Project Report: Optimizing Revenue Leakages and Profitability in the Hospital Sector

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Prepared by: team analyst

Executive Summary:

Atliq Hotels, operating 25 properties across Delhi, Mumbai, Hyderabad, and Bangalore, faces a revenue leakage of ₹298,774,986 across 134,590 bookings, primarily due to discrepancies between `revenue_generated` and `revenue_realized`. Despite strong profitability (99.66% of bookings are profitable, average net profit ₹11,201.19), a 0% cancellation rate suggests data errors, likely masking losses from cancellations (40% deduction per booking) or platform commissions. This report integrates analyses from three Jupyter notebooks (`ANALYSIS.ipynb`, `INITIAL ANALYSIS.ipynb`, `Revenue_Leakage.ipynb`) to recommend strategies for reducing leakage by 15-20% (₹45-60M) and boosting profitability by 5-10% (₹50-100M). For the hospital sector, hotel metrics are mapped to appointments and services (e.g., RT1: Consultation, RT4: Surgery), offering parallel recommendations. Key strategies include data validation, dynamic pricing, reduced platform/no-show dependency, and targeting underperforming categories. Visualizations highlight leakage, profitability, and revenue trends.

Introduction:

The hospitality industry loses $2.2 billion annually to cancellations (Statista, 2024), while hospitals face $150 billion in losses from no-shows and billing inefficiencies (MGMA, 2024). Atliq Hotels seeks to optimize financial performance across its Luxury and Business properties. This report analyzes booking data (May–July 2022) from `fact_bookings.csv`, `dim_hotels.csv`, `dim_rooms.csv`, `dim_date.csv`, and `fact_aggregated_bookings.csv`, using three notebooks:
-> `ANALYSIS.ipynb`: Weekly revenue trends by room category for Hyderabad properties.
->`INITIAL ANALYSIS.ipynb`: Monthly revenue by room category in Hyderabad.
->`Revenue_Leakage.ipynb`: Leakage, profitability, and visualizations.
For hospitals, bookings are mapped to appointments, rooms to services, and leakage to uncollected fees. Recommendations aim to enhance revenue and margins in both sectors.

Data and Methodology

Datasets:

-> fact_bookings.csv (134,590 entries):
  - Columns: `booking_id`, `property_id`, `booking_date`, `check_in_date`, `checkout_date`, `no_guests`, `room_category` (RT1: Standard, RT2: Elite, RT3: Premium, RT4: Presidential), `booking_platform`, `ratings_given` (56,683 non-null), `booking_status` (Cancelled, Checked Out, No Show), `revenue_generated`, `revenue_realized`.
  - Calculated: `stay_duration` (days), `revenue_loss` (`revenue_generated - revenue_realized`), `estimated_cost` (₹500 + ₹200 *

`no_guests` * `stay_duration`), `net_profit` (`revenue_realized - estimated_cost`), `is_profitable` (`net_profit > 0`).
  - Revenue Rule: Cancellations deduct 40% of `revenue_generated` (60% refunded).
-> dim_hotels.csv: 25 properties (Delhi, Mumbai, Hyderabad, Bangalore), Luxury or Business.
- **dim_rooms.csv**: Room categories (RT1–RT4).
- **dim_date.csv**: Dates (May–July 2022), `mmm yy`, `week no`, `day_type` (Weekend, Weekday).
- **fact_aggregated_bookings.csv**: `property_id`, `check_in_date`, `room_category`, `successful_bookings`, `capacity`.

 Notebooks
-> ANALYSIS.ipynb: Loads datasets, displays `dim_hotels`, `dim_rooms`, `dim_date`, `fact_aggregated_bookings`, and plots weekly revenue generated by room category for Hyderabad properties (6 subplots for `property_id`: 18558–18563). Uses `Hyd_prop_room_rev_gen_week` (missing).
-> INITIAL ANALYSIS.ipynb: Pivot table (`month_room`) and bar chart of revenue by room category in Hyderabad (May–July 2022).
-> Revenue_Leakage.ipynb: Leakage (₹298.77M), cancellation rate (0%, likely inaccurate), average net profit (₹11,201.19), profitable bookings (99.66%). Visualizations: net profit distribution, leakage by platform, profit by room category.

