UNIVERSITY OF NIAGARA FALLS CANADA

MASTER OF DATA ANALYTICS

STRATEGIC SALES ANALYSIS AND FORECASTING WITH POWER BI

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Note: For optimal viewing of the Power BI dashboard, please reduce the canvas zoom level to 60%. I have customized the canvas size to 1600px width and 900px height to accommodate detailed visualizations more effectively, as the default 16:9 layout was not sufficient for displaying all elements clearly.

Introduction

This report presents the findings and insights from the Strategic Sales Analysis and Forecasting assignment using Power BI. The project aimed to analyze sales trends, customer behavior, product performance, and regional dynamics, and to forecast future sales using advanced Power BI tools and DAX functions.

Task 1: Sales Trend Forecasting

To gain a comprehensive understanding of sales performance over time and predict future trends, we conducted a multi-layered temporal analysis of the dataset. This included monthly and quarterly sales aggregation, identification of seasonal trends, peak period recognition, and sales forecasting using Power BI's built-in forecasting tools.

1.1 Time Intelligence & Data Modeling

A robust Date Table was created to support time-series analysis. This Date Table allows accurate slicing and grouping of data across multiple temporal dimensions such as year, month, quarter, and weekday. The DAX formula used is as follows:

```
DAX
DateTable =
VAR MinDate = MIN('Sales'[Date])
VAR MaxDate = MAX('Sales'[Date])
RETURN
ADDCOLUMNS(
    CALENDAR(MinDate, MaxDate),
    "Year", YEAR([Date]),
    "Month", FORMAT([Date], "MMMM"),
    "Month Number", MONTH([Date]),
    "Quarter", "Q" & FORMAT([Date], "Q"),
    "YearMonth", FORMAT([Date], "YYYY-MM"),
    "Weekday", FORMAT([Date], "dddd"),
    "Weekday Number", WEEKDAY([Date], 2)
)
```

This Date Table was then related to the Sales[Date] field via a **one-to-many relationship**, forming

the foundation for time-based visualizations and calculations.

1.2 Monthly & Quarterly Sales Analysis

We created multiple visualizations to track:

- **Monthly Sales Trends**: A line chart showing the progression of sales month over month

  from 2022 to 2024.
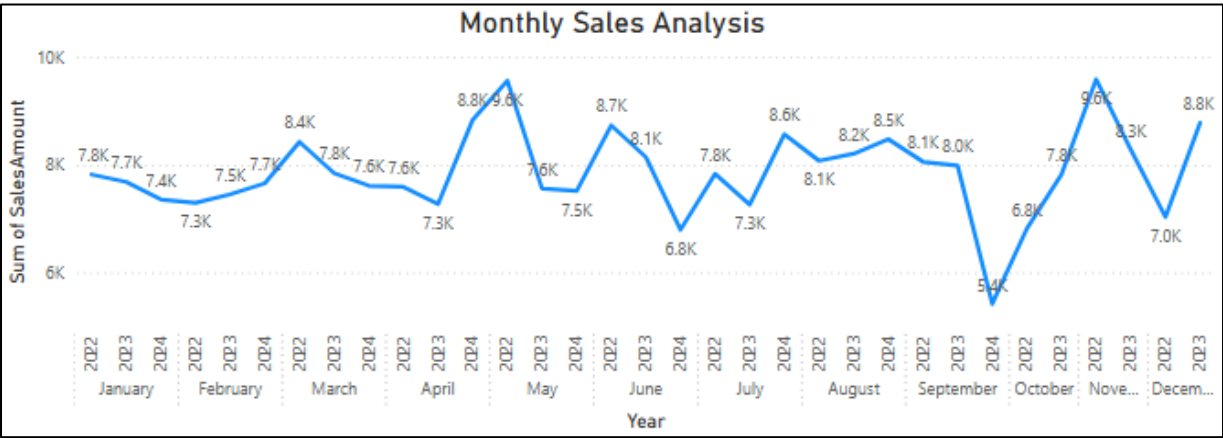
Figure 1: Monthly Sales Analysis

- **Quarterly Sales Comparison**: A line chart comparing quarterly sales year over year.
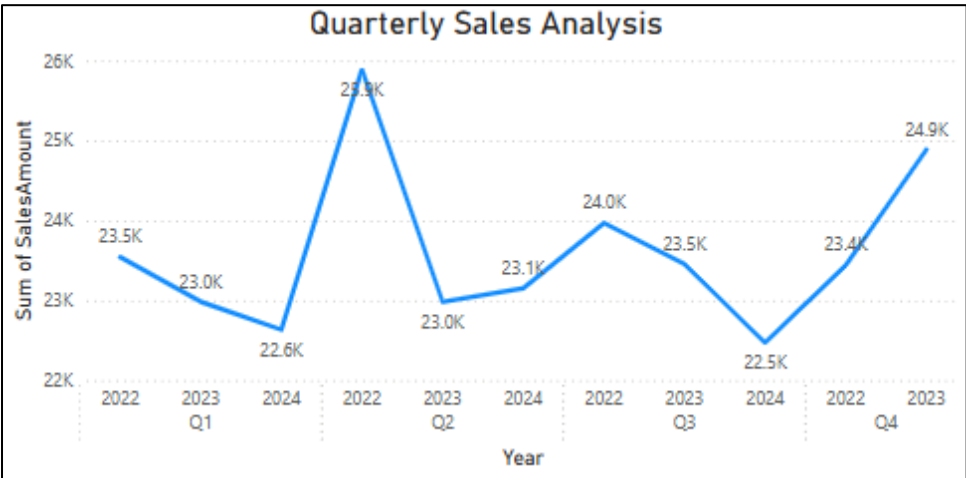
Figure 2: Quarterly Sales Analysis

- Peak sales were consistently observed in **Q2 and Q4**, aligning with seasonal purchasing behaviors (e.g., mid-year promotions and end-of-year holidays).

- Sales dipped slightly in Q3, suggesting a potential slowdown period or opportunity for targeted campaigns.

