Business Report - 7

PG Program in Data Science and Business Analytics

submitted by

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Introduction to SQL

1 Business Context

A lot of people in the world share a common desire: to own a vehicle. A car or an automobile is seen as an object that gives the freedom of mobility. Many now prefer pre-owned vehicles because they come at an affordable cost, but at the same time, they are also concerned about whether the after-sales service provided by the resale vendors is as good as the care you may get from the actual manufacturers.

New-Wheels, a vehicle resale company, has launched an app with an end-to-end service from listing the vehicle on the platform to shipping it to the customer's location. This app also captures the overall after-sales feedback given by the customer.

2 Objective

New-Wheels sales have been dipping steadily in the past year, and due to the critical customer feedback and ratings online, there has been a drop in new customers every quarter, which is concerning to the business. The CEO of the company now wants a quarterly report with all the key metrics sent to him so he can assess the health of the business and make the necessary decisions.

As a data analyst, you see that there is an array of questions that are being asked at the leadership level that need to be answered using data. Import the dump file that contains various tables that are present in the database. Use the data to answer the questions posed and create a quarterly business report for the CEO.

3 Data Description

The data provided has

1. Attributes on the vehicles New-Wheels sells - What are the make, model, and year? What is the price point?
2. Attributes on the customers, such as where they live and payment methods
3. Attributes on orders and shipments, such as when the order was shipped and received, what the after-sales feedback was, and so on.

3.1 Data dictionary

- **shipper_id**: Unique ID of the Shipper
- **shipper_name**: Name of the Shipper
- **shipper_contact_details**: Contact detail of the Shipper
- **product_id**: Unique ID of the Product
- **vehicle_maker**: Vehicle Manufacturing company name
- **vehicle_model**: Vehicle model name
- **vehicle_color**: Color of the Vehicle
- **vehicle_model_year**: Year of Manufacturing
- **vehicle_price**: Price of the Vehicle
- **quantity**: Ordered Quantity
- **customer_id**: Unique ID of the customer
- **customer_name**: Name of the customer
- **gender**: Gender of the customer
- **job_title**: Job Title of the customer
- **phone_number**: Contact detail of the customer

- **email_address**: Email address of the customer
- **city**: Residing city of the customer
- **country**: Residing country of the customer
- **state**: Residing state of the customer
- **customer_address**: Address of the customer
- **order_date**: Date on which customer ordered the vehicle
- **order_id**: Unique ID of the order
- **ship_date**: Shipment Date
- **ship_mode**: Shipping Mode/Class
- **shipping**: Shipping Ways
- **postal_code**: Postal Code of the customer
- **discount**: Discount given to the customer for the particular order by credit card in percentage
- **credit_card_type**: Credit Card Type
- **credit_card_number**: Credit card number
- **customer_feedback**: Feedback of the customer
- **quarter_number**: Quarter Number

3.2 ER Diagram

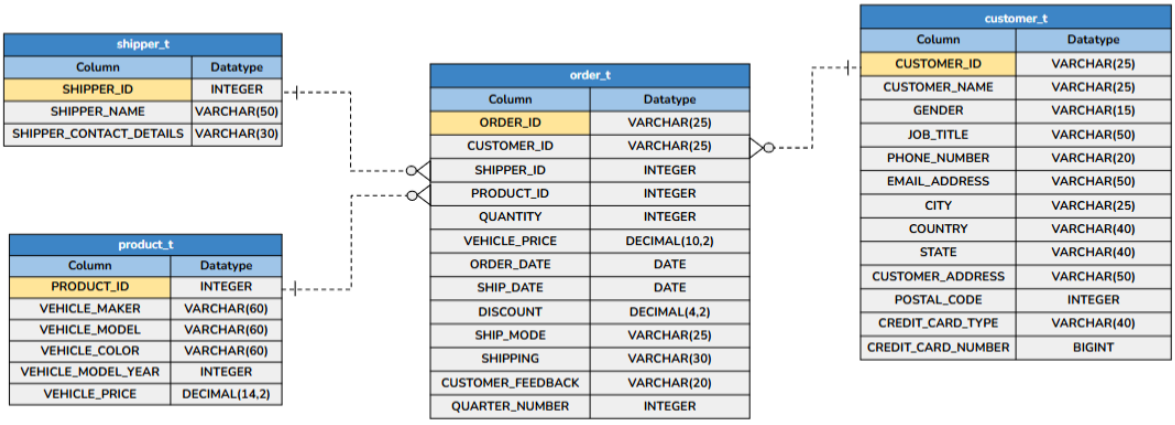

Figure 1: ER diagram

4 Business Questions

Note - I have completed this project in Mysql and SQLite platform both. The codes I have provided in this document are from Mysql and the codes for the SQLite platform are submitted in the website itself under the section SQL Playground - Coded Project.