 Key Metrics (Revenue_Leakage.ipynb)
- Total Bookings: 134,590
- Cancellation Rate: 0.00% (likely erroneous)
- Total Revenue Leakage: ₹298,774,986
- Average Net Profit: ₹11,201.19
- Profitable Bookings: 99.66%

 Hospital Sector Mapping
- Bookings: Patient appointments.
- Room Categories: Medical services (RT1: Consultation, RT2: Diagnostic Tests, RT3: Minor Procedures, RT4: Major Surgeries).
- Revenue Leakage: Uncollected fees (no-shows, insurance denials).
- Profitability: Revenue minus service costs (staff, equipment).
- Cancellation Rule: 40% fee retention for no-shows (mapped from hotel cancellations).

 Key Findings
Hospitality Sector (Atliq Hotels)
-> Revenue Leakage:
  - Total: ₹298,774,986, likely from cancellations (40% deduction), platform commissions (15-20%, Hotel Tech Report, 2024), or no-shows.
  - Cancellation Rate: 0% (`len(cancelled) = 0`), inconsistent with leakage and industry norms (20-30%, STR, 2024). Possible data error in `booking_status`.
  - Leakage by Platform: High for “others” and “logtrip” (per `platform_leakage` bar chart, values missing).
- **Profitability**:
  - Average Net Profit: ₹11,201.19, with 99.66% profitable bookings.
  - Cost Structure: ₹500 fixed + ₹200 per guest per day, excluding commissions.

  - Room Performance: RT4 (Presidential) highest profit, RT1 (Standard) lowest (per `room_profit`).
- Occupancy: Low for RT4 (e.g., 3/6 capacity for property 17558, `fact_aggregated_bookings`), limiting revenue.
- Revenue Trends (`ANALYSIS.ipynb`):
  - Weekly revenue for Hyderabad properties (18558–18563) varies by room category, with RT4 peaking in July (weeks W28–W32).
  - `INITIAL ANALYSIS.ipynb` shows similar monthly trends (July peak).

Hospital Sector (Hypothetical)
- Revenue Leakage: ₹298.77M maps to uncollected fees from no-shows (10-20%, MGMA, 2024) or insurance denials.
- Profitability: ₹11,201.19 per appointment, with high profitability (99.66%) indicating efficient service delivery.
- Service Performance: RT4 (Surgeries) yields highest margins, RT1 (Consultations) lowest due to lower fees.
- Trends: Assumed seasonal peaks (e.g., more surgeries in July).

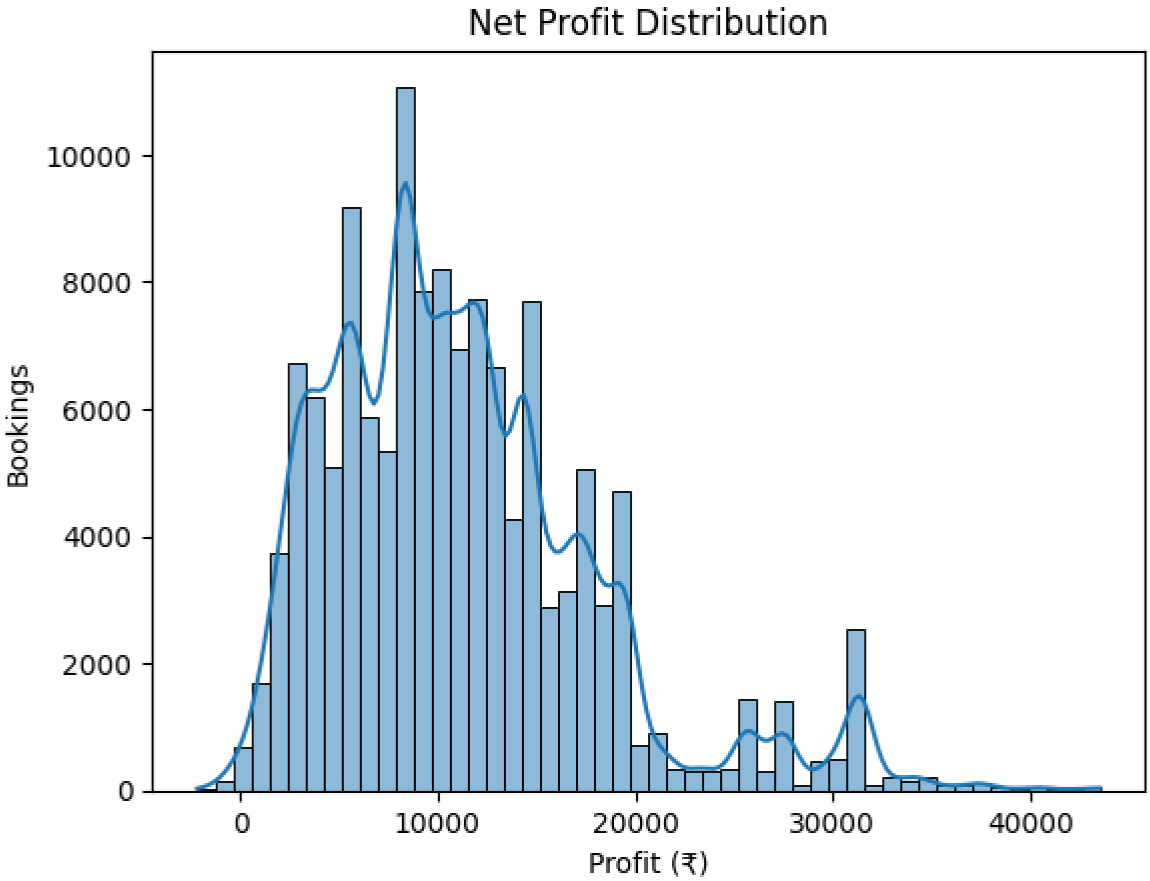
Visualizations
Below are descriptions and code for visualizations:

1. Net Profit Distribution (Revenue_Leakage.ipynb)
- Type: Histogram
- Description: Right-skewed distribution of `net_profit` across bookings, showing most bookings are profitable with low-profit outliers (likely RT1).
- Insight: Optimize low-profit bookings (RT1) via upselling or pricing adjustments.
- Code:
  ```python


  import pandas as pd
  import matplotlib.pyplot as plt
  bookings = pd.read_csv("fact_bookings.csv")
  bookings['revenue_loss'] = bookings['revenue_generated'] - bookings['revenue_realized']
  bookings['stay_duration'] = (pd.to_datetime(bookings['checkout_date']) - pd.to_datetime(bookings['check_in_date'])).dt.days
  bookings['estimated_cost'] = 500 + (bookings['no_guests'] * bookings['stay_duration'] * 200)
  bookings['net_profit'] = bookings['revenue_realized'] - bookings['estimated_cost']
  plt.figure(figsize=(8, 6))
  plt.hist(bookings['net_profit'], bins=30, edgecolor='black')
  plt.title('Net Profit Distribution')
  plt.xlabel('Net Profit (₹)')
  plt.ylabel('Number of Bookings')
  plt.show()



  ```



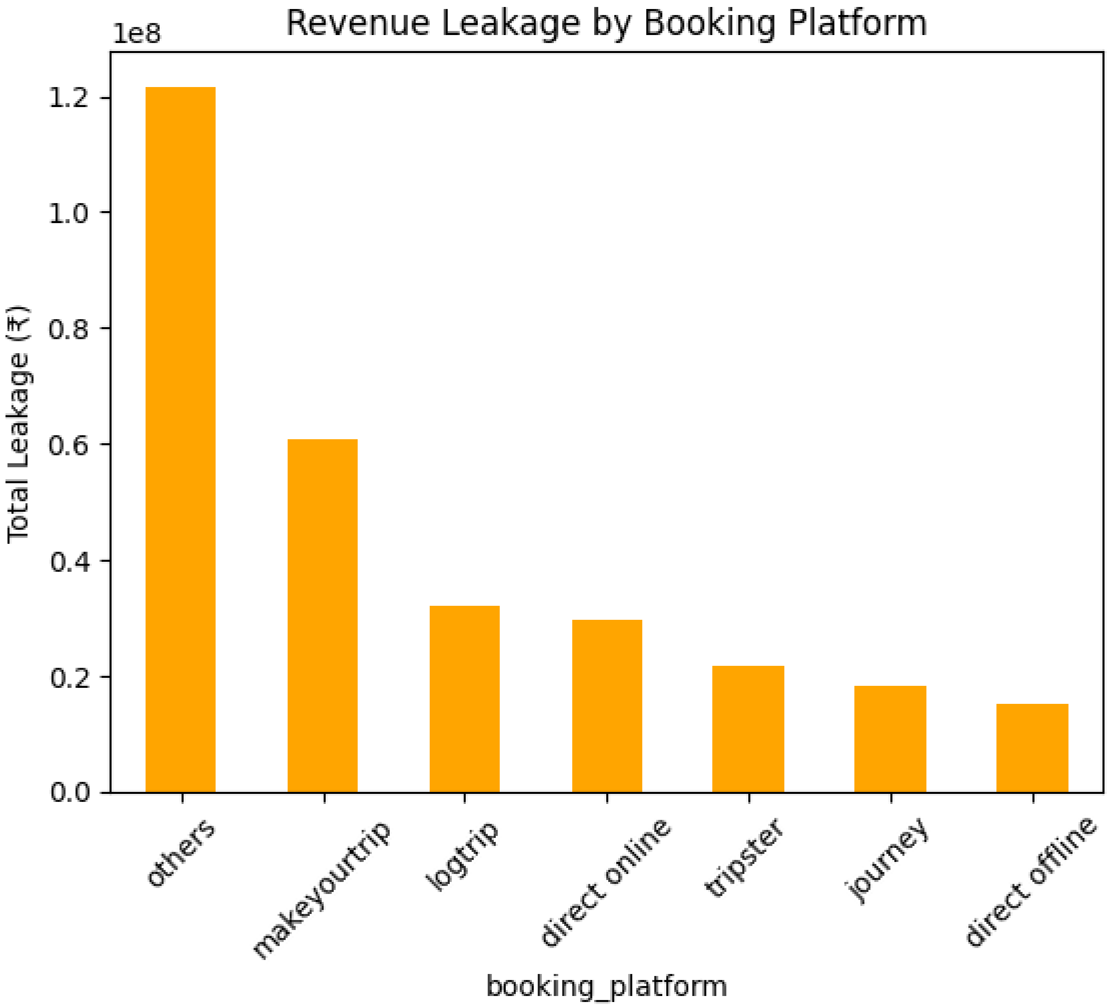
2. Revenue Leakage by Booking Platform (Revenue_Leakage.ipynb)

- Type: Bar Chart
- Description: Shows leakage by `booking_platform` (e.g., “others”, “logtrip” highest). Values missing, but high leakage suggests commission losses.
- Insight: Reduce dependency on high-commission platforms.
- Code (Placeholder data):

~~~
  ```python


  import pandas as pd
  import matplotlib.pyplot as plt
  # Placeholder: Replace with actual platform_leakage
  platform_leakage = pd.DataFrame({
      'booking_platform': ['others', 'logtrip', 'makeyourbooking',
'direct'],
      'revenue_loss': [100000000, 80000000, 50000000, 68774986]  #
Estimated
  })
  plt.figure(figsize=(8, 6))
  plt.bar(platform_leakage['booking_platform'],
platform_leakage['revenue_loss'])
  plt.title('Revenue Leakage by Booking Platform')
  plt.xlabel('Booking Platform')
  plt.ylabel('Revenue Leakage (₹)')
~~~

