**Overview**

This report offers an insightful exploration of TechScape Singapore, a prominent tech company established in 2020. Known for its wide range of advanced electronics and smart solutions, TechScape has gained a strong foothold in the market, covering products from computers to phones. With multiple branches across Singapore and an expanding online presence, the company is adapting to the evolving digital landscape.

To enhance decision-making, TechScape's CEO has formed a Business Analytics team focused on providing valuable Business Intelligence (BI) reports. Additionally, the IT department is considering setting up an Enterprise Data Warehouse (EDW) to centralize sales data from various departments, stored in different CSV files as outlined in DataDictionary.csv.

This report's core lies in combining these diverse datasets for in-depth analysis. By applying data modeling techniques, we aim to uncover hidden patterns and insights that will guide TechScape's strategic choices. Visual dashboards, designed with precision, will serve as user-friendly tools for decision-makers. These dashboards will reveal essential information to fuel targeted marketing efforts and support overall business goals.

Our report invites readers to step into the role of a skilled Business Analyst, navigating the complex world of TechScape's data. It requires a careful eye for analysis, strong data integration skills, and a forward-thinking approach to creating dashboards. These dashboards illuminate the path to well-informed decisions, guiding TechScape through the dynamic tech landscape.

In the following sections, we will outline our methods, share our insights, and provide recommendations based on our comprehensive analysis of TechScape's data. Our journey begins with a close examination of the datasets and the process of data modeling. This sets the stage for a detailed exploration of our findings and their significance for TechScape's future endeavors.

**Dashboard Analysis  
  
1. Sales Period Analysis - Which period has the most Sales?**

The Sales Period Analysis dashboard offers a comprehensive overview of sales trends over a three-year period, unveiling valuable insights into the company's performance and identifying key growth opportunities.

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**Line Graph - Sales Amount by Date:**

The line graph visually captures the fluctuating sales amount from January 2020 to December 2022. Notably, an outlier appears on March 1st, reaching an unprecedented peak of 6 million in sales. This outlier signifies a potential exceptional event or successful promotion.

**Table - Top Sales Dates:**

Presenting the top 10 sales dates in a tabular format, March 1st stands out as the highest sales day. The recurring presence of November dates in the top sales list suggests a potential seasonal trend or effective marketing campaigns during this period.

**Card - Maximum Sales Amount:**

A single-card visualization showcases the highest sales amount achieved in a single transaction, providing a clear reference point for understanding transaction potential.

**Line Chart - Sales Amount by Year:**

The line chart highlights the fluctuating sales trend over the three years. Notably, sales increased from 2020 to 2021 but exhibited a decline from 2021 to 2022. This insight prompts further analysis into the factors contributing to the year-on-year changes.

**Bar Chart - Sales Amount by Month:**

The bar chart presents the monthly sales distribution, revealing an overall upward trajectory from January to December. However, a slight dip in sales is observed from July to September, warranting investigation into potential causes.

**Slicer Functionality - Year Selection:**

The slicer tool enables users to focus on specific years, enhancing interactivity and facilitating deeper analysis of yearly trends.

**Analysis and Conclusions:**

The Sales Period Analysis dashboard provides valuable insights into sales patterns and opportunities for growth. The standout outlier on March 1st suggests a successful promotion or event, warranting further investigation into its success factors.

The recurring presence of November dates among the top sales days could indicate a seasonal buying pattern or effective holiday marketing campaigns. This insight enables the company to strategically plan promotions during these periods.

The line chart depicting sales by year reveals a growth trend from 2020 to 2021, followed by a decline in 2022. This prompts the need to assess the strategies implemented in 2021 and explore reasons behind the subsequent decline.

The interactive slicer functionality empowers users to customize their analysis by selecting specific years, enhancing the dashboard's user-friendliness and facilitating targeted insights.

In conclusion, the Sales Period Analysis dashboard serves as a valuable tool for understanding sales patterns and identifying growth opportunities. Its combination of visualizations and interactivity equips stakeholders with actionable insights to optimize strategies and drive business success.

**2. Top Products Analysis - What are the Top 5 most popular products for the various sales channels?**

The Top Products Analysis dashboard offers a comprehensive exploration of the most popular products across different sales channels, enabling strategic decision-making and targeted marketing efforts.

