

# GROUP-1

**The effects of delays and your customer satisfaction.**

**JANUARY 2024**



# Meet the team



**Blake Medwed**

- USDC  
Analyst Strategy/Analytics
- Gilbert Arizona
- Been at the firm for  
7 months



**Ahmed Isse**

- USDC  
Analyst Strategy/Analytics
- Gilbert Arizona
- Been at the firm for  
7 months



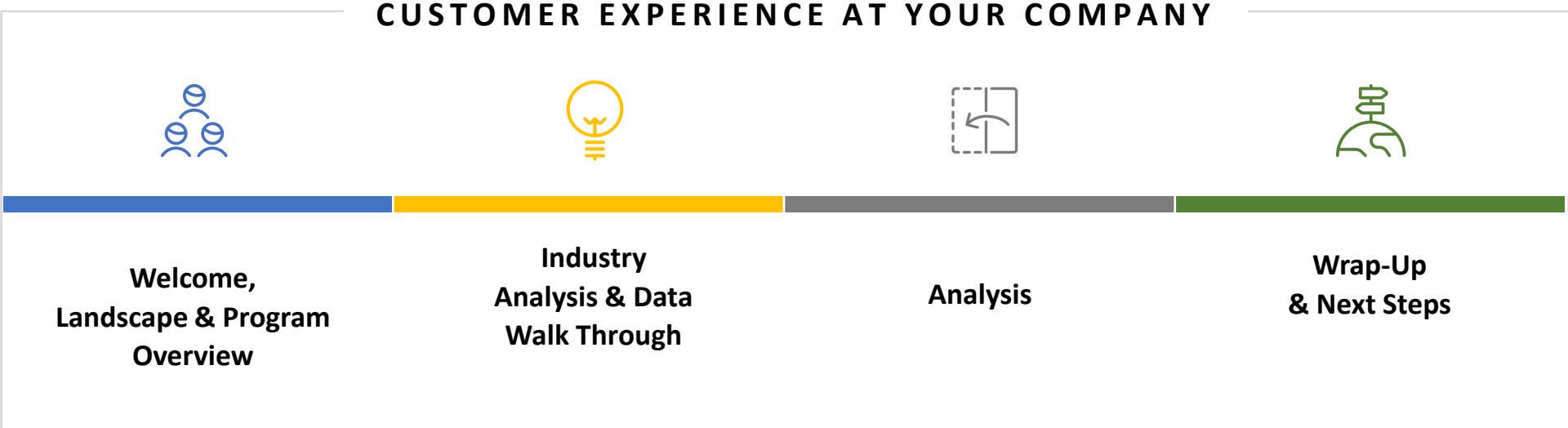
**Alberto Ruiz Martinez**

- USDC  
Analyst Strategy/Analytics
- Gilbert Arizona
- Been at the firm for  
7 months





