Business & Operations Analysis Report: ACME

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Overview

In the ever-evolving landscape of the e-commerce industry, it is imperative to make informed decisions to ensure consistent operations and upkeep a sustainable long-term business performance. To optimise ACMEs' scale of operations and intricate operation system for all its factors that may impact a business including consumer behaviour, distribution process, inventory management, the following analysis report outlines the current trends in behaviour and performance while visualising the next years. The analysis aims to identify challenges within ACMEs' business operations that warrant a closer examination with the idea that such will not only address immediate unforeseen concerns but will also extend its reach to explore potential hidden factors that may impact performance in the long run. In a dynamic business environment, operations should leverage the power of foresight which data analysis provides rather than relying on intuition and past experience. This data-driven foresight will empower ACME to make strategic decisions with confidence, anticipate challenges and capitalise on emerging opportunities.

The recommendations in this report are based on the assumption that the current business operations stay unchanged.

Data Processing & Methods

Feature List

The following list of attributes are utilised in the SQL queries for the analysis to identify current patterns and forecast for the future.

- ❖ ordersummary
  - ➢ orderId
  - ➢ orderDate
  - ➢ totalAmount
  - ➢ shiptoState
- ❖ product
  - ➢ productId
  - ➢ productName
  - ➢ productPrice
- ❖ Orderproduct
  - ➢ orderId
  - ➢ productId
  - ➢ quantity
  - ➢ price
- ❖ paymentmethod
  - ➢ paymentType
- ❖ customer
  - ➢ customerId
- ❖ warehouse
  - ➢ warehouseName
  - ➢ warehouseId
- ❖ productinventory
  - ➢ warehouseId
  - ➢ Quantity
  - ➢ productId

Regional Customer Base

To determine the customer base by province, the total sales generated by orders were used as an indicator. By performing a SQL query on the ordersummary table, *Figure 1(A)* was generated to retrieve the historical data for each of the years. This historical data by year would then be used to forecast future data using Excel's Forecast Sheet for each of the provinces in the year 2023 and 2024. This approach is deemed suitable with the following assumptions.

1. Higher total sales generated by ACME in a given province translate to higher customer presence.
2. Customer behaviour shall remain unchanged for the year 2023 and 2024.
3. Customer base, all current ACME customers remain loyal through 2023 and 2024.
4. Product order growth rate for customer bases in each province remains consistent.

Upon analysis, the following trends were identified.

In the year 2019, AB, NB and NF had the highest sales of $15,655.43, $20,874.68 and $16,072.40 corresponding to the top three provinces with the most number of customers.

In the following year 2020, the provinces AB ranked the highest total sales of $107,874.65, NS and SK increasing their customer bases and with subsequent highest sales of $87,858.38 and $97,501.09.

In 2021, AB remained the highest sales generating province with $128,388.94 total revenue from products ordered. NS increased sales from $87,858.38 to $121,721.89 after AB. PE saw an increase from $50,369.32 to $90,113.32.

In 2022, AB however generated less than the two years before with $84,504.53. The top three provinces were MB with $122,508.02, NS with $104,665.09 and SK with $86,051.54. With this historical data present, the *Figures 5(A) through 14(A)* show the sales forecast for the year 2023, 2024 for each province.
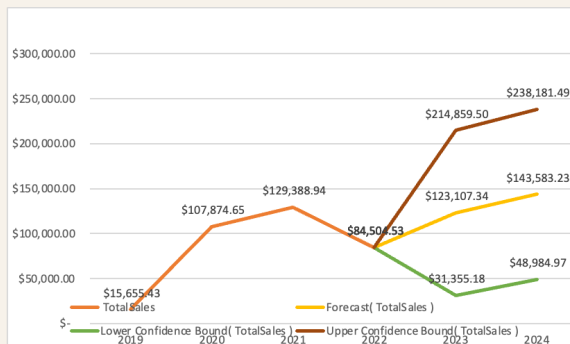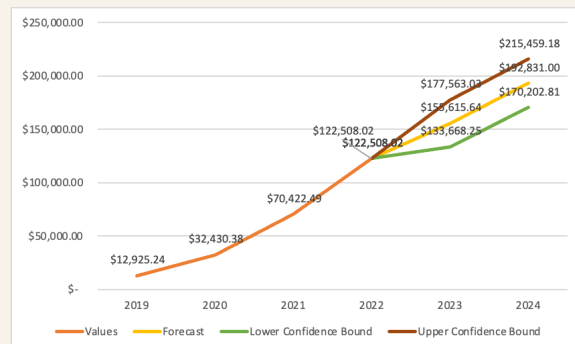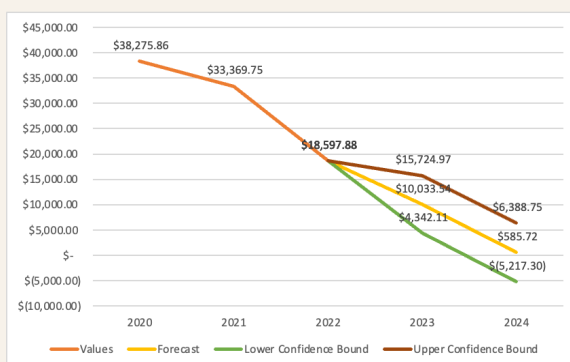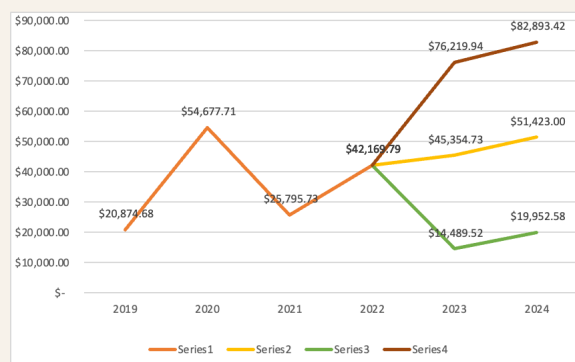

