

Module 5: Technique Practice

ALY6040 – Data Mining, Northeastern University

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Introduction

In the rapidly evolving business landscape, data-driven decision-making has become a cornerstone of business strategy. Companies are increasingly relying on data analysis to understand their performance, identify opportunities for growth, and address challenges. This is where the role of a comprehensive dashboard becomes pivotal. A well-designed dashboard not only provides a snapshot of the business's current state but also offers insights into trends and areas requiring attention.

Business Problem

The primary challenge for the '***Sample – Superstore***' business is to gain a deeper understanding of its operational performance across various dimensions such as sales, profits, customer segments, product categories, and geographical regions. The business needs to identify which areas are excelling and which require strategic adjustments. Key questions include:

- ***How are sales and profits trending over time?***
- ***Which product categories and sub-categories are the most profitable?***
- ***What are the sales and profit trends across different regions?***
- ***How is the business performing in terms of customer acquisition and retention?***

Approach and Methodology

In our approach to enhance business understanding through data analysis, we begin with an in-depth EDA of the "Sample – Superstore" dataset. This step is essential to grasp the data structure, identify key variables, and uncover initial insights, particularly focusing on sales and profit trends, product category performance, regional analysis, and customer behavior. From these insights, we select the most impactful Key Performance Indicators that align with the business's objectives. Using Tableau, we then design a comprehensive dashboard, incorporating

various visual elements like bar charts, line graphs, and pie charts, tailored for clarity and ease of interpretation.

Data Cleanup

Data cleaning for the Super Store dataset is an indispensable step that enhances the accuracy and relevance of the subsequent analysis. By preparing the dataset through a meticulous cleaning process, researchers ensure that the foundation upon which they build their insights is robust and reliable, leading to more credible and actionable outcomes. After thorough analysis of the dataset, there were no columns that has null values or duplicate records. The data is completely clean to go ahead with Tableau analysis.

Exploratory Data Analysis

EDA is done to answer the hypothesis questions and have a visual interpretation of it.

Hypothesis 1: The business has experienced consistent growth in both sales and profits from 2019 to 2022.

This hypothesis is supported by the upward trends visible in both lines on the graph in **Figure 1(see Appendix)**. The **sales** line shows a steady increase, indicating that the company has been successfully increasing its revenue year over year. Similarly, the **profit** line also shows a rise, suggesting that not only is the company selling more, but it's also retaining more of its revenue as profit, which could be due to improved margins, better cost management, or a combination of factors. The graph answers the question of whether the business is growing in terms of sales and profitability. The positive upward trends in both metrics suggest that the company's strategic initiatives and operational efficiencies are effective, and the business is on a healthy growth trajectory.

Hypothesis 2: In the “Technology” category, the “Corporate” segment is the most profitable, indicating either a higher margin or a more efficient cost structure in this category and segment combination.

This hypothesis is supported by the fact that in the **Technology** category, the **profit** is not only high in absolute terms but also represents a **high-profit-to-sales** ratio, particularly in the **Corporate** segment (see **Appendix – Figure 2**). This suggests that **sales of Technology** products to corporate customers are more profitable than sales of the other two categories, possibly due to higher margins or better cost control. Conversely, the **Furniture** category, despite its sales, seems to have a lower profitability, which could be due to higher costs or lower margins, particularly in the **Home Office** segment.

Dashboard Modeling

Dashboard modeling is essential because it synthesizes complex data into actionable insights through visual representations, enabling decision-makers to grasp multifaceted information quickly and respond to changes effectively. **Tableau** stands out in this domain with its robust features, including an intuitive drag-and-drop interface that simplifies the creation of complex visualizations without the need for advanced programming skills. In the Super Store dashboard named **Super Store** (marked in yellow in the dashboard file) (see **Appendix Figure 3**), we see **5 KPI's** and **7 visuals** showcasing how the store business is functioning. The filters on top of the Super Store dashboard will empower the customers to channel every one of the graphs by filtering the data as per the data requirement of the clients. This can assist with getting out the undesirable data and just spotlight on the necessary information for better investigation. The Superstore is performing well overall, with significant growth in sales and customer acquisition. However, there are areas where the business could improve, particularly in the profitability of

certain product categories. The dashboard provides a clear visualization of these key areas, offering actionable insights that could help steer the company's strategic decisions to optimize performance and address any challenges.

Data Analysis

The dashboard provides a multi-dimensional view of the Superstore's operations, encapsulating several aspects of its performance:

Total Sales and Profit: The KPI's in the top left corner (\$2,297,200.86 in sales and \$286,397.02 in profit) indicate that the store is generating substantial revenue and maintaining a healthy profit margin. This is a positive indicator of the store's financial health.

Sales and Profit Trends: Both sales and profit lines are trending upwards from 2019 to 2022, which shows that the store is on a growth path. This positive trend and the thickness of the line graph signifies the business's success in increasing revenue and maintaining a trajectory that has translated into higher profits. Year-over-year increases suggest successful sales strategies and possibly an expanding customer base or improved operational efficiency.