1.3 Seasonal Trends & Peak Period Identification

Using the Month field from the Date table and Total sales from the Sales table, we performed a comparative analysis of seasonal patterns.
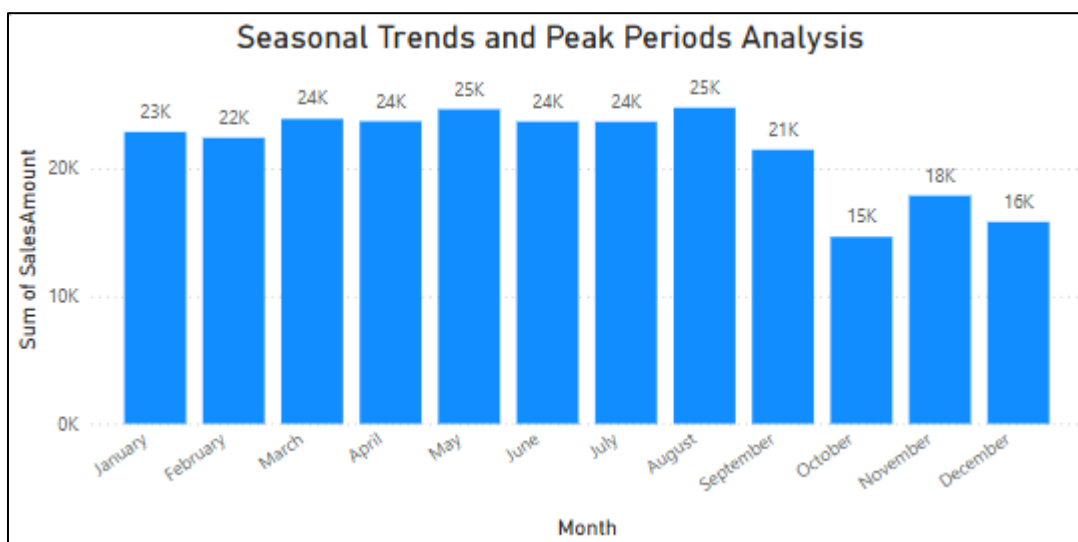
Figure 3: Seasonal Trends and Peak Periods Analysis

March, April, May, June, July and August emerged as peak months across years.

Consistent low points in **October to December** indicated potential customer disengagement or lack of promotions during that time.

A **stacked bar chart** of sales by Month confirmed these patterns, highlighting the repeatability of strong seasonal cycles.

1.4 Sales Forecasting using Power BI

Power BI's **forecasting tool** was applied directly to the monthly sales line chart using **exponential smoothing (ETS)**.

Forecast Configuration:

- **Forecast Length**: 3 future Years

- **Confidence Interval**: 95%

- **Seasonality**: Automatically detected by Power BI

- **Data Range Used**: Entire historical dataset (2022–2024)
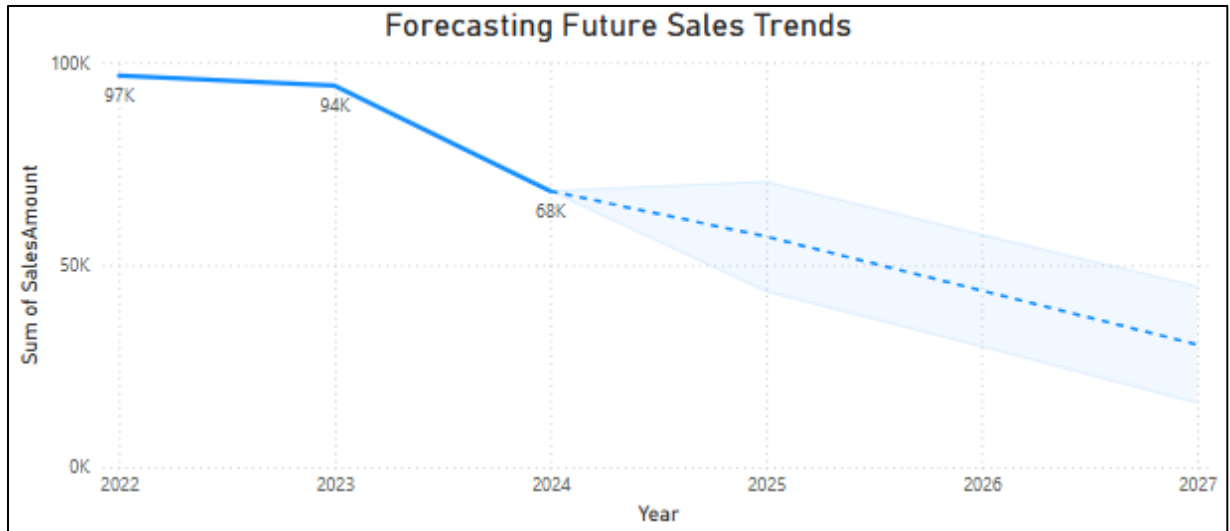
Figure 4: Line Chart - Forecasting Future Sales Trends

A **projected declination** in sales is expected in the coming years, as **month-over-month sales growth is negative 42.02%.**

```
DAX
SalesGrowth% =
VAR CurrentMonthSales =
  CALCULATE(
    SUM(Sales[SalesAmount]),
    DATESINPERIOD(
      'DateTable'[Date],
      MAX('DateTable'[Date]),
      -1,
      MONTH ) )
VAR PreviousMonthSales =
  CALCULATE(
    SUM(Sales[SalesAmount]),
    DATESINPERIOD(
      'DateTable'[Date],
      EDATE(MAX('DateTable'[Date]), -1),
      -1,
      MONTH ))
```

Task 2: Customer & Segment Insights

This task focused on understanding the characteristics and behaviors of the customer base, segmented by age group, gender, and geographical location. The goal was to identify high-value customer groups and regional purchasing patterns that can inform targeted marketing strategies.

2.1 Customer Age Group Segmentation

To segment the customer base meaningfully, we created a new calculated column in the Customers table using DAX to group customers into four age categories:

```
DAX
AgeGroup =
IF(Customers[Age] < 25, "Below 25",
IF(Customers[Age] <= 40, "25 - 40",
IF(Customers[Age] <= 60, "41 - 60", "60+")
)
)
```

This segmentation allowed for the analysis of customer volume and sales contribution by age group.