Figure 5(A), AB
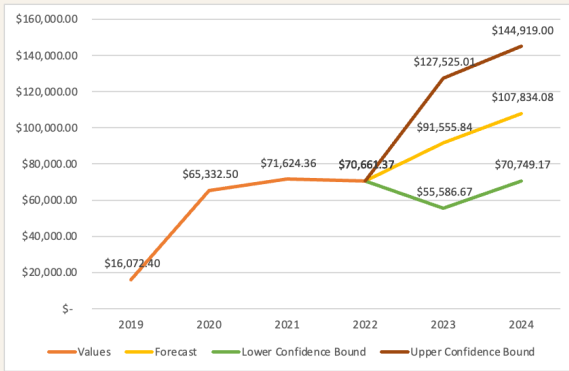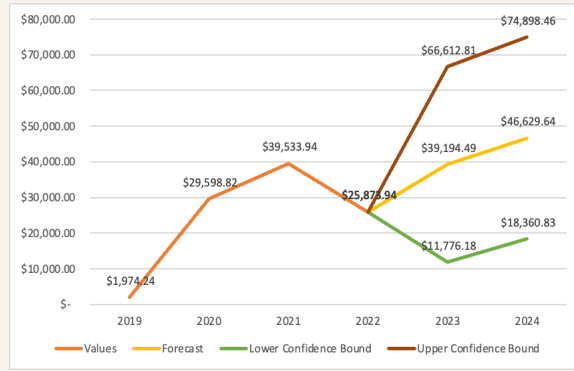

