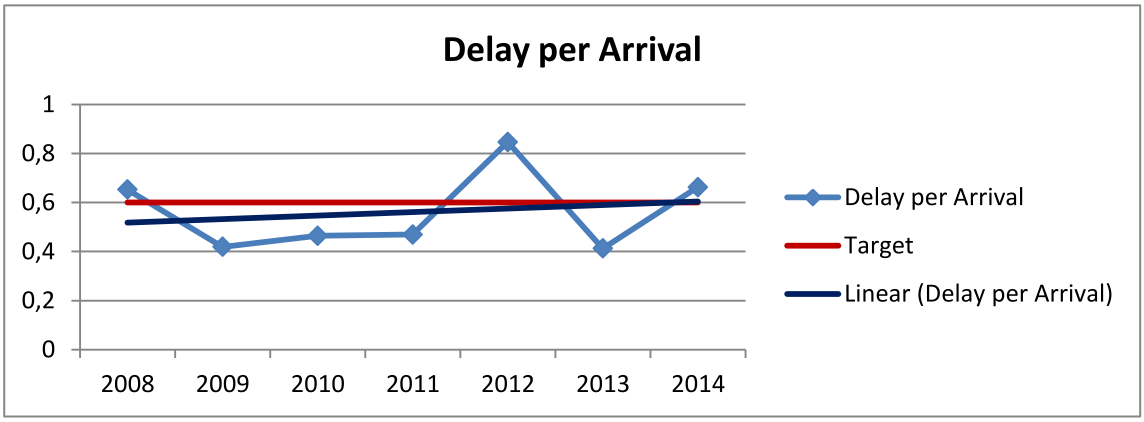


Graphic 2: Delay per Flight, forecast per year.

By looking at Graphic 2, it is clear that the trend of the company is to keep increasing the value of this KPI, becoming further away from meeting the required target (in red) throughout the reference period until 2019.

KPI #2

For this indicator, the available data ranges from the beginning of 2008 until the end of 2014. As previously mentioned, this KPI analyzes the delay per arrival at the airports, including the minutes of delay generated by all causes but exceptional events, which means that previously mentioned causes (such as weather and ATC Capacity) are therefore included in the calculation (excerpt shown in Appendix 4, complete information in Extra File 3 – KPI 2).



Graphic 3: Delay per Arrival, all causes included excluding exceptional causes, per month.

As we can see from Graphic 3, the evolution of the delay per arrival has been an oscillating but still increasing trend throughout the seven years of historical analysis (trend line in dark blue), and in 2014 the KPI was registered at 0,66 minutes of delay per arrival, which failed to meet the target set of only 0,6 (represented by the red line).

