AIRLINE PASSENGER SATISFACTION

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Purpose of the Study

The primary aim of this study is to analyze passenger satisfaction within the airline industry, identifying key factors that influence customer experiences. By understanding the drivers behind passenger satisfaction and dissatisfaction, airlines can make data-driven decisions to improve service quality, enhance customer loyalty, and address areas requiring attention. This analysis serves as a foundation for optimizing customer interactions, improving services, and increasing overall satisfaction.

Introduction

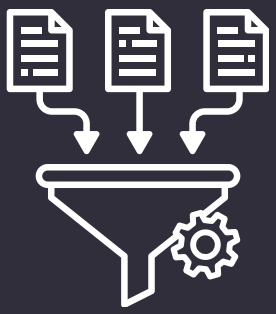
Data Source and Description

The dataset used for this analysis was sourced from Kaggle's Airline Passenger Satisfaction dataset. It contains 129,880 rows and 23 columns, representing various characteristics and responses of airline passengers. The dataset includes information about passenger demographics, flight details, and satisfaction ratings, along with feedback on different aspects of the travel experience, such as inflight services, seat comfort, and cleanliness.

Key variables in the dataset include:

- Gender: Passenger gender (Male/Female).
- Customer Type: Whether the passenger is a loyal customer or a first-time flyer.
- Age: Passenger age group.
- Type of Travel: Whether the travel was for business or personal purposes.
- Flight Distance: Distance of the flight in miles.
- Satisfaction: Overall satisfaction rating (Satisfied/Neutral or Dissatisfied).

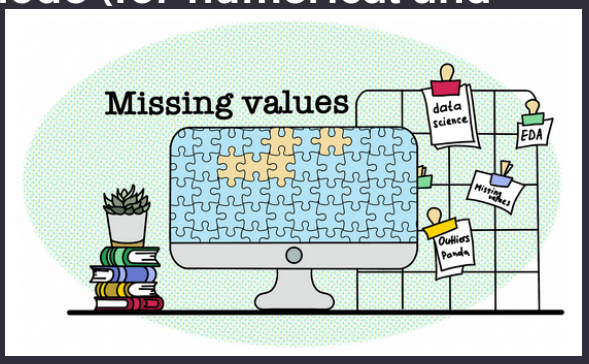
Data Preparation



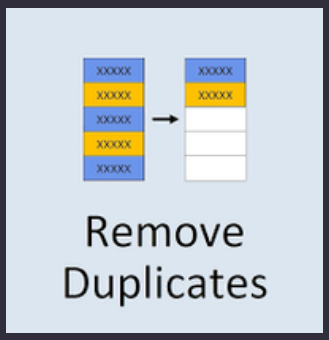
Data Cleaning and Preprocessing

To ensure accurate and reliable analysis, the dataset underwent a thorough data cleaning process. This involved addressing the following issues:

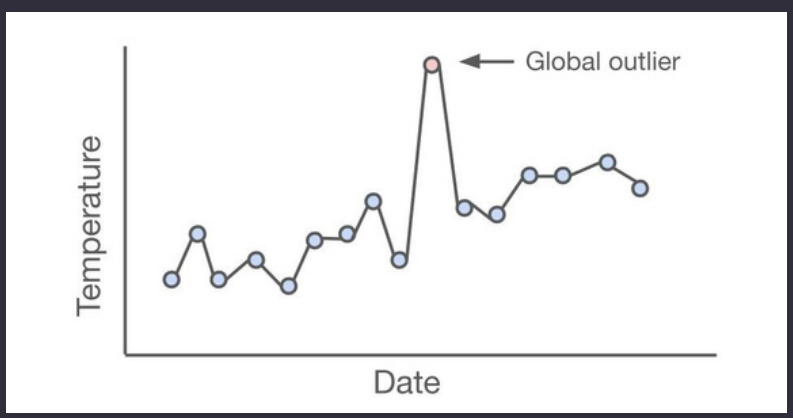
- Handling Missing Values: Some columns contained missing or null values. These missing values were addressed by either:
  - Imputing them with the median or mode (for numerical and categorical data, respectively).
  - Dropping rows where a significant portion of the data was missing, which ensured no bias was introduced into the analysis.