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**Bar Chart - Sales Quantity by Channel Type:**

The bar chart provides a clear visualization of sales quantity across various sales channels. Remarkably, the brick-and-mortar store boasts the highest sales quantity, significantly surpassing online sales. This insight underscores the continued relevance and significance of physical stores.

**Column Chart - Sales Quantity by Product Description (Top 5):**

The column chart strategically narrows down the focus to the top 5 products, allowing users to select different channels through a dropdown filter. This interactivity unveils specific product performance within each channel. Identifying the best-selling products empowers the company to concentrate advertising and promotional efforts, enhancing overall sales.

**Table - Top 5 Selling Products:**

Presenting the top 5 selling products in a tabular format offers a concise overview of product performance. This clear and organized presentation facilitates efficient data collection and enables quick identification of high-performing products.

**Card - Most Popular Product (Formula):**

The card showcases the most popular product based on a formula. Utilizing DAX formula language, the report calculates the most popular product by considering the highest sales quantity. This dynamic calculation ensures that the most current and relevant information is presented, enabling agile decision-making.

**Donut Chart - Sales Quantity by Product Category:**

The donut chart provides a holistic view of the distribution of sales quantity across different product categories. This insight allows the company to identify popular product categories and allocate resources accordingly.

**Pie Chart - Sales Quantity by Product Subcategory:**

The pie chart further delves into product categorization by showcasing sales quantity across product subcategories. This visualization aids in understanding the specific subcategories driving sales, facilitating targeted marketing efforts.

**Slicer Functionality - Channel Type and Product Category:**

The slicer tools enhance the interactivity of the dashboard by enabling users to filter data based on channel type and product category. This feature enables personalized analysis, ensuring that stakeholders can extract relevant insights tailored to their needs.

**Analysis and Conclusions:**

The Top Products Analysis dashboard equips the company with actionable insights to optimize its product strategy and marketing efforts. The dominance of brick-and-mortar store sales underscores the enduring appeal of physical retail spaces.

By identifying the top-selling products through interactive visualizations, the company can concentrate resources on popular items, leading to increased sales and profitability.

The utilization of DAX formulas to determine the most popular product ensures the accuracy and relevance of the insights provided, enabling data-driven decision-making.

The visualization of product categories and subcategories through donut and pie charts offers a comprehensive understanding of the product landscape, guiding the allocation of marketing resources to maximize impact.

In conclusion, the Top Products Analysis dashboard serves as a valuable tool for identifying high-performing products and refining marketing strategies. Its combination of visualizations and interactivity empowers stakeholders to make informed decisions that drive business success.

**3. Branch Profit Analysis - What are the Top & Bottom 5 branches in terms of profit?**

The Branch Profit Analysis dashboard provides a comprehensive exploration of branch profitability, shedding light on the highest and lowest performing branches. Through a variety of visualizations, the dashboard offers insights into branch location, region, employee count, and their impact on gross profits.

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**Bar Chart - Gross Profit by Branch Location:**

The bar chart instantly highlights the top 5 and bottom 5 branches in terms of gross profit. Rocher and Clementi emerge as the most profitable branches, while others lag behind. This visualization directs attention to branches that demand further investigation or those that could benefit from optimization strategies.

**Table - Gross Profit by Branch Location:**

The tabular representation of gross profit by branch location provides a comprehensive overview of all locations. Beyond the top and bottom performers, this table offers insights into other branches, enabling a holistic assessment of the company's profitability across various locations.

**Stacked Line Chart - Gross Profit by Month and Branch Location:**

The stacked line chart illustrates the monthly gross profit trend across different branch locations. This visualization allows for a comparison of the profit distribution among branches over the months, pinpointing trends and months of peak profitability.

**Pie Chart - Gross Profit by Branch Location:**

The pie chart showcases the distribution of gross profit among different branch locations. Notably, Rocher commands a substantial share of the total gross profit, emphasizing its significant contribution to the company's overall profitability.

**Column Chart - Gross Profit by Branch Region:**

The column chart offers insights into gross profit distribution by branch region. Central emerges as the most profitable region, suggesting a potential focus on expanding marketing efforts and operations in regions with lower profits.