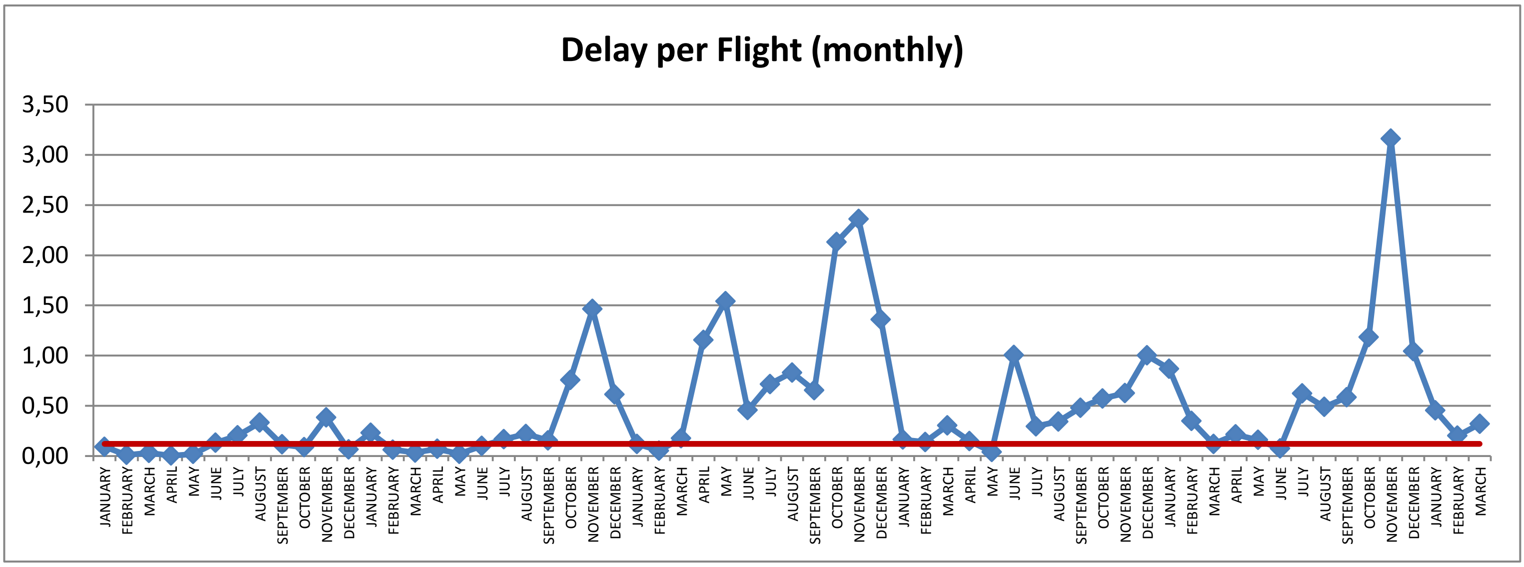
In order to try to understand whether or not such failure will happen again in the future, I ran regressions to be able to compute forecasts (full information on Extra File 4 – Forecast KPI 2). I started by running a normal regression for the number of arrivals per month, but, because this provided only an R^2 of approximately 10,44%, I decided to run a seasonal regression, establishing groups that apparently followed some sort of trend throughout the years. To do so, I grouped the months in five groups: January-February, March-June, July-August, September-October, and November-December. Although this regression provided a higher R^2 of 38,79%, I still tried to look for better results and computed a regression for each month of the year. Despite this providing me a low $R^2$to some months, such as 0,04% and 4,54% to March and January (respectively), it still provided me with much higher R^2 for other months, like 78,33%, 76,57%, and 82,28%, to September, July and August. Because these were the highest values I was able to find, these monthly regressions were the ones I decided to use to compute the forecasts of the number of arrivals.

After this, I started to try to compute meaningful regressions to forecast the minutes of arrival delays. In total, I computed a normal regression, a biannual regression, monthly regressions, a four-month period regression, and six different seasonal regressions that grouped the data into different periods that should make sense. However, among all these tested possibilities, the highest R^2 found was one of 16,67% for the monthly regression of February, which is obviously not good enough. This problem arises from the fact that there is no clear trend of the minutes of arrival delays along the seven-year presented data, which makes any shot of predicting the future extremely uncertain. Consequently, due to the insecure nature of the data provided, I was not able to make any reliable predictions for this KPI until the end of the reference period, and therefore drew conclusions only from the presented trend throughout the years of analysis. Considering that the target set for this indicator was a delay of 0,6 minutes per arrival, it is fairly obvious that if the company's trend in this indicator keeps evolving has it has been increasing since 2008, it will probably fail to meet the target throughout the reference period of the project, presenting a higher delay per arrival than it should.

RECOMMENDATIONS

KPI #1

As previously presented before, this KPI is currently not likely to meet the target set by the initiative, nor will it in the future, based on the computed predictions. To try to understand why this is happening, it is possible to disaggregate the available data from 2010 to the first trimester of 2015 in months and spot when the peeks of the KPI happened.



Graphic 4: Delay per Flight, per month.

By plotting such decomposition of the data on a monthly basis as in Graphic 4 above, it is quite easy to notice that there are a few periods when the delays oscillated a lot. By crossing this information with the data available in Extra File 5 – Delays per Cause, it is detectible that the majority of the delays imposed by the registered regulations are caused by ATC Capacity (graph with all causes presented in Appendix 5). To overcome this major problem, there are two recommendations that could be followed by the company and that could eventually result in a better performance in this KPI. The first one would be to redesign the sectors.

