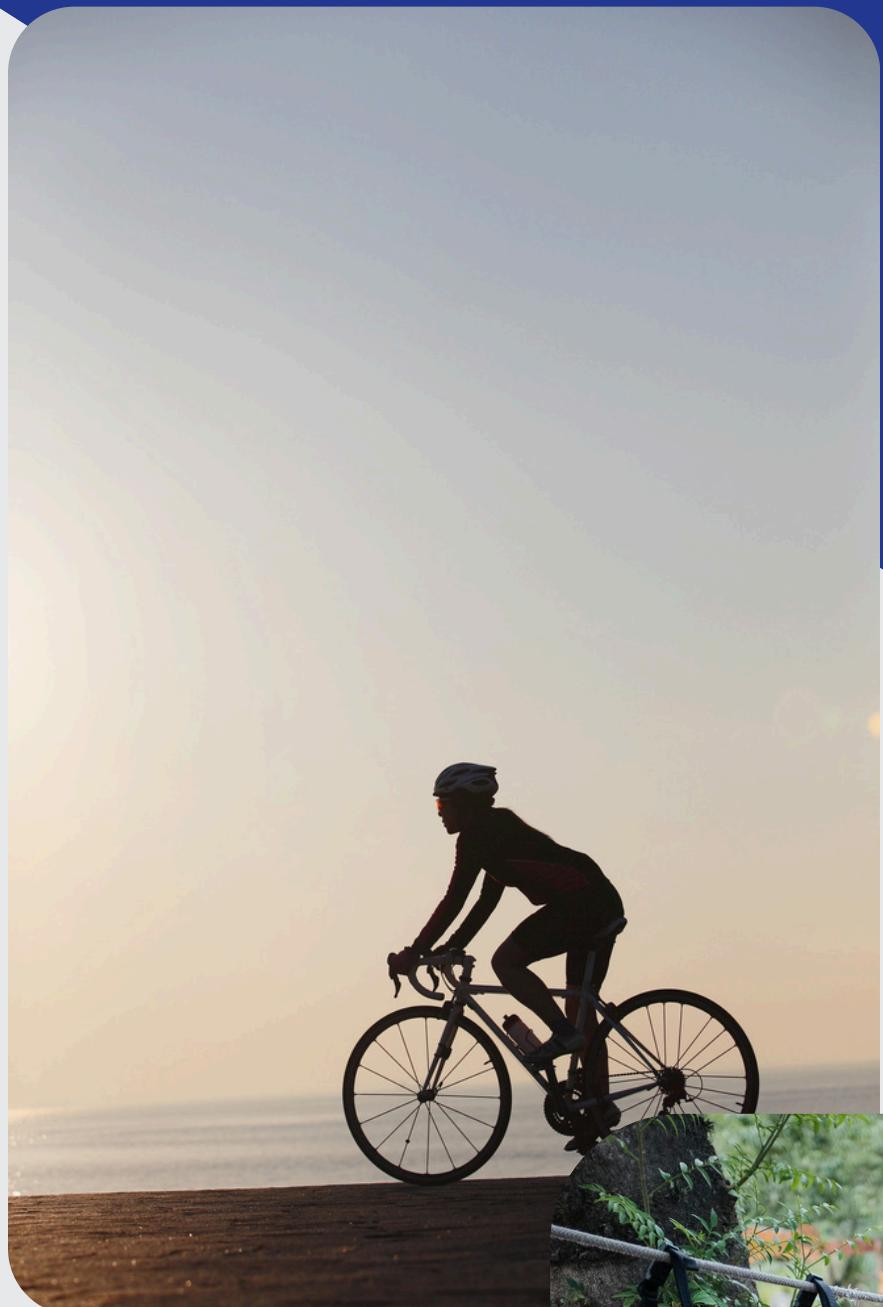




CAPSTONE PROJECT

Adventure Works

HARNEK SINGH



Project Overview

As a Data Analyst at Adventure Works Cycles, a global bicycle and accessory manufacturer, you're tasked with transforming enterprise data from sales, products, customers, and geography into actionable business insights. This project simulates a real-world analytics workflow, incorporating advanced SQL, interactive dashboards, and predictive modeling.



Capstone Project

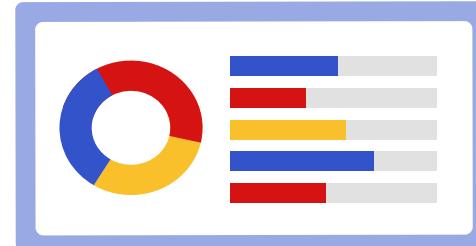
Key Focus Area



Part 1

ADVANCED SQL ANALYSIS

SALES & OPERATIONS INTELLIGENCE



Part 2

INTERACTIVE DASHBOARDS

MULTI-PAGE INTERACTIVE DASHBOARD



Part 3

MACHINE LEARNING

PREDICTIVE ANALYTICS

PART ~ 01

Advanced SQL Analysis

Sales & Operations Intelligence

Extract strategic insights from Adventure Works operational data covering product performance, customer trends, and regional profitability.



1. Annual Revenue Trends

Analyze year-over-year revenue growth and identify peak performing years.

```
WITH A AS(
    SELECT YEAR(OrderDate) AS Years,
    ROUND(SUM(s.OrderQuantity * p.ProductPrice),2) AS Curr_Year
    FROM sales s
    JOIN products p
    ON s.ProductKey = p.ProductKey
    GROUP BY YEAR(OrderDate),
)

B AS
(SELECT *,
LAG(Curr_Year, 1) OVER(ORDER BY Years) AS Prev_Year FROM A)

SELECT *, ROUND(((Curr_Year - Prev_Year) / Prev_Year) * 100, 2) AS YOY_Growth FROM B
```

Years	Curr_Year	Prev_Year	YOY_Growth
2015	6404933.62	NULL	NULL
2016	9324203.83	6404933.62	45.58
2017	9185449.48	9324203.83	-1.49

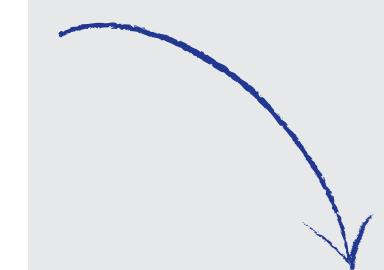
- The Year-over-Year from 2015 to 2017, highlighting a surge in **2016 (45.58% YOY growth)**, then a modest decline in **2017 (-1.49% growth)**, reflecting changing annual performance.



2. Category Performance

Rank product categories by total sales and compare margins across categories.

```
SELECT
    pc.CategoryName,
    ROUND(SUM(s.OrderQuantity * p.ProductPrice), 2) AS Total_Sales,
    ROUND(SUM((p.ProductPrice - p.ProductCost) * s.OrderQuantity), 2) AS Total_Profit,
    ROUND(SUM((p.ProductPrice - p.ProductCost) * s.OrderQuantity) /
        SUM(s.OrderQuantity * p.ProductPrice) * 100, 2) AS Profit_Marign_Percent
FROM sales s
JOIN products p ON s.ProductKey = p.ProductKey
JOIN product_subcategories ps ON p.ProductSubcategoryKey = ps.ProductSubcategoryKey
JOIN product_categories pc ON ps.ProductCategoryKey = pc.ProductCategoryKey
GROUP BY pc.CategoryName
ORDER BY Total_Sales DESC
```



	CategoryName	Total_Sales	Total_Profit	Profit_Marign_Percent
1.	Bikes	23642495.22	9726168.23	41.14
2.	Accessories	906673.1	569760.05	62.84
3.	Clothing	365418.62	161787.1	44.27

- Bikes generated \$23,642,495 in sales with a 41.14% profit margin. Accessories, though only \$906,673 in sales, had the highest margin at 62.84%. Clothing contributed \$365,419 in sales and a 44.27% margin.