Figure 6(A), MB

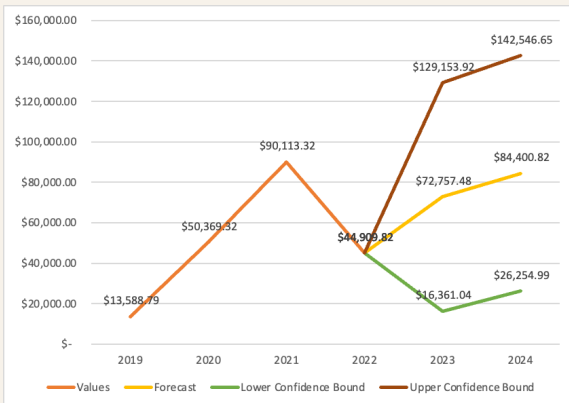*Figure 7(A), BC*

Figure 8(A), NB

Figure 9(A), NF

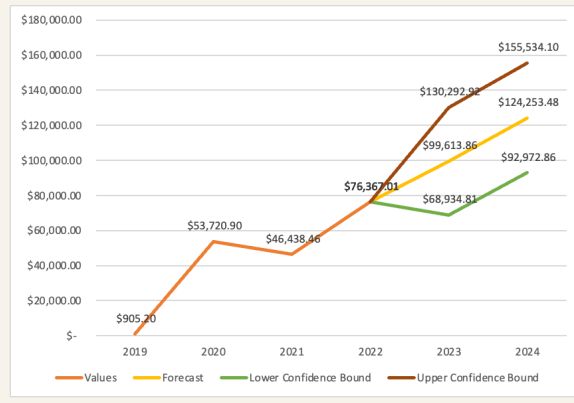*Figure 10(A), ON*

Figure 11(A), PE
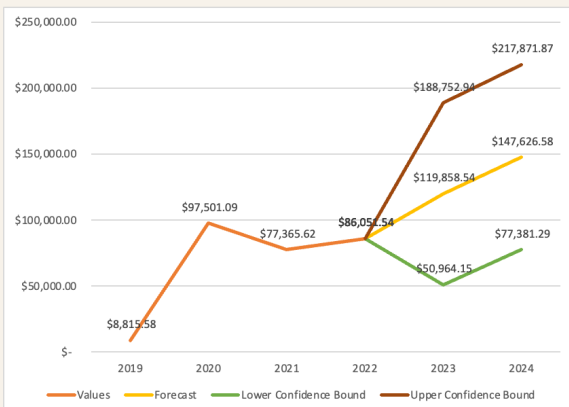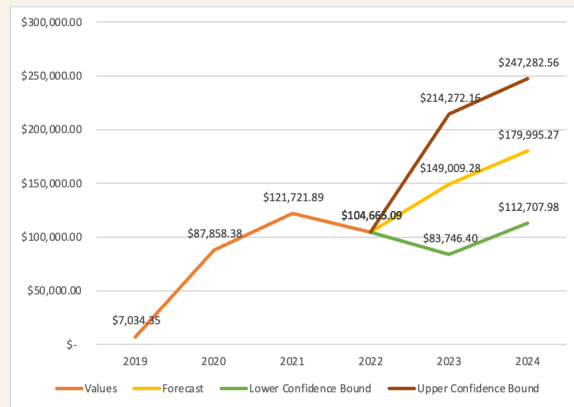

Figure 12(A), QC

Figure 13(A), SK

Figure 14(A), NS

From *figure 2* and *3* which displays the summary of all forecasts, the top three provinces in 2023 are MB, NS, and AB while for 2024 are MB, NS, and SK. With MB and NS seeing a steady growth, the strategy the company has directed towards them are predicted to be sufficient to see a noticeable increase in sales. On the other hand, BC has seen a significant decrease in sales through 2024 with $585.72 in total sales. This demonstrates the inconsistency in a strategy to be applicable to all provinces. ACME is advised to change their outreach strategy, distribution process to better customer engagement.

From analysing the changes in the provinces sales, it can be said that with evolving behaviour AB was unable to see similar growth to NS and SK which saw steady increase in their sales revenue through the years, ideally though marketing efforts, increased efficiency in distribution system. However, such

cannot be determined from sales statistics alone and hence, the subsequent analysis was conducted to better understand the cause of sales pattern changes.

Product Analysis

Changes in sales may be attributed to popularity of products and changes in consumer behaviour. Hence, this analysis was conducted to determine the top and bottom five products. From the products, and ordersummary table all the statistics of the current most and least popular products were retrieved in *Figure 1(B) and 2(B)* overall. To understand the disparity between the generally popular and least popular products, they were further broken down by year. The sales for each of the products were then retrieved into *Figure 7(B)* and growth rates calculated each year, and then used to forecast 2023. To forecast the sales generated by each product in 2024, the growth rate fromt the forecast value in 2023 was used to then calculate the same for 2024. This was an effective approach as it took into consideration every product by their growth rate, their current and past trends to determine how the product might perform in 2023,2024. Such was analysed under the following assumptions.

1. The price for each product was to remain the same through 2023, 2024.
2. No external factors other than company operations would impact the growth rate of each product sales.
3. No new products were introduced in the inventory.
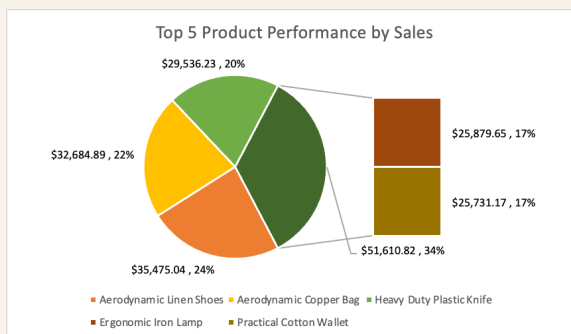4. Product sales translated to the popularity of a product.

Figure 5(B)
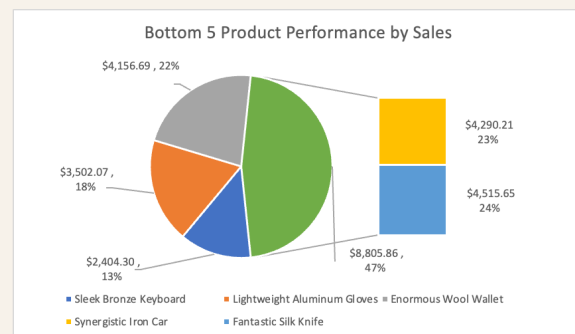
Figure 6(B)

Based on *figure 5, 6* these were the top and bottom five products based on their sales performance overall.
Top Performing Products: Aerodynamic Linen Shoes, Aerodynamic Copper Bag, Heavy Duty Plastic Knife, Ergonomic, Iron Lamp, Practical Cotton Wallet.
Bottom Performing Products: Sleek Bronze Keyboard, Lightweight Aluminum Gloves, Enormous Wool Wallet, Synergistic Iron Car, Fantastic Silk Knife.

Upon forecasting the sales for each product from the calculated growth rates, *Figure 9(B) shows the five best performing products* and *Figure 11(B)* shows the five worst performing products by sales.