- Removing Duplicates: Any duplicated entries were removed to avoid inflating certain results and misrepresenting the findings.



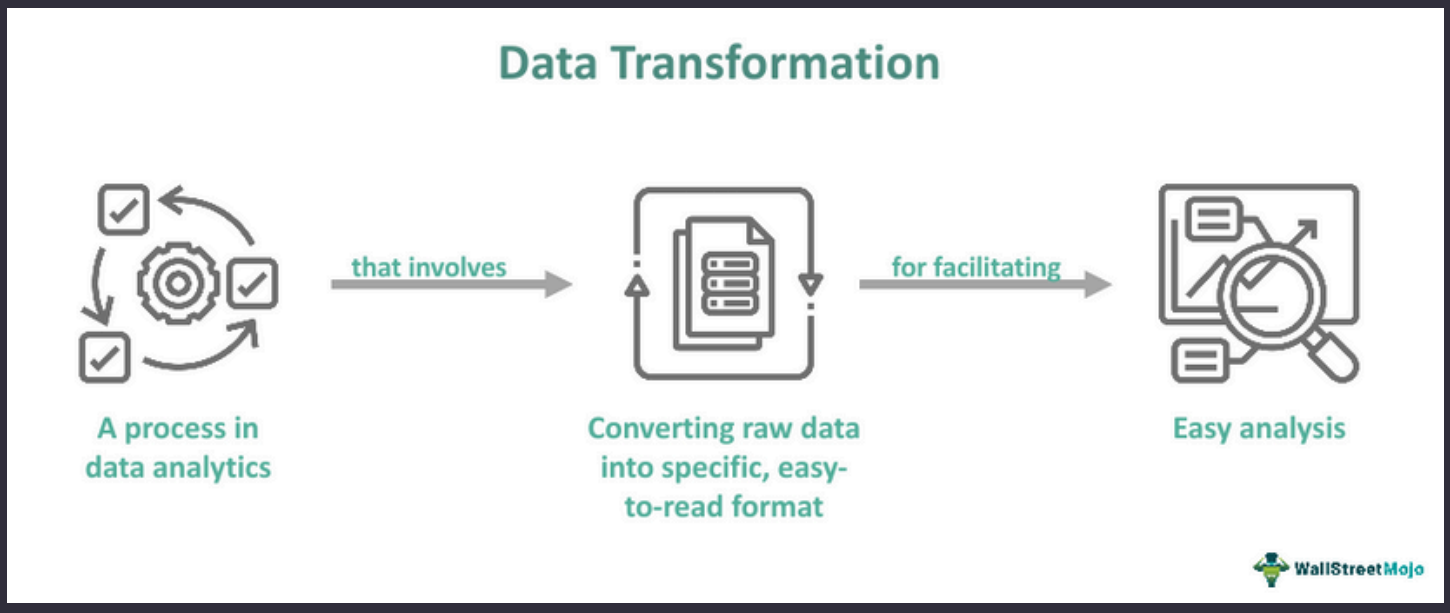
- Dealing with Outliers: A detailed analysis was performed to identify potential outliers in the numerical variables (e.g., flight distance, age). Where necessary, extreme outliers were either removed or investigated to understand their impact on the dataset.



Data Transformation Techniques

Several transformations were applied to the data to ensure it was in a suitable format for analysis:

- Encoding Categorical Variables: Since the dataset contains categorical variables such as "Gender," "Customer Type," and "Type of Travel," these were converted into numerical format using label encoding. This allowed the dataset to be used in various machine learning models and statistical analyses.
- Creating New Variables: Additional variables were created to support further analysis. For example, a satisfaction score variable was derived from existing satisfaction ratings to quantify the level of satisfaction and enable more detailed comparisons.
- Normalization of Continuous Variables: Variables such as "Flight Distance" were normalized to ensure that features on different scales did not skew the analysis. This technique was particularly important for any predictive modeling carried out later in the analysis.
- Date and Time Features: Although the dataset does not directly include date features, flight distance and type of travel were used to create insights related to travel duration and class-based satisfaction.