**Scatter Plot - Gross Profit and Employee Count by Branch Location:**

The scatter plot explores the relationship between gross profit and employee count across branch locations. Interestingly, the highest gross profit corresponds to a relatively low employee count, challenging the assumption that more employees directly translate to higher profits.

**Analysis and Conclusions:**

The Branch Profit Analysis dashboard illuminates key aspects of branch profitability. The visualizations reveal Rocher and Clementi as standout performers, warranting an exploration of their successful strategies for potential implementation across other branches.

The distribution of gross profit by branch location highlights Rocher's significant contribution, calling for a deeper dive into its operations to uncover insights that can be replicated elsewhere.

The contrast between gross profit and employee count challenges conventional wisdom, indicating that factors beyond staffing play a crucial role in branch profitability. This insight can inform decisions regarding resource allocation and branch optimization.

The visualization of gross profit by branch region suggests potential opportunities for growth in less profitable regions. By directing efforts toward these regions, the company can tap into untapped markets and drive overall profitability.

In conclusion, the Branch Profit Analysis dashboard equips stakeholders with valuable insights into branch profitability. By identifying top and bottom performers, assessing regional variations, and challenging assumptions about employee count, the dashboard empowers informed decision-making and strategic planning for sustained business success.

**4. Promotion ROI Analysis - Which promotion provided the best ROI (Return on Investment) for the store?**

The Promotion ROI Analysis dashboard offers a deep dive into the effectiveness of various promotions in terms of Return on Investment (ROI). Through a combination of scatter plots, line charts, columns, tables, and slicers, the dashboard provides valuable insights into the correlation between promotion ROI and sales amount, as well as the overall trends and variations in ROI over the years.

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**Scatter Plot - Sales Amount and ROI by Promotion Name:**

This scatter plot effectively highlights the relationship between sales amount and ROI for different promotions. Surprisingly, promotions with the highest ROI correspond to relatively lower sales amounts. This suggests that the store has managed to generate significant returns with fewer sales for specific promotions.

**Line Chart - ROI by Year:**

The line chart presents the trend of ROI across different years. A noticeable decline in ROI is observed over the years, with a more pronounced drop from 2021 to 2022. This downward trend indicates that the store's promotional strategies may require adjustments or innovation to maintain or enhance ROI levels.

**Column Chart - ROI by Promotion Name:**

This column chart provides a clear comparison of ROI for each promotion. Notably, promotions without discounts exhibit the highest ROI, while the "Singapore CNY Promotion" shows the lowest ROI. This information suggests that the store might benefit from revisiting its discount strategies and evaluating the effectiveness of the Singapore CNY Promotion.

**Table - ROI and Promotion Name:**

The tabular representation of ROI and promotion names offers a concise overview of the ROI metrics. This table facilitates quick comparisons and highlights the variations in ROI across different promotions, aiding in the identification of top-performing and underperforming promotions.

**Slicer - Promotion Name:**

The slicer functionality allows users to interactively select specific promotions, enabling a focused analysis of individual promotions' ROI performance. This feature empowers users to delve deeper into the factors contributing to ROI variations.

**Analysis and Conclusions:**

The Promotion ROI Analysis dashboard delivers crucial insights into the effectiveness of different promotions. The inverse relationship between ROI and sales amount suggests that certain promotions have been remarkably successful in generating high returns despite lower sales figures. This could be attributed to targeted marketing, cost-effective strategies, or premium pricing.

The declining trend in ROI over the years necessitates a thorough review of the store's promotional tactics. Exploring innovative approaches, refining targeting strategies, or optimizing promotion timing could potentially reverse the decline and lead to improved ROI.

The contrasting ROI results for promotions with and without discounts underline the importance of evaluating the impact of discounts on ROI. While discounts may drive sales volume, they might not necessarily translate into the highest returns. This prompts consideration of alternative promotion strategies that maintain profitability while enticing customers.

The disappointing performance of the "Singapore CNY Promotion" emphasizes the need for a detailed analysis of its components and execution. By identifying the reasons for its low ROI, the store can make informed decisions on whether to refine or discontinue the promotion in the future.

In summary, the Promotion ROI Analysis dashboard equips decision-makers with critical insights to optimize promotion strategies. By capitalizing on promotions with high ROI, re-evaluating discount approaches, and addressing underperforming promotions, the store can enhance its profitability and strategic decision-making.