3. Top & Underperforming Products

Identify the best- and worst-selling products in terms of quantity sold and revenue generation.

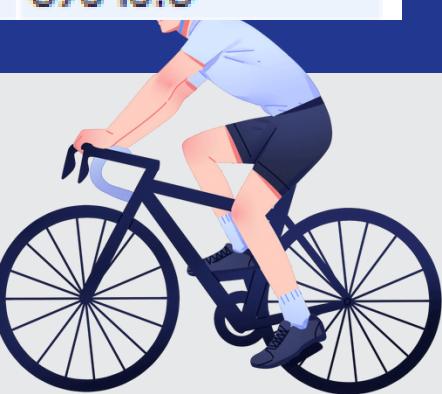
Best Selling Products

```
# Best Selling Product

SELECT
    p.ProductName,
    SUM(s.OrderQuantity) AS Total_Units_Sold,
    ROUND(SUM(s.OrderQuantity * p.ProductPrice),2) AS Total_Revenue
FROM Sales s
JOIN products p ON s.ProductKey = p.ProductKey
GROUP BY p.ProductName
ORDER BY Total_Units_Sold DESC
LIMIT 10;
```

- Water Bottle sold 7,967 units for \$39,755, AWC Logo Cap sold 4,151 units for \$35,882, and Fender Set delivered highest revenue, \$87,041, from 3,960 units. Other products contributed variously to overall sales.

ProductName	Total_Units_Sold	Total_Revenue
Water Bottle - 30 oz.	7967	39755.33
Patch Kit/8 Patches	5898	13506.42
Mountain Tire Tube	5678	28333.22
Road Tire Tube	4327	17264.73
AWC Logo Cap	4151	35882.08
Fender Set - Mountain	3960	87040.8



3. Top & Underperforming Products

Identify the best- and worst-selling products in terms of quantity sold and revenue generation.

Worst Selling Products

```
# Worst Selling Product

SELECT
    p.ProductName,
    SUM(s.OrderQuantity) AS Total_Units_Sold,
    ROUND(SUM(s.OrderQuantity * p.ProductPrice),2) AS Total_Revenue
FROM Sales s
JOIN products p ON s.ProductKey = p.ProductKey
GROUP BY p.ProductName
ORDER BY Total_Revenue DESC
LIMIT 10;
```

- Mountain-200 Black, 46 sold 606 units generating \$1,241,753 revenue; Mountain-200 Silver, 38 sold 586 units, \$1,213,852. Other sizes and colors achieved sales from 547 to 602 units and \$1,130,667 to \$1,233,557 revenue.

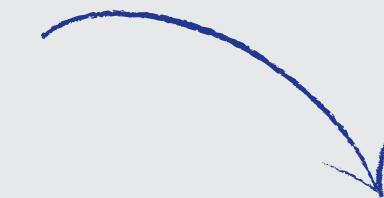
ProductName	Total_Units_Sold	Total_Revenue
Mountain-200 Black, 46	606	1241753.48
Mountain-200 Black, 42	602	1233557.08
Mountain-200 Silver, 38	586	1213851.93
Mountain-200 Silver, 46	571	1182780.64
Mountain-200 Black, 38	569	1165936.84
Mountain-200 Silver, 42	547	1133066.56



4. Customer Segmentation by Spend

Segment customers based on their total lifetime spend (e.g., low, mid, high) and determine their share of total revenue.

```
• WITH Customer_Spent AS (
    SELECT
        c.CustomerKey,
        c.FirstName,
        c.LastName,
        ROUND(SUM(s.OrderQuantity * p.ProductPrice), 2) AS Total_Spend
    FROM customers c
    JOIN sales s ON c.CustomerKey = s.CustomerKey
    JOIN products p ON s.ProductKey = p.Productkey
    GROUP BY c.CustomerKey, c.FirstName, c.LastName
)
SELECT
    Customerkey,
    FirstName,
    LastName,
    Total_Spend,
    CASE
        WHEN Total_Spend < 1000 THEN 'Low Spend'
        WHEN Total_Spend BETWEEN 1000 AND 5000 THEN 'Mid Spend'
        ELSE 'High Spend'
    END AS Spend_Class
FROM Customer_Spent
ORDER BY Total_Spend DESC
```



Customerkey	FirstName	LastName	Total_Spend	Spend_Class
11433	MAURICE	SHAN	12407.95	High Spend
11439	JANET	MUNOZ	12015.4	High Spend
11241	LISA	CAI	11330.45	High Spend
11417	LACEY	ZHENG	11085.75	High Spend
11420	JORDAN	TURNER	11022.4	High Spend
11242	LARRY	MUNOZ	10852.03	High Spend
13263	KATE	ANAND	10436.51	High Spend
12655	LARRY	VAZQUEZ	10394.98	High Spend
11425	ARIANA	GRAY	10391.43	High Spend
12631	CLARENCE	GAO	10331.73	High Spend

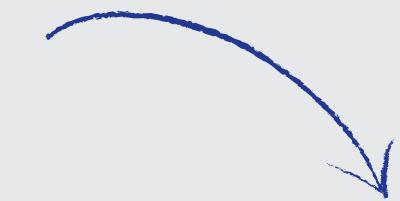
- **Customer Segmentation by Spend**
- Top customers like Maurice Shan (\$12,408), Janet Munoz (\$12,016), and Lisa Cai (\$11,330) fall under "High Spend," each contributing significantly to overall revenue and validating strategic focus on high-spend retention.



5. Geographic Sales Leadership

Identify top countries and regions by total sales and average order size.

```
SELECT
    t.Continent,
    t.Country,
    t.Region,
    ROUND(SUM(p.ProductPrice * s.OrderQuantity),2) AS Total_Sales,
    ROUND(AVG(p.ProductPrice * s.OrderQuantity),2) AS Avg_Order_Value
FROM sales s
JOIN territories t ON s.TerritoryKey = t.SalesTerritoryKey
JOIN products p ON s.ProductKey = p.ProductKey
GROUP BY t.Continent, t.Country, t.Region
ORDER BY Total_Sales DESC;
```



Continent	Country	Region	Total_Sales	Avg_Order_Value
Pacific	Australia	Australia	7416456.24	597.67
North America	United States	Southwest	4822794.72	420.73
North America	United States	Northwest	3095074.48	374.39
Europe	United Kingdom	United Kingdom	2902562.11	451.9
Europe	Germany	Germany	2524679.99	477.35
Europe	France	France	2362643.33	450.97
North America	Canada	Canada	1769245.82	257.34
North America	United States	Southeast	11585.62	340.75
North America	United States	Northeast	6401.57	237.1
North America	United States	Central	3143.06	157.15

- **Geographic Sales Leadership**
- Australia (\$7.4M, avg. order \$597.67) leads, followed by U.S. Southwest (\$4.8M, \$420.73) and U.S. Northwest (\$3.1M, \$374.39). UK (\$2.9M, \$451.9), Germany, and France also show strong sales performance.