4.1 Question-1

4.1.1 Find the total number of customers who have placed orders? What is the distribution of the customers across states?

4.1.2 Query

```
WITH statewise_customers AS (
        SELECT c.state,
                COUNT(DISTINCT c.customer_id) AS Total_customers
        FROM customer_t c
        JOIN order_t o ON c.customer_id = o.customer_id
        GROUP BY c.state
)
SELECT *, SUM(Total_customers) OVER () AS Total_customers_with_orders
FROM statewise_customers
ORDER BY Total_customers DESC;
```

4.1.3 Output

state	Total_customers	Total_customers_with_orders
California	97	994
Texas	97	994
Florida	86	994
New York	69	994
District of Columbia	35	994
Colorado	33	994
Ohio	33	994
Alabama	29	994
Washington	28	994
Arizona	26	994
Illinois	25	994
Pennsylvania	25	994
Virginia	24	994

Figure 2: State-wise Customers

4.1.4 Observations and Insights

- **State-Wise Distribution**: California, Texas, and Florida have the highest customer counts.
- **Customers with Orders**: All 994 listed customers have placed orders, indicating high conversion.
- **Regional Market Penetration**: The top 4 states dominate sales, while others may suffer from low demand or weak marketing.
- **Business Implications**: Analyzing revenue per customer and customer feedback is crucial. Low-engagement states need targeted promotions.

4.1.5 Recommendations

- **Boost Sales in Low-Engagement States**: Launch promotions and strengthen dealer partnerships.
- **Enhance Retention in Key Markets**: Improve after-sales service and introduce loyalty programs.
- **Investigate Customer Satisfaction**: Analyze complaints regarding shipping, vehicle quality, and pricing.
- **Optimize Pricing Strategy**: Assess revenue per customer, segment data by vehicle model, price, and discounts.

4.2 Question-2

4.2.1 Which are the top 5 vehicle makers preferred by the customers?

4.2.2 Query

```
SELECT
        p.vehicle_maker,
        COUNT(o.customer_id) AS customer_count
FROM product_t p
JOIN order_t o ON p.product_id = o.product_id
GROUP BY p.vehicle_maker
ORDER BY customer_count DESC;
```

4.2.3 Output

vehicle_maker	customer_count
Chevrolet	83
Ford	63
Toyota	52
Dodge	50
Pontiac	50
Mercedes-Benz	45
Mazda	43
Mitsubishi	41
Buick	40
GMC	37
Volkswagen	35
Nissan	31
BMW	28
Volvo	26
Audi	25
Subaru	22
Suzuki	22
Honda	19
Cadillac	18
Isuzu	18
Lexus	18
Kia	16

Figure 3: Vehicle Makers and Customer Count

4.2.4 Observations and Insights

- **Preferred Vehicle Makers**: Chevrolet (83 customers), Ford (63), and Toyota (52) are the most popular brands.
- **Customer Preferences**: The top 5 brands dominate sales, while lower-ranked brands like Ram,Austin etc. have fewer buyers.
- **Market Trends**: American brands (Chevrolet, Ford, Dodge) are more favored than luxury brands (BMW, Mercedes-Benz).
- **Business Implications**: High-demand brands should be prioritized for stock and promotions. Less popular brands may need better marketing.

4.2.5 Recommendations

- **Stock Optimization**: Focus on high-demand brands to improve inventory efficiency.
- **Targeted Marketing**: Promote lesser-sold brands via discounts and advertising.

- **Customer Insights**: Conduct surveys to understand brand preferences better.
- **Sales Strategy**: Offer bundled deals or financing options to boost sales for mid-tier brands.

