Using BI to Optimize Last-Mile Logistics

Objective:

This project explores a large dataset of Amazon deliveries to uncover insights that can improve delivery efficiency and optimize operations. The analysis focuses on customer behavior, delivery performance, product trends, and traffic impacts—both overall and by area.

1. Ask the Right Questions (Define the Problem)

Guiding Questions:

- What factors affect delivery efficiency?
- Which product categories are most and least popular?
- How do traffic, delivery area, and vehicle type impact transit time?
- When are orders most frequently placed?
- What patterns exist in agent performance across different conditions?

2. Collect the Data

Dataset Source:

The dataset used for this analysis was downloaded from Kaggle and can be found at Amazon Delivery Dataset

Key Features:

Size: 43,648 rows x 16 columns

Features:

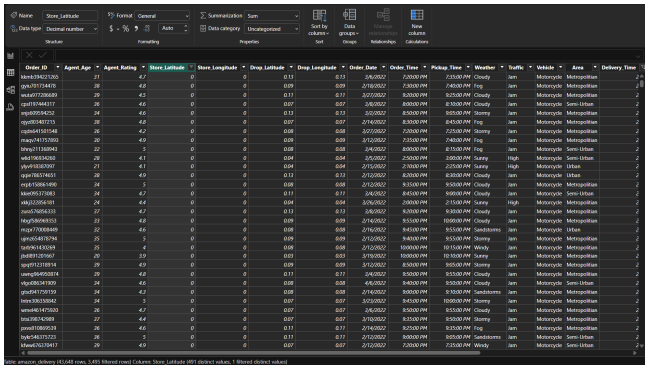
- `Order_ID`
- `Agent_Age` (numeric)
- `Agent_Rating` (decimal)
- `Transit_Time` (in minutes)
- `Traffic`, `Weather`, `Vehicle` (categorical)
- `Area`, `Order_Date`, `Category`

