

## **Air Transport**

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**Assessment Cover Page**

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**Declaration**

By submitting this assessment, I confirm that I have read the CCT policy on academic misconduct and understand the implications of submitting work that is not my own or does not appropriately reference material taken from a third party or other source.

I declare it to be my own work and that all material from third parties has been appropriately referenced.

I further confirm that this work has not previously been submitted for assessment by myself or someone else in CCT College Dublin or any other higher education institution.

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# Introduction

In this study, relevant air traffic data will be analyzed, including increases and decreases in the years following 2024, to understand growth and reduction rates in passenger and cargo flights, among other metrics. This will provide a deeper understanding of patterns and major congestion routes, allowing for developing improvement strategies through data analysis.

Additionally, the study will outline the objectives to be achieved through advanced analysis of the main factors causing flight delays and cancellations, along with their possible causes based on statistical reviews. This will help determine how these factors or patterns might be reduced based on the predictions of the present study.

An analysis of CO2 emission levels generated by air transport will also be conducted, as this is currently a challenge due to the increase in travel, which in turn raises emissions and impacts climate conditions. This analysis will aim to understand how aviation emissions can be reduced or controlled.

Finally, the path to completing the air transport data analysis will be outlined. This will be divided into two semesters, detailing the steps to be followed in each phase, including the analytical processes involved and those that will be excluded for various reasons.

# Title : Analysis of Air Transport Traffic for Route Optimization and Its Impact on CO2 Emissions.

## **Problem Definition:**

After the pandemic, air transport showed a recovery in both passenger and cargo flight volumes; however, numbers remain lower compared to 2019. The increase in flights also brings a rise in CO2 emissions.

In the first months of 2024, there was an increase in flights in most EU countries. According to Eurostat, “ During the first three months of 2024, 198 million passengers were transported across the EU, an 11.5% increase compared to the same period in 2023. International non-EU transport accounted for 50.1% of all passengers transported” (Eurostat Statistics Explained, 2024).

Currently, the number of flights in air transport is on the rise; however, this increase has led to more delays for airlines. Issues related to flight punctuality, delays, and cancellations are among the main data analysis points airlines focus on when aiming to improve customer satisfaction through strategic measures. Another issue arising from this increase is CO2 emissions, which impact the environment.

Interfaz de usuario gráfica, Texto, Aplicación, Tabla

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## **Objectives**

The main objective of this study is to identify the busiest air traffic routes from 2022 to 2024, following the pandemic, and to compare the years. This aims to identify and predict factors such as

* Analyzing the main factors influencing delays and cancellations in air transport to optimize routes.
* Examining CO2 emissions impacting climate conditions to implement improvement and prevention techniques.
* Proposing improvements based on air transport data analysis to achieve route optimization and explore potential sustainable solutions.

Gráfico, Gráfico de barras

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Figure 2: Air passenger transport, 2022(%change compared to previous year) Source: Eurostat (online data code: avia\_paoc)

Gráfico

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Figure 3: Air passengers transport, EU, January 2023 – March2024 Source: Eurostat ([Avia\_paoc](https://ec.europa.eu/eurostat/databrowser/view/avia_paoc/default/table?lang=en))

## **Scope:**

This capstone project will be developed over two semesters. In the first semester, resources will be analyzed to gather data for air traffic analysis aimed at route optimization. In the second semester, this data will be analyzed to obtain predictions, patterns, and possible areas for improvement.

**Data Sources:** Historical data will be obtained from data.cso.ie, Eurostat, and CRISP-DM, enabling analysis and evaluation. Open air traffic data sources include Eurostat Statistics Explained.

**Analysis Tools:** Jupyter Notebook and Pandas for data handling and cleaning.

**Analysis Process:**

1. **Data Collection:** Exploratory Data Analysis (EDA).
2. **Data Cleaning:** Relevant data will be identified and processed. For air traffic analysis and route optimization, we will collect flight information and air traffic data, such as airport congestion, delay times, and cancellation causes (e.g., weather conditions, geographical data). Another key aspect of data cleaning will be the removal of incomplete, empty, or duplicated data.

Modelado:

Algorithms are used for route optimization, delay prediction, and pattern analysis based on historical data. These algorithms detect the likelihood, probability of delays due to external factors such as weather conditions.

* Main congested routes.
* Factors influencing delays.
* CO2 emissions derived from historical data.