Figure 9(B)

Figure 11(B)
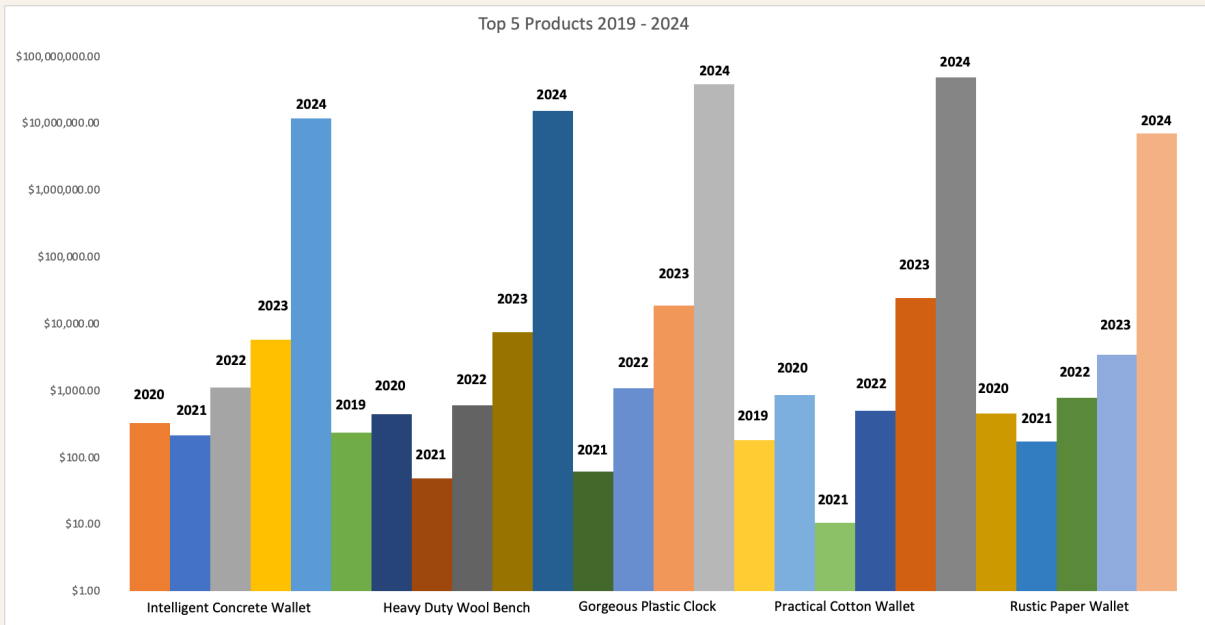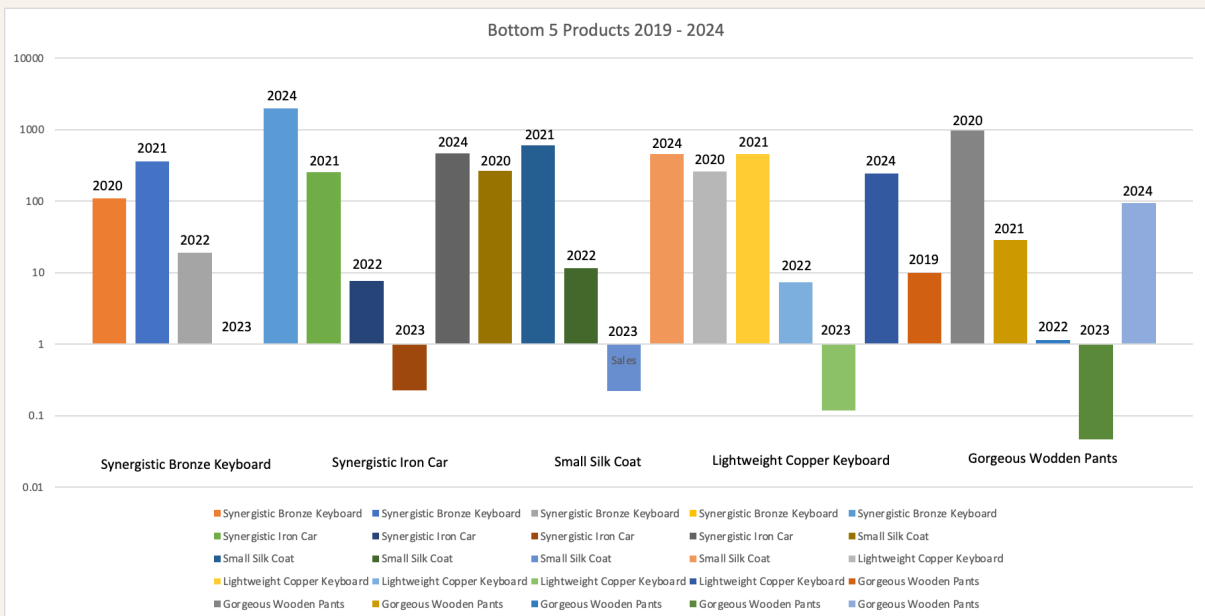
When comparing the generally more popular products in *Figure 1(B)* with the forecasted products and their sales, there seems to be no overlap in the products that are currently or have been popular in the past. One can conclude that with the current company strategy in marketing and consumer engagement, these generally popular products might lose their appeal, unless action is taken to upkeep their popularity. Hence, it is encouraged to give proper care to these products to ensure consumer satisfaction. One such suggestion may be to encourage customers to review these products further and seek any changes in consumer behaviour. Additionally, one product that continues to be one of the least popular is the Synergistic Iron Car. Its negative growth rate suggests that there needs to be additional care taken to upgrade the product to ensure customers are not receiving the same product as it is forecasted to be one of the least profitable products in distribution.