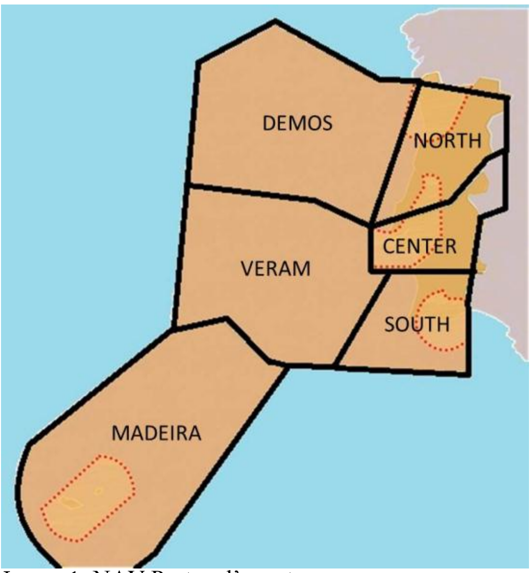


Image 1: NAV Portugal's sectors.

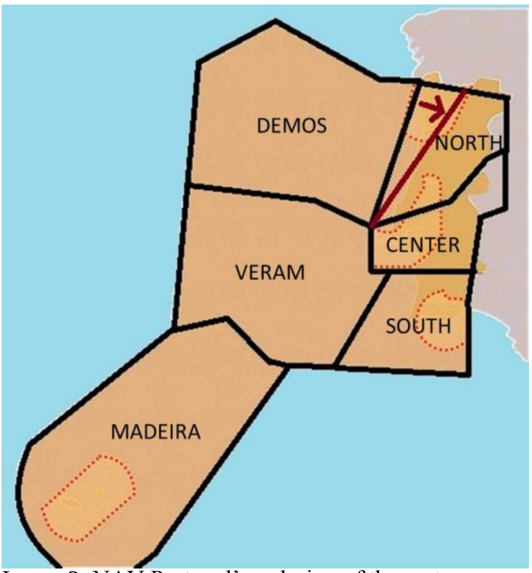


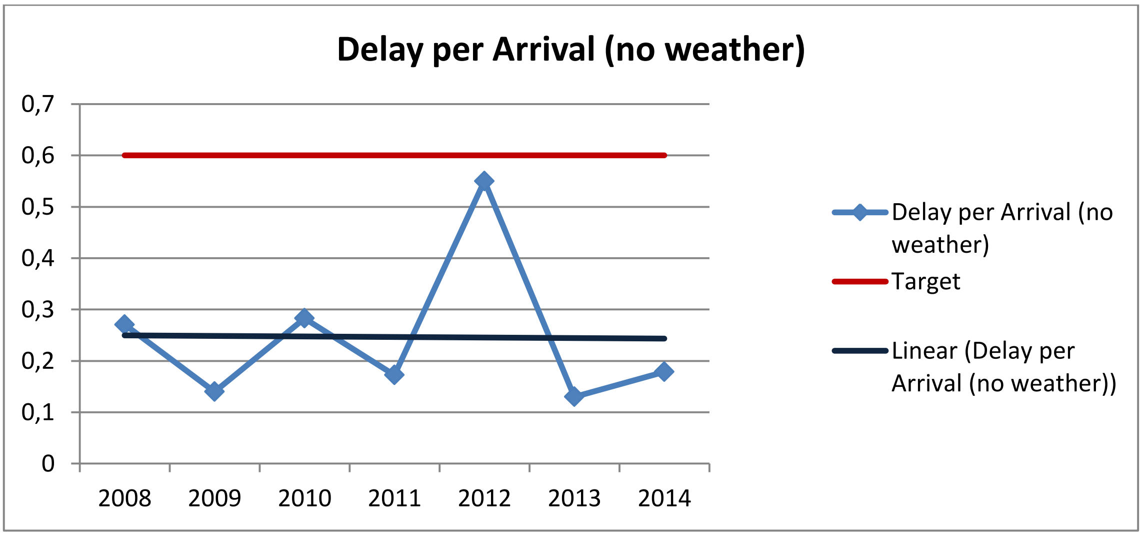
Image 2: NAV Portugal's redesign of the sectors.