Applications**:**

* Predicting potential flight delays.
* Route optimization.
* Flight congestion analysis.
* CO2 emissions analysis.

### Expected Results:

The data analysis will identify the routes with the highest traffic and pinpoint the key factors influencing delays and cancellations. This information will enable us to propose effective route optimization strategies and implement measures for emission reduction.

### Project impact:

This analysis is anticipated to have a positive impact on airlines by facilitating cost reductions, minimizing delays, optimizing routes, and enhancing sustainability through a reduction in CO2 emissions.

### Inclusiones

|  |
| --- |
| * Collecting and Analysing Data. * Cleaning data * Exploratory Data Analysis (EDA) * Visualisations data; charts Visualisations * Models’ development and evaluation * Predictions and recommendations |

### Exclusiones

Limitations

1. Limited data access because incomplete data or outdated data sets may be found.

2. Analyzing large amounts of data can be complex and require more resources.

3. Difficulty in implementing points of improvement when external factors such as the policies of the departments in charge of regulating airlines are presented.

### Cronograma:

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| --- | --- |
| **1 semester** | |
| **1 trimester** | **2 trimester** |
| Data collection: The data sources will be used to gather historical data, which will enable analysis and visualisation. “Exploratory Data Analysis (EDA) will help analyse the data appropriately, avoiding assumptions, identifying errors, and visualizing the data” (OpenAI, 2024).  Data cleaning: It is crucial to ensure that the data being used is accurate and complete during the cleaning process. This aims to eliminate incomplete records. | Exploration and analysis: Exploratory Data Analysis (EDA) where charts can be used to visualize potential patterns.  Identify routes with the highest traffic or congestion, as well as external factors such as weather conditions. |

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| **2 semester** | |
| 1. **Month** | Advanced analysis: During this period, data analysis will be explored in depth. |
| 1. **Month** | Model development: Algorithms will be used to optimize routes and suggest improvements for flights. |
| 1. **Month** | Model evaluation: Proceed with evaluating the models used to identify patterns, delays, cancellations, distribution, and the models used to estimate CO2 emissions. |
| 1. **Month** | Visualization in tools that allow data exploration: Maps will be used to visualize routes with the highest traffic. |
| 1. **Month** | Predictions. Solutions and recommendations based on the results obtained from the data analysis |
| 1. **Month** | Interpretation of results and report generation: Project impact such as improvements in punctuality and reductions in CO2 emissions. Presentation of the final project |

Escala de tiempo

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# Data Sources

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| --- | --- |
| **Title** | **Dataset** |
| Air transport | Eurostat: https://ec.europa.eu/eurostat/data/database |
| Air Travel Statistics | CSO: <https://data.cso.ie/table/ASM01>  <https://data.cso.ie/table/ASA01> |

# Ethical Considerations

This project does not involve medical data, and it respects confidentiality and user privacy. It utilizes publicly available data.

Transparency in data usage is a priority.

Only the information necessary for research and analysis will be used. Quotes, images, and references will be provided in accordance with Harvard referencing guidelines.

# References

Bureau of Transportation Statistics (2024) *Understanding the Reporting of Causes of Flight Delays and Cancellations.* Available at: <https://www.bts.gov/topics/airlines-and-airports/understanding-reporting-causes-flight-delays-and-cancellations#q1> (Accessed: 19 October 2024)**.**

Eurostat Statistics Explained (2024) *Air passenger transport - data by month.* Available at*:*https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Air\_passenger\_transport\_-\_data\_by\_month#In\_the\_first\_3\_months\_of\_2024.2C\_there\_were\_198\_million\_air\_passengers\_carried\_at\_EU\_level.2C\_an\_11.5.25\_increase\_compared\_with\_the\_same\_period\_in\_2023 (Accessed: 20 October 2024).

Eurostat Statistics Explained (2024) *Air transport statistics.* Available at: <https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Air_transport_statistics#Number_of_passengers_transported_by_air_increased_to_820_million_in_2022> (Accessed: 20 October 2024).

OpenAI. (2023). ChatGPT (Mar 14 version) [Large language model].

<https://chatgpt.com/share/6713ac1e-146c-8010-99d8-92db0e4ce236>

https://chatgpt.com/share/671d2884-57b0-8010-8f06-8f90c26c3fe8

Github: https://github.com/Mariferq05/Caso-proposal/blob/main/Capstone%20Project%20Air%20Transport%20.docx