Upon further analysis of the data from *Figure 2(B)* and *4(B)*, even though Lightweight Aluminum Gloves and Enormous Wool Wallet were among the five least popular products, when further broken down into the years, they did not appear to be in the bottom five products by sale from 2019 through

2022. This may be due to the fact that they are priced higher per unit than the least popular products and their prices in *Figure 4*. Hence, it is advised to conduct further analysis on these products individually to determine consumer patterns and identify accurately which products may need more attention with regards to consumer engagement or product discontinuation to upkeep ACMEs' integrity in product delivery and mission.

Payment Methods

The number of transactions for each payment type and the total number of transactions made were retrieved by SQL query into *Figure 1(C)*. To conduct analysis on the number of transactions made for the years 2019-2022, growth rates were calculated to predict the values for 2023 and then the same for 2024. The method of analysis stayed consistent with the previous section with the limited tools available for analysis. Once the values for the number of payments made for the years 2023 and 2024 were retrieved, the patterns of payment methods used were identified and graphed into a Bar Plot for better visualisation. This method was the most efficient as it took into account the growth rate by year and with the following assumptions, was able to retrieve reasonable values.

1. Most popular payment method corresponds to the payment method with the most number of transactions.
2. Most popular payment methods do not have a correlation with the total transaction amount, although it should be noted that certain payment methods provide specific flexibility with the spending amount. This will be a point of consideration in the analysis provided below.
3. All the transactions recorded were irrespective of any refunds issued to the card upon order cancellations or any incomplete transactions.
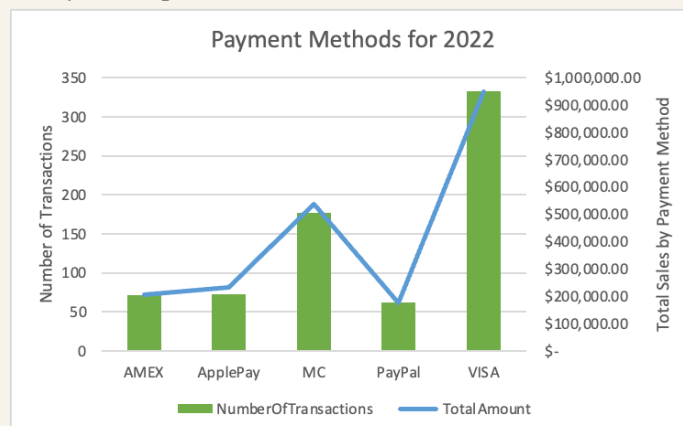

Figure 2(C)

According to *figure 2(C),* VISA was the payment method used most in a total of 333 transactions. This plot also disregards the assumption (2), as there is a direct correlation between the number of transactions made by the payment method and the total transaction amount.
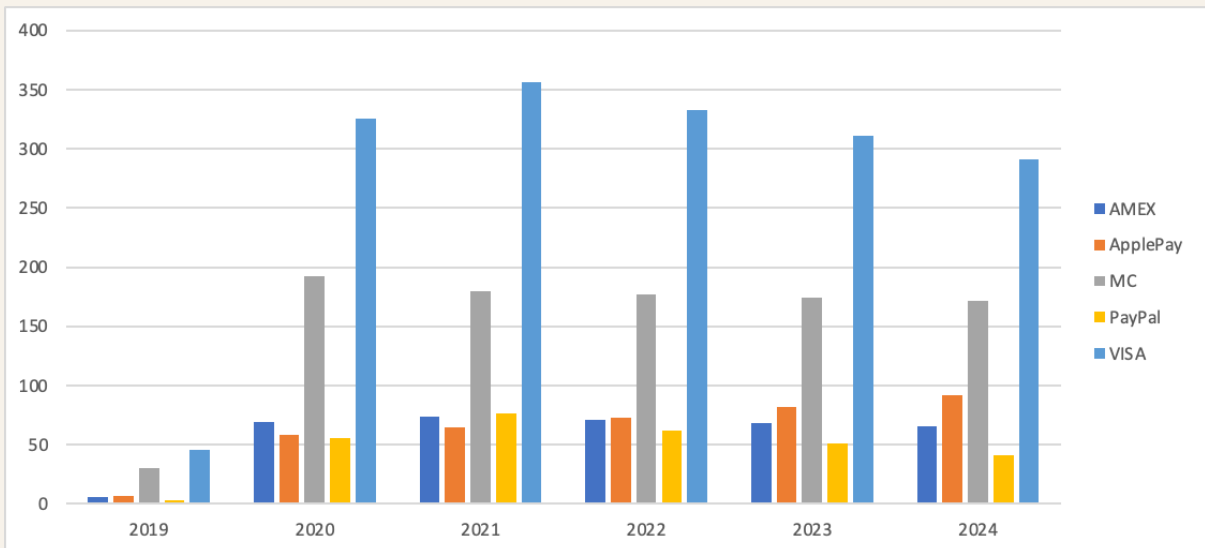
Figure 5(C)