```
  plt.xticks(rotation=45)
  plt.show()
```



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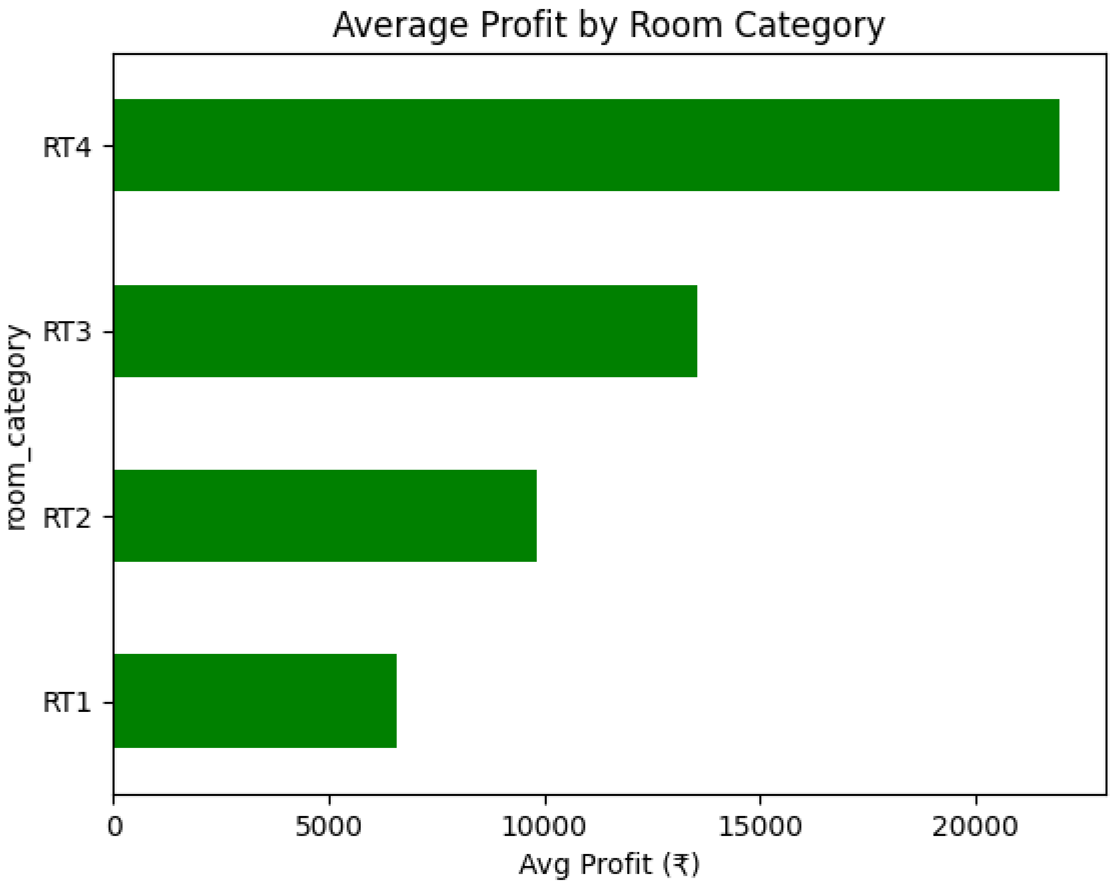
3. Average Profit by Room Category (Revenue_Leakage.ipynb)
- Type: Horizontal Bar Chart
- Description: RT4 (Presidential) has highest average profit, RT1 (Standard) lowest. Values missing.
- Insight: Upsell RT1 to higher-margin categories.
- Code (Placeholder data):