Descriptive Analysis

Overview of Key Variables

Total Passengers: The dataset includes 104K passengers.
Gender Split: 51K male and 53K female passengers.
Loyal Customers: 85K passengers are classified as loyal customers.
Overall Satisfaction: 45% of the total passengers reported being satisfied with their experience.
Average Flight Distance: The average flight distance in the dataset is approximately 1.19K miles.

Passenger Demographics

Gender by Travel Type: Business travel is dominated by male passengers, while personal travel is more evenly distributed between males and females.
Customer Type by Gender: Loyal customers are almost evenly distributed between males and females, indicating that customer loyalty is not significantly influenced by gender.

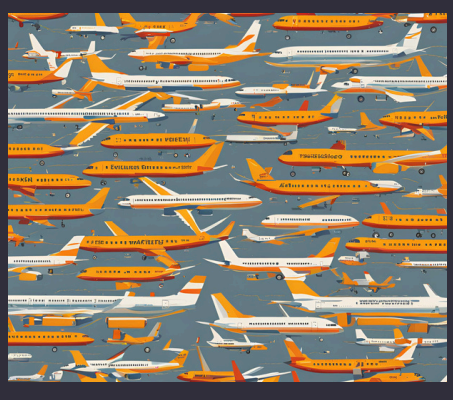
Exploratory Data Analysis (EDA)

Satisfaction Analysis

The satisfaction analysis highlights several key insights regarding how passengers rate their overall experiences with the airline, segmented by various factors such as online boarding, inflight services, and the type of travel. The total number of satisfied customers stands at 45K, with 22K satisfied males and 23K satisfied females, indicating a fairly even distribution between genders.

- Online Boarding Satisfaction:
  - Passengers by Online Boarding: The largest group of passengers, around 40K, rated their online boarding experience as very good. Passengers with good and excellent ratings follow closely, while those rating their experience as neutral, bad, or very bad make up a smaller portion of the total.
  - Online Boarding by Type of Travel: A breakdown of satisfaction by business and personal travel shows that business travelers generally report higher satisfaction compared to personal travelers, especially in terms of online boarding.

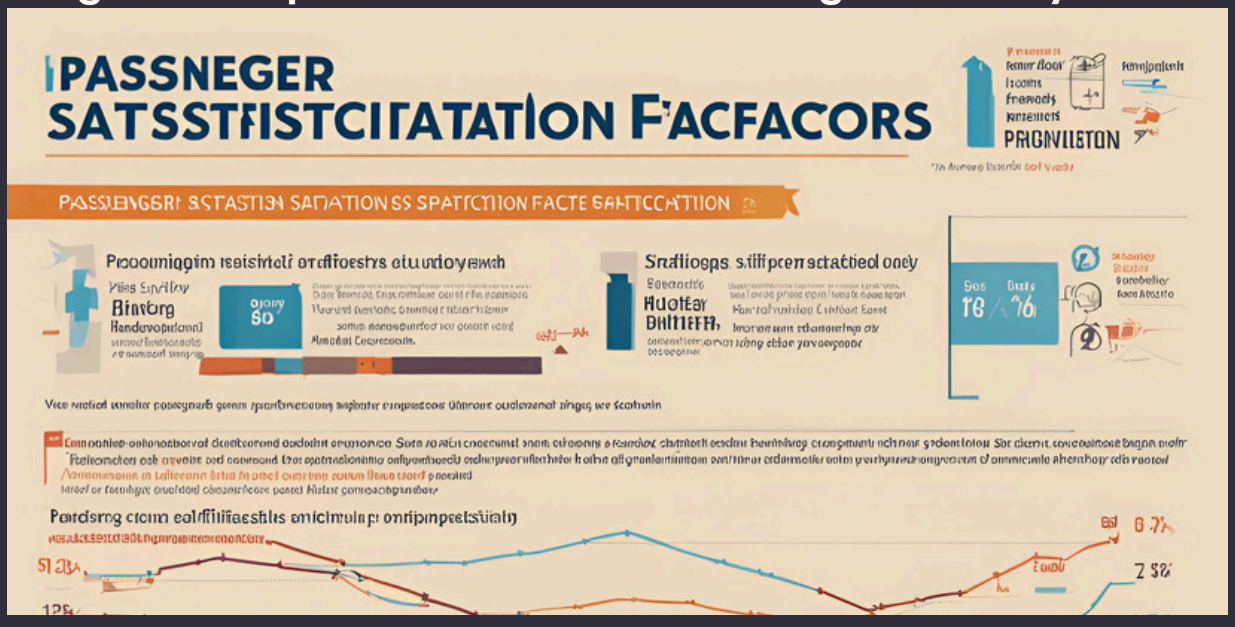
- **Inflight Services:**
  - Passengers by Inflight Services: Satisfaction decreases steadily as inflight service quality declines. The highest number of passengers, about 40K, rated the inflight service as very good, but as service quality worsens, the number of satisfied passengers drops significantly.
  - Passengers rating inflight services as bad or very bad are a smaller percentage, indicating that inflight services have a considerable impact on satisfaction.
- **Service Segmentation by Flight Distance:**
  - The data shows that passengers flying longer distances tend to report higher satisfaction. High satisfaction is most common for far distances, while low satisfaction is more frequent for shorter flights or those categorized as near or in-between distances.
- **Satisfied Passengers by Type of Travel:**
  - A large majority of business travelers report being satisfied with their experience, with around 40K satisfied business travelers compared to a much smaller number of personal travelers.
- **Passengers by Online Booking:**
  - Satisfaction with online booking services varies, with good and neutral ratings being the most common, followed by very good ratings. Fewer passengers rated their online booking experience as bad, excellent, or very bad, showing that while online booking services are generally well-received, there is room for improvement, especially in the excellent category.