	Agent_Age	Agent_Rating	Store_Latitude	Store_Longitude	Drop_Latitude	Drop_Longitude	Order_Date	Order_Time	Pickup_Time	Weather	Traffic	Vehicle	Area	Transit_Time	Category
7571	20	4.6	12.934365	77.616155	13.024365	77.706155	3/18/2022	8:35:00 PM	8:50:00 PM	Fog	Jam	Motorcycle	Metropolitian	220	Home
5734	23	4.6	18.563934	73.915367	18.653934	74.005367	3/31/2022	9:40:00 PM	9:55:00 PM	Fog	Jam	Motorcycle	Metropolitian	230	Home
8882	35	4.6	26.892312	75.806896	27.022313	75.936896	3/25/2022	7:15:00 PM	7:20:00 PM	Fog	Jam	Motorcycle	Metropolitian	255	Pet Supp
2868	24	4.6	17.458998	78.500366	17.538998	78.580366	3/12/2022	7:40:00 PM	7:55:00 PM	Fog	Jam	Motorcycle	Metropolitian	38	Grocery
0969	25	4.6	19.1093	72.825451	19.1793	72.895451	3/14/2022	7:45:00 PM	7:50:00 PM	Fog	Jam	Motorcycle	Metropolitian	225	Electroni
8210	39	4.6	11.024839	77.007003	11.094839	77.077003	3/16/2022	8:55:00 PM	9:10:00 PM	Fog	Jam	Motorcycle	Metropolitian	215	Home
8325	34	4.6	12.325461	76.632278	12.405461	76.712278	3/14/2022	9:00:00 PM	9:15:00 PM	Fog	Jam	Motorcycle	Metropolitian	40	Grocery
0538	35	4.6	21.175975	72.795503	21.285975	72.905503	3/20/2022	9:10:00 PM	9:25:00 PM	Fog	Jam	Motorcycle	Metropolitian	225	Cosmeti
8949	32	4.6	13.044694	80.26147	13.174694	80.39147	3/25/2022	8:00:00 PM	8:10:00 PM	Fog	Jam	Motorcycle	Metropolitian	210	Shoes
807	21	4.6	23.359194	85.325447	23.389194	85.355447	3/9/2022	7:45:00 PM	8:00:00 PM	Fog	Jam	Motorcycle	Metropolitian	105	Home
2623	39	4.6	26.905287	75.794592	27.015287	75.904592	3/29/2022	8:50:00 PM	9:05:00 PM	Fog	Jam	Motorcycle	Metropolitian	205	Books
7455	22	4.6	12.970221	77.645396	13.060221	77.735396	3/20/2022	7:30:00 PM	7:35:00 PM	Fog	Jam	Motorcycle	Metropolitian	175	Apparel
9069	30	4.6	22.31279	73.170283	22.42279	73.280283	3/20/2022	9:30:00 PM	9:40:00 PM	Fog	Jam	Motorcycle	Metropolitian	225	Skincare
0627	32	4.6	12.933284	77.615428	13.013284	77.695428	3/31/2022	7:55:00 PM	8:05:00 PM	Fog	Jam	Motorcycle	Metropolitian	215	Books
1197	23	4.6	22.745536	75.893106	22.825536	75.973106	3/14/2022	8:25:00 PM	8:40:00 PM	Fog	Jam	Motorcycle	Metropolitian	230	Toys