- **Treemap of Total Customers by Age Group**
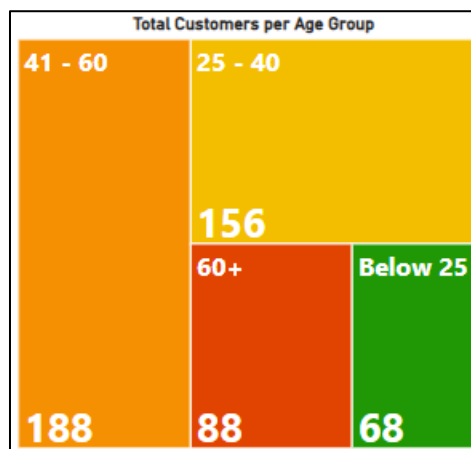
Figure 5: Treemap - Total Customers per age group

- **Area Chart of Total Sales by Age Group**
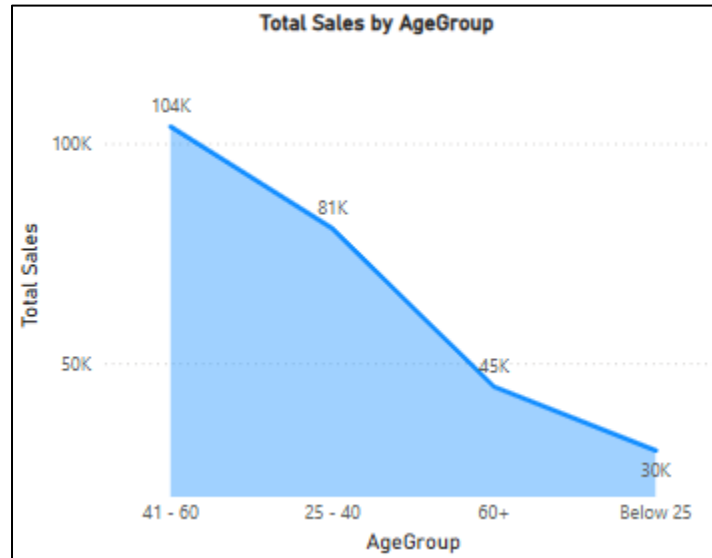
Figure 6: Area Chart - Total Sales by Age Group

- The **41–60 age group** had the **highest customer count** (188 customers) and was responsible for the **highest sales volume** totaling **$102,805.63**.

- The **Below 25 age group** had the **lowest sales contribution** at **$30,177.29**, suggesting limited purchasing power or engagement.

- These insights support the idea that customers aged 41–60 are likely to be the most financially stable and brand-loyal group, making them an ideal target for premium offerings or loyalty programs.

2.2 Top Customers by Sales

A bar chart displaying the **Top 10 Customers by Total Sales** was used to identify key revenue drivers.

Insights:

- The top 10 customers collectively contributed a significant portion of total revenue.

- Targeted retention strategies (e.g., personalized offers, exclusive discounts) for these customers could have a high ROI.
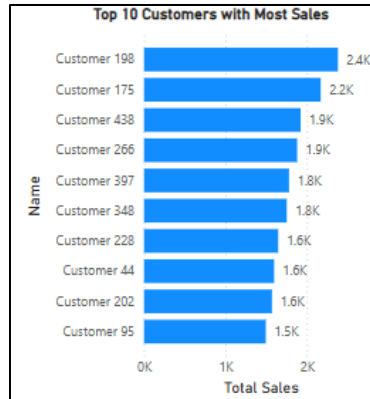
Figure 7: Top 10 Customers with most sales

2.3 Customer Segmentation by Location

We analyzed customer distribution and sales performance by location, region, and gender.

- **Donut Chart**: Number of Customers by Region
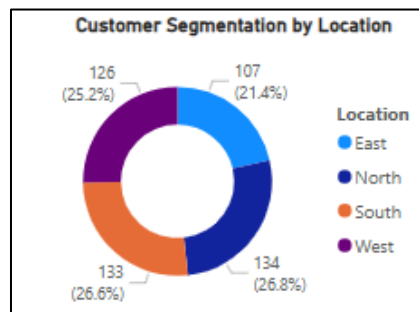
Figure 8: Customer Segmentation by Location

- **Pie Chart**: Total Sales by Region
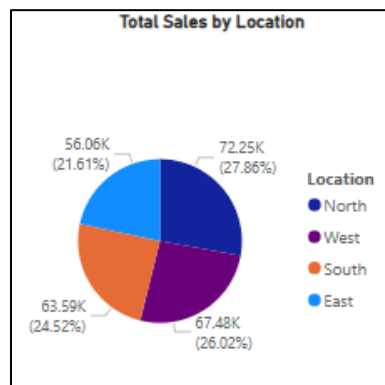
Figure 9:Total sales by location

- **Clustered Column Chart**: Gender-wise Customer Count by Region
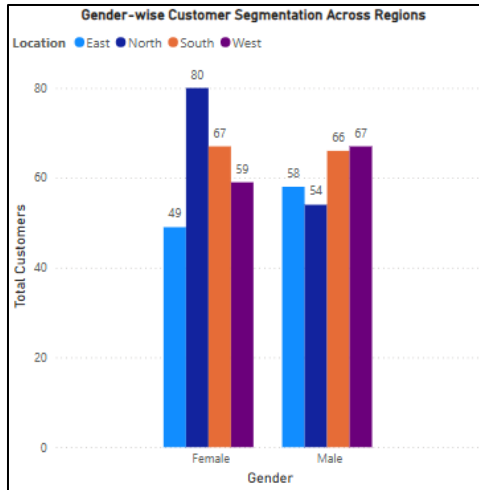
Figure 10: Gender-wise Customer Segmentation Across Regions