## CUSTOMER EXPERIENCE AT YOUR COMPANY

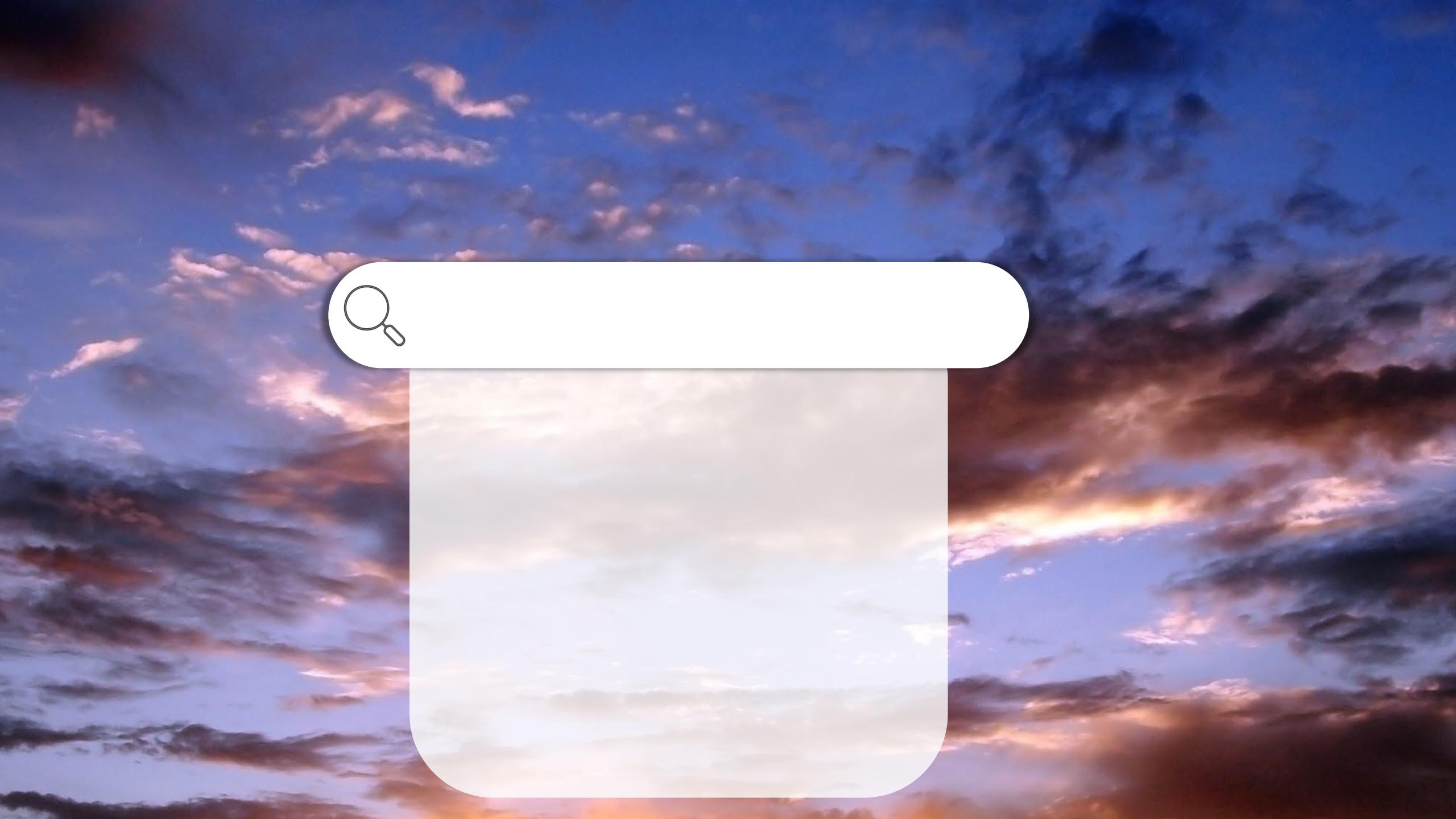


Understanding of the data  
Why is it important?

What is the problem, why is it important, and what metrics would determine success

Analysis of the data

Alignment on action items,  
what comes next, and  
questions about the journey  
ahead





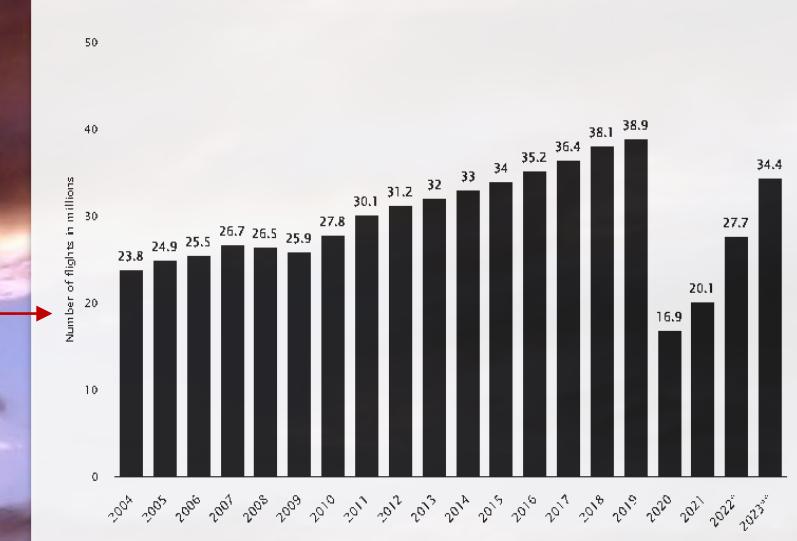
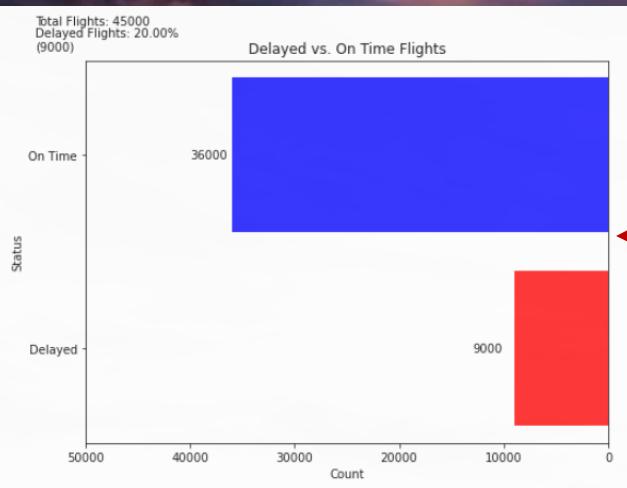
## Airline industry statistics

45,000 daily flights

2.9 Million daily customers

A recovering industry

9,000 to 11,000 delays in a day



# Why Do Delays Matter?

01

Industry average:

12 minutes  
24 seconds

X

02

Our average delay:

85 minutes

6.9x larger

03

The cost per minute:

\$74.20

6,307\$ per delay

04

19% of flights were  
delayed.

418 Flights

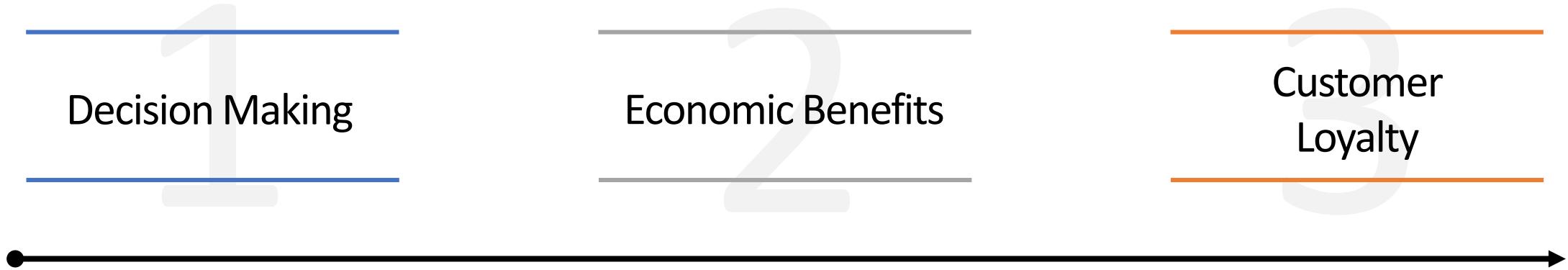
Per month

05

Total Cost:

**2,636,326\$**

# Why Will This Project Be Valuable



The data serves as a foundation for data-driven decision-making. Airlines can make strategic decisions based on insights derived from historical and real-time operational data, leading to better adaptability to market dynamics and competitive pressures.