Upon forecasting, it can be seen that VISA eventually remains as the most popular payment method with the highest number of payments used in 2023 and 2024. Paypal decreasing steadily, and AMEX remaining consistent over the years. To conclude, there seems to be no change in the payment methods used over years.

Inventory Management

To understand ACME's inventory management, SQL query was used to retrieve all relevant information pertaining to warehouses and the product distribution in each warehouse. Another query was used to retrieve the total inventory of products at each warehouse. Furthermore, the product categories were used to determine which type of products were housed in which warehouse. The following assumptions were made prior to justify the analysis.

1. Location of the warehouse and its close proximity to the province at which the orders are shipped to determine distribution efficiency. They are proportional to one another.
2. High inventory capacity allows the company to expand and increase production capacity.
3. Inventory at each warehouse is consistent with the number of orders received within the province at which it is based in.

To better understand the category breakdown of products in each of the warehouses, *Figure 6(D)* was created from a pivot table.
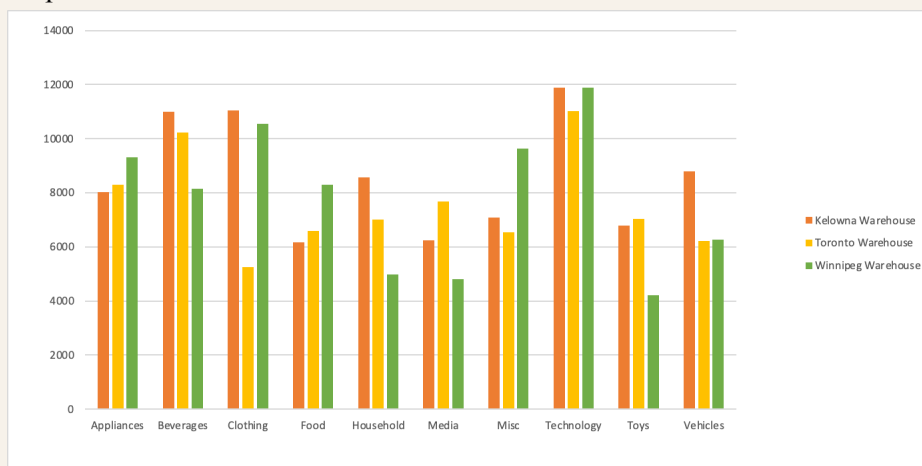

Figure 6(D)

Based on this information, it can be concluded that the Kelowna Warehouse houses the most number of products from each category, except a select few in Appliances, Food, Media and Misc. It has the largest capacity for products manufactured and ordered. Based on the popularity of orders from each province, it may be advisable to expand warehouse operations to Alberta to increase distribution efficiency and sustain sales, following the sales forecast in Regional Customer Base analysis.
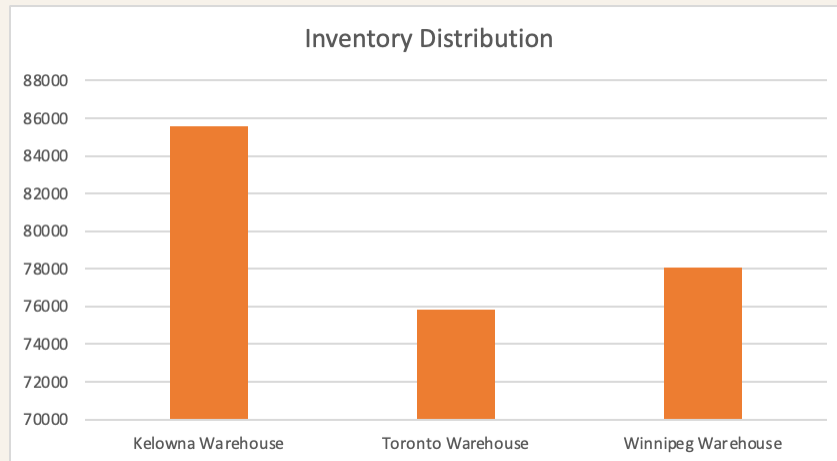

Figure 3(D)

Toronto has the lowest number of products in inventory, which is consistent with the number of orders ACME receives from Ontario. In order to combat low sales in a province of such a population and leverage such an advantage if it chooses, it can implement marketing strategies and consumer engagement opportunities in Toronto to generate more sales based on the category of products that is more popular in those provinces. ACME can also implement seasonal sales and discounts to increase the sales of those categories of products that aren't as popular in each province. In order to identify which of these categories of products are more popular by province, the following analysis was done to provide more details on the specifics.