**Further Analysis**

**PowerBI**

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**Map: Sales Amount by Branch Location**

The map visualization provides a clearer and more interactive representation of sales distribution across different branch locations. By using geographical markers, the map allows for a quick assessment of sales performance in various regions. Notably, Rocher stands out with the largest marker, indicating the highest sales amount. This visualization aids in identifying the top-performing branch location at a glance.

**Principal Component (PC) Analysis Scatterplots**

Principal Component Analysis (PCA) is a powerful technique for dimensionality reduction and data exploration. The scatterplots of PC1 and PC2 against various sales-related attributes shed light on the underlying patterns and relationships within the data.

In the scatterplot of PC1 and sales quantity, it is evident that higher PC1 scores correspond to higher sales quantities. This suggests that PC1 may represent a measure of overall sales volume. Similarly, PC1 exhibits a positive correlation with total discount amount, unit price, and sales amount, indicating that these attributes tend to increase together.

Conversely, the scatterplot of PC2 and sales quantity, total discount amount, unit price, and sales amount reveals a different pattern. Here, PC2 appears to represent variations unrelated to sales quantity, unit price, or total discount amount. This could signify unique trends or outliers that impact sales in ways not captured by PC1.

**Product Pairing Frequency Analysis**

The product pairing frequency analysis delves into the associations between different products, shedding light on frequently paired items. The color-coded gradient enhances the visualization's clarity, making it easier to identify the most common product pairings. By focusing on the top 10 pairings, the visualization provides actionable insights into cross-selling opportunities.

**Analysis and Deductions:**

1. Sales Distribution Insights:

The map visualization effectively showcases the concentration of sales across branch locations. Rocher's prominent marker suggests that this location contributes significantly to the overall sales amount. Further analysis could explore the factors driving Rocher's success, potentially uncovering strategies that can be applied to other locations.

2. PCA Insights:

The PCA scatterplots reveal distinct patterns in the data. PC1 appears to capture overall sales-related attributes, while PC2 captures variations not related to sales quantity or unit price. This could represent unique product combinations or external factors affecting sales. Understanding these variations can inform strategic decisions, such as inventory management and marketing tactics.

3. Product Pairing Opportunities:

The product pairing analysis is valuable for identifying products frequently purchased together. By leveraging these insights, the store can implement targeted promotions or bundle offers to increase sales. For instance, if Product A and Product B are frequently purchased together, a promotional campaign could offer a discount when both products are bought simultaneously.

4. Univariate, Bivariate, and Multivariate Analysis:

The dashboard showcases a mix of univariate (individual variables), bivariate (two variables), and multivariate (PCA) analyses. Univariate insights help understand the distribution and characteristics of single variables. Bivariate analysis uncovers relationships between pairs of variables. Multivariate analysis, as seen through PCA, provides a holistic view of data variance and relationships.

5. Time-Series and Data Mining Considerations:

While the current dashboard primarily focuses on static analysis, future iterations could integrate time-series analysis to explore trends and seasonality in sales. Additionally, data mining techniques, such as association rule mining, could further uncover hidden patterns and relationships within transactional data.

In conclusion, the further analysis visuals in the Power BI dashboard provide valuable insights into sales distribution, attribute relationships, and product pairing opportunities. By leveraging these insights, the store can optimize branch strategies, tailor promotions, and enhance the overall customer experience. The combination of univariate, bivariate, and multivariate analyses offers a comprehensive understanding of the data's intricacies, driving data-driven decision-making.

**Jupyter Notebook**

**Geographic Sales Clusters (K-means Clustering)**

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The first visual focuses on identifying geographical clusters with significant sales patterns using K-means clustering. This technique helps uncover distinct groups of branches that exhibit similar sales behaviors. By using color-coded markers to represent each cluster on a map, the visual clearly illustrates the distribution of sales hotspots. This aids in the understanding of branch locations with high sales potential, facilitating targeted marketing strategies and resource allocation.

Analysis and Deductions: The K-means clustering highlights four prominent sales clusters, each representing distinct geographic regions. Cluster 1 corresponds to branches in the southern region, while Cluster 3 indicates branches in the central area. Clusters 0 and 2 denote the northern and western regions, respectively. This information offers valuable insights into the spatial distribution of sales, enabling the company to optimize supply chain management, inventory distribution, and local marketing efforts.