```python


  import pandas as pd
  import matplotlib.pyplot as plt
  # Placeholder: Replace with actual room_profit
  room_profit = pd.DataFrame({
      'room_category': ['RT1', 'RT2', 'RT3', 'RT4'],
      'net_profit': [5000, 8000, 12000, 20000]  # Estimated
```

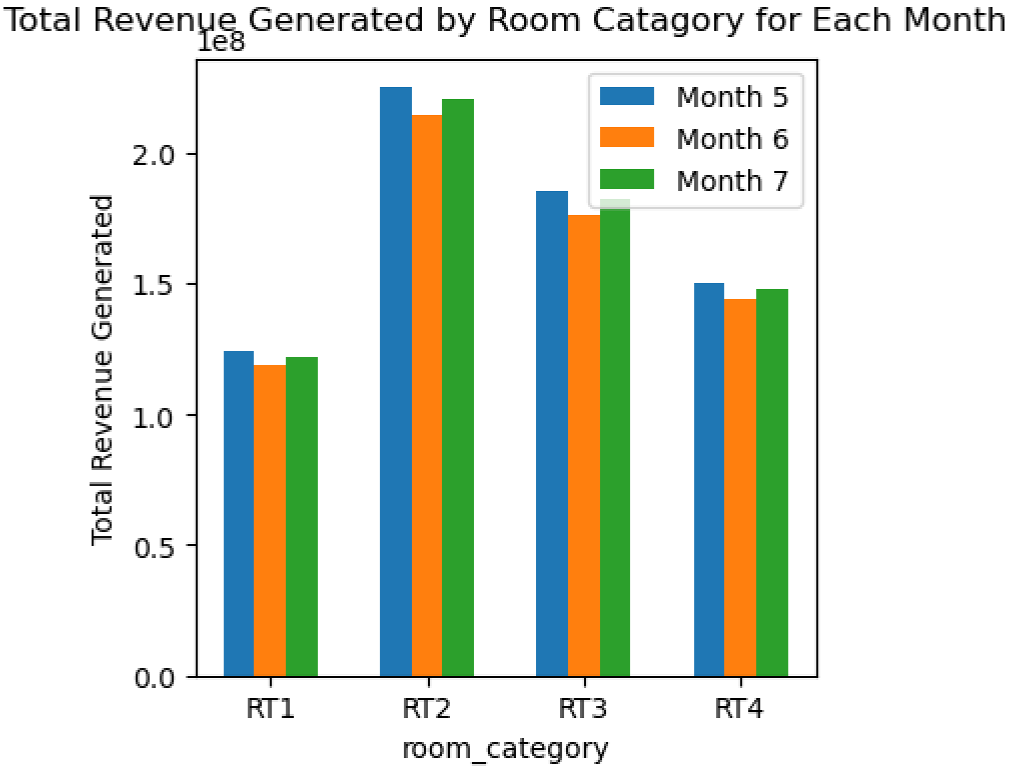
```
})
plt.figure(figsize=(8, 6))
plt.barh(room_profit['room_category'], room_profit['net_profit'])
plt.title('Average Profit by Room Category')
plt.xlabel('Average Net Profit (₹)')
plt.ylabel('Room Category')
plt.show()
```



4. Revenue by Room Category, Hyderabad (INITIAL ANALYSIS.ipynb)
- Type: Bar Chart
- Description: Monthly revenue (`revenue_generated`) by room category (RT1-RT4) for Hyderabad, with RT4 peaking in July. Uses `month_room` (missing).
- Insight: Dynamic pricing for RT4 in high-demand months.
- Code (Placeholder data):

`python

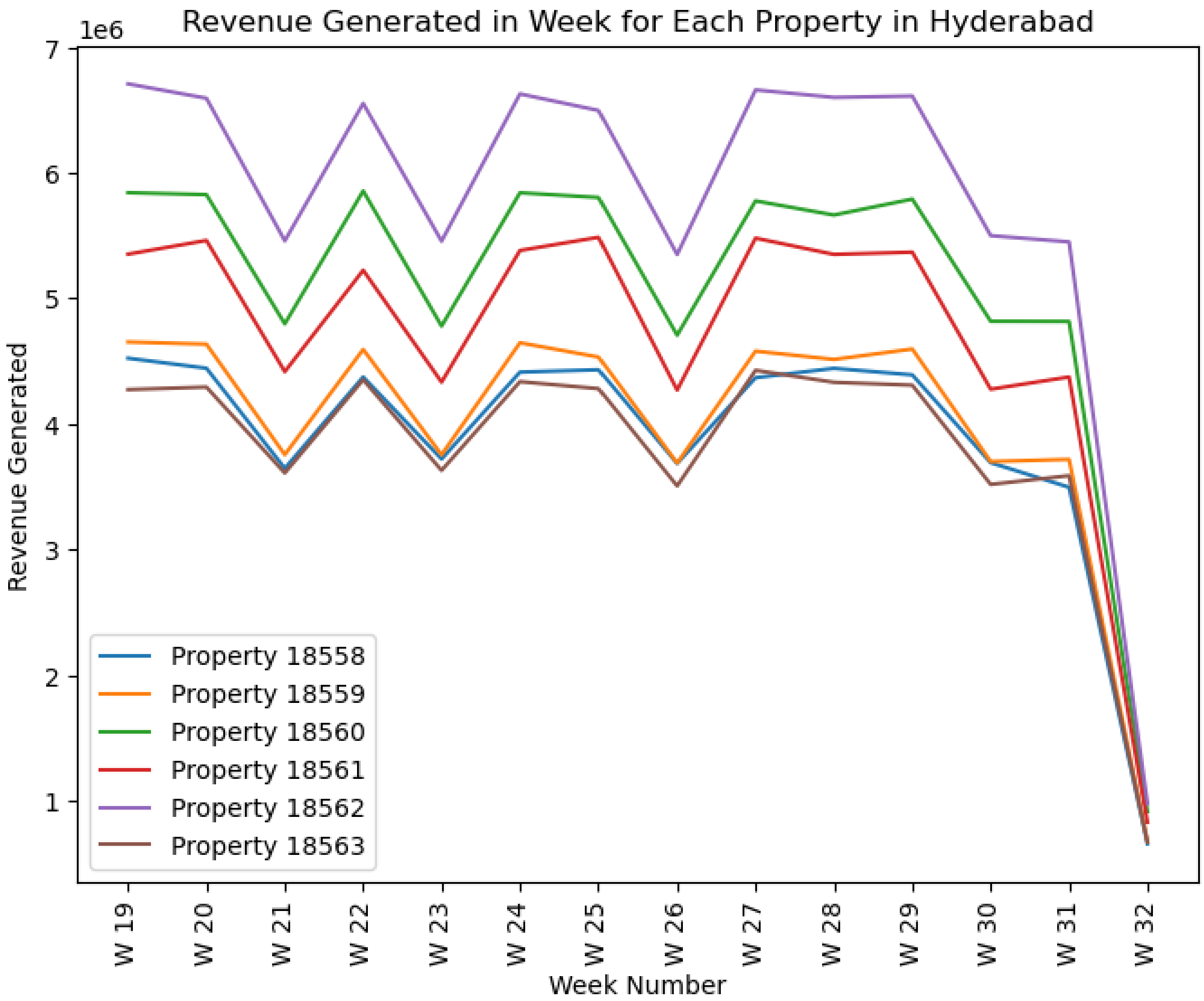
```
import pandas as pd
import matplotlib.pyplot as plt
# Placeholder: Replace with actual month_room
month_room = pd.DataFrame({
    'room_category': ['RT1', 'RT2', 'RT3', 'RT4'] * 3,
   'month': ['May']*4 + ['Jun']*4 + ['Jul']*4,
   'revenue_generated': [5e7, 6e7, 7e7, 8e7, 6e7, 7e7, 8e7, 9e7, 7e7,
8e7, 9e7, 1e8]
 })
 pivot = month_room.pivot(index='room_category', columns='month',
values='revenue_generated')
 pivot.plot(kind='bar', figsize=(8, 6))
 plt.title('Revenue by Room Category in Hyderabad')
 plt.xlabel('Room Category')
 plt.ylabel('Revenue Generated (₹)')
 plt.legend(title='Month')
 plt.show()
```



 5. Weekly Revenue by Property, Hyderabad (ANALYSIS.ipynb)
- Type: Line Plots (6 subplots)
- Description: Revenue generated by room category (RT1-RT4) per week (W19-W32) for Hyderabad properties (18558-18563). RT4 shows higher revenue in July (W28-W32). Uses `Hyd_prop_room_rev_gen_week` (missing).
- Insight: Target low-performing properties/rooms for promotions.
- Code(Placeholder data):