4.3 Question-3

4.3.1 Which is the most preferred vehicle maker in each state?

4.3.2 Query

```
WITH VehicleRank AS (
        SELECT
                c.state,
                p.vehicle_maker,
                COUNT(DISTINCT c.customer_id) AS customer_count,
                RANK() OVER (PARTITION BY c.state ORDER BY COUNT(DISTINCT c.
                    customer_id) DESC) AS rnk
        FROM customer_t c
        JOIN order_t o ON c.customer_id = o.customer_id
        JOIN product_t p ON o.product_id = p.product_id
        GROUP BY c.state, p.vehicle_maker
)
SELECT
        state, vehicle_maker, customer_count
        FROM VehicleRank
        WHERE rnk = 1;
```

4.3.3 Output

state	vehicle_maker	customer_count
Alabama	Dodge	5
Alaska	Chevrolet	2
Arizona	Cadillac	3
Arizona	Pontiac	3
Arkansas	Chevrolet	1
Arkansas	GMC	1
Arkansas	Mitsubishi	1
Arkansas	Pontiac	1
Arkansas	Suzuki	1
Arkansas	Volkswagen	1
California	Audi	6
California	Chevrolet	6
California	Dodge	6
California	Ford	6
California	Nissan	6

Figure 4: Most Preferred Vehicle Maker by State

4.3.4 Observations and Insights

- **State-Wise Vehicle Preference**: Chevrolet, Dodge, and Toyota dominate as preferred vehicle makers in multiple states, indicating strong customer trust in these brands.
- **Diverse Preferences**: Some states have multiple top vehicle makers with the same customer count, suggesting a competitive resale market.
- **Market Concentration**: California and Florida show higher customer counts per vehicle maker, reinforcing them as key markets.
- **Low Customer Engagement**: Several states have only 1-2 customers per top-ranked vehicle maker, indicating potential marketing gaps.

4.3.5 Recommendations

- **Strengthen Popular Brand Sales**: Optimize supply chain and inventory for Chevrolet, Dodge, and Toyota to meet demand efficiently.
- **Expand Low-Engagement States**: Implement targeted promotions to attract more customers in states with minimal sales.
- **Competitive Analysis**: Study states with shared top vehicle makers to identify differentiating factors driving customer choices.
- **Improve Regional Strategies**: Customize advertising and dealership collaborations based on state-wise preferences.

4.4 Question-4

4.4.1 Find the overall average rating given by the customers. What is the average rating in each quarter?

4.4.2 Query

```
SELECT
        CASE
                WHEN quarter_number IS NULL THEN 'Overall Average'
                ELSE quarter_number
        END AS quarter_info,
        AVG(rating) AS avg_rating
FROM (
        SELECT
                quarter_number,
                CASE
                        WHEN customer_feedback = 'Very Bad' THEN 1
                        WHEN customer_feedback = 'Bad' THEN 2
                        WHEN customer_feedback = 'Okay' THEN 3
                        WHEN customer_feedback = 'Good' THEN 4
                        WHEN customer_feedback = 'Very Good' THEN 5
                        ELSE NULL
                END AS rating
        FROM order_t
) AS feedback_scores
GROUP BY quarter_number WITH ROLLUP;
```

Note - 'WITH ROLLUP' function is not working in SQL Playground but I have used MYSQL so it is perfectly working.

4.4.3 Output

quarter_info	avg_rating
1	3.5548
2	3.3550
3	2.9563
4	2.3970
Overall Average	3.1350

Figure 5: Average Rating by Quarter

4.4.4 Observations and Insights

- **Declining Customer Satisfaction:** Average ratings dropped significantly from 3.55 in Q1 to 2.39 in Q4.
- **Consistent Downtrend:** Each quarter saw a steady decline in ratings, indicating persistent customer dissatisfaction.
- **Lowest Ratings in Q4:** Q4 had the worst performance, suggesting possible service, product quality, or seasonal issues.
- **Overall Decline:** The overall average rating across all quarters is 3.135, much lower than Q1's peak of 3.55.

4.4.5 Recommendations

- **Service Improvement:** Address key concerns from customer feedback to enhance experience.
- **Product Quality Check:** Investigate quality issues leading to negative perceptions.
- **Proactive Engagement:** Improve customer support to prevent dissatisfaction.
- **Targeted Promotions:** Offer incentives in Q3 and Q4 to improve ratings.