If the DEMOS sector was expanded to the right on its northern right frontier (as shown from Image 1 to Image 2 above), it would cover several flights that cross the north side of the country and are currently covered by NORTH sector. Mainly due to departures and arrivals in the country's airports, this ladder sector is an extremely busy one, so if the former sector widens its northern right border to the right, it would be relieving capacity in the NORTH sector, avoiding this one to be excessively busy and saving possible minutes of delay.

The second recommendation for this KPI would be to turn the UPPER and LOWER sectors limits dynamic. As mentioned previously, these two sectors are divided at a height of 34.500 feet, and each one of them has its own capacities. Transforming this limit into a flexible one would allow the air traffic controllers to adapt the division limit according to the demand at a given time for both the UPPER and LOWER sectors, avoiding to have unused capacity in one while the other one could be reaching overload. Consequently, this would allow the company to optimize the available space and ultimately avoiding unnecessary minutes of delay being caused by a higher concentrated capacity.

KPI #2

As mentioned throughout the analysis, this indicator presents an increasing trend for the last seven years, and has already exceeded the target in 2014. Among the several causes that lead to the registered delays, it is important to remember that there is one that is not controllable – weather. This is the only cause one has absolutely no influence in and is unable to improve it, and therefore, by removing this variable out of the KPI analysis, it is possible to study how the company is doing in this indicator among the controllable factors (excerpt shown in Appendix 4, complete information in Extra File 3 – KPI 2).



Graphic 5: Delay per Arrival, excluding “Weather” variable, per month.

If we exclude the weather variable, it is possible to see in Graphic 5 that the delay per arrival decreases a lot per year. In fact, it becomes a decreasing trend, and in some cases, the delay per arrival decreases by even more than half than it was before.

This allows us to understand that weather is probably the main cause for the delays in the arrivals. Obviously, stability and visibility are extremely important conditions that need to be met while taking-off and landing, and rainy, windy or foggy days certainly have an impact on the entrances and exits of planes at the airports. More importantly, although still an irregular trend, this KPI would be much lower than the target set of 0,6 minutes per arrival, meaning that if the weather was not taken into account when calculating this indicator (but rather just including the variables that are controllable), NAV Portugal would be doing a lot better in this indicator.

Perhaps a reasonable recommendation for this KPI would be for the company to try to renegotiate the target assigned to it, alleging that it is unrealistic, and should be increased in order to cover the delay effects that arise from the characteristic weather in Portugal.

CONCLUSIONS

Throughout this work project, the required KPIs within the Capacity area of the Single European Sky initiative were computed for the reference period ending in 2019, using the available data to reach both the historical and forecasted values of each indicator.

For the first KPI, Delay per Flight, one reached the conclusion that the indicator's values throughout the years have been much higher than the target set of only 0,12 minutes of delay. Besides this, the historical data allowed to compute forecasted values of the indicator until 2019, which show an increasing trend, therefore the company being further away than the targets that were set by the European Commission for this project. As stated throughout the analysis, ATC Capacity was registered as the main reason of the minutes of delays. This shows that the way the airspace is organized may be having an influence on the results of NAV Portugal in this indicator, and therefore the provided recommendations aim for reorganizing the airspace's structure in order to improve the ATC Capacity and reducing minutes of delay per flight.

Concerning the second KPI, Delay per Arrival, the company is doing better than in the first one but it is still not perfect. NAV Portugal presents an increasing trend in this indicator throughout the available historical data, which, if continued in the future, will be exceeding the target set of 0,6 minutes of delay per arrival. However, when analyzing the indicator including only the controllable variables (i.e., excluding weather), it is noticeable that the company is actually doing much better. Consequently, the recommendation given was that it may be necessary for NAV Portugal to renegotiate the target that was attributed, asking for a higher one that takes better into consideration the weather in Portugal.