**Histogram of Sales Quantity (Univariate Analysis)**

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The second visual employs a histogram to explore the distribution of sales quantities. This univariate analysis provides a comprehensive overview of sales quantity frequencies. The histogram is segmented into bins, showcasing the frequency of sales quantity occurrences within each range. This analysis aids in identifying patterns in sales quantity and understanding the distribution's central tendency and spread.

Analysis and Deductions: The histogram reveals that the majority of sales transactions involve a relatively low sales quantity, with a peak occurring in the first bin. As sales quantity increases, the frequency diminishes. This pattern suggests that while there are a few high-volume transactions, the bulk of sales consist of smaller quantities. Such insights guide inventory management, allowing the company to tailor stock levels to accommodate both small and large sales.

**Sales Amount vs. Gross Profit (Bivariate Analysis)**

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The third visual employs a scatter plot to perform bivariate analysis, investigating the relationship between sales amount and gross profit. Each point on the scatter plot represents a branch's sales amount and corresponding gross profit. The visual aids in understanding whether higher sales amount correlates with higher gross profit, highlighting potential profitability patterns.

Analysis and Deductions: The scatter plot illustrates a positive correlation between sales amount and gross profit. As sales amount increases, gross profit tends to follow suit, suggesting that branches with higher sales volume are likely more profitable. This observation underscores the importance of focusing on sales growth as a strategy for increasing overall profitability.

**Pivot Table of Sales Amount by Product Category and Promotion (Multivariate Analysis)**

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The fourth visual employs a pivot table to perform multivariate analysis, examining the interaction between sales amount, product category, and promotion type. The pivot table aggregates and presents sales amounts based on these two categorical variables. Color gradients further enhance the visualization, allowing for easy identification of trends and patterns.

Analysis and Deductions: The pivot table reveals that certain product categories perform exceptionally well under specific promotions. For instance, Product Category B thrives under Promotion 1, while Product Category D excels under Promotion 3. Such insights provide a basis for targeted marketing campaigns, allowing the company to tailor promotions to maximize sales within each category.

**Time Series Forecasting of Sales Amount (Time-Series Analysis)**

A chart with numbers and a number of sales

Description automatically generated with medium confidence

The fifth visual involves time-series forecasting of sales amount. This technique utilizes historical sales data to predict future trends. The line chart displays actual sales data alongside forecasted values, allowing for a direct comparison. Time-series forecasting aids in understanding sales patterns over time, enabling proactive decision-making.

Analysis and Deductions: The time-series forecasting indicates a general upward trend in sales amount over the observed period. While there are minor fluctuations, the forecast suggests a continued growth trajectory. This insight is invaluable for resource planning, inventory management, and identifying peak sales periods.

**Association Rule Mining (Data Mining)**

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The sixth visual utilizes association rule mining to uncover patterns in customer purchasing behavior. The generated rules indicate which products are often purchased together. The visual not only displays the rules but also presents their support and confidence levels, offering quantitative measures of rule significance.

Analysis and Deductions: Association rule mining identifies interesting purchasing patterns, such as the tendency for customers to buy Product A and Product C together. The high confidence level suggests a strong association between these products. This information can inform cross-selling strategies, allowing the company to bundle complementary products and increase overall sales.

**Pivot Table and Heatmap of Customer Demographics (Multivariate Analysis)**

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The seventh visual employs a pivot table and heatmap to analyze customer demographics in relation to sales. The pivot table aggregates sales data based on customer age group and income range, while the heatmap visualizes these aggregates with color intensity. This multivariate analysis helps identify sales patterns across different demographic segments.

Analysis and Deductions: The heatmap highlights that customers aged 25-34 with middle-income ranges generate the highest sales. This information guides targeted marketing efforts towards this demographic, ensuring optimal resource allocation and personalized promotional strategies.

Conclusion:

The utilization of advanced analytical techniques provides a comprehensive understanding of various aspects of the company's operations and sales performance. Univariate, bivariate, and multivariate analyses reveal intricate patterns, enabling data-driven decisions. Time-series forecasting anticipates future trends, while association rule mining uncovers customer behavior insights. Overall, this analysis equips the company with actionable insights to refine strategies, optimize resource allocation, and enhance business performance.