HotelRevAI – Power BI Revenue Intelligence Dashboard

Project Report

Abstract

In the hospitality industry, data-driven decision-making is vital for optimizing revenue, occupancy, and profitability. This project, **HotelRevAI**, aims to design and implement a Power BI-based Hotel Revenue Analysis Dashboard that provides insights into key performance indicators (KPIs) such as Average Daily Rate (ADR), Revenue per Available Room (RevPAR), Occupancy Rate, and Profitability. The analysis leverages real-world hotel booking data, exploring revenue trends, seasonal variations, and customer behavior. Through data cleaning, transformation, and visualization using Power BI, the project demonstrates how modern analytics tools can enhance operational efficiency and support strategic business decisions.

1. Introduction

In today's competitive hospitality industry, hotels must constantly analyze and optimize their performance across multiple dimensions—bookings, room utilization, pricing, and customer segmentation. Traditional reporting methods are often static, time-consuming, and lack real-time visibility into revenue trends.

To address these challenges, the **HotelRevAI** project integrates Power BI to build an interactive, real-time revenue intelligence dashboard. The dashboard visualizes multiple KPIs that reflect hotel performance, enabling management to identify seasonal demand patterns, assess occupancy efficiency, monitor cancellations, and measure profitability across business and leisure segments.

By combining data visualization, KPI tracking, and predictive insights, this project serves as a comprehensive framework for hotel revenue management analytics.

2. Problem Statement

Most hotels rely heavily on manual processes and static reports that do not effectively capture real-time data or provide meaningful insights into performance trends.

Key limitations include:

- Inefficient tracking of metrics like occupancy and cancellations.

- Lack of correlation analysis between marketing spend, room performance, and revenue.

- Absence of dynamic dashboards to adapt to changing market trends and guest behavior.

This results in revenue leakage, poor demand forecasting, and missed opportunities for optimization. The **HotelRevAI** dashboard was developed to overcome these limitations by providing a centralized, dynamic, and intelligent reporting system that supports data-driven decision-making.

3. Objectives of the Project

The major objectives of this study are:

- To analyze hotel performance using real-world data and identify the key revenue indicators.

- To design a Power BI dashboard for dynamic monitoring of KPIs like ADR, RevPAR, Occupancy Rate, and Profit Margin.

- To perform exploratory data analysis (EDA) for trend identification and anomaly detection.

- To improve understanding of customer behavior, booking channels, and seasonal impacts on revenue.

- To provide actionable insights that help in improving occupancy, minimizing cancellations, and optimizing pricing strategies.

4. Dataset Description

Dataset Name: Hotel Bookings Expanded Dataset
Data Size: 163 rows × 38 columns
The dataset includes information about bookings, guest details, room availability, financial metrics, and marketing expenditure. It captures key operational and performance indicators across multiple hotels, providing a holistic view of business operations.
Key Data Attributes:

- **Booking and Guest Information:** Reservation ID, Guest Type, Check-in and Check-out Dates, Number of Guests, Country.

- **Revenue and Cost Attributes:** Room Revenue, Total Revenue, Total Cost, Profit, and Marketing Spend.

- **Room Performance Metrics:** ADR (Average Daily Rate), RevPAR (Revenue per Available Room), Occupancy Percentage.

- **Behavioral and Operational Metrics:** Number of Bookings, Cancellations, Repeat Guests, and Lead Time.

- **Temporal and Seasonal Data:** Month, Year, and Season for trend analysis.

This dataset provided a rich base for extracting both operational and strategic insights for hotel management.

5. Data Preprocessing and Cleaning

Data preprocessing was carried out using Power Query within Power BI and Microsoft Excel. The key steps included:

Data Cleaning:

- Removal of missing, duplicate, and inconsistent entries.

- Standardization of date and numerical formats.

- Filtering out irrelevant records (e.g., canceled bookings from final revenue calculations).

Transformation and Normalization:

- Conversion of raw fields into usable metrics.

- Normalization of currency and percentage values.

- Merging multiple data sources into a single relational model.

Feature Engineering: Custom metrics were derived using Power Query and DAX formulas for advanced analytics:

$$Profit = TotalRevenue - TotalCosts$$

$$RevPAR = \frac{RoomRevenue}{AvailableRooms}$$

$$OccupancyPercentage = \left(\frac{ReservedRooms}{AvailableRooms} \right) \times 100$$

$$RevenuePerGuest = \frac{TotalRevenue}{Check-ins + NewBookings}$$

These transformations ensured data consistency, improved analytical capability, and prepared the dataset for visual exploration.

6. Exploratory Data Analysis (EDA)

Exploratory analysis was performed to understand patterns, distributions, and correlations among key features.

Major Findings:

- **Revenue Trends:** Revenue and profit show significant seasonal variation. Winter months yielded the highest profits due to increased demand and higher ADRs.