- When it comes to passenger satisfaction, several factors play pivotal roles, each with its own unique impact on the overall experience. Perhaps the most glaring influence is the timeliness of flights. Passengers who experience delays are significantly less satisfied, as even the most comfortable journey can be overshadowed by long waits and missed connections. It is clear that for airlines, time is not just money—it's the key to customer happiness. Reducing delay risks, especially for high-frequency travelers, would go a long way in boosting satisfaction levels, particularly among passengers already wary of tight schedules.

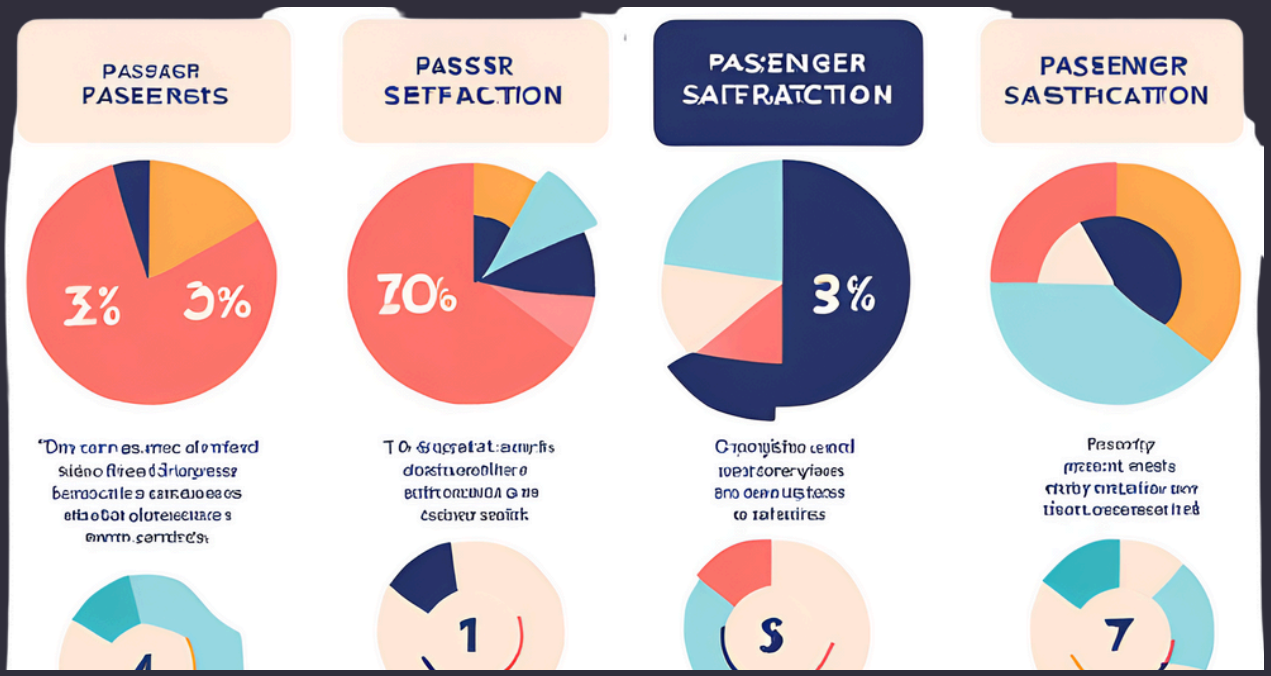
Passenger Satisfaction Factors

- Beyond punctuality, the importance of inflight services cannot be overstated. In an age of digital connectivity, passengers expect seamless Wi-Fi services and comfortable seating that makes even long-haul flights enjoyable. The data is clear: passengers who rate Wi-Fi and seat comfort highly are exponentially more likely to express satisfaction. For business travelers, these services can be the defining difference between a productive flight and a frustrating experience. It's not just about getting from point A to point B; it's about the comfort and efficiency that come with the journey. Offering these top-tier amenities is no longer a luxury for airlines.



- Another essential aspect of satisfaction is the class in which passengers travel. It's no surprise that business class passengers—with their plush seats, priority boarding, and premium services—report the highest satisfaction rates. The contrast with economy and eco plus classes, where comfort and space are more limited, is stark. These passengers often face lower satisfaction, not necessarily because of service failures, but because their expectations for comfort and convenience are harder to meet in these constrained environments. However, there is ample opportunity for airlines to innovate and improve in this space, offering budget-conscious travelers more comfort without compromising affordability.