4.5 Question-5

4.5.1 Find the percentage distribution of feedback from the customers. Are customers getting more dissatisfied over time?

4.5.2 Query

```
SELECT
        quarter_number,
        COUNT(*) AS Total_Feedback,
        ROUND(100.0 * SUM(CASE WHEN customer_feedback = 'Very Bad' THEN 1 ELSE 0 END) / COUNT(*), 2) AS Very_Bad_Perc,
        ROUND(100.0 * SUM(CASE WHEN customer_feedback = 'Bad' THEN 1 ELSE 0 END) / COUNT(*), 2) AS Bad_Perc,
        ROUND(100.0 * SUM(CASE WHEN customer_feedback = 'Okay' THEN 1 ELSE 0 END) / COUNT(*), 2) AS Okay_Perc,
        ROUND(100.0 * SUM(CASE WHEN customer_feedback = 'Good' THEN 1 ELSE 0 END) / COUNT(*), 2) AS Good_Perc,
        ROUND(100.0 * SUM(CASE WHEN customer_feedback = 'Very Good' THEN 1 ELSE 0 END) / COUNT(*), 2) AS Very_Good_Perc
FROM order_t
GROUP BY quarter_number
ORDER BY quarter_number;
```

4.5.3 Output

quarter_number	Total_Feedback	Very_Bad_Perc	Bad_Perc	Okay_Perc	Good_Perc	Very_Good_Perc
1	310	10.97	11.29	19.03	28.71	30.00
2	262	14.89	14.12	20.23	22.14	28.63
3	229	17.90	22.71	21.83	20.96	16.59
4	199	30.65	29.15	20.10	10.05	10.05

Figure 6: Customer Feedback Percentages by Quarter

4.5.4 Observations and Insights

- **Rising Customer Dissatisfaction**: The percentage of *Very Bad* feedback has increased from **10.97%** in Q1 to **30.65%** in Q4, indicating worsening service quality.
- **Declining Positive Feedback**: The combined percentage of *Good* and *Very Good* ratings dropped significantly from **58.71%** in Q1 to **20.10%** in Q4, reflecting a decline in customer satisfaction.
- **Decreasing Customer Engagement**: The total number of feedback entries has reduced over quarters, from **310** in Q1 to **199** in Q4, suggesting a shrinking customer base.
- **Surge in Negative Feedback**: The combined percentage of *Very Bad* and *Bad* ratings increased from **22.26%** in Q1 to **59.80%** in Q4, highlighting serious customer dissatisfaction.

4.5.5 Recommendations

- **Enhance After-Sales Support**: Implement proactive customer service strategies, including quicker issue resolution and better post-purchase engagement.
- **Improve Product and Delivery Standards**: Conduct a detailed analysis of delivery delays and vehicle quality concerns to address recurring complaints.
- **Launch Retention Programs**: Introduce loyalty benefits, extended warranties, and personalized discounts to retain customers.
- **Monitor Competitor Strategies**: Investigate competitor pricing and service offerings to identify gaps and improve customer satisfaction.

4.6 Question-6

4.6.1 What is the trend of the number of orders by quarter?

4.6.2 Query

```
SELECT
        quarter_number,
        COUNT(order_id) AS total_orders
FROM order_t
GROUP BY quarter_number
ORDER BY quarter_number;
```

4.6.3 Output

quarter_number	total_orders
1	310
2	262
3	229
4	199

Figure 7: Total Orders by Quarter

4.6.4 Observations and Insights

- **Declining Orders**: The number of orders decreased from 310 in Q1 to 199 in Q4, showing a steady decline.
- **Q4 Drop**: A significant drop of 13.1% from Q3 and 35.8% from Q1 suggests possible seasonal effects or customer dissatisfaction.
- **Potential Causes**:

- **Negative Feedback**: Poor service or vehicle issues may discourage repeat customers.
- **Market Competition**: Competitors might be offering better deals.
- **Economic Factors**: Inflation or financial constraints could be affecting purchasing power.

4.6.5 Business Recommendations

- **Improve Customer Experience**: Address after-sales issues to restore customer trust.
- **Targeted Marketing**: Implement strategic discounts, especially in Q4, to boost sales.
- **Competitive Analysis**: Conduct a thorough market study to understand competitors' offerings and enhance services.