8502	38	4.6	22.75004	75.902847	22.88004	76.032847	3/6/2022	9:10:00 PM	9:15:00 PM	Fog	Jam	Motorcycle	Metropolitian	46	Grocery
876	21	4.6	11.022298	76.998349	11.052298	77.028349	3/17/2022	8:35:00 PM	8:40:00 PM	Fog	Jam	Motorcycle	Metropolitian	125	Books
2813	37	4.6	18.546258	73.904337	18.596258	73.954337	3/9/2022	9:40:00 PM	9:50:00 PM	Fog	Jam	Motorcycle	Metropolitian	170	Cosmeti
1025	21	4.6	18.994237	72.825553	19.054237	72.885553	3/28/2022	8:55:00 PM	9:00:00 PM	Fog	Jam	Motorcycle	Metropolitian	100	Electroni
9523	31	4.6	26.88842	75.800689	26.91842	75.830689	3/15/2022	7:40:00 PM	7:45:00 PM	Fog	Jam	Motorcycle	Metropolitian	160	Jewelry
7448	29	4.6	17.431668	78.408321	17.481668	78.458321	3/5/2022	7:50:00 PM	7:55:00 PM	Fog	Jam	Motorcycle	Metropolitian	135	Cosmeti
9466	38	4.6	11.024839	77.007003	11.054839	77.037003	3/9/2022	7:50:00 PM	7:55:00 PM	Fog	Jam	Motorcycle	Metropolitian	160	Toys
892	35	4.6	13.005801	80.250744	13.115801	80.360744	3/10/2022	7:40:00 PM	7:50:00 PM	Fog	Jam	Motorcycle	Metropolitian	200	Snacks
4960	33	4.6	22.311844	73.165081	22.401844	73.255081	3/25/2022	8:45:00 PM	9:00:00 PM	Fog	Jam	Motorcycle	Metropolitian	265	Clothing
7182	23	4.6	12.311072	76.654878	12.381072	76.724878	3/31/2022	8:00:00 PM	8:10:00 PM	Fog	Jam	Motorcycle	Metropolitian	175	Apparel
5110	21	4.6	23.333017	85.3172	23.443017	85.4272	3/2/2022	8:00:00 PM	8:15:00 PM	Fog	Jam	Motorcycle	Metropolitian	180	Sports
2474	22	4.6	11.022477	76.995667	11.082477	77.055667	3/9/2022	8:15:00 PM	8:20:00 PM	Fog	Jam	Motorcycle	Metropolitian	100	Pet Supp
9602	33	4.6	22.651847	75.881991	22.701847	75.931991	3/24/2022	7:25:00 PM	7:30:00 PM	Fog	Jam	Motorcycle	Metropolitian	140	Snacks
7314	38	4.6	19.121999	72.908493	19.151999	72.938493	3/28/2022	7:10:00 PM	7:15:00 PM	Fog	Jam	Motorcycle	Metropolitian	155	Skincare
3778	23	4.6	23.355164	85.324097	23.485164	85.454097	3/29/2022	7:20:00 PM	7:30:00 PM	Fog	Jam	Motorcycle	Metropolitian	205	Skincare
9077	34	4.6	18.927584	72.832585	18.997584	72.902585	3/29/2022	8:10:00 PM	8:25:00 PM	Fog	Jam	Motorcycle	Metropolitian	36	Grocery