- Finally, customer loyalty plays a crucial role in determining how satisfied passengers are with their flights. Loyal customers—those who fly frequently with the same airline—report much higher satisfaction, largely because they receive personalized services and benefits that elevate their experience. Airlines are smart to invest in loyalty programs, as these passengers often become long-term advocates. On the other hand, disloyal customers, those flying infrequently or trying a new airline, often experience lower satisfaction. This group, particularly in economy, tends to be more critical, and their lower satisfaction levels reflect unmet expectations or unfamiliarity with the airline's service offerings.



Flight Performance

The Flight Performance analysis provides insights into the key factors influencing passenger satisfaction with different aspects of their journey, such as departure/arrival time, check-in service, seat comfort, and inflight services.

- Passengers by Departure/Arrival Time:
  - The satisfaction with departure and arrival times declines steadily as the quality of service drops. Passengers rated very good to good tend to have higher satisfaction, but this diminishes as the ratings move to neutral, bad, and very bad.
- Passengers by Check-in Service:
  - A significant number of passengers rated check-in services as very good and good, with smaller proportions rating them as neutral, bad, or excellent. This suggests that while most passengers are generally happy with the check-in process, there is room to improve, particularly in enhancing the overall experience from neutral and bad ratings.
- Count of Gender by Seat Comfort Status:
  - Seat comfort remains a crucial factor in passenger satisfaction. The majority of passengers, particularly males, rated seat comfort as very good and excellent, with fewer passengers giving lower ratings such as neutral, bad, or very bad. Improving seat comfort across all classes, especially for those dissatisfied, can enhance overall flight performance and customer experience.