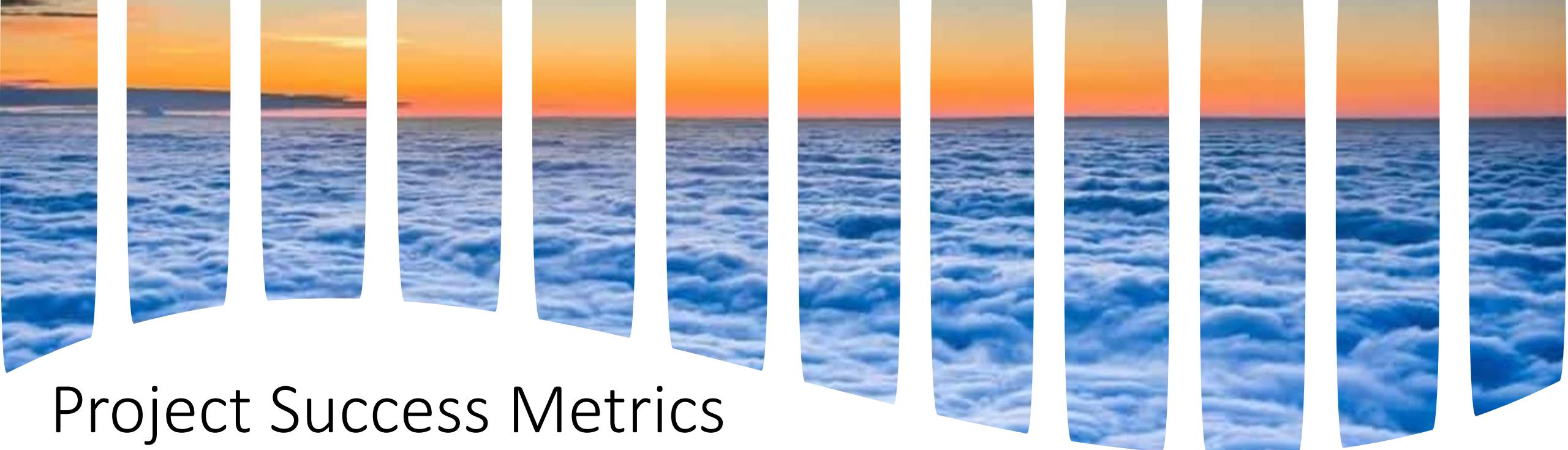
Predictable air travel encourages business travel and tourism, boosting economic activity and generating revenue for airlines and related industries.

Municipalities with heavy tourism can use the results of the model to improve airline travel to boost overall economic activity.

Airlines often define their userbase with loyal and unloyal tags.

"Loyal" customers tend to stick with a certain airline without deviating to others. It is important to not only keep loyal customers but to also use airline data to figure out ways to make other customers loyal as well.





# Project Success Metrics



Develop an artificial intelligence model that can accurately predict if a flight is going to be delayed.



Develop an artificial intelligence model that can accurately predict how long will a flight be delayed by.



Figure out how results developed here could influence future projects

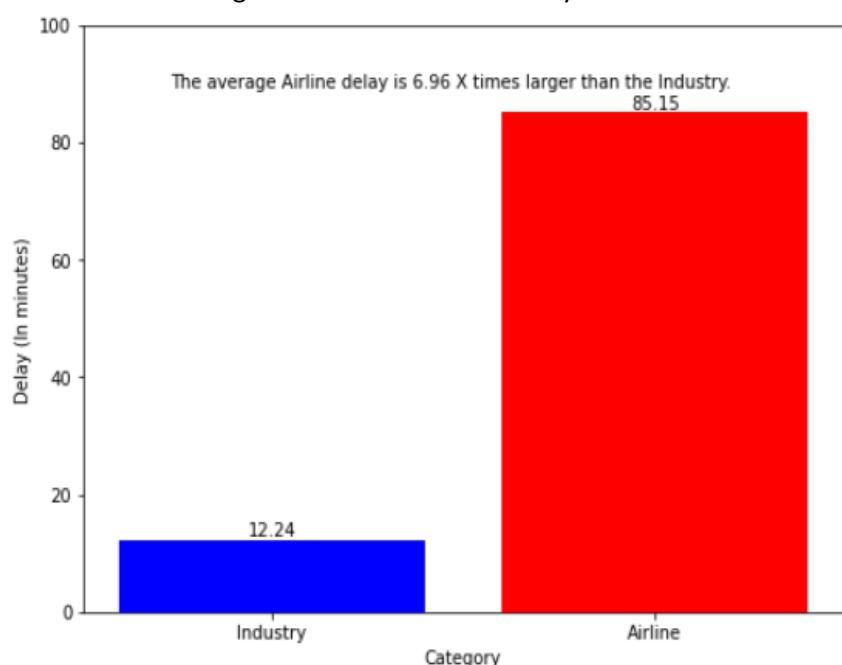
# Understanding the data

## Four Value Drivers



### Flight Time Information

- CRS\_DEP\_TIME: Scheduled departure time.
- DEP\_TIME: Actual departure time.
- Flight Status: "Ontime" or "Delayed"



### Plane Details

- CARRIER: The airline carrier code.
- DEST: The abbreviated airport arrival
- DISTANCE: Flight distance (M)
- FL\_NUM: The flight number.
- ORIGIN: The origin airport code.
- TAIL\_NUM: Aircraft tail number.