- **Stacked Column Chart**: Total Sales by Product Category and Region
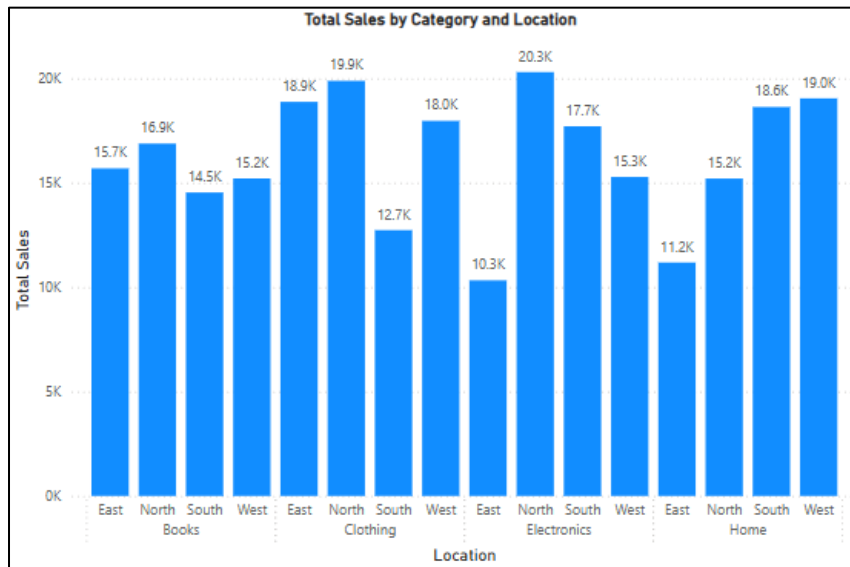
Figure 11: Total sales by product category and location

- **North and South** regions had the highest **customer volumes**, suggesting stronger brand reach or presence in these zones.

- The **North region** generated **27.86% of total sales**, followed closely by the **West region** at **26.02%**, indicating high sales conversion rates in these regions.

- **East and South** regions showed moderate-to-low engagement, which may indicate untapped markets or a need for region-specific strategies.

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Gender-Based Observations:

- Across all regions, **female customers** slightly outnumbered males in total count, but **male customers** accounted for slightly higher average purchase values.

- This could inform differentiated marketing approaches based on customer behavior patterns by gender.

2.4. Recommendations Based on Segment Insights

- **Target the 41–60 Age Group**: This segment demonstrated both the highest customer count and the largest sales contribution. Tailored loyalty programs, premium product bundles, and targeted email campaigns could enhance retention and lifetime value from this high-performing age group.

- **Engage the Below 25 Segment**: Customers under 25 showed the lowest sales contribution. This group may be more price-sensitive or less brand-loyal. Introducing student discounts, gamified reward systems, or social media-driven campaigns could help increase engagement.

- **Focus on High-Performing Regions**: The **North and West regions** contributed significantly to total sales. These regions have proven market potential and should be prioritized for promotional campaigns, inventory optimization, and marketing investment.

- **Develop Strategies for Underperforming Regions**: The **East and South regions** showed lower customer volume and sales. These may represent untapped opportunities. Regional promotions, local partnerships, or influencer-led marketing could help build brand presence and boost engagement.

- **Retain Top Customers**: The top 10 customers represent a substantial portion of total revenue. Offering personalized experiences such as early access to products, premium

support, and exclusive discounts would strengthen relationships with these high-value individuals.

- **Leverage Gender-Based Behavior**: Gender segmentation analysis revealed regional differences in customer distribution and behavior. Marketing efforts should consider tailoring product messaging and visuals to match local demographics and preferences, especially in regions with skewed gender-based sales trends.

Task 3: Product Analysis

The objective of this task was to evaluate the performance of individual products and product categories, identify top and underperforming products, and provide category-level insights to support product strategy and inventory planning.

3.1 Product Category Sales Distribution

A **pie chart visualization** was developed to display the proportion of total sales contributed by each product category. A **category filter button** was also implemented to allow interactive drilling into sub-category and product-level performance.
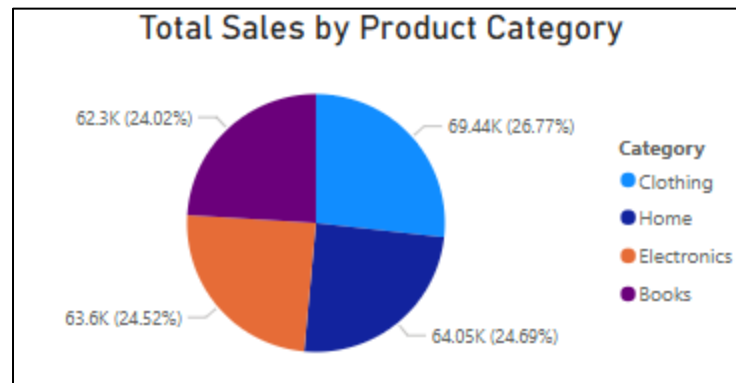
Figure 12: Total sales by product category

- **Clothing** emerged as the leading category, accounting for **26.77%** of total sales.

- The **Home (24.69%)**, **Electronics (24.52%)**, and **Books (24.02%)** categories closely followed, indicating a relatively even distribution of sales across major categories.

The competitive closeness among the categories suggests that each segment holds significant weight in the revenue portfolio, and no single category overwhelmingly dominates.

3.2 Top and Bottom Performing Products

To identify specific product-level performance, we utilized **DAX measures with the TOPN and BottomN functions**. This allowed dynamic ranking of products by total sales, highlighting best- and worst-performing items.

- **Clustered Column Chart** showing the **Top 5 Products by Sales**

Figure 13: Top selling product

- **Clustered Column Chart** showing the **Bottom 5 Products by Sales**

Figure 14: Worst selling product

The **Top 5 products** significantly outpaced others in terms of revenue, suggesting potential for bulk stocking, upselling, and feature placement on the e-commerce platform.

Conversely, the **Bottom 5 products** showed minimal contribution, indicating the need for further investigation into pricing, demand, or marketing inefficiencies.