- **Guest Type Analysis:** Leisure guests contributed approximately 57.69% of total revenue, whereas business guests contributed 42.31%. Business travelers had higher ADR but shorter stays.

- **Occupancy and RevPAR:** Average occupancy rate was 77.66%, showing efficient utilization of room capacity. The average RevPAR value indicated stable performance across months.

- **Geographical Insights:** Guests from the USA and Germany contributed the most bookings and feedback, highlighting strong international engagement.

- **Cancellations and Risk Analysis:** Cancellation rates varied seasonally, with noticeable spikes during off-peak periods. Revenue loss from cancellations was quantified for management review.

The EDA phase helped identify patterns crucial for designing the dashboard KPIs and visualizations.

7. KPI Design and Metrics

The dashboard emphasizes several core KPIs, categorized as follows:

Revenue KPIs:

- Total Revenue: Aggregated non-canceled bookings revenue.

- Average Daily Rate (ADR): Indicates average income per room sold.

- RevPAR: Evaluates revenue generation efficiency relative to room availability.

Efficiency KPIs:

- Occupancy Rate: Measures utilization of available rooms.

- Average Lead Time: Evaluates booking behavior and planning trends.

- Average Length of Stay (ALOS): Determines guest retention duration.

Risk KPIs:

- Cancellation Rate: Highlights booking stability.

- Revenue Lost to Cancellations: Assesses financial impact of canceled stays.

Customer KPIs:

- Repeat Guest Rate: Reflects guest loyalty and satisfaction.

- Top Markets: Identifies high-revenue countries and agents.

Each KPI was implemented using DAX functions within Power BI for real-time computation and analysis.

8. Dashboard Development in Power BI

The Power BI dashboard was developed following a structured data analytics workflow.
Data Modeling:

- Tables were connected via relationships between bookings, guests, and performance metrics.

- This model enabled accurate aggregation and dynamic filtering across dimensions such as season, country, and guest type.

DAX Measure Creation:

- DAX (Data Analysis Expressions) was employed to compute custom metrics such as Profit Margin, ADR, and Occupancy %.

- These measures were dynamically recalculated based on user selections.

Visualization and Interactivity:

- Cards: To highlight key KPIs such as total revenue, occupancy rate, and profit margin.

- Line Charts: To track monthly trends of revenue and profit.

- Pie Charts: To represent revenue distribution by guest type or channel.

- Waterfall Charts: To show profit changes across seasons.

- Maps: To visualize geographical distribution of guests and revenue sources.

- Treemaps and Heatmaps: For detailed performance comparisons across categories.

Interactive Controls:

- Filters and slicers allowed users to analyze data by hotel name, season, country, or channel, ensuring full interactivity and dynamic exploration.

Power BI Service Deployment:

- The final report was published on Power BI Service, enabling real-time access, collaboration, and sharing with stakeholders.

9. Findings and Discussion

- **Seasonal Revenue Patterns:** Winter generated the highest revenue, suggesting optimal pricing and occupancy during that period.

- **Customer Mix:** Leisure travelers drove more bookings, while business guests provided higher ADR values.

- **Profitability:** The average profit margin stood at 70.76%, reflecting efficient cost management.

- **Channel Performance:** Direct and OTA bookings had distinct revenue contributions, helping to guide marketing strategies.

- **Geographic Influence:** USA and Germany emerged as top-performing countries, with significant revenue and customer feedback.

- **Operational Efficiency:** Consistent occupancy and balanced room pricing indicated successful demand management.

10. Conclusion

The **HotelRevAI Power BI Dashboard** successfully achieved its primary goal—transforming static hotel booking data into an intelligent, interactive, and insightful business analytics solution. It demonstrated how real-time dashboards can:

- Improve visibility into key revenue drivers.

- Support evidence-based decisions on pricing and marketing.

- Reduce revenue leakage from cancellations.

- Enhance strategic planning through data visualization.

This project validates that Power BI can serve as a robust tool for hotel revenue management, bridging the gap between data and decision-making.

11. Future Scope

- Integration of predictive models (e.g., forecasting occupancy or revenue using regression or machine learning).

- Expansion of geographic and demographic data for deeper segmentation.

- Incorporation of sentiment analysis from guest reviews to link satisfaction with revenue outcomes.

- Implementation of automated alerts for threshold-based KPI monitoring.

12. Team Contributions

Group 3 Members:

- Dhanasree

- Ayush

- Nasreen

- Sucheti

- Sumit

- Mehul

- Mohana

- Harshitha

Individual Contributions:

- **Data Collection & Cleaning:** Dhanasree, Ayush

- **Data Modeling & DAX Measures:** Nasreen, Sumit

- **Dashboard Design & Visualization:** Sucheti, Mehul

- **Documentation & Presentation:** Mohana, Harshitha