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COMMISSION REGULATION (EU) No 691/2010 of 29 July 2010 laying down a performance scheme for air navigation services and network functions and amending Regulation (EC) No 2096/2005 laying down common requirements for the provision of air navigation services

COMMISSION IMPLEMENTING REGULATION (EU) No 390/2013 of 3 May 2013 laying down a performance scheme for air navigation services and network functions

http://www.budgetairlineguide.com

http://www.flightradar24.com

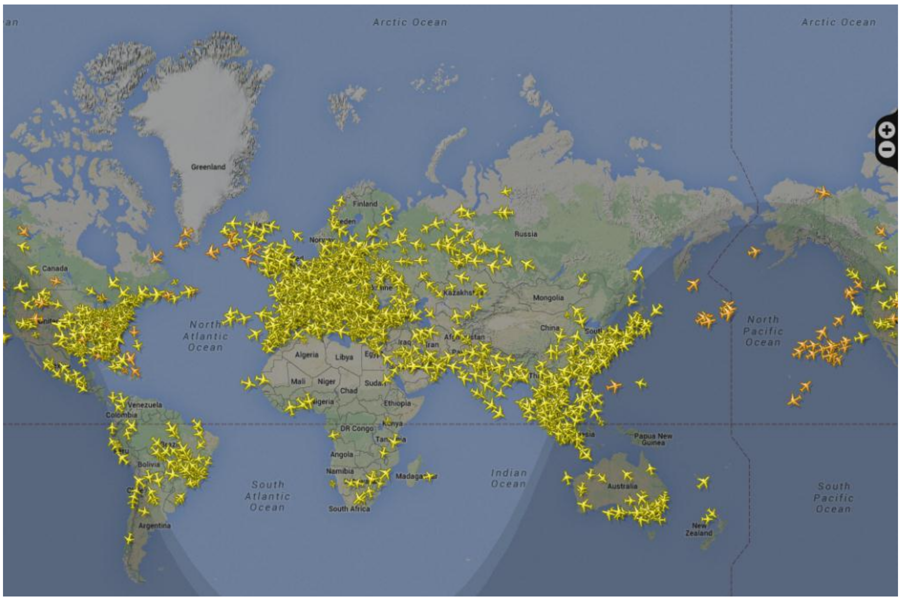
http://www.worldbank.org

http://www.europarl.europa.eu

http://www.nav.pt

APPENDICES

APPENDIX 1 Credit: Flight Radar 24 – Live Air Traffic (12 p.m.)



APPENDIX 2 Excerpt from Extra File 1 – KPI 1

Period	Total flights	Nb of Delayed Flights	Total Delay (min.)	Delay per Flight (min.)
2010	400.441	1.997	50.965	0,13
2011	420.862	6.885	131.554	0,31
2012	410.259	20.150	389.532	0,95
2013	419.698	9.352	180.896	0,43
2014	448.512	17.566	320.999	0,72
1st TRIM 2015	105.614	2.007	34.797	0,33

APPENDIX 3 Excerpt from Extra File 2 – Forecast KPI 1

PERIOD	FLIGHTS	DELAYS	KPI (min/flight)
TOTAL ANNUAL 2015	441.732	382.376	0,87
TOTAL ANNUAL 2016	456.053	1.215.306	0,99
TOTAL ANNUAL 2017	465.078	509.494	1,10
TOTAL ANNUAL 2018	474.103	568.435	1,20
TOTAL ANNUAL 2019	483.127	627.376	1,30

APPENDIX 4 Excerpt from Extra File 3 – KPI 2

Year	Arrivals	Arrival Delay (min.)	Arrival Delay (Weather)	Arrival Delay (No weather)	Delay per Arrival	Delay per Arrival (no weather)
2008	100.571	65.698	38.464	27.234	0,653249943	0,270793768
2009	94.499	39.605	26.366	13.239	0,419104964	0,140096721
2010	99.386	46.157	18.051	28.106	0,464421548	0,28279637
2011	102.060	47.909	30.301	17.608	0,469419949	0,172525965
2012	101.353	85.827	30.083	55.744	0,846812625	0,54999852
2013	102.728	42.373	28.996	13.377	0,412477611	0,130217662
2014	110.066	72.941	53.260	19.681	0,662702379	0,178810895

APPENDIX 5 Graph from Extra File 5 – Delays per Cause