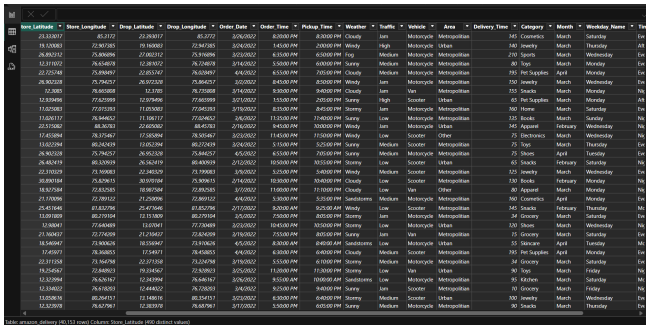
3. Clean & Prepare the Data

Data Cleaning Tasks:

- Removed invalid geolocation values (`Store_Latitude`/`Store_Longitude` = 0 - in the Indian Ocean)

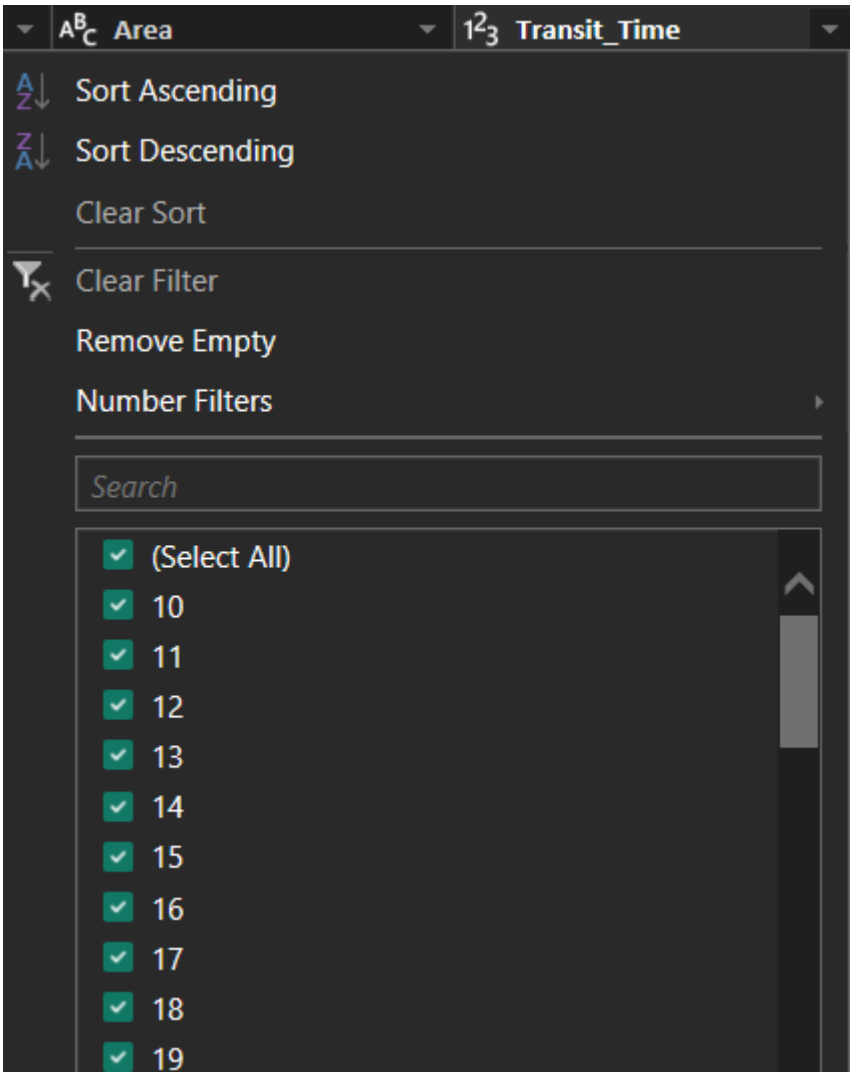


Before



After

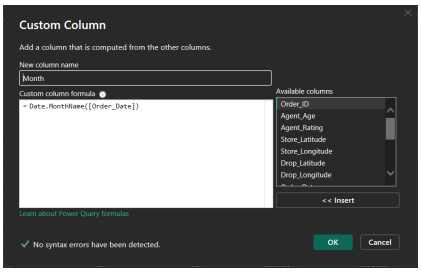
- Dropped rows with a blank in the `Transit_Time` column to preserve metric integrity

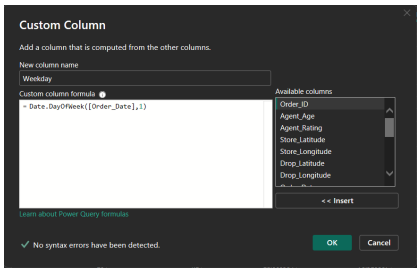


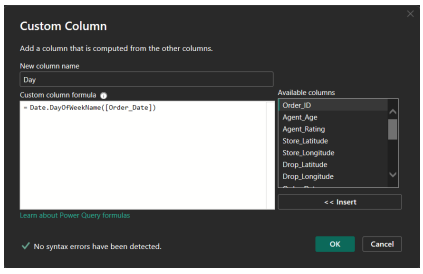
- Standardized data types (e.g., converted agent age from string to integer)
- Capitalized first letter of `Vehicle` types for better visuals

Feature Engineering:

- Created `Month`, `Weekday`, `Weekday_Name` columns using Power Query date functions