6. Profitability by Territory

Rank sales territories by profit margin percentage and highlight high-margin regions.

```
SELECT
    t.Country,
    t.Region,
    ROUND(SUM(p.ProductPrice * s.OrderQuantity),2) AS Total_Sales,
    ROUND(SUM((p.ProductPrice - p.ProductCost) * s.OrderQuantity),2) AS Profit,
    ROUND(SUM((p.ProductPrice - p.ProductCost) * s.OrderQuantity) / SUM(s.OrderQuantity * p.ProductPrice) * 100, 2) AS Profit_Margin_Perct
FROM sales s
JOIN territories t ON s.TerritoryKey = t.SalesTerritoryKey
JOIN products p ON s.ProductKey = p.ProductKey
GROUP BY t.Country, t.Region
ORDER BY Profit_Margin_Perct DESC;
```

- **Profitability by Territory**
- U.S. Central leads with a 45.73% margin, followed by Northeast at 44.9%. Southeast posts 44.31%. Canada (42.83%) and major European regions all maintain margins near 42%. These areas drive high profitability.

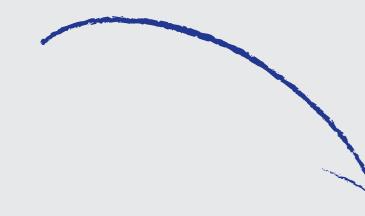


Country	Region	Total_Sales	Profit	Profit_Margin_Perct
United States	Central	3143.06	1437.44	45.73
United States	Northeast	6401.57	2874.58	44.9
United States	Southeast	11585.62	5133.29	44.31
Canada	Canada	1769245.82	757844.19	42.83
United States	Northwest	3095074.48	1314751.26	42.48
United States	Southwest	4822794.72	2040345.16	42.31
France	France	2362643.33	989346.05	41.87
United Kingdom	United Kingdom	2902562.11	1214774.41	41.85
Germany	Germany	2524679.99	1054186.2	41.76
Australia	Australia	7416456.24	3077022.8	41.49

7. Return Analysis

Calculate the return rate per category or product, and spotlight items with the highest returns.

```
SELECT
    p.ProductName,
    SUM(r.ReturnQuantity) AS Total>Returns,
    SUM(s.OrderQuantity) AS Total>Sold,
    ROUND(SUM(r.ReturnQuantity) / SUM(s.OrderQuantity) * 100, 2) AS Return>Rate>Percent
FROM returns r
JOIN products p ON r.ProductKey = p.ProductKey
JOIN sales s ON s.ProductKey = p.ProductKey
GROUP BY p.ProductName
ORDER BY Return>Rate>Percent DESC;
```



ProductName	Total>Returns	Total>Sold	Return>Rate>Percent
Road-750 Black, 48	5325	4970	107.14
Mountain-200 Silver, 38	9962	9376	106.25
Mountain-100 Black, 44	62	62	100.00
Road-150 Red, 48	1432	1432	100.00
Road-650 Black, 58	128	128	100.00
Road-150 Red, 56	785	785	100.00
Road-150 Red, 62	676	676	100.00
Road-150 Red, 52	840	840	100.00
Mountain-100 Black, 48	72	72	100.00
Road-650 Red, 44	195	195	100.00

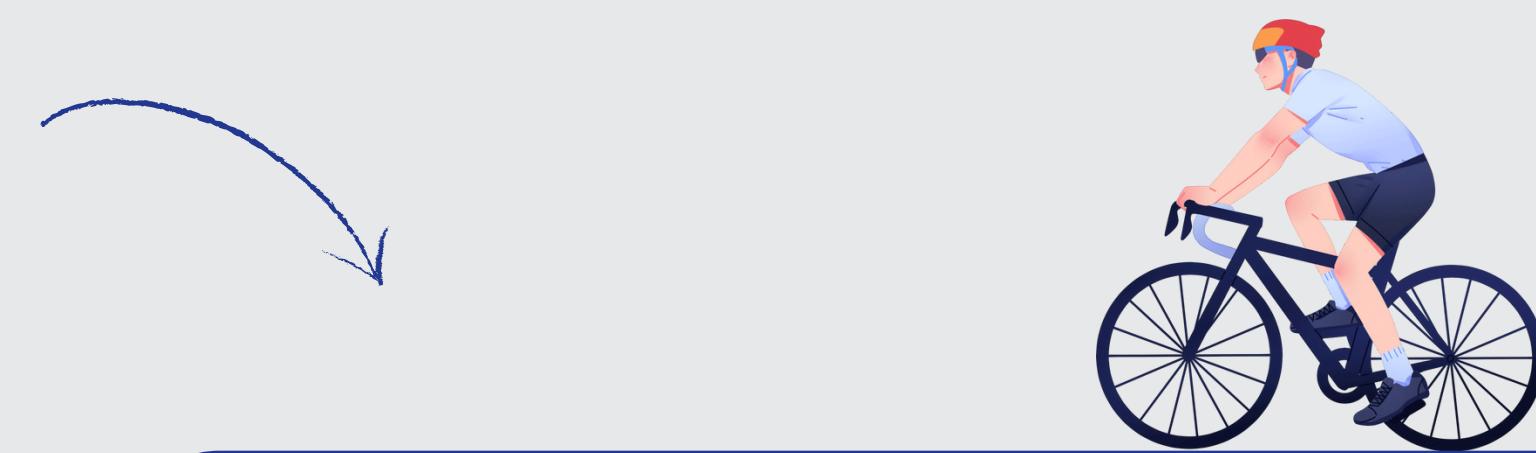
- **Return Analysis**
- Road-750 Black, 48 shows a 107.14% return rate with 5,325 returns.
- Mountain-200 Silver, 38 has a 106.25% return rate, with 9,962 returns.
- Multiple products report a 100% return rate, indicating potential quality or demand issues.

8. Sales Seasonality

Detect monthly or quarterly sales peaks and troughs—identify key seasonal patterns.

```
SELECT  
YEAR(OrderDate) AS Year,  
QUARTER(OrderDate) AS Qtr,  
MONTH(OrderDate) AS Month,  
ROUND(SUM(s.OrderQuantity * p.ProductPrice),2) AS Total_Revenue,  
ROUND(SUM(SUM(s.OrderQuantity * p.ProductPrice))  
    OVER(PARTITION BY YEAR(OrderDate), QUARTER(OrderDate)  
        ORDER BY MONTH(OrderDate)), 2) AS Running_Total  
  
FROM sales s  
JOIN products p ON s.ProductKey = p.ProductKey  
GROUP BY YEAR(OrderDate), QUARTER(OrderDate), MONTH(OrderDate)  
ORDER BY Year, Qtr, Month DESC;
```

- **Sales Seasonality**
- March (643,436), June (669,989), and December (563,762) mark revenue peaks in 2015. Seasonal highs occur in Q1 and Q2, while August (536,453) and April (653,364) also show strong sales patterns.