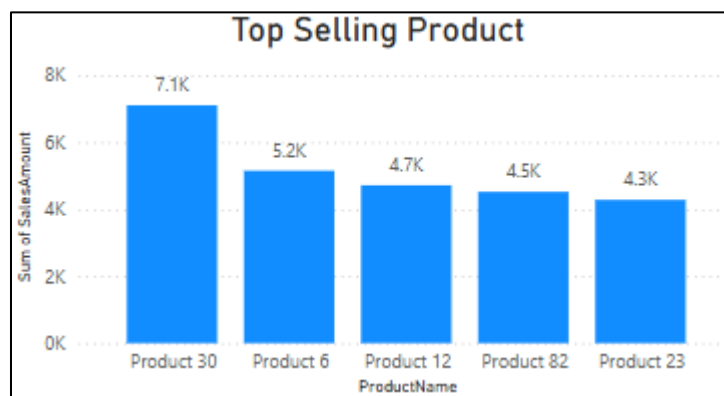### 3.3 Detailed Product-Level Breakdown

A **stacked bar chart** was created to visualize **sales by product category and product name**, providing a granular view of sales performance across all SKUs.
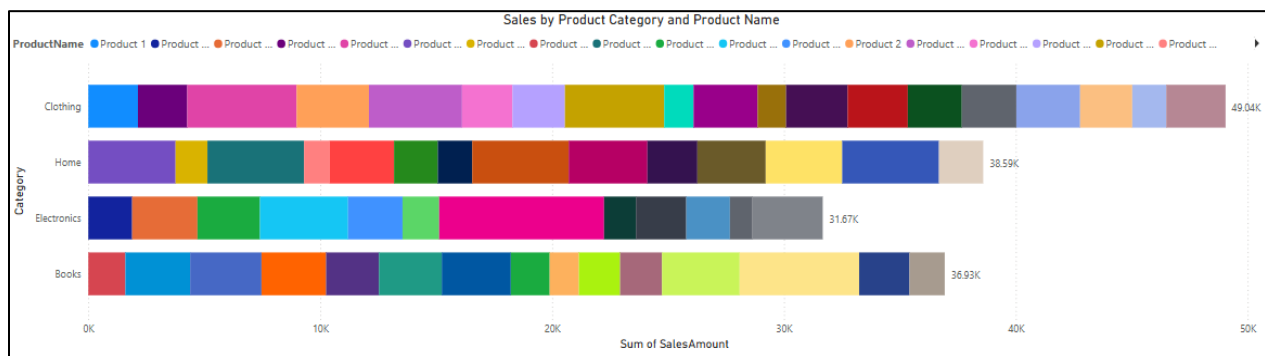
Figure 15: Sales by product category and product names

- Within each product category, a small number of products typically generated a disproportionate amount of revenue.

- This Pareto-like distribution (80/20 rule) confirms the importance of identifying and promoting top sellers while evaluating the ROI of lower-performing SKUs.

- The stacked chart also supports cross-comparison between categories, enabling product managers to analyze diversification and dependency.

3.4 Recommendations Based on Product Analysis

- **Prioritize High-Contribution Categories**: Focus marketing and stocking efforts on the top two categories—**Clothing and Home**—as they represent over 50% of total revenue combined.

- **Promote Top-Performing Products**: Consider exclusive promotions, cross-selling, and inventory scaling for top 5 products to maximize revenue efficiency.

- **Optimize or Phase Out Underperformers**: Analyze bottom-performing products for possible reasons (e.g., lack of demand, high price, poor visibility) and decide whether to revamp, reprice, or discontinue.

- **Maintain Balanced Inventory**: Given the evenly spread category performance, it's advisable to ensure broad product availability across categories to cater to diverse customer preferences.

- **Leverage Filters for Strategic Exploration**: Interactive category filters should be regularly used by business analysts and decision-makers to explore performance nuances by region, time, and demographic segments.

Task 4: Shipping & Regional Dynamics

Since the original dataset lacked explicit shipping mode information, we created a derived column to simulate this variable and allow for meaningful logistics analysis.

4.1 Creation of Shipping Mode Column

Due to the absence of predefined shipping modes in the dataset, a new column was engineered using DAX logic based on the **quantity of items ordered**, following a logical assumption:

```
DAX
Shipping Mode =
SWITCH(TRUE(),
    Sales[Quantity] >= 7, "Freight",
    Sales[Quantity] >= 4, "Express",
    Sales[Quantity] < 4, "Standard",
    "Standard"
)
```

This classification mimics real-world logistics practices:

- **Freight** for high-volume orders (bulk purchases),

- **Express** for mid-volume orders,

- **Standard** for low-quantity individual orders.

This allowed us to incorporate shipping behavior into regional and category-based sales visualizations.

4.2 Global and Regional Sales Analysis

Total Sales by Country

We used the following DAX measure to calculate and visualize sales distribution globally:

```
DAX
Total Sales by Country =
CALCULATE(
    SUM(Sales[SalesAmount]),
    VALUES(Regions[Country])
)
```
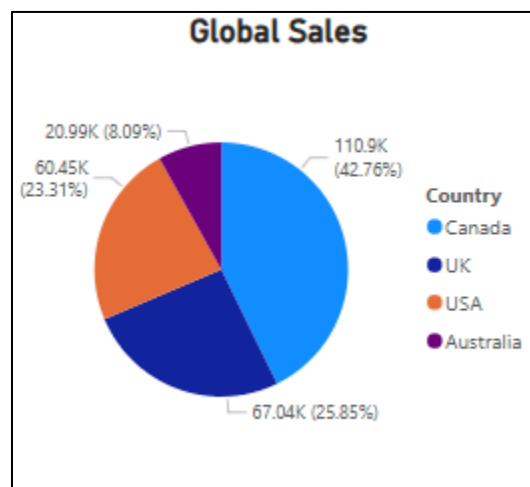

Figure 16: Global Sales

Pie Chart Visualization highlighted that:

- o **Canada** led with **42.76%** of total global sales.

- o **UK** followed at **25.85%**.

- o **USA** contributed **23.31%**.

- o **Australia** had the lowest among the four with **8.09%**.

This indicates Canada as the most strategic market, suggesting further investment or expanded fulfillment operations there.

Regional Sales Patterns

We broke down sales performance by region and state using various visualizations:

- **Stacked Column Chart**
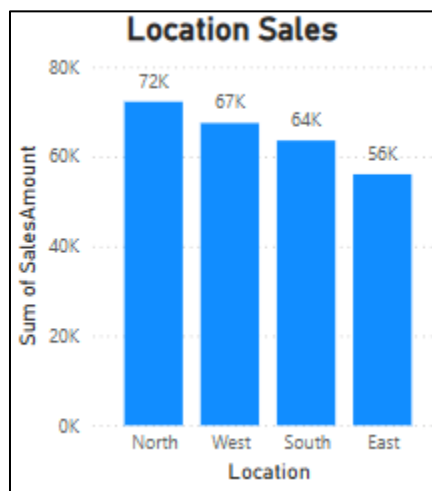
Figure 17: Total sales by location

North region generated the highest sales at **$72,253.23**.