Product Popularity By Province & Consumer Behaviour

Total quantity sold in each province grouped by category was retrieved and inputted into *Figure 1(E)*. They were then visualised through a bar plot. No further analysis was conducted as there is no information available regarding consumer behaviour changes that can be predictable. Hence, any predictions made for the future may be ineffective. The goal was to analyse which product categories are popular based on province such that ACME can take any further actions on product changes, marketing strategies and increasing distribution efficiencies based on the warehouse capacities and consumer needs. Additionally, the total number of orders by province were also shown to understand if a warehouse capacity needed to be expanded. The following assumptions were made.

1. Despite the capacity of each warehouse, each of them is to be equipped with the same amount of inventory.
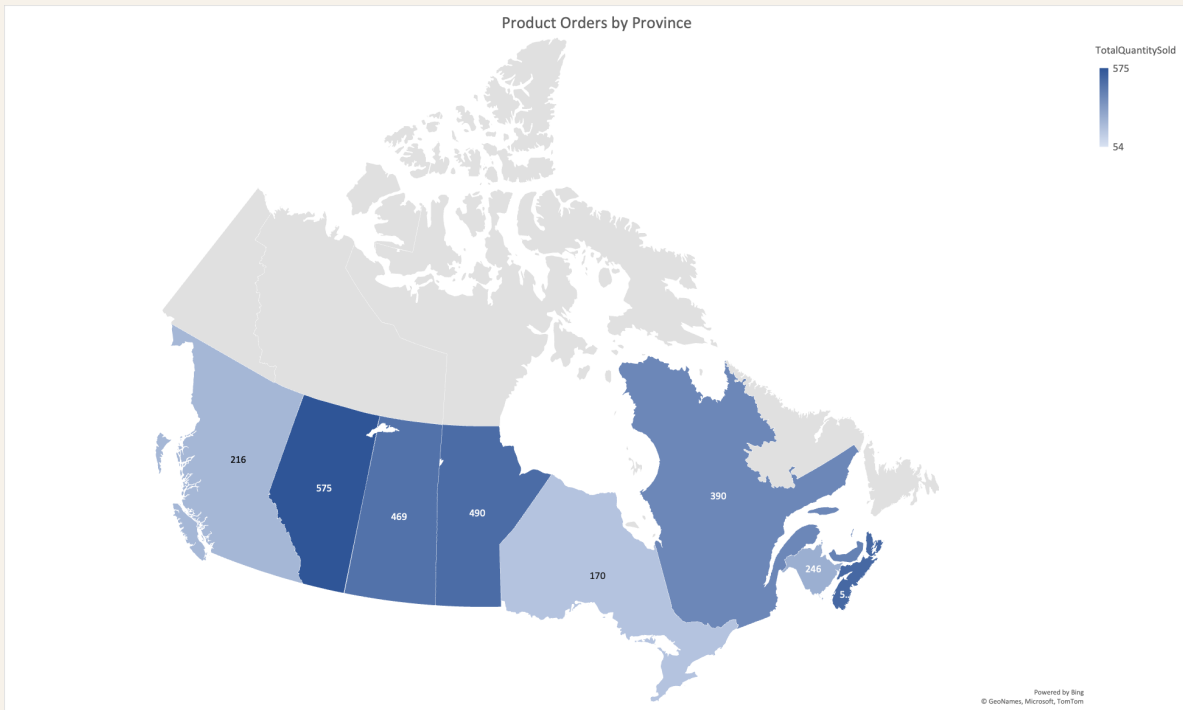
Figure 4(E)

Figure 4(E) was used to visualise the number of orders by province and understand warehouse capabilities and recognise discrepancies in delivery efficiencies. The following analysis is consistent with the orders placed from each of the provinces above, with AB having the highest number of orders overall and SK close second.