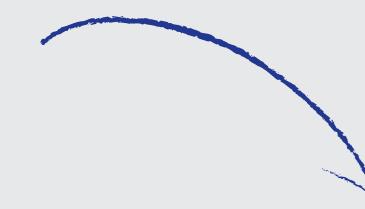


Year	Qtr	Month	Total_Revenue	Running_Total
2015	1	3	643436.11	1760975.01
2015	1	2	532226.25	1117538.9
2015	1	1	585312.65	585312.65
2015	2	6	669988.67	1982678.61
2015	2	5	659325.9	1312689.94
2015	2	4	653364.04	653364.04
2015	3	9	344062.88	1366630.71
2015	3	8	536452.82	1022567.83
2015	3	7	486115.01	486115.01
2015	4	12	563761.53	1294649.29

9. New vs. Returning Customers

Determine revenue contribution from new customers versus repeat purchasers and assess changes over time.

```
WITH First_Purchase AS(
    SELECT
        CustomerKey,
        MIN(OrderDate) AS First_Order_Date
    FROM sales
    GROUP BY CustomerKey
)
SELECT
    CASE
        WHEN s.OrderDate = fp.First_Order_Date THEN 'New Customer'
        ELSE 'Returning Customer'
    END AS Customer_Type,
    ROUND(SUM(s.OrderQuantity * p.ProductPrice),2) AS Total_Revenue
FROM sales s
JOIN products p ON s.ProductKey = p.ProductKey
JOIN First_Purchase fp ON s.CustomerKey = fp.CustomerKey
GROUP BY Customer_Type;
```



Customer_Type	Total_Revenue
New Customer	16168835.58
Returning Customer	8745751.35

- **New vs. Returning Customers**
- New customers contributed \$16,168,836 in revenue, while returning customers generated \$8,745,751. New purchasers account for nearly double the revenue, signaling substantial acquisition effectiveness and growth from first-time buyers.

PART ~ 02

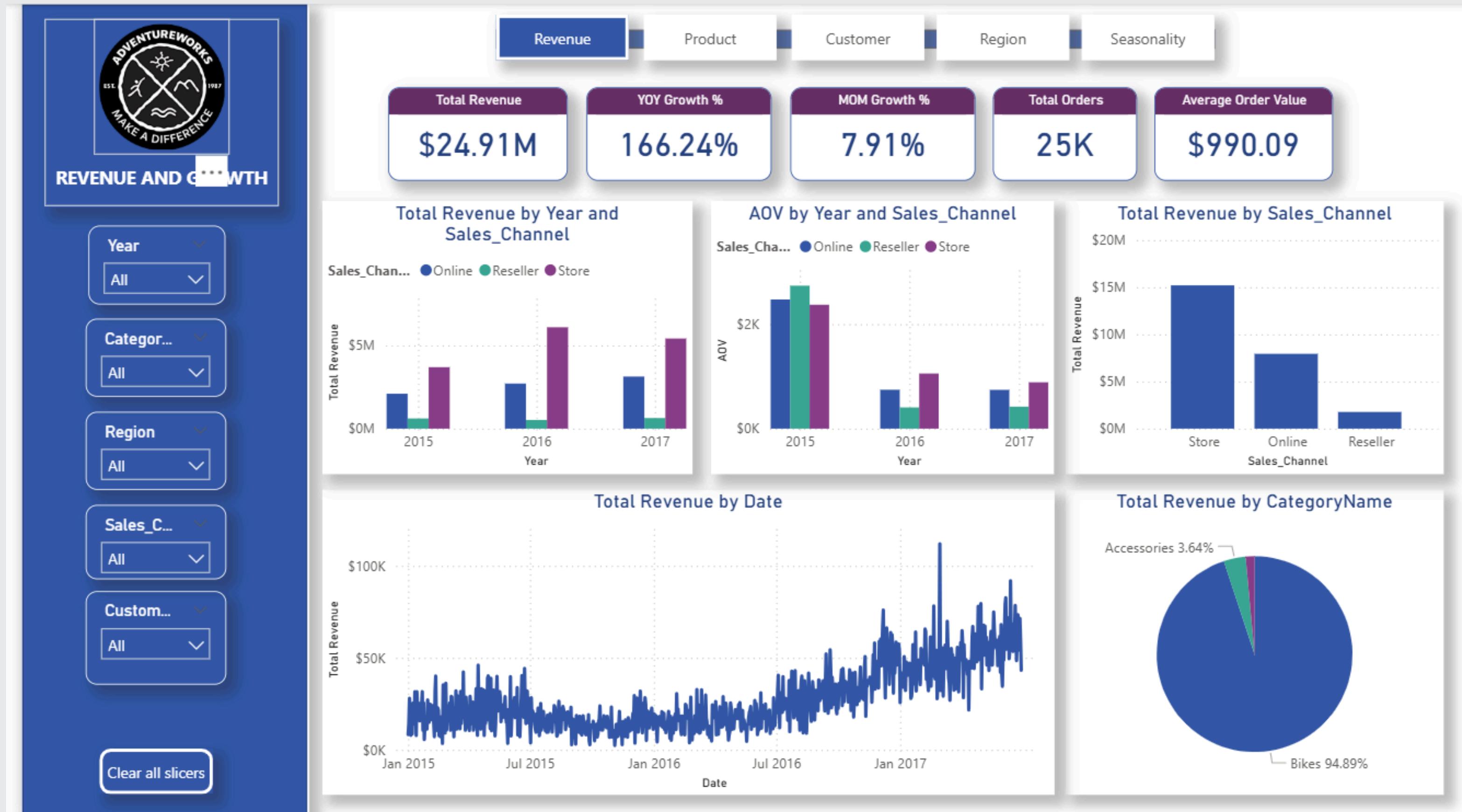
Interactive Dashboards

Multi-page interactive dashboard

Craft a multi-page interactive dashboard to empower leadership with insights into revenue dynamics, product performance, customer behavior, and regional strategy.



Revenue and Growth Overview



Product Category Performance



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EST. 1987
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PRODUCT CATEGORY AND INSIGHTS

Year: All

Category: All

Region: All

Sales_C: All

Custom: All

[Clear all slicers](#)

Revenue Product Customer Region Seasonality

Total Revenue: \$24.91M Total Cost: \$14.46M Profit Margin %: 41.97% Quantity Sold: 84K Return Rate %: 2.17%

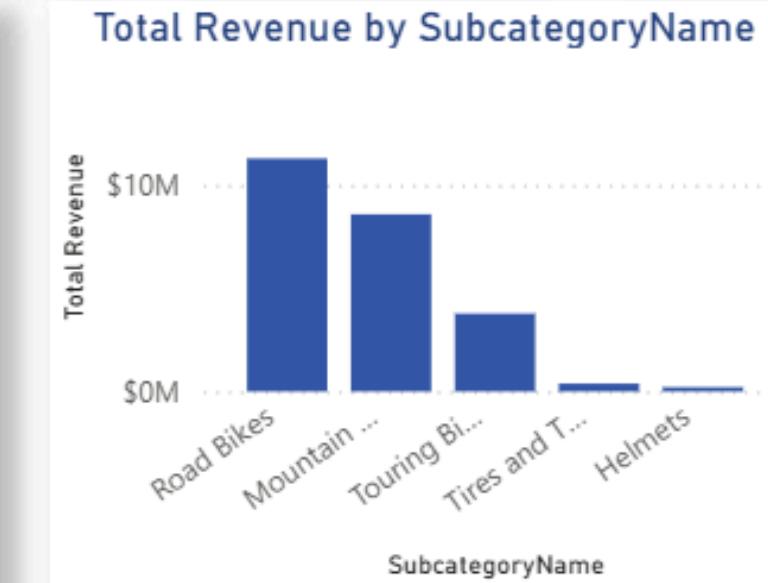
Top SubCategories by Revenue

Road Bikes	\$11,287,182.69
Mountain Bikes	\$8,583,747.75
Touring Bikes	\$3,771,564.66
Tires and Tubes	\$380,826.68
Helmets	\$205,833.94