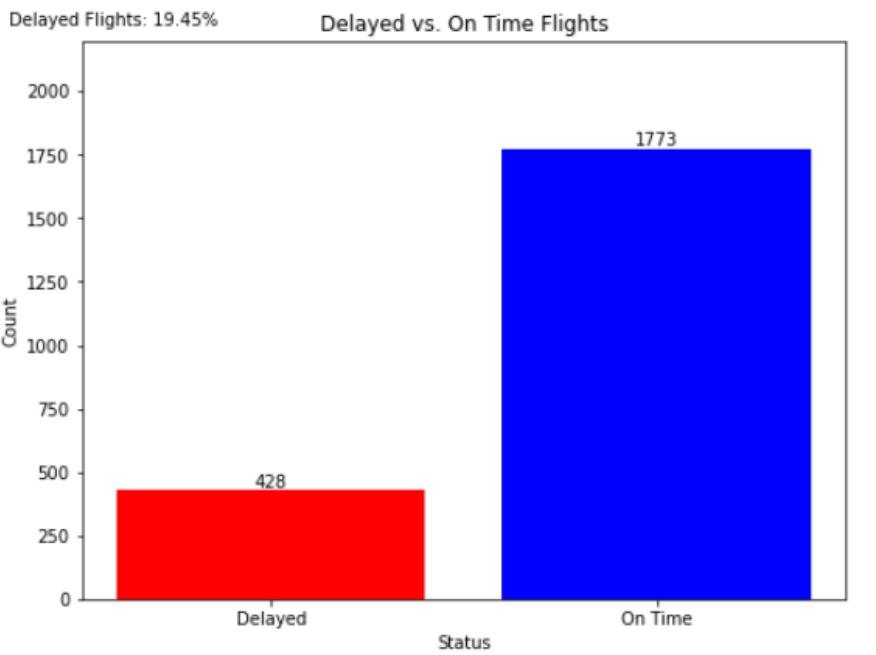
### Timing of Year

- DAY\_WEEK: Day of the week.
- DAY\_OF\_MONTH: Day of the month.



### Environment Factors

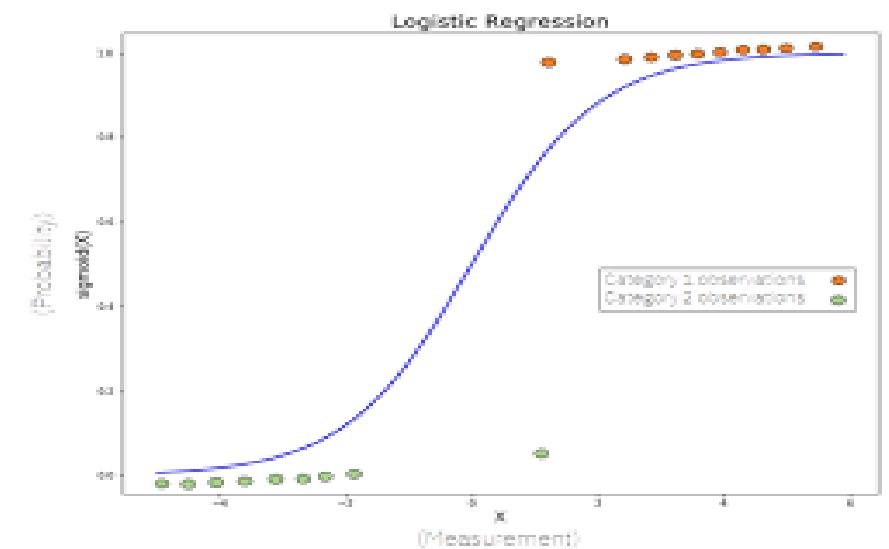
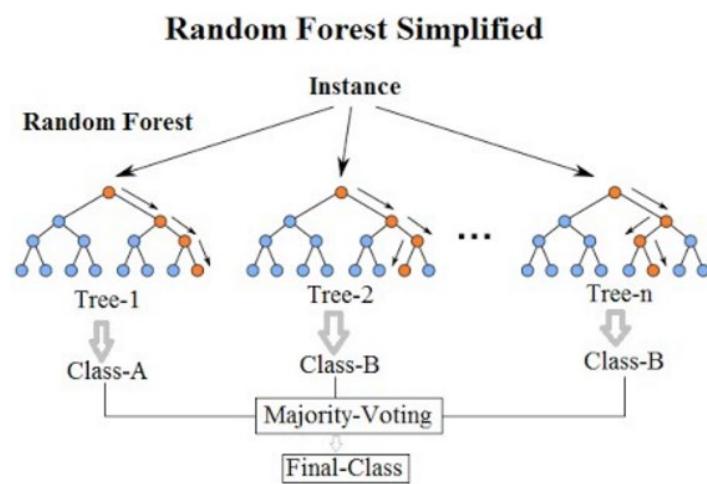
- Weather: Code of 1 represents there was a weather-related delay, Code of 0 represents there was no weather-related delay





# Setting up the Machine Learning problem

- To predict delays or not we will use multiple classification models.
- Logistic Regression Model
- Decision Tree Model
- Random Forest Model



# Machine Learning Evaluation Metrics

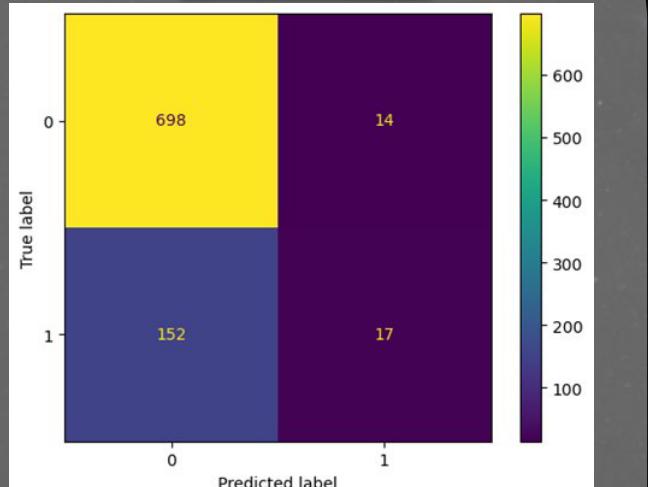
		Predicted Classes	
		Negative	Positive
Actual Classes	Negative	True Negative	False Positive
	Positive	False Negative	True Positive

$$\text{Recall} = \frac{\text{True Positive}(TP)}{\text{True Positive}(TP) + \text{False Negative}(FN)}$$