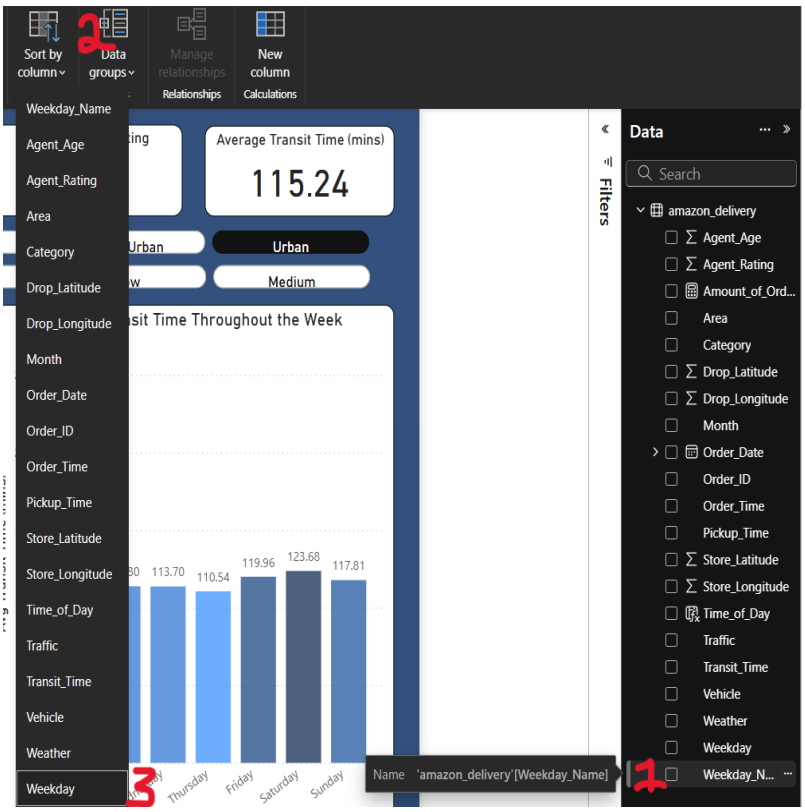


- Built `Time_of_Day` column using DAX SWITCH() for Morning/Afternoon/Evening/Night
- Created `Amount_Of_Orders` measure to track volume

```
Time_of_Day =
SWITCH(
    TRUE(),
    TIMEVALUE([Order_Time]) >= TIME(5,0,0) && TIMEVALUE([Order_Time]) <= TIME(11,59,59), "Morning",
    TIMEVALUE([Order_Time]) >= TIME(12,0,0) && TIMEVALUE([Order_Time]) <= TIME(16,59,59), "Afternoon",
    TIMEVALUE([Order_Time]) >= TIME(17,0,0) && TIMEVALUE([Order_Time]) <= TIME(20,59,59), "Evening",
    "Night"
)
```

```
Amount_of_Orders = COUNTROWS(amazon_delivery)
```

- Ensured bar chart would be sorted by `Weekday_Name` using numerical `Weekday` values



4. Analyze the Data

a. Time-Series Trends:

- Significant order increases from Feb 18 – Mar 1 (likely due to end-of-month promotions)
- March had the most complete data; February and April had partial coverage
- Delivery times varied significantly based on traffic and area:
    - Fastest: low-traffic urban areas
    - Slowest: semi-urban in high traffic

b. Traffic Pattern Insights:

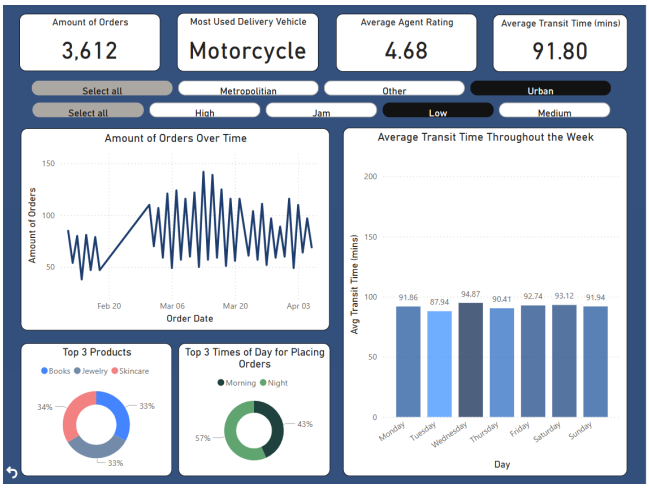
- Traffic Jams = longest average transit times (148 mins), lowest ratings
- Low traffic = quickest deliveries (101 mins), highest ratings

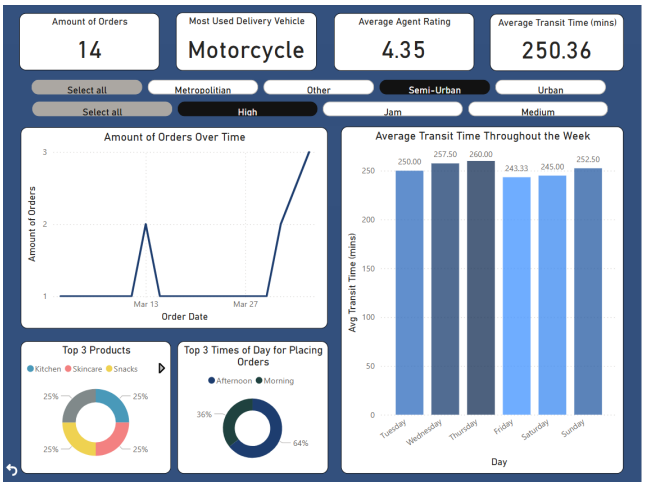
c. Descriptive & Exploratory Analysis:

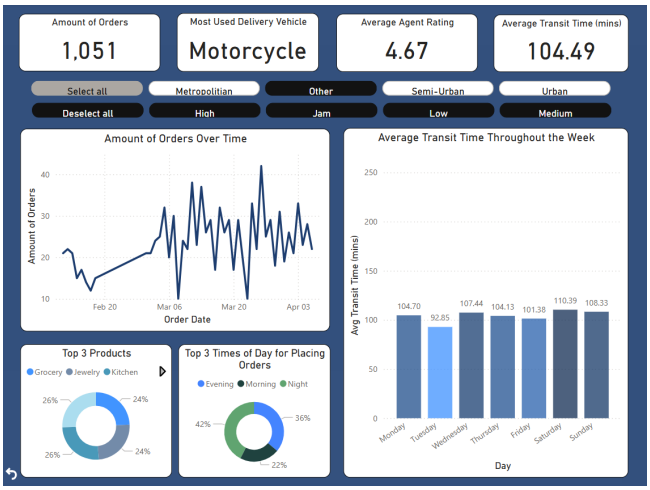
- Majority of deliveries were made to Metropolitan areas (30K+ orders)
- Motorcycles were the most used delivery vehicle across all areas
- Evenings had the highest order activity, especially on Wednesdays and Sundays
- Electronics, books, and jewelry were the top products purchased

5. Share & Visualize Results

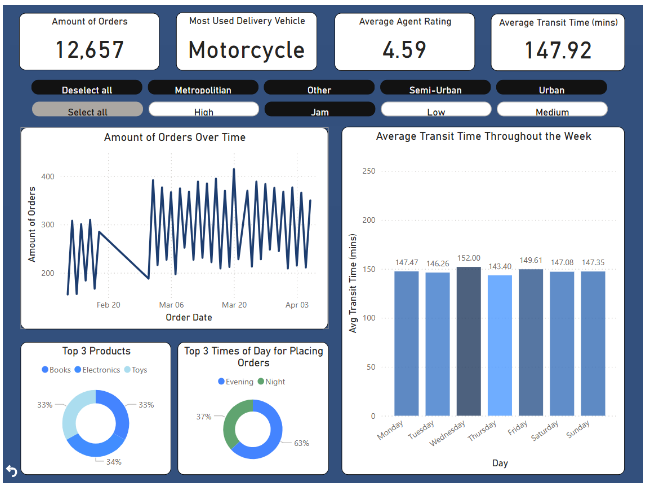
4.a Time-Series Trends Visuals:

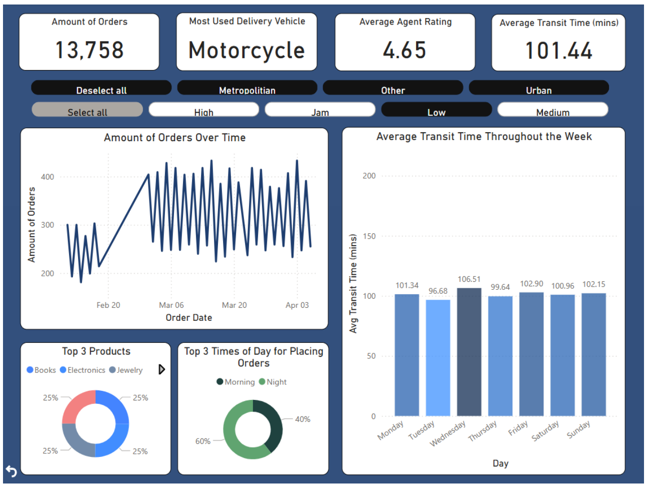




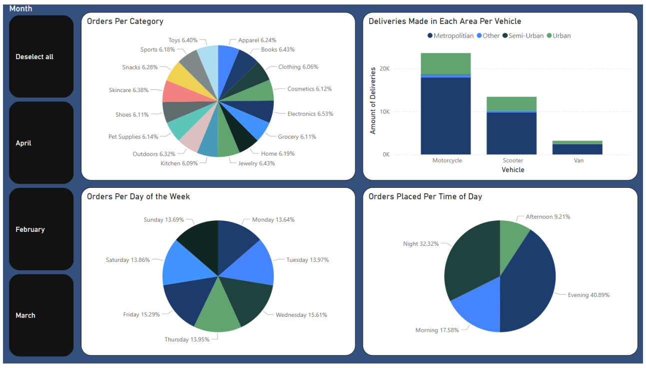


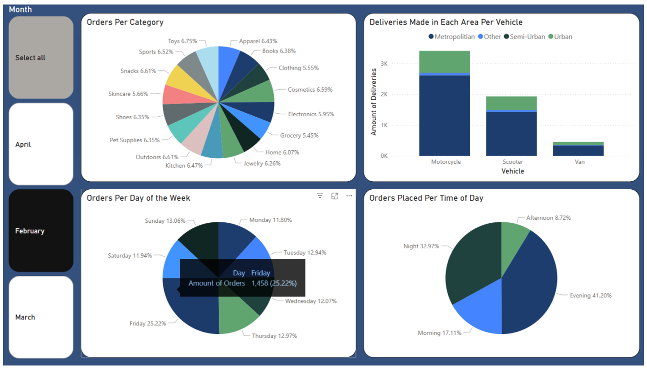
4.b Traffic Pattern Insights Visuals:

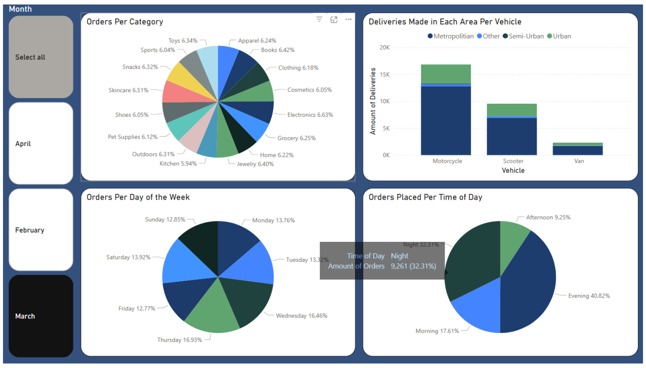


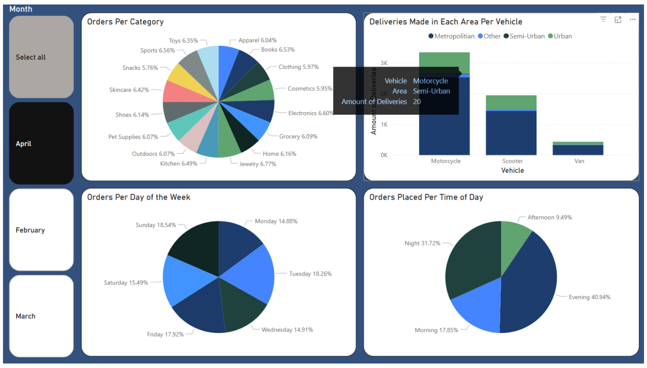


4.c Descriptive & Exploratory Analysis Visuals:









6. Act (Draw Conclusions & Recommend Actions)

Key Takeaways:

- Transit time influences agent ratings — the quicker the delivery, the better the customer feedback
- Agents riding motorcycles in low traffic, urban areas are the fastest and get the highest ratings
- Delivery optimization should prioritize time of day, vehicle type, and regional traffic trends
- High traffic times correlate with Afternoon deliveries that consist mostly of skincare, sports, and pet supplies products
- Evening orders dominate—especially on Wednesdays and Sundays

Recommendations:

- Route deliveries to Urban/Other zones during low-traffic times
- Assign motorcycle deliveries for congested routes
- Focus on high-efficiency time slots (Evenings, Weds/Thurs) to deliver packages
- Use agent performance data for training purposes
- Develop demand-based staffing forecasts by day & hour