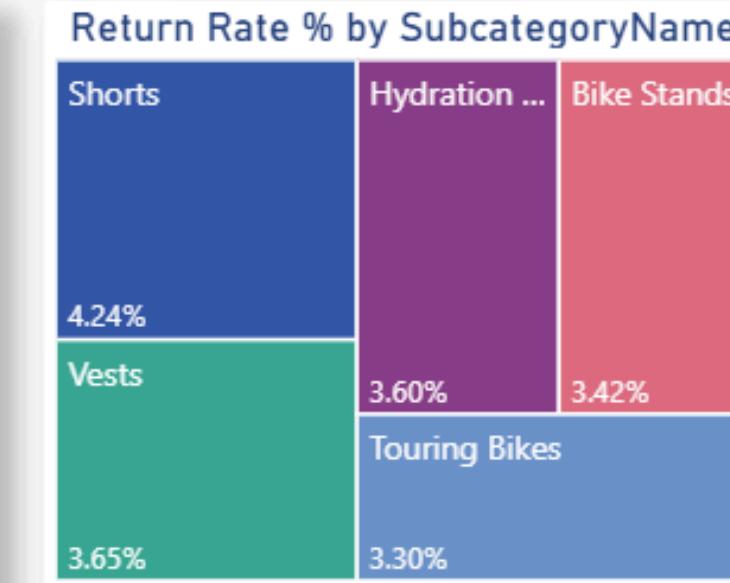
Top SubCategories by Return Rate %

Shorts	4.24%
Vests	3.65%
Hydration Packs	3.60%
Bike Stands	3.42%
Touring Bikes	3.30%

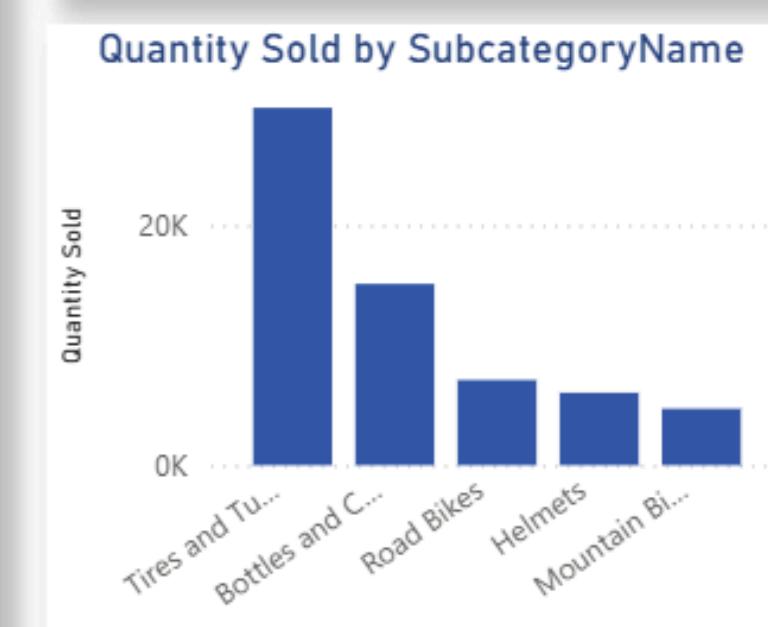
Total Revenue by SubcategoryName



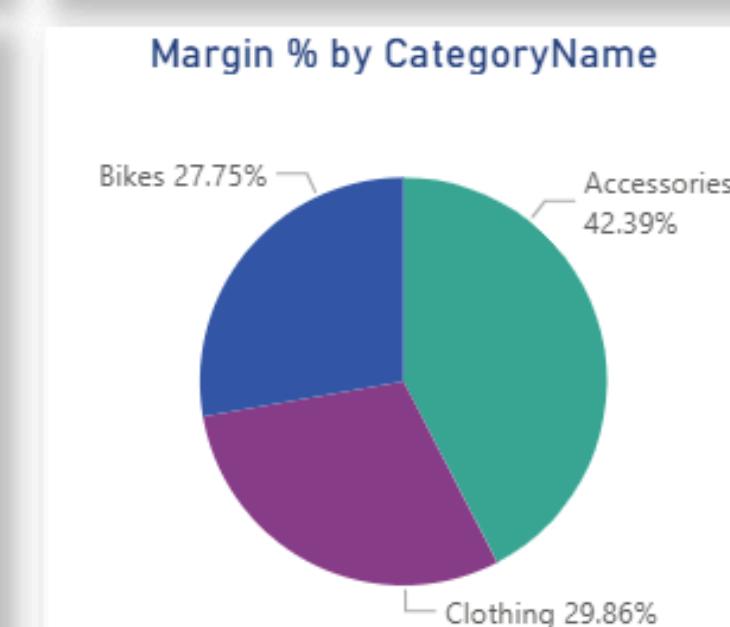
Return Rate % by SubcategoryName



Quantity Sold by SubcategoryName



Margin % by CategoryName



Customer Insights & Segmentation



CUSTOMER ANALYSIS

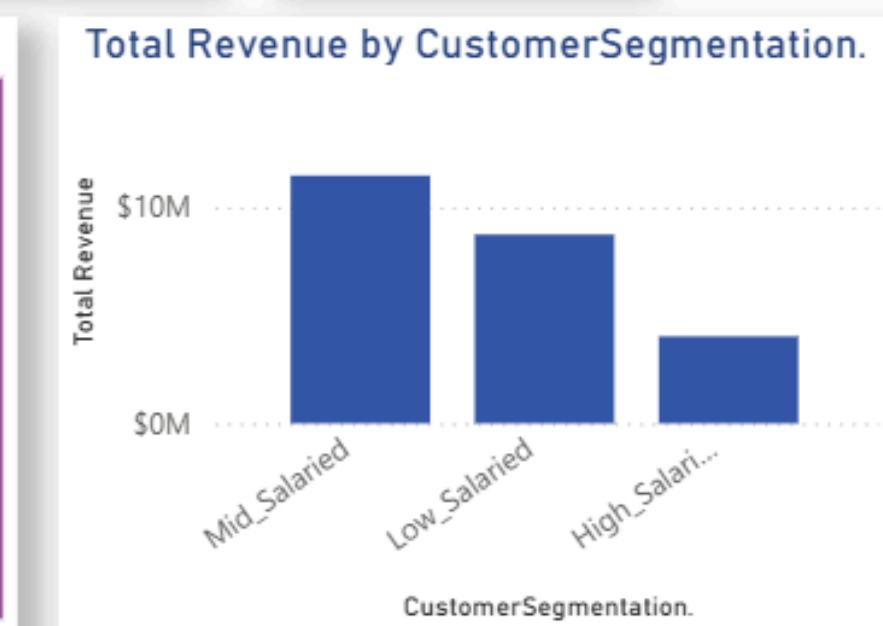
Revenue Product Customer Region Seasonality