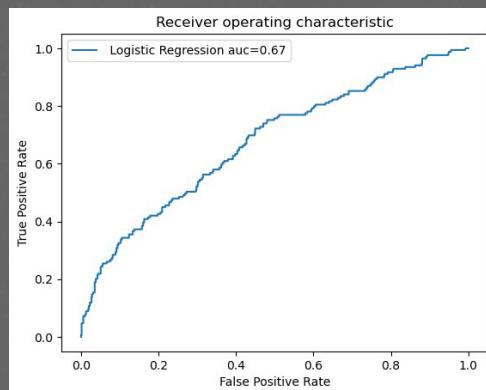
# LOGISTIC REGRESSION

Base

Accuracy::0.812

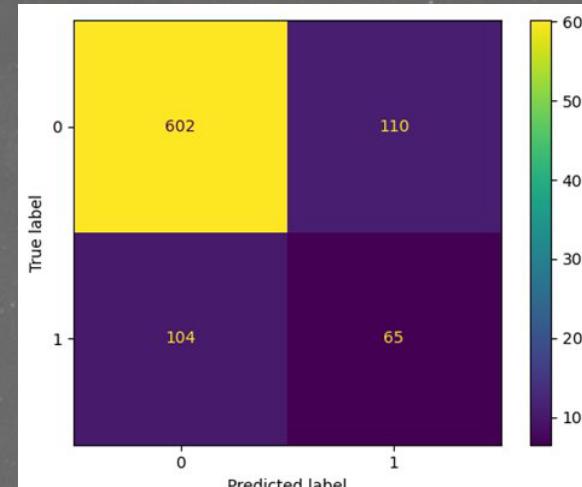


	precision	recall
0	0.82	0.98
1	0.55	0.10

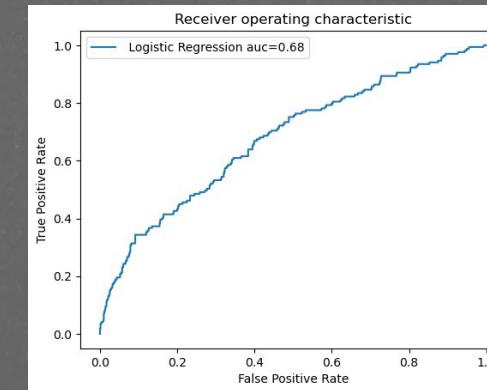


Weight Class

Accuracy::0.757

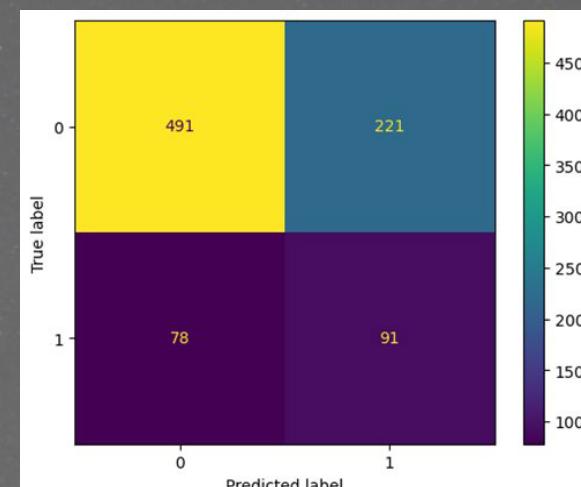


	precision	recall
0	0.85	0.85
1	0.37	0.38

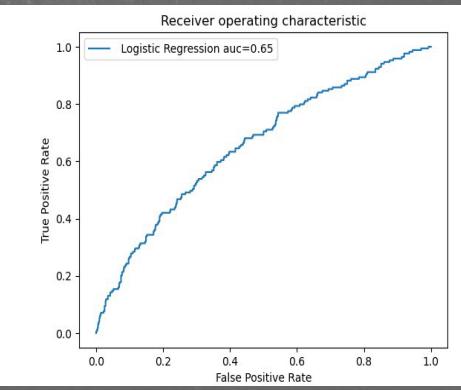


SMOTE

Accuracy::0.661



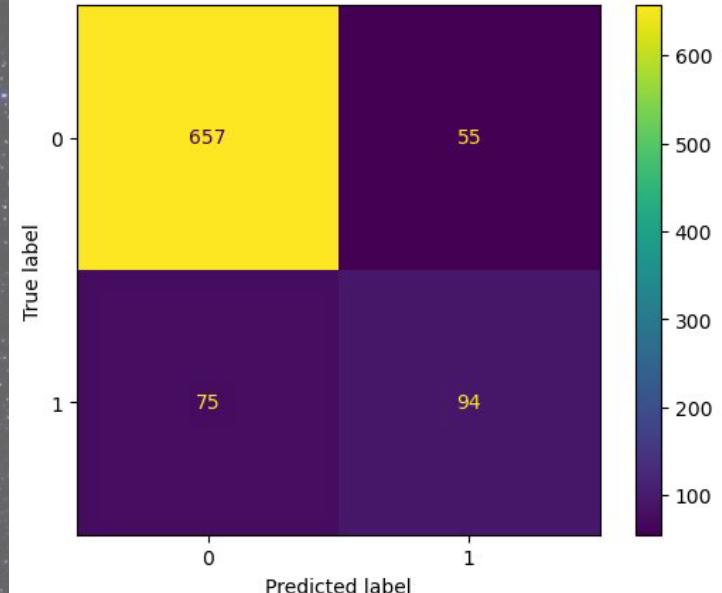
	precision	recall
0	0.86	0.69
1	0.29	0.54