4.7 Question-7

4.7.1 Calculate the net revenue generated by the company. What is the quarter-over-quarter % change in net revenue?

4.7.2 Query

```
SELECT quarter_number, net_revenue,
  CASE
        WHEN prev_quarter_revenue IS NULL THEN NULL
        ELSE ((net_revenue - prev_quarter_revenue) / prev_quarter_revenue) * 100
  END AS qoq_percentage_change
FROM (
        SELECT quarter_number,
                    SUM(vehicle_price * (1 - discount) * quantity) AS net_revenue,
                   LAG(SUM(vehicle_price * (1 - discount) * quantity))
            OVER (ORDER BY quarter_number) AS prev_quarter_revenue
    FROM order_t
        GROUP BY quarter_number
) AS RevenueWithLag
ORDER BY quarter_number;
```

4.7.3 Output

quarter_number	net_revenue	qoq_percentage_change
1	18032549.8996	NULL
2	13122995.7562	-27.22606714
3	8882298.8449	-32.31500635
4	8573149.2806	-3.48051298

Figure 8: Quarter-over-Quarter Revenue Change

4.7.4 Observations and Insights

- **Declining Sales**: Net revenue dropped consistently, with the sharpest decline in Q3 (-32.31%).
- **High Q1 Revenue**: Strong initial sales, but declining momentum afterward.
- **Q4 Stabilization**: Revenue still fell (-3.48%) but at a slower rate.

4.7.5 Recommendations

- **Customer Retention**: Improve after-sales service to boost trust.
- **Strategic Pricing**: Offer discounts in low-sales quarters.
- **Brand Enhancement**: Act on feedback to improve perception.
- **Market Expansion**: Explore new segments to sustain growth.

4.8 Question-8

4.8.1 What is the trend of net revenue and orders by quarters?

4.8.2 Query

```
SELECT
        quarter_number,
        SUM(vehicle_price * (1 - discount) * quantity) AS net_revenue,
        COUNT(DISTINCT order_id) AS total_orders
FROM order_t
GROUP BY quarter_number
ORDER BY quarter_number;
```

4.8.3 Output

quarter_number	net_revenue	total_orders
1	18032549.8996	310
2	13122995.7562	262
3	8882298.8449	229
4	8573149.2806	199

Figure 9: Net Revenue and Orders by Quarter

4.8.4 Observations and Insights

- **Consistent Decline**: Both net revenue and total orders show a steady drop across quarters.
- **Q1 Peak Performance**: Highest revenue and orders, indicating strong initial sales.
- **Q2-Q3 Drop**: Significant decline in Q2 (-27.2%) and Q3 (-32.3%), signaling major sales concerns.
- **Q4 Lowest Sales**: Net revenue stabilizes but remains low, with orders decreasing further.

4.8.5 Recommendations

- **Revamp Marketing**: Re-engage customers with promotions and loyalty programs.
- **Targeted Discounts**: Offer strategic price reductions to boost Q2-Q3 sales.
- **Customer Experience**: Address service issues to retain customers.
- **Diversify Offerings**: Introduce new vehicle models or financing options to drive demand.

4.9 Question-9

4.9.1 What is the average discount offered for different types of credit cards?

4.9.2 Query

```
SELECT
        c.credit_card_type,
        AVG(o.discount) AS avg_discount
FROM customer_t c
JOIN order_t o ON o.customer_id = c.customer_id
GROUP BY c.credit_card_type
ORDER BY avg_discount DESC;
```

4.9.3 Output

credit_card_type	Avg_discount
laser	0.643846
mastercard	0.629500
maestro	0.624219
visa-electron	0.623469
china-unionpay	0.622174
instapayment	0.620625
americanexpress	0.616327
diners-club-us-ca	0.614615
diners-club-carte-blanche	0.614490
switch	0.610233
bankcard	0.609545
jcb	0.607382
visa	0.600833
diners-club-enroute	0.599792
solo	0.585000
diners-club-international	0.584000

Figure 10: Average Discount by Credit Card Type

4.9.4 Observations and Insights

- **Highest Discounts**: The *Laser* credit card received the highest average discount (0.643846).
- **Top Payment Methods**: Mastercard, Maestro, and Visa Electron also received higher-than-average discounts.
- **Lower Discounts**: Diners Club International received the lowest discount (0.584).
- **Popular Cards**: Visa and Mastercard are widely used, but their discounts are not the highest.