Total Revenue: \$24.91M Total Cost: \$14.46M Total Profit: \$10.46M Repeat Purchase %: 33.63% Avg Spend per Customer: \$1.43K

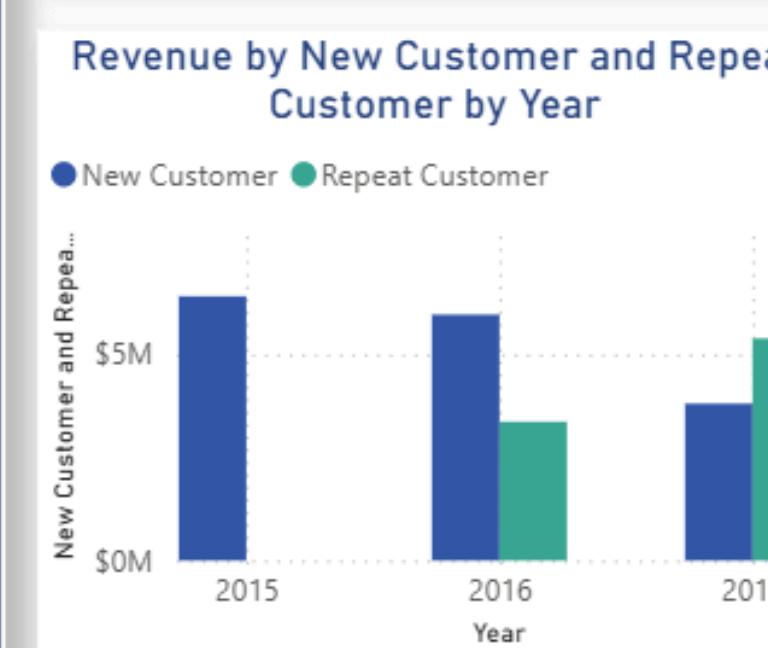
Count of CustomerSegmentation. by CustomerSegmentation.

CustomerSegmentation.	Count
Mid_Salaried	8.20K
Low_Salaried	7.80K
High_Salaried	2.14K

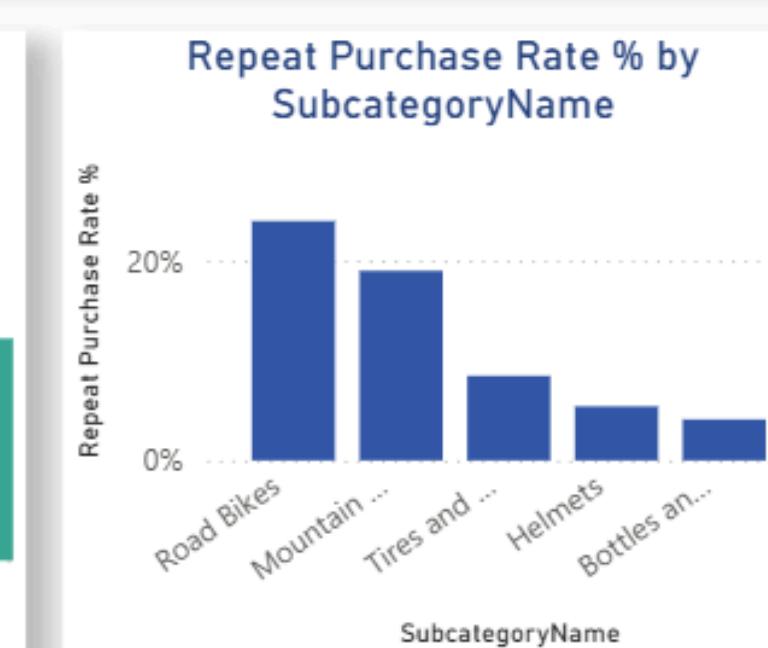
Total Revenue by CustomerSegmentation.



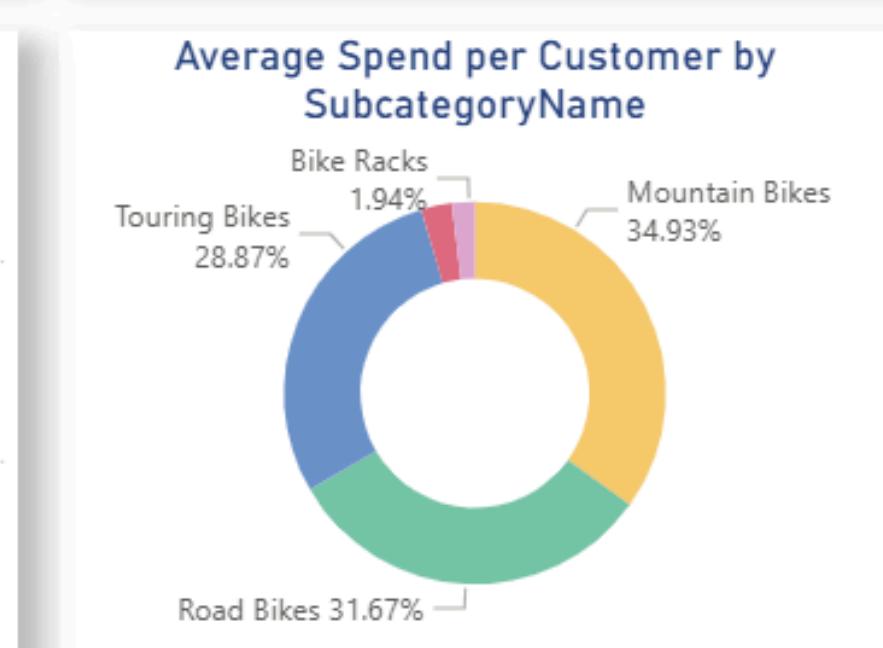
Revenue by New Customer and Repeat Customer by Year