- **Passengers by Food and Drink:**
  - Food and drink quality also plays a role in satisfaction, with most passengers rating their experience as very good, excellent, or good. Lower satisfaction levels are associated with neutral or bad ratings, indicating a need for improvement in inflight meals for a small but notable proportion of passengers.
- **Count of Gender by Inflight Entertainment Status:**
  - The inflight entertainment system is another key area for customer satisfaction. Male passengers tend to rate inflight entertainment highly, with many giving very good or excellent ratings. However, some passengers, particularly those giving neutral or lower ratings, show that there is still space for enhancing inflight entertainment to meet or exceed expectations.
- **Passengers by Inflight Service:**
  - The inflight services (overall experience) show a steep decline in satisfaction as service quality decreases. The very good category holds the largest number of passengers, but satisfaction quickly declines through good, neutral, bad, and very bad ratings, showing that maintaining a high standard of inflight service is critical to keeping passengers satisfied throughout the journey.

Predictive Analysis

The Predictive Analysis focuses on identifying key factors that influence business travel, profitability, and customer satisfaction. The insights reveal the importance of seat comfort, inflight Wi-Fi service, and flight delay risks in shaping customer behavior and driving profitability.

- Key Influencers for Business Travel:
  - The likelihood of passengers traveling for business purposes increases when the flight delay risk is high, with an influence score of 1.45x. This suggests that business travelers are more likely to book flights when they anticipate delays, likely due to the premium services offered in business class that mitigate the inconvenience of delays.
  - The inflight Wi-Fi service, rated higher than 4, increases the likelihood of business travel by 1.34x. This highlights the importance of reliable connectivity for business passengers.
  - Seat comfort scores above 3 also influence business travel, increasing the likelihood by 1.18x, showing the need for a comfortable flying experience for business customers.

- Key Influencers for Profitability:
  - The likelihood of achieving high profitability increases significantly when seat comfort scores are above 3, with an influence of 1.72x. This emphasizes the role of passenger comfort in driving higher revenue.
  - Inflight Wi-Fi service rated above 4 also boosts profitability by 1.52x, demonstrating how essential internet access is to passengers, especially those flying for business.
  - The overall quality of inflight services—from entertainment to food and seating—further drives profitability, particularly when passengers rate their experience highly.

- Sum of Revenue Estimation by Type of Travel:
  - Business travel is the primary contributor to revenue, with a significantly higher sum of revenue compared to personal travel. This indicates that business travelers are a key customer segment for airlines, and focusing on improving their satisfaction could further enhance profitability.

- On-Time Performance by Type of Travel:
  - On-time performance is relatively consistent between business and personal travel, with minimal variation. Both travel types have on-time performance ratings near 46, suggesting that efforts to improve punctuality could benefit all customer types equally.

- Sum of Customer Engagement Score by Customer Type:
  - Loyal customers exhibit much higher engagement than disloyal customers, with a significant difference in the sum of customer engagement scores. This indicates that loyal customers are more likely to engage with the airline and remain satisfied, making them a valuable segment for retention strategies.

- High, Very Low, and Low Profit Categories:

  - High Profit: With 34,216 satisfied customers, this group enjoys a 46.03 on-time performance and 40,163 loyal customers, contributing to a sum of revenue of 42.3M. The high profit category is clearly driven by on-time performance and customer loyalty, which are key factors for maximizing revenue.
  - Very Low Profit: This group has 8,701 satisfied customers and an on-time performance of 45.74, which is slightly lower than the high-profit group. They have 35,835 loyal customers but generate much less revenue, only 14M, suggesting that even though loyalty exists, the average revenue per customer is lower.
  - Low Profit: This group, with 1,844 satisfied customers and an on-time performance of 44.92, represents the smallest portion of revenue, generating only 5.1M. Improving customer satisfaction and loyalty within this group could result in higher revenue, especially by addressing issues related to on-time performance and service quality.
- Passengers by NPS Group:

  - The Net Promoter Score (NPS) breakdown shows that 45.03K passengers fall under the Detractor group, indicating dissatisfaction or neutral feelings about the airline. 30.39K passengers are classified as Passive, and 28.49K are Promoters, meaning they are likely to recommend the airline. The high proportion of Detractors suggests that focusing on improvements to services and addressing pain points for dissatisfied customers is key to boosting overall satisfaction and increasing the number of Promoters.