West, South, and East followed, indicating varied regional strengths.

- **Donut Chart** representing sales by internal **Region Codes (Region 2, 4, 6)** revealed that these had higher concentration of sales, helping isolate the strongest performing internal zones.

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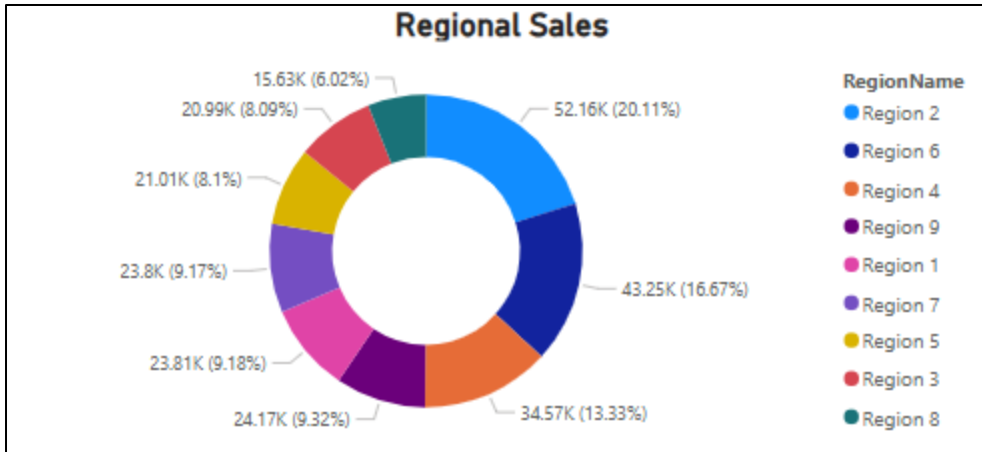
Figure 18: Regional Sales Distribution

4.3 Shipping Mode Performance

Shipping Mode Sales Distribution

A **stacked bar chart** displayed total sales by shipping mode:
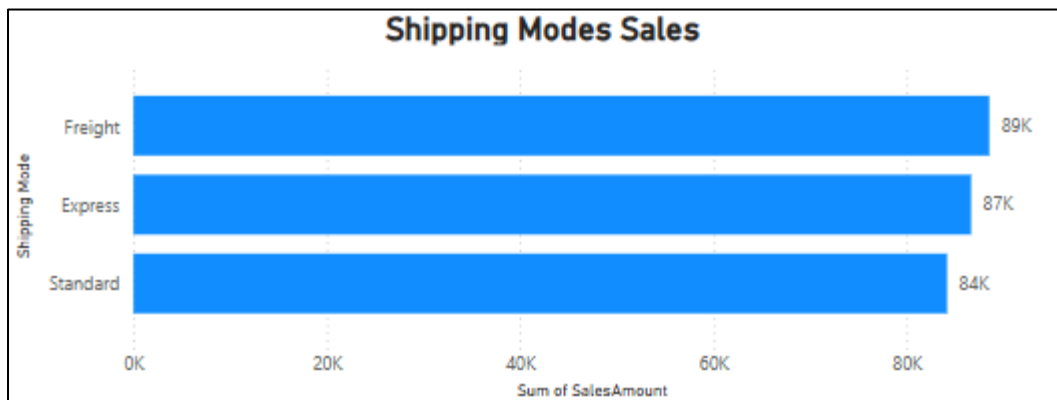
Figure 19: Total sales by Different Shipping Modes

Freight emerged as the most used and profitable method, contributing **$88,547.10**.

Express and **Standard** followed, confirming that high-volume orders are a critical revenue stream.

Shipping Mode by Region

We implemented a **100% stacked bar chart** to compare the **proportion of shipping modes by location**. This revealed:

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- Regions like **North and South** heavily relied on **Freight**, indicating strong bulk orders or B2B activities.
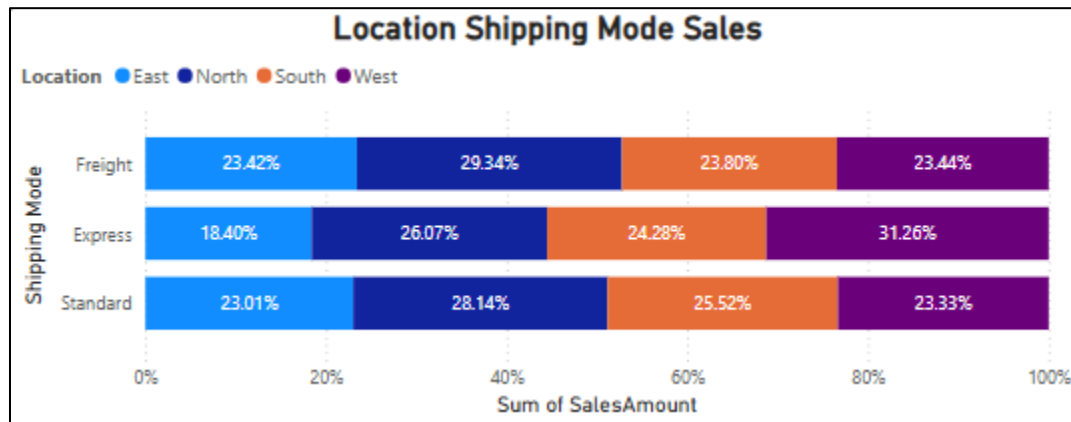
Figure 20: Sales Distribution by Location and Shipping Modes

- **Standard** shipping was more prevalent in **North and South**, suggesting consumer-based small orders.

4.4 Additional Metrics

To deepen insights, the following calculations were performed:

- **Average Order Value (AOV):**

```
DAX
AvgOrderValue =
DIVIDE(SUM(Sales[SalesAmount]), COUNT(Sales[SalesID]))
```

This metric allowed us to compare purchase behavior across regions—identifying high-spend regions or those with frequent low-value transactions.

- **Most Used Shipping Mode:**

```
DAX
Most Used Mode =
CALCULATE(
   MAX(Sales[Shipping Mode]),
   TOPN(1, VALUES(Sales[Shipping Mode]), CALCULATE(COUNTROWS(Sales)))
)
```

This helped determine the shipping mode used most often, confirming **Freight** as the dominant mode due to frequent large-quantity purchases.