Repeat Purchase Rate % by SubcategoryName



Average Spend per Customer by SubcategoryName



Year
All

Categor...
All

Region
All

Sales_C...
All

Custom...
All

Clear all slicers

Regional & Channel Performance



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REGIONAL PERFORMANCE

Year

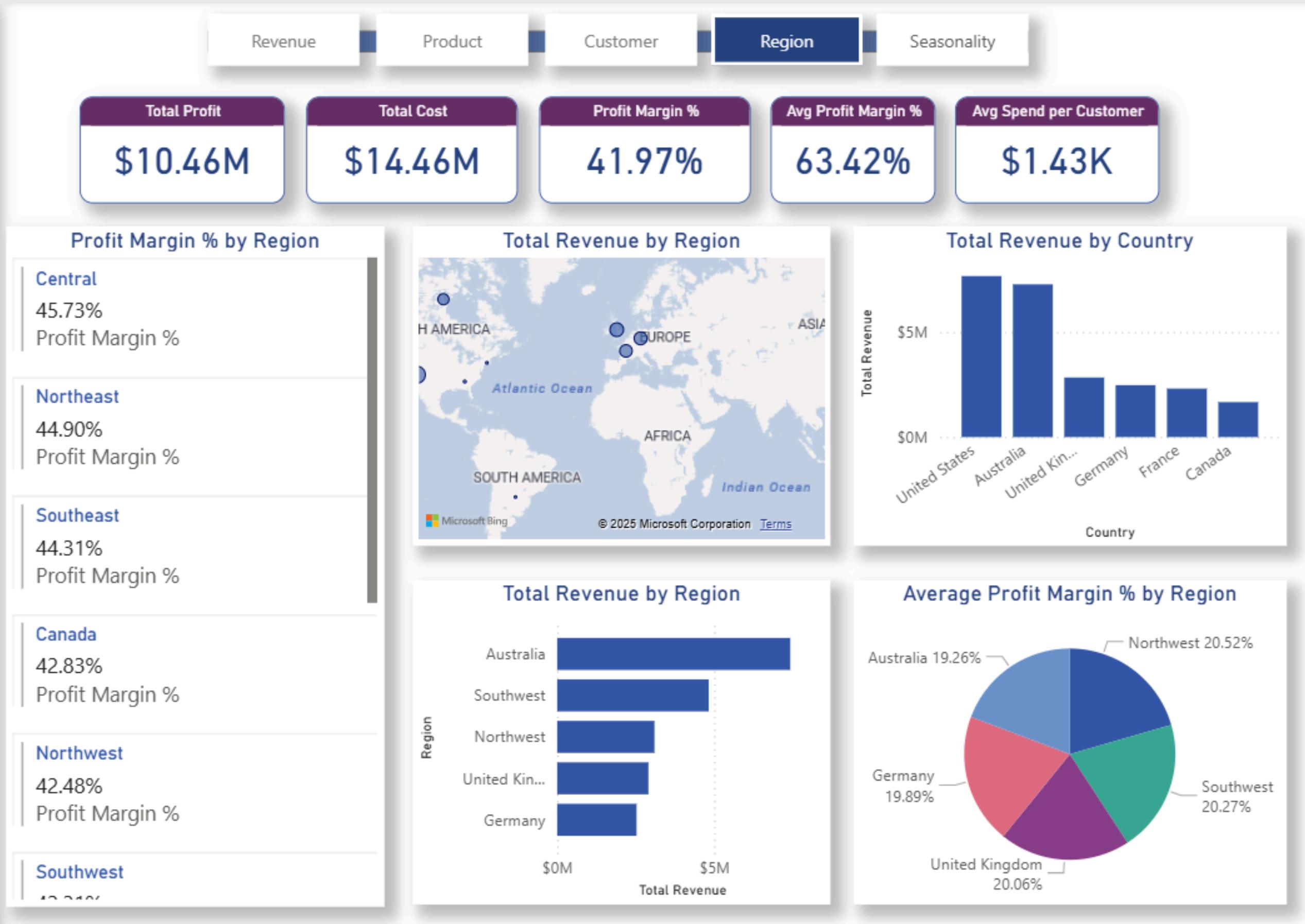
Category

Region

Sales_C

Custom...

Clear all slicers



Seasonality and Sales Channels



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MAKE A DIFFERENCE

SEASONALITY AND CHANNELS

Year: All

Category: All

Region: All

Sales_Channel: All

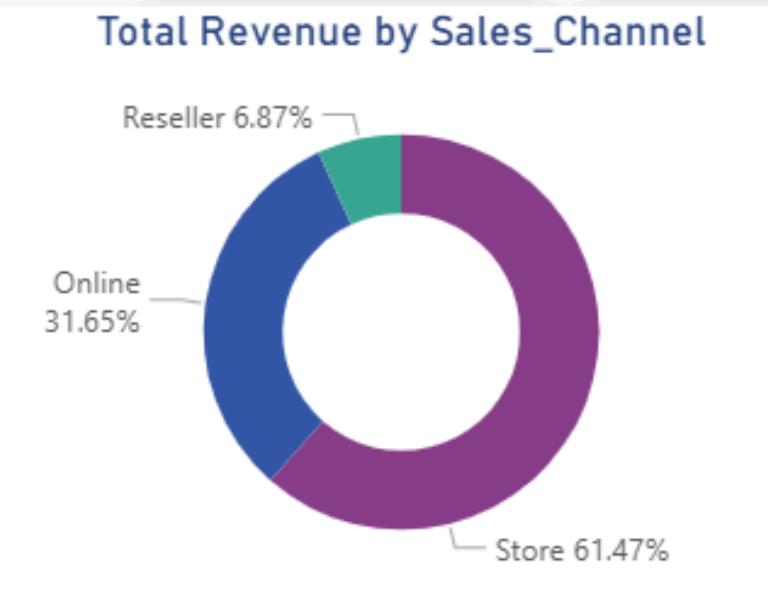
Customer: All

Clear all slicers

Revenue Product Customer Region Seasonality

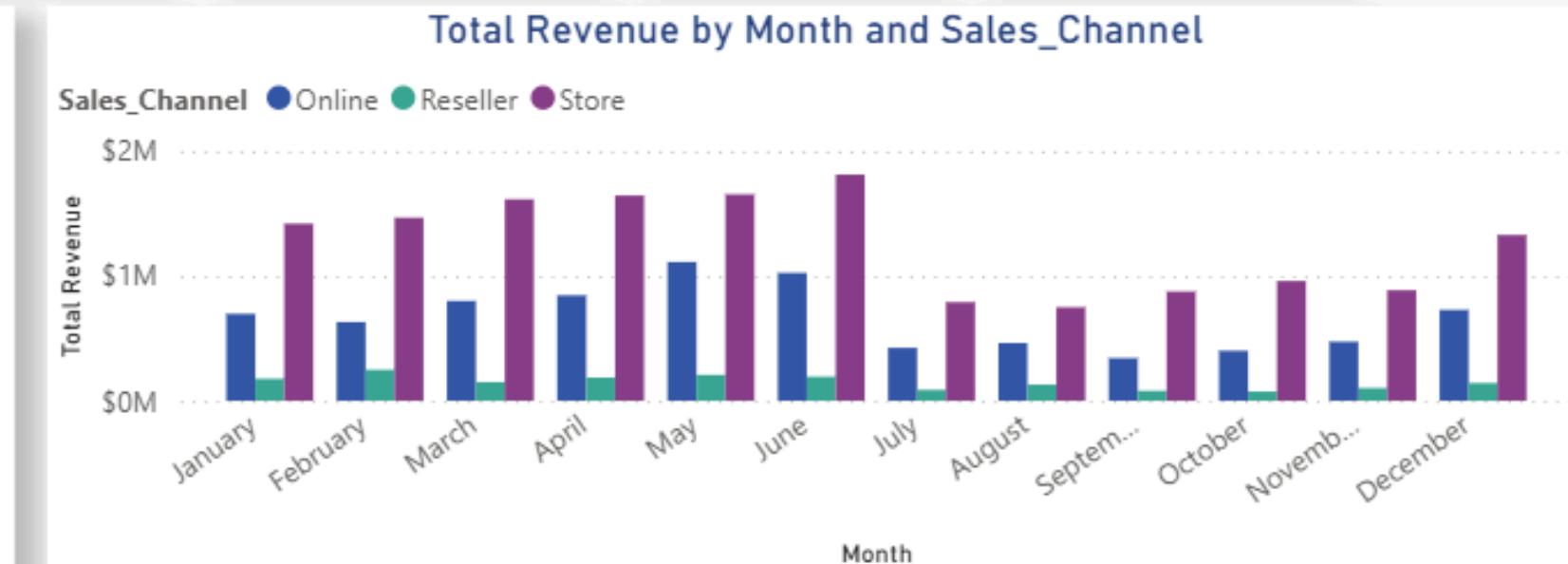
Total Revenue: \$24.91M YOY Growth %: 166.24% MOM Growth %: 7.91% WOW Growth %: 50.57 Profit Margin %: 41.97%