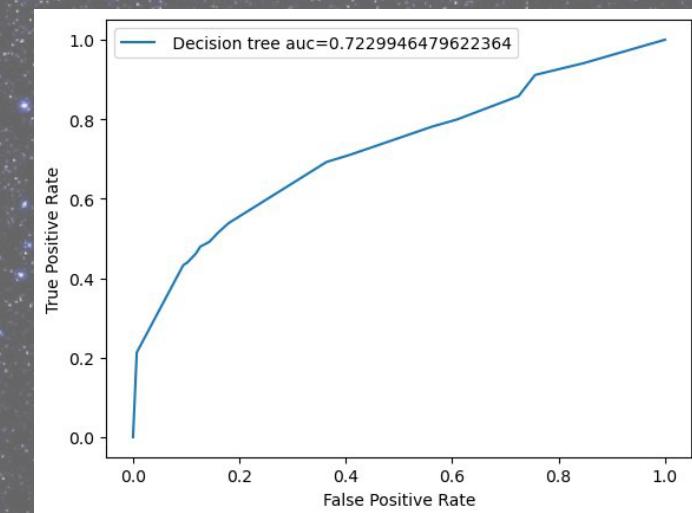
# DECISION TREE & RANDOM FOREST

## Results

- The Decision tree identified more delayed flights
- The Random Forest model has a higher AUC number.
- Decision Tree was able to correctly identify more True Positives(delayed flights) than the Random Forest.
- Random Forest Confusion Matrix was comparable to base Logistic Regression model.
- The optimal model seems to be either Logistic Regression with SMOTE or a Decision Tree



	precision	recall
0	0.90	0.92
1	0.63	0.56



# How long will a delay last?

How long is the flight going to potentially be delayed?

What factors are contributing to the delay?

How much money is this going to cost the airline?

# Setting up the problem

01

Create a variable that shows the amount of time a flight was delayed

02

Define a correlation matrix

03

Extract every variable along with their correlation to the departure difference

04

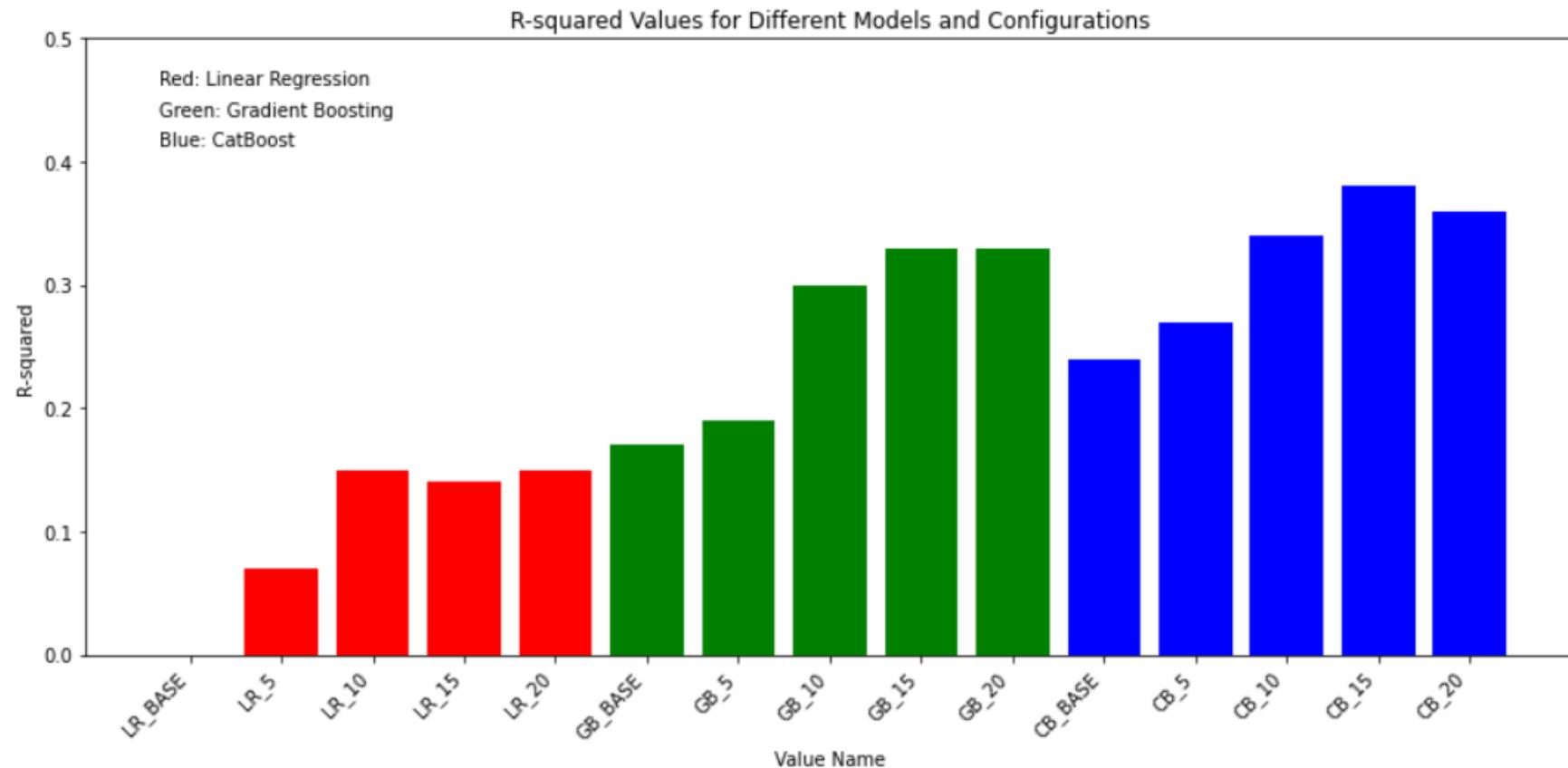
Sub extract variables base on correlation percentage