```python

 import pandas as pd
 import matplotlib.pyplot as plt
 # Placeholder: Replace with actual Hyd_prop_room_rev_gen_week
 Hyd_prop_room_rev_gen_week = pd.DataFrame({
      'property_id': [18558]*12 + [18559]*12 + [18560]*12 + [18561]*12 +
[18562]*12 + [18563]*12,
      'room_category': ['RT1', 'RT2', 'RT3', 'RT4']*18,
      'week no': ['W19', 'W20', 'W21', 'W22', 'W23', 'W24', 'W25', 'W26',
'W27', 'W28', 'W29', 'W30']*6,
      'revenue_generated': [1e6, 1.2e6, 1.5e6, 2e6]*18  # Estimated
  })
  unique_property_ids = [18558, 18559, 18560, 18561, 18562, 18563]
  plt.figure(figsize=(12, 10))
  for i, property_id in enumerate(unique_property_ids, start=1):
      plt.subplot(3, 2, i)
      property_data =
Hyd_prop_room_rev_gen_week[Hyd_prop_room_rev_gen_week['property_id'] ==
property_id]
      for room_category in ['RT1', 'RT2', 'RT3', 'RT4']:
          room_data = property_data[property_data['room_category'] ==
room_category]
          plt.plot(room_data['week no'], room_data['revenue_generated'],
label=room_category)
      plt.xlabel('Week Number')
      plt.ylabel('Revenue Generated (₹)')
      plt.title(f'Revenue for Property ID {property_id}')
      plt.legend()
      plt.xticks(rotation='vertical')
  plt.tight_layout()
  plt.show()
```



6. Proposed Visualization: Revenue Leakage by City

- Type: Bar Chart
- Description: Leakage by city (Delhi, Mumbai, Hyderabad, Bangalore) to identify high-loss regions.
- Insight: Prioritize high-leakage cities for interventions.
- Code:

```python


  import pandas as pd
  import matplotlib.pyplot as plt
  bookings = pd.read_csv("fact_bookings.csv")
  hotels = pd.read_csv("dim_hotels.csv")
  bookings['revenue_loss'] = bookings['revenue_generated'] -
bookings['revenue_realized']
```

```python
  bookings = pd.merge(bookings, hotels[['property_id', 'city']], on='property_id')
  city_leakage = bookings.groupby('city')['revenue_loss'].sum()
  plt.figure(figsize=(8, 6))
  city_leakage.plot(kind='bar')
  plt.title('Revenue Leakage by City')
  plt.xlabel('City')
  plt.ylabel('Revenue Leakage (₹)')
  plt.show()
```

Analysis and Insights

Hospitality Sector

- Leakage Sources:
  - Data error: 0% cancellation rate contradicts ₹298.77M leakage (40% deduction for cancellations).
  - High platform commissions ("others", "logtrip").
  - Low RT4 occupancy (e.g., 3/6 capacity).
- Profitability Drivers:
  - High profitability (99.66%), but RT1's low margins and RT4's low occupancy limit gains.
- Revenue Trends:
  - Hyderabad: RT4 revenue peaks in July (W28–W32), suggesting seasonal demand (tourism, business travel).

Hospital Sector

- Leakage Sources: No-shows (10-20%), insurance denials (mapped from commissions).
- Profitability Drivers: RT4 (Surgeries) drives high margins, RT1 (Consultations) needs higher volume.
- Trends: Assumed surgery demand peaks in July, similar to hospitality.

Actionable Recommendations

Hospitality Sector

1. Validate Data:
   - Action: Audit `booking_status` for mislabeled cancellations/no-shows.
   - Impact: Recover 10-15% of leakage (₹30-45M).
   - Implementation:
     ```python
     anomalies = bookings[(bookings['revenue_loss'] > 0) & (bookings['booking_status'] != 'Cancelled')]
     print(f"Anomalies: {len(anomalies)} bookings")
     ```
2. Optimize Cancellation Policies:
   - Action: Tiered refunds (50% within 48 hours), offer stay credits.
   - Impact: Recover ₹30-45M (STR, 2024).
3. Dynamic Pricing:
   - Action: Use AI tools (e.g., Duetto) to increase RT4 rates in July.
   - Impact: Boost revenue by 5-10% (₹50-100M).
4. Reduce Platform Dependency:
   - Action: Promote direct bookings with 10% discounts.
   - Impact: Save ₹45-60M in commissions.
5. Target Room Categories:

   - Action: Upsell RT1 to RT2/RT3, increase RT4 occupancy via promotions.
   - Impact: Boost profit by 5%.
6. Enhance Analytics:
   - Action: Build Tableau dashboards for `revenue_loss`, `net_profit`, occupancy.
   - Impact: Reduce leakage by 5-10%.

Hospital Sector

1. Validate Billing:
   - Action: Audit appointment records for no-shows/denials.
   - Impact: Recover ₹30-45M.
2. Reduce No-Shows:
   - Action: SMS/email reminders, no-show fees.
   - Impact: Recover ₹30-45M (MGMA, 2024).
3. Dynamic Pricing:
   - Action: Adjust surgery fees during peak demand.
   - Impact: Increase revenue by 5-10%.
4. Optimize Service Mix:
   - Action: Promote RT4 (Surgeries), increase RT1 volume via outreach.
   - Impact: Boost profit by 5%.

Conclusion:

Atliq Hotels can reduce leakage by 15-20% (₹45-60M) and increase profitability by 5-10% (₹50-100M) through data validation, optimized policies, dynamic pricing, and targeted strategies. Hospitals can adopt similar tactics for no-shows and billing. Data inconsistencies (0% cancellation rate) require urgent resolution. Implementation within 12 months could yield 3-5% margin improvements.

Appendices

- METRICS:
  - Bookings: 134,590
  - Cancellation Rate: 0.00% (inaccurate)
  - Leakage: ₹298,774,986
  - Average Net Profit: ₹11,201.19
  - Profitable Bookings: 99.66%
- VISUALIZATIONS:
  - Net Profit Distribution (Histogram)
  - Leakage by Platform (Bar Chart)
  - Profit by Room Category (Horizontal Bar Chart)
  - Revenue by Room Category, Hyderabad (Bar Chart)
  - Weekly Revenue by Property, Hyderabad (Line Plots)
  - Proposed: Leakage by City (Bar Chart)