Total Revenue by Sales_Channel



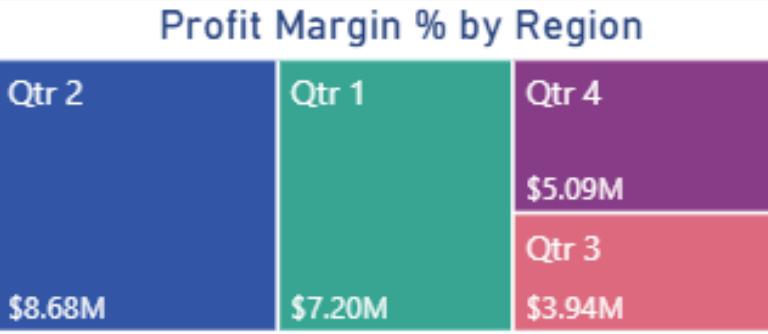
Sales_Channel	Percentage
Online	31.65%
Reseller	6.87%
Store	61.47%

Total Revenue by Month and Sales_Channel



Month	Online	Reseller	Store
January	\$800K	\$200K	\$1.5M
February	\$700K	\$200K	\$1.5M
March	\$900K	\$200K	\$1.5M
April	\$900K	\$200K	\$1.5M
May	\$1.1M	\$200K	\$1.5M
June	\$1.1M	\$200K	\$1.5M
July	\$500K	\$200K	\$1.5M
August	\$500K	\$200K	\$800K
September	\$500K	\$200K	\$800K
October	\$500K	\$200K	\$1M
November	\$500K	\$200K	\$1M
December	\$700K	\$200K	\$1.5M

Profit Margin % by Region



Quarter	Profit Margin %	Total Revenue
Qtr 2	~40%	\$8.68M
Qtr 1	~40%	\$7.20M
Qtr 3	~40%	\$3.94M
Qtr 4	~40%	\$5.09M

Peak Quarter: Qtr 2, \$8,680,229.11 Total Revenue

Peak Month: June, \$3,030,800.79 Total Revenue

Total Revenue by Region



Month	Total Revenue
January	\$2M
February	\$1.9M
March	\$2.2M
April	\$2.3M
May	\$2.5M
June	\$2.5M
July	\$1.1M
August	\$1.1M
September	\$1.1M
October	\$1.3M
November	\$1.3M
December	\$1.8M

Revenue and Growth Overview

\$24.91M

Total Revenue

166.24%

YOY Growth

7.91%

MOM Growth

25K

Total Orders

\$990

Average Order Value

Revenue by Product Category

- Bikes: 94.89% of total revenue — primary revenue driver
- Accessories: 3.64% — complementary sales potential
- Clothing: Remaining balance with growth opportunity

Channel Performance

- Store sales lead revenue generation
- Online and Reseller channels show solid contribution
- AOV increased steadily, indicating improved upselling and premium product adoption



Product Category Performance

\$14.46M

Total Cost

41.97%

Profit Margin

84K

Quantity Sold

2.17%

Return Rate

Profitable Category

\$14.46M

Road Bikes

8.58M

Mountain Bikes

\$3.77M

Touring Bikes

Product Category Performance

- **Clothing** delivers the highest profit margin (42.39%), despite contributing less to total revenue.
- **Return issues** are concentrated in **Shorts (4.24%)**, **Vests (3.65%)**, and **Hydration Packs (3.6%)**, highlighting product quality or fit concerns.
- **Volume Drivers:** Items like **Tires & Tubes** sell in large quantities but yield lower profit margins, suggesting a trade-off between volume and profitability.



Customer Insights & Segmentation

\$10.46M

Total Profit

33.63%

Repeat Purchase Rate

\$1.43K

Average Spend per Customer

Customer Insights & Segmentation

- The **Mid-salaried group** forms the **largest customer base (8.2K)**, followed by **Low-salaried (7.8K)** and **High-salaried (2.1K)** customers.
- Despite being fewer, **High-salaried customers generate the most revenue per person**, indicating premium buying potential.
- **Repeat purchases contribute over one-third of total sales**, showing growing customer trust. However, a **loyalty gap remains** that can be improved through engagement strategies.
- **Spending is concentrated in Road and Mountain Bikes**, reaffirming product preference consistency across customer groups.



Regional & Channel Performance

41.97%

Profit Margin

63.42%

Average Profit Margin by Region

\$1.43K

Average Spend per Customer

Top Performing Regions

45.73%

Central

44.90%

Northeast

44.31%

Southeast

Regional & Channel Performance

- The **Central U.S. and Australia** stand out for both **high profit and sales**, signaling well-optimized operations.
- **Canada and the Southwest regions** underperform slightly, possibly due to **higher costs or weaker marketing penetration**.



Seasonality and Sales Channels

\$24.91M

Total Revenue

166.24%

YOY Growth

7.91%

MOM Growth

41.97%

Profit Margin

Sales Channel Split

61.47%

Stores

31.65%

Reseller

6.87%

Online

Seasonality and Sales Channels

- Q2 (Apr-Jun) is the **peak sales quarter** with **\$8.68M**, and June alone **contributes \$3.03M**, marking the seasonal high point.
- Q4 shows a **mild dip**, possibly due to post-peak seasonal slowdown.
- The **dominance of store sales** highlights a strong offline network, while **online growth remains an untapped opportunity**.
- **Resellers maintain consistent sales**, but margin optimization could further enhance channel profitability.



Business Recommendations

Expand Online Sales Channel

- With only **6.87% of total revenue** online, prioritize digital transformation through website optimization, SEO, and targeted online campaigns.

Enhance Customer Retention

- Leverage CRM data to build **personalized loyalty programs** and **email marketing** to lift the **repeat rate above 40%**.

Improve Product Return Management

- Focus on **apparel quality control and fit accuracy** to reduce return rates, enhancing overall customer satisfaction and margin.

Double Down on High-Margin Categories

- Clothing** offers the best profitability – expand this line with **seasonal promotions** and **new product launches**.

Strengthen Underperforming Regions

- Investigate **Canada and Southwest** for pricing, logistics, or marketing issues. Localized campaigns could unlock hidden demand.

Capitalize on Seasonality

- Launch **pre-summer (Q2)** campaigns and **bundle offers** to capitalize on peak months like June.

Optimize Reseller Partnerships

- Introduce **performance-linked incentives** and **margin-based targets** to improve reseller accountability and efficiency.





Thank You