Customer Acquisition Trend: The line graph shows a significant rise in the number of returning customers, particularly between 2020 and 2021. This surge might be attributed to successful marketing campaigns or an expansion of product offerings. But we see a decrease in order count for new customers. The company should come up with a strategy to attract more newly added customers for them to place the order according to their needs.

Top 10 Customers: This list indicates customer loyalty and identifies the store's most valuable customers based on the frequency of their purchases. It points to the effectiveness of customer retention strategies and the potential for targeted marketing.

Profit Margin Analysis: This complex graph with dual axes reveals that certain sub-categories (like Copiers and Labels) have high profit margins, while others (like Tables) may be operating at a loss. This signals a need for review of the pricing strategy or cost structure in certain areas.

Category Performance per Segment: The bar charts show that the **Technology** category is performing well in terms of profit across all segments, suggesting high margins or effective sales strategies. Conversely, the **Furniture** category has a disparity between sales and profit, indicating potential inefficiencies. This suggests that while the products are selling, they may not be as profitable, which could indicate issues with pricing or cost structures.

Regional Performance: The map visual and the bubble sizes show that the West and East regions might be the best-performing areas in terms of sales, indicating regional market strengths that could be leveraged further.

Orders Handled by Regional Managers: The pie charts show the distribution of order management among regional managers, which could be an indicator of workload balance and regional sales performance.

Learnings from Each Visual:

The upward trends in sales and profit suggest that the store's overall strategy is working well.

The rapid growth in customer acquisition points to a successful expansion in the store's market reach for existing or returning customers. High-profit margins in Technology imply that this category is particularly strong and should possibly receive more focus. The disparity between sales and profit in some categories, like Furniture, suggests the need to revisit the product strategy, possibly by looking into pricing, promotion, or cost-cutting measures.

Regional performance variations indicate potential for regional-specific strategies, taking advantage of strengths in the West and East. The operational insight regarding orders handled by

regional managers could point to training, hiring, or redistribution of responsibilities as potential areas for operational improvement. This dashboard tells a story of success and opportunity, highlighting areas where the Superstore excels and where strategic adjustments could yield even greater results.

Interpretation and Recommendation

Sales and Profit Trends: The consistent upward trend in sales and profit indicates effective sales strategies and market growth. The business should continue to invest in the strategies driving this growth. They should conduct market analysis to understand what products or services are contributing most to these trends and consider expanding those areas.

Customer Acquisition: The sharp increase in customer acquisition, particularly in the last year, suggests that recent initiatives are successfully attracting new customers. The business should analyze the marketing and sales tactics employed during this period to understand what worked for existing customers and what didn't work for new customers. Apply these successful strategies to other segments or regions. Also, focus on customer retention strategies to ensure that new customers become loyal ones.

Profit Margin Analysis: Varying profit margins across sub-categories suggest that some products are more profitable than others. Negative margins on certain items like Tables indicate potential issues. The business should review the pricing strategy and cost structure for underperforming sub-categories. Consider discontinuing products that consistently incur losses or reevaluate suppliers and pricing to improve margins.

Category Performance per Segment: Technology shows high profitability across all segments, indicating strong market fit and pricing strategy. Allocate more resources to promote the

Technology category. Investigate what aspects of the Technology offerings are performing well and apply these learnings to other categories.

Regional Performance: The significant sales volumes in the West and East suggest strong market presence and/or higher demand in these regions. Conduct a regional analysis to determine the drivers of success in these areas. Explore whether these drivers can be replicated in other regions. Consider regional marketing campaigns to further capitalize on these strongholds.

Operational Insights: The workload distribution among regional managers is uneven, which could affect sales and customer service quality. Assess the capacity and performance of regional managers. Redistribute responsibilities or provide additional support where needed to ensure balanced workloads and sustained performance.

Additional Variables for Consideration:

Market Penetration Rates: Comparing sales data to the size of the potential market in different regions could identify under-served areas with growth potential.

Customer Demographics: Understanding who is buying can help tailor products and marketing strategies. Are certain products popular among specific age groups or households with children?

Economic Indicators: Broader economic trends could inform decisions about inventory levels, staffing, and expansion.

By incorporating these recommendations and additional variables, the Superstore can refine its strategies to not only sustain the current growth but also to improve profitability and operational efficiency across all aspects of the business.

Conclusion

The analysis of the Superstore dashboard has provided us with a clear picture of a business during a successful growth phase, marked by robust sales increases, healthy profit margins, and a

rapidly expanding customer base. We learned that the Technology category is a standout performer, yielding high profits across all customer segments, and that certain regions, particularly the West and East, are significant contributors to the company's success. However, we also identified areas for improvement, such as the profitability of the Furniture category and the operational efficiency suggested by the uneven workload distribution among regional managers. The dashboard proved to be an invaluable tool, offering a comprehensive and interactive representation of the business's health. It highlighted the effectiveness of current strategies and shed light on potential areas where strategic adjustments could further optimize performance. With the insights gleaned, the Superstore is well-positioned to capitalize on its strengths, address its weaknesses, and steer