4.9.5 Recommendations

- **Strategic Partnerships**: Focus on collaborations with banks offering high-discount cards to drive sales.
- **Targeted Promotions**: Offer exclusive deals for lower-discount cardholders to balance the distribution.
- **Discount Optimization**: Re-evaluate discount policies for frequently used cards like Visa and Mastercard.
- **Customer Engagement**: Conduct surveys to understand why certain cardholders receive higher discounts.

4.10 Question-10

4.10.1 What is the average time taken to ship the placed orders for each quarter?

4.10.2 Query

```
SELECT
        quarter_number,
        AVG(DATEDIFF(ship_date, order_date)) AS avg_shipping_time
FROM order_t
GROUP BY quarter_number
ORDER BY quarter_number;
```

4.10.3 Output

quarter_number	avg_shipping_time
1	57.1677
2	71.1107
3	117.7555
4	174.0955

Figure 11: Average Shipping Time by Quarter

4.10.4 Observations and Insights

- **Increasing Shipping Delays**: The average shipping time has significantly increased from Q1 (57.17 days) to Q4 (174.10 days), indicating a growing inefficiency in logistics.
- **Q3 and Q4 Critical**: The steep rise in Q3 (117.76 days) and Q4 suggests severe delays, possibly due to supply chain disruptions or operational inefficiencies.
- **Potential Customer Dissatisfaction**: Longer shipping times can negatively impact customer satisfaction, leading to declining sales and brand trust.

4.10.5 Recommendations

- **Optimize Supply Chain**: Identify bottlenecks in logistics and implement faster shipping methods.
- **Inventory Management**: Maintain stock closer to high-demand regions to reduce shipping delays.
- **Strategic Partnerships**: Collaborate with efficient shipping vendors to streamline delivery processes.
- **Customer Communication**: Provide real-time tracking and proactive updates to manage customer expectations.

5 Business Metrics Overview

Total Revenue	Total Orders	Total Customers	Average Rating
48610993.7813	1000	994	3.1350
Last Quarter Revenue	**Last quarter Orders**	**Average Days to Ship**	**% Good Feedback**
8573149.2806	199	97.9640	44.1

Note: % Good Feedback includes both 'Good' and 'Very Good' ratings.

6 Actionable Insights and Business Recommendations

6.1 Key Insights

- **Declining Orders:** Orders fell 35.8% from Q1 to Q4, indicating potential customer dissatisfaction or seasonal factors.
- **Increasing Negative Feedback:** "Very Bad" ratings surged from 10.97% in Q1 to 30.65% in Q4, while positive ratings dropped from 58.71% to 20.10%.
- **Falling Revenue:** Net revenue consistently declined quarter-over-quarter, with discounts failing to drive sufficient growth.
- **Shipping Delays:** Prolonged average shipping times could be impacting customer satisfaction and retention.
- **Declining Customer Satisfaction:** Average ratings steadily fell from 3.55 in Q1 to 2.39 in Q4, reflecting a downward trend in perceived service quality.
- **Credit Card Discounts:** Variation in discount rates based on credit card type suggests potential for customized promotional strategies.
- **Preferred Vehicle Makers:** Leading brands dominate in most states, with customer loyalty influencing purchase decisions.

6.2 Business Recommendations

- **Enhance Customer Experience:** Improve after-sales support, address major service issues, and implement quality assurance measures to reverse the downward trend in customer satisfaction.
- **Improve Competitive Positioning:** Conduct competitor benchmarking to optimize pricing strategies and refine product offerings.
- **Targeted Promotions:** Launch strategic discount campaigns, especially in Q4, to counteract declining sales and boost customer retention.
- **Streamline Logistics:** Reduce shipping delays by optimizing delivery processes, improving vendor coordination, and enhancing supply chain efficiency.
- **Strengthen Marketing Strategies:** Utilize customer feedback to highlight positive experiences, promote brand reputation, and rebuild trust.
- **Leverage Customer Data:** Personalize offers based on purchasing patterns, feedback trends, and satisfaction scores to drive engagement and repeat sales.
- **Proactive Engagement:** Address customer concerns early, introduce loyalty programs, and enhance communication to foster long-term relationships.