05

Run the date based on three different models: Linear Regression, Gradient Boosting, Cat Boost

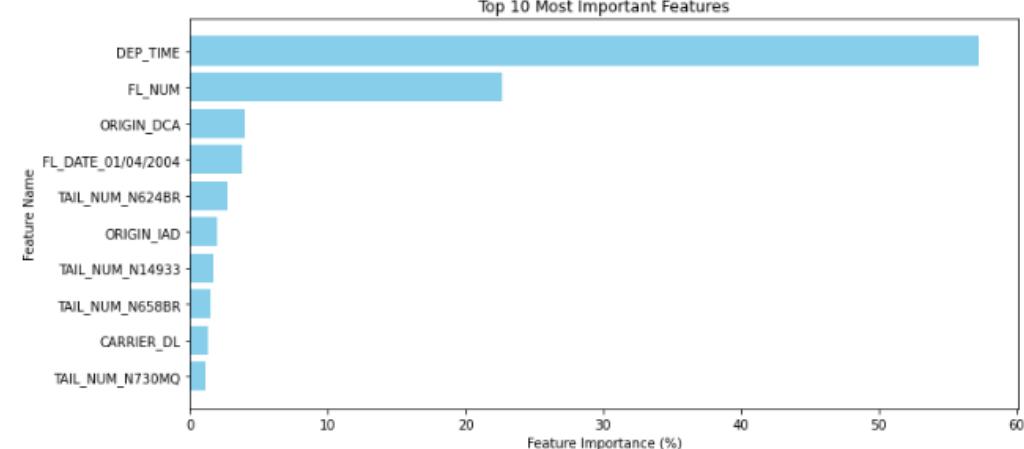
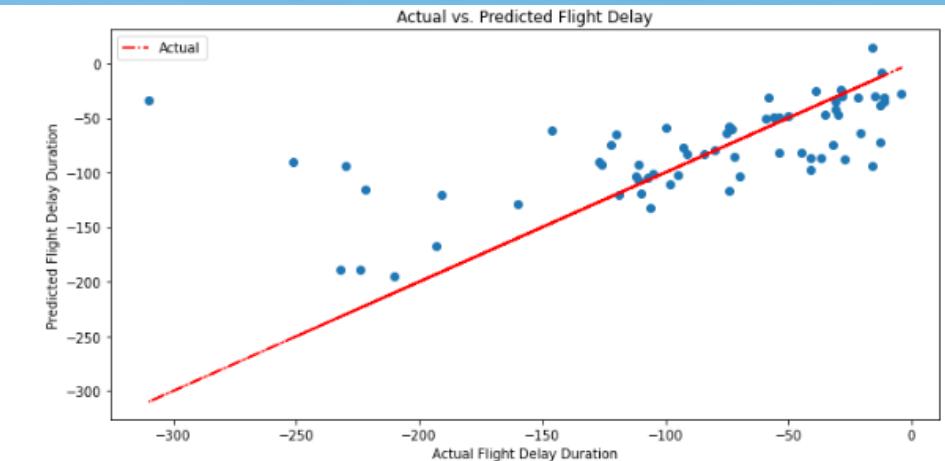
# Results

- MSE and SE have a similar trend
- Cat boost with at least 15% correlation factors had the greatest results
- What factors contribute to the results?