4.5 Sales by Category and Region

A **clustered column chart** visualized sales by **product category across different regions**.

- In almost all regions, **Clothing and Home** categories led in sales.

- **Books and Electronics** showed moderate performance, but with significant regional variation.
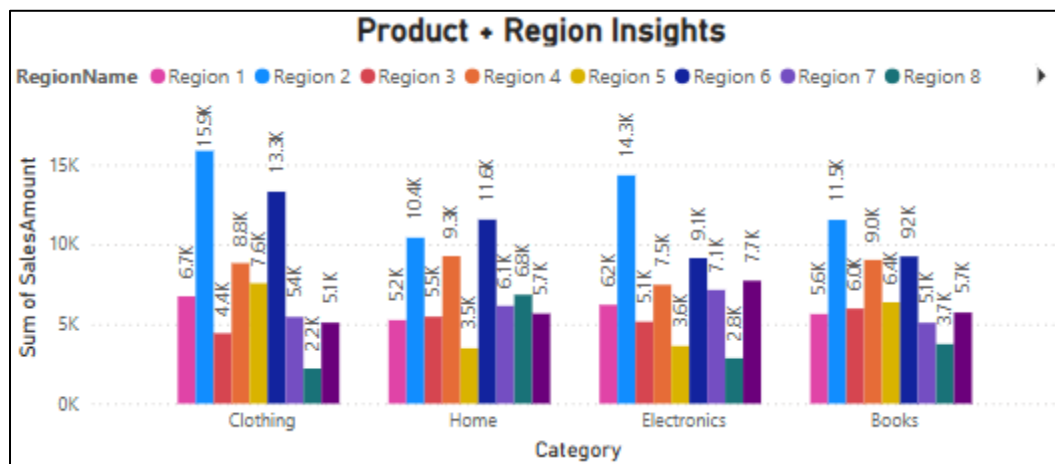
Figure 21: Sales Distribution by Product and Regional insights

4.6 Recommendations Based on Regional & Shipping Analysis

- **Expand Infrastructure in Canada and North Region**: With the highest sales volumes, investing in regional warehouses and shipping partnerships here could reduce logistics costs and improve customer experience.

- **Leverage Freight for High-Value Orders**: As Freight accounts for the largest sales volume, ensuring its cost-effectiveness and delivery speed should be prioritized.

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- **Tailor Strategies to Regional Behavior**: High Express usage in mid-volume markets suggests potential for "priority shipping promotions" to encourage larger baskets.

- **Monitor Underperforming Regions**: Regions with lower total and average order value could benefit from localized marketing, bundled discounts, or shipping subsidies.

- **Optimize Shipping Mode Allocation**: Use order quantity data to intelligently assign shipping methods and reduce fulfillment costs.

Task 5: Predictive Scenarios

We've created predictive scenarios to simulate business outcomes under alternative pricing and quantity strategies using **Power BI's What-If parameters** and **custom DAX measures**. This allowed us to analyze how revenue would be impacted by changes in pricing and purchase volume across different categories and regions.

5.1 Creation of What-If Parameter Tables

To facilitate simulation, we generated two parameter tables using **GENERATESERIES** to represent price and quantity changes from **-50% to +50%** in **5% increments**:

```
DAX
PriceChange = GENERATESERIES(-0.5, 0.5, 0.05)
QuantityChange = GENERATESERIES(-0.5, 0.5, 0.05)
```

These tables were used to create interactive **slicers** in the Power BI dashboard, enabling users to dynamically select price or quantity changes and immediately observe the resulting effects on revenue.

Selected values from these tables were retrieved using:

DAX
PriceChange Value = SELECTEDVALUE('PriceChange'[PriceChange])
QuantityChange Value = SELECTEDVALUE('QuantityChange'[QuantityChange])

5.2 Adjusted Revenue Based on Price Changes

To calculate how price changes would affect revenue by product category, we used the following DAX formula:

DAX
Adjusted Revenue =
SUMX(
   Sales,
   Sales[SalesAmount] * (1 + SELECTEDVALUE(PriceChange[PriceChange], 0))
)

A **Line Chart** was used to plot **Adjusted Revenue vs. Price Change** for each product category.
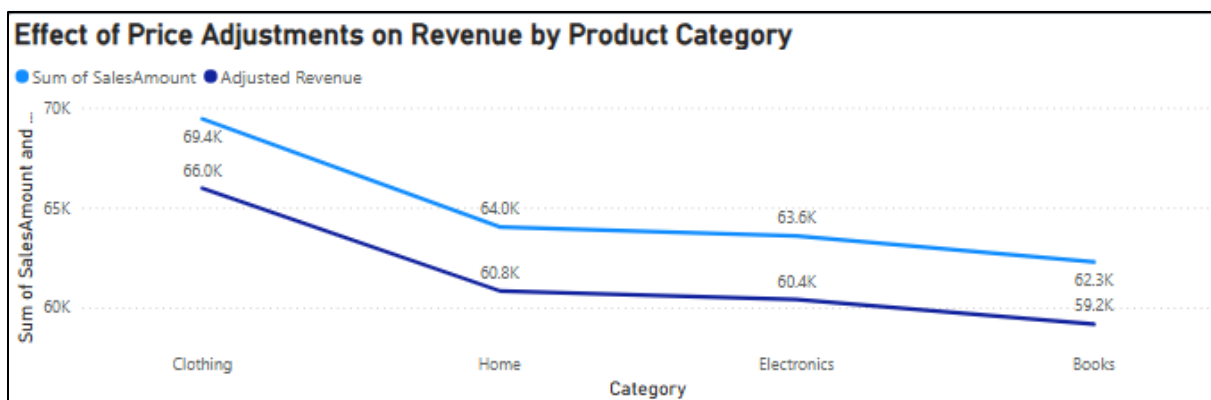

Figure 22: Effect of Price Adjustments on Revenue by Product Category

- Revenue trends linearly increased or decreased with the selected price adjustment.

- High-selling categories like **Clothing and Home** were more sensitive to price changes in absolute terms.

- Small increases in price led to significantly higher adjusted revenue in categories with high base sales volume.