Recommendations

Based on the analysis of customer satisfaction, flight performance, and predictive insights, several key areas can be improved to enhance passenger experiences, drive loyalty, and increase profitability. Below are the primary recommendations:

1. **Enhance Inflight Services:**
   - **Seat Comfort:** The analysis reveals that seat comfort is a major factor in driving both passenger satisfaction and profitability. Airlines should consider upgrading seats, particularly in eco and eco plus classes, where satisfaction is lower. Offering more legroom, better recline, or additional amenities can significantly improve the customer experience, especially for long-haul flights.
   - **Inflight Wi-Fi:** With connectivity being a high priority for business travelers, improving inflight Wi-Fi services can greatly enhance satisfaction and encourage more business travel. Offering reliable, high-speed internet across all classes would increase customer loyalty, particularly for business travelers who rely on internet access for productivity during flights.
2. **Reduce Flight Delays:**
   - **On-time Performance** is critical for customer satisfaction. Passengers who experience frequent delays are much less likely to be satisfied, regardless of the inflight services provided. Airlines should invest in improving logistics and operational efficiencies to minimize flight delays. This could involve optimizing ground operations, improving communication between air traffic control and pilots, or even providing real-time updates and compensations to passengers affected by delays.

3. Improve Customer Retention through Loyalty Programs:

- **Loyalty Programs:** The analysis highlights the importance of loyal customers, particularly in business class, who contribute significantly to high profitability. Airlines should focus on enhancing loyalty programs by offering personalized rewards, exclusive services, and priority boarding or upgrades. Tailoring these programs to meet the needs of high-value customers would further improve satisfaction and retention.
- **Target Disloyal Customers:** Disloyal customers, especially those in economy class, report lower satisfaction levels. Airlines could target these customers with special offers, upgrades, or personalized services to convert them into repeat travelers. Engaging them through targeted promotions or improving the inflight experience could help boost retention.

4.Focus on High-Value Business Travelers:

- **Business Travel:** Business travelers consistently report higher satisfaction rates due to better services and amenities. To continue capitalizing on this high-value customer segment, airlines should maintain or further improve business class offerings, such as priority services, luxury seating, and access to exclusive lounges. Additionally, ensuring on-time performance for business travelers is crucial in retaining their loyalty.

5.Data-Driven Decision Making:

- **Leverage Predictive Analysis:** The predictive insights show that enhancing seat comfort and Wi-Fi services not only improves satisfaction but also drives profitability. Airlines should utilize data from customer feedback, predictive models, and operational metrics to make informed decisions about where to allocate resources for maximum impact. This could include targeted investments in specific routes, classes, or services that are most profitable.

Conclusion

In conclusion, the Airline Passenger Satisfaction Report highlights several critical factors that directly influence both customer satisfaction and profitability. Through the analysis of flight performance, customer segmentation, and predictive insights, we've identified that seat comfort, inflight Wi-Fi services, and on-time performance are key drivers of passenger satisfaction, particularly for business travelers and loyal customers. These factors not only enhance the flying experience but also play a significant role in determining the profitability of the airline.

Business class passengers, with their high expectations for premium services, consistently report the highest levels of satisfaction and are the most profitable segment for airlines. Meanwhile, economy and eco plus passengers tend to have lower satisfaction levels, primarily due to less comfortable seating and limited inflight services. The data also shows that flight delays significantly impact passenger satisfaction, underscoring the need for airlines to improve on-time performance and minimize disruptions.

Based on the insights gathered, several recommendations have been provided, including enhancing inflight services, reducing flight delays, improving customer retention through loyalty programs, and leveraging predictive analysis for data-driven decision-making. By addressing these areas, airlines can improve customer satisfaction, drive higher profitability, and build long-term loyalty, particularly among high-value business travelers.

Ultimately, the findings of this report underscore the importance of passenger comfort, timely performance, and personalized services in creating a satisfying and profitable airline experience. By focusing on these key areas, airlines have the opportunity to significantly improve the overall customer journey and foster stronger, more loyal relationships with their passengers.

Thank You

and have a safe flight