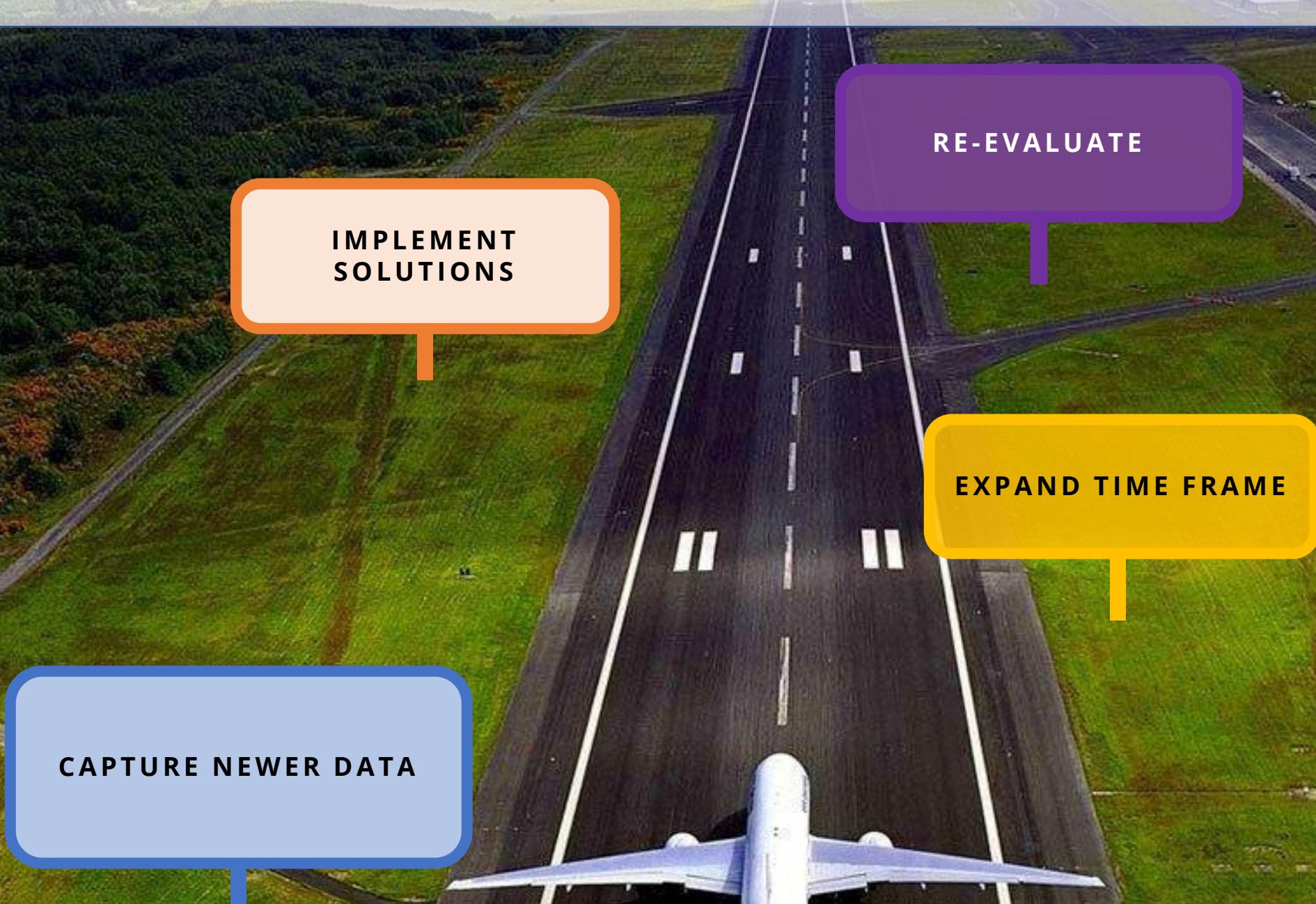


# Analyzing Cat Boost

- Departure time had the greatest impact on the algorithm
- Flight number had the second greatest impact. Why?
- Flight numbers have embedded information
- East/West, airline, region, etc.
- Recommended to gather more data to cross validate results



# How to improve?



Thank you for your time!



# Use Cases

## Airlines

The data serves as a foundation for data-driven decision-making.

Airlines can make strategic decisions based on insights derived from historical and real-time operational data, leading to better adaptability to market dynamics and competitive pressures.

Strategic changes in flight plans, types of planes, or estimates can greatly increase revenue and overall economic standing.

## Economic Benefits

Predictable air travel encourages business travel and tourism, boosting economic activity and generating revenue for airlines and related industries.

Municipalities with heavy tourism can use the results of the model to improve airline travel to boost overall economic activity.

## Customer Loyalty

Airlines often define their userbase with loyal and unroyal tags.

"Loyal" customers tend to stick with a certain airline without deviating to others. It is important to not only keep loyal customers but to also use airline data to figure out ways to make other customers loyal as well.

# Understanding Data

Subtitle



## ASSESS CURRENT STATE

This all starts with getting in deep, and looking at your world from a different perspective. We gather documentation, review code and interview your key stakeholders to understand the existing user experience, operating model, pain points, and requirements while gaining input and consensus on the priorities, and needs of your organization.

## DEFINE FUTURE STATE

We then take these inputs and use our experience to articulate the end state. We have run multiple Adobe programs end to end and have encountered all varieties of issues/problems – we have the experience to identify gaps in your solution.

## PRIORITIZED RECOMMENDATIONS

Finally, we align the gaps, and convert them into digestible initiatives—packaging these around a high-level plan tied to business value and severity. Our goal: to enable the Client to take action and make better decisions regarding the implementation of digital technologies, specifically Adobe.

# Key considerations for developing ambitions

Subtitle

## Considerations Ver 3.0



### Focus on humans, not technology

Human behavior is the fundamental economic gear of every business. If you can identify which behaviors to drive (internally and externally) to create the greatest return, and marshal your digital resources to achieve that behavioral change, you will win.



### Find opportunities at the intersections

Don't try to come up with new ideas alone. To find the future of your business, look to unexpected intersections: between disciplines and domains of expertise, across departments and organizational silos, between industries, and through partnerships that span markets and geographies.



### 'Get it out' beats 'get it perfect'

In a world dominated by uncertainty, the only way to get effective market feedback is to give the market something to react to. Succeed faster via a cadence of rapidly delivering minimally viable offerings (MVOs) into the market, and learning from the feedback you obtain for each subsequent iteration.

# The Airline Industry

Client's customer engagement success is dependent on customer satisfaction and repetitive engagement strategies.

## R F P S C O P E



### Industry Statistics

#### **A massive customer base**

There is an average of 45,000 flights carrying roughly 2.9 million passengers. All of this occurs within a 24-hour period

#### **It is a growing industry**

Up until 2019, the airline industry was steadily growing its customer base. Current market trends are indicating a return to a 2019 market



### Analytical Consulting

#### **Flight Delays**

A delay is defined as a flight that would depart 15 minutes later compared to the posted schedule time.

#### **How often does a delay occur?**

It is calculated that 20% - 25% of all flights result in a delay, roughly 9,000 - 11,000 delays in a single day.



### Business Success Metrics

#### **How accurately could we predict a flight is going to be delayed?**

Can our model predict if a flight is going to be delayed based on certain metrics.

#### **How long is a flight going to be delayed?**

After we determine if a flight is going to be delayed, we want to determine how much time is said flight going to be delayed.

## Key tenets of our approach

### Flights Per Year

**2004-2023**

### Accelerate Execution

Leverage Deloitte's proven accelerators for use case prioritization, customer marketing integrations, and analytics to accelerate the release dates

US AIRLINE INDUSTRY ANNUAL REVENUE (2010 -2022)



### Revenue Per Year

**2010-2022**