Referring to *Figure 3(E)*, it can be deduced that appliances are significantly more popular within AB, as well as household, food, clothing, technology and vehicles. However, there is no warehouse in AB which may translate to greater shipment times as they may be shipped from warehouses in Kelowna and Winnipeg. Therefore, ACME may benefit to expand their warehouse locations to AB where they would be able to leverage the proximity to significantly lower delivery times. On the other hand, SK has a high popularity of Media products, technology and toys. The warehouse capacity in ON may place ACME at a disadvantage when it comes to delivery. Additionally, if SK's sales forecast determines their orders are to increase significantly by 2024, the company will benefit from operational changes in their delivery routes and their warehouse capacities. BC also has the least consumer engagement with any of the categories in the inventory. This could indicate that ACME should focus on consumer engagement more in BC and aim to increase company presence. This is under the assumption that consumers are choosing to order from other companies. Further market analysis should be done to identify strategies they must implement to address this issue.
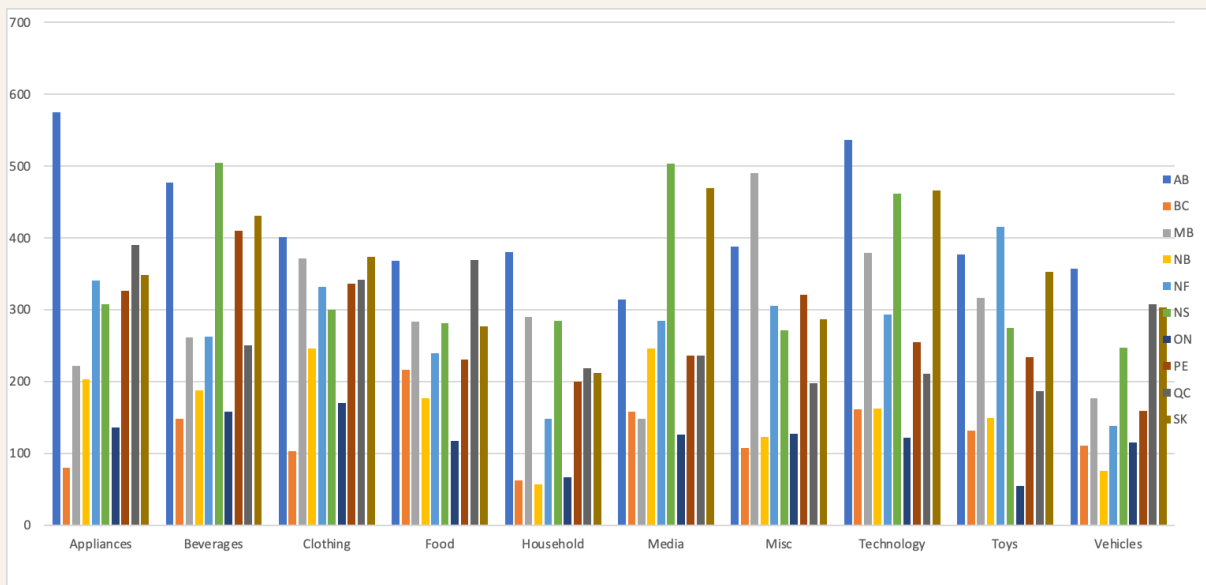
Figure 3(E)

On the other hand, based on the chart above ACME can benefit from introducing more products within the same category that the province deems popular by orders. For instance, ACME can aim to diversify its technology category in Alberta by introducing more products within the same category and generating new sales. In summary, ACME can leverage the popularity of each category of product in each province and choose to invest in manufacturing products that can generate more sales.

Technical & Analysis Improvements

A recent review of using SQL for statistical queries, and Excel for graphs and pivot tables provided an excellent overview, but there could be a significantly more efficient and well informed approach using a combination of alternative tools and techniques. Python will allow one to manipulate statistics and run statistical models that could better account for external factors such as dynamic consumer behaviour, supply-chain behaviour and patterns as well as create visualisations from complex datasets to understand business operations better. Libraries in Python such as; Pandas for statistical manipulation, Matplotlib and Seaborn for better visualisations, and SciPy and scikit-browser for statistical applications and visualisation tools that provide a range of functionality go beyond streaming spreadsheets. Not only can this simplify the assessment process, but it can open the door to more complex analytics, with predictive modelling and identification tools that can uncover deeper, actionable insights. Additionally, external visualisation tools such as Tableau can be used to make a concise analysis dashboard that can better engage and inform ACME's decision makers of the actionable changes that need to be made in order to take charge of the company's direction as well as give them the opportunity to make informed, long-term statistical choices.

Executive Summary

Upon recognising the noteworthy inventory patterns, consumer behaviour, sales forecasts and payment methods, the following recommendations are being made with the intention that they are modified and adapted to ACME's operations and to make an informed decision regarding any changes to its marketing strategy, customer outreach and logistical changes. The comprehensive data analysis conducted for ACME has revealed critical insights into various facets of its operations, ranging from regional customer bases and product popularity to payment methods and inventory management. Our findings suggest a dynamic and evolving market landscape that ACME must adeptly navigate to maintain and enhance its market position.

Key Insights and Observations:
Regional Sales Trends: Analysis indicates a shifting regional customer base, with provinces like MB and NS showing steady sales growth, while regions like BC demonstrate a notable decline. This uneven geographical performance underscores the need for region-specific strategies.
Product Performance: The disparity in sales of top and bottom products highlights evolving consumer preferences. The decline in popularity of previously favoured items signals a critical need for ACME to refresh its product lineup and marketing strategies.
Payment Method Preferences: The dominance of VISA as the preferred payment method, along with the steady use of other methods like PayPal and AMEX, suggests a diverse consumer preference in transaction methods. This trend should inform ACME's payment and checkout strategies to enhance customer convenience.
Inventory and Distribution: The analysis shows significant variations in inventory management efficiency across different warehouses. Particularly, the potential expansion of warehouse operations in Alberta and possibly Saskatchwan could address the increasing demand and improve distribution logistics.

References

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