5.3 Adjusted Revenue Based on Quantity Changes

To simulate the effect of customer behavior shifts (i.e., changes in purchase volume), we

created:

```
DAX
Adjusted Quantity Revenue =
SUMX(
    Sales,
    Sales[Unit Price] *
    Sales[Quantity] *
    (1 + SELECTEDVALUE(QuantityChange[QuantityChange], 0))
)
```

A **Clustered Column Chart** displayed the **impact of quantity adjustments** on revenue across
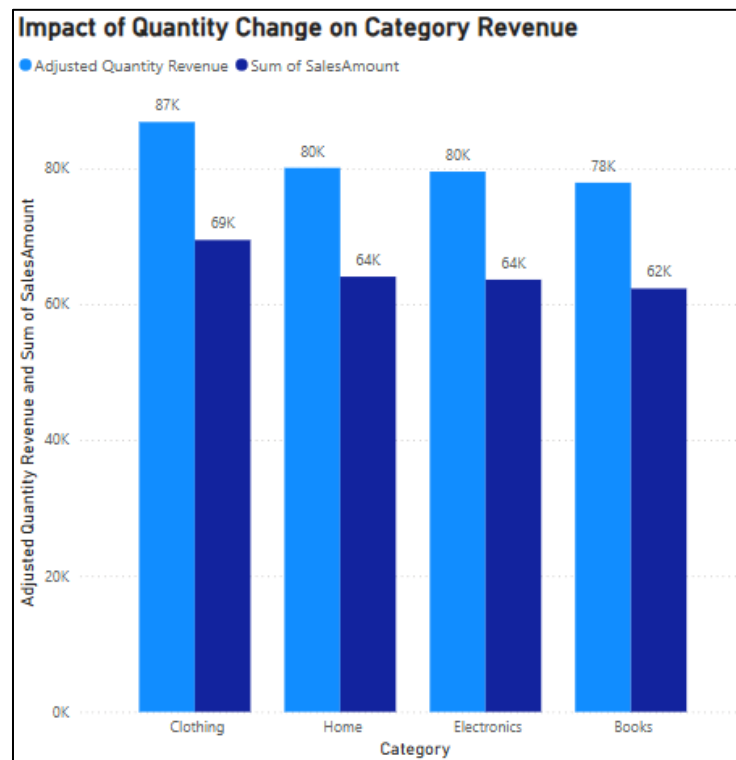
categories.

Figure 23: Impact of Quantity change on Category Revenue

An increase in quantity sold across all categories uniformly improved revenue, with particularly strong growth in categories with lower average prices (e.g., **Books**).

- Negative quantity changes (simulating demand drops) exposed vulnerabilities in **Electronics** and **Home**, which may rely on volume-based promotions.

5.4 Regional Sensitivity to Price Changes

We also analyzed how pricing strategies affected revenue across **different regions** using the same Adjusted Revenue measure grouped by **Region**.
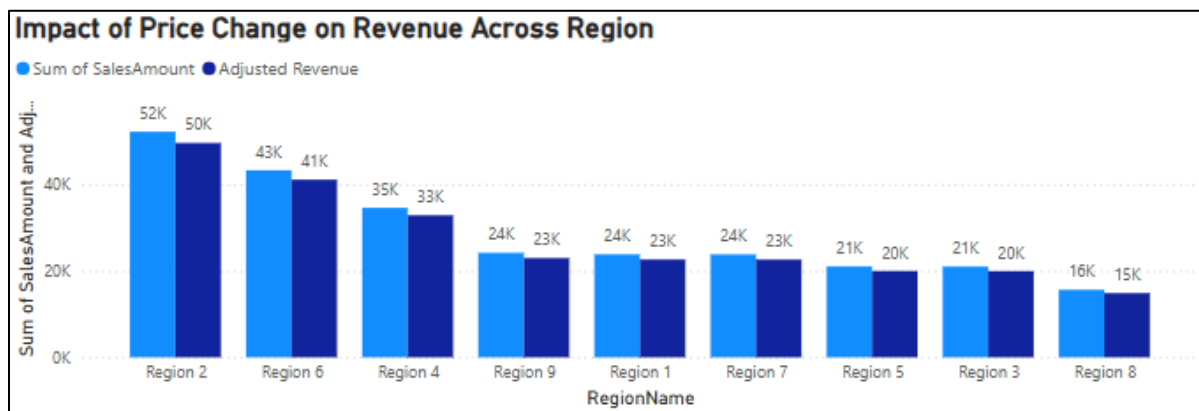

Figure 24: Impact of Price Change on revenue Across Region

A **Clustered Column Chart** showed **adjusted revenue by region** under various pricing scenarios.

- Regions number 2,6 and 4, which contribute more to the total sales, displayed higher responsiveness to price changes.

- This insight can guide **region-specific pricing strategies**, offering selective discounts or markups to optimize profits.

5.5 Recommendations Based on Predictive Scenarios

- **Use Targeted Pricing Strategies**: Tailor pricing changes per region and category to maximize margins while maintaining competitive positioning.

- **Leverage Quantity-Based Promotions**: Bundling or "buy more save more" promotions could significantly lift revenue in low-cost categories like **Books** and **Electronics**.

- **Run A/B Testing on Pricing Adjustments**: Before implementing permanent price changes, simulate different pricing levels and monitor customer reactions using test groups.

- **Dynamic Dashboards for Management**: Empower decision-makers with this interactive "what-if" dashboard to test pricing models and forecast revenue in real time.

- **Apply Predictive Models to Seasonal Planning**: Combine these simulations with seasonal sales trends (from Task 1) to determine optimal pricing windows.

6 Conclusion

Through careful data modeling, time-series analysis, customer segmentation, and scenario forecasting, the project delivered a comprehensive, interactive dashboard that empowers data-driven decision-making.

Our exploration revealed significant trends in sales seasonality, regional and customer behavior differences, and product performance variations. Forecasting tools highlighted predictable growth patterns and peak sales periods, enabling better inventory and marketing planning. Customer insights, particularly around age groups and regional segments, provided direction for targeted sales campaigns. Product analysis emphasized the importance of category-level focus, while the integration of simulated pricing and quantity scenarios showcased the potential financial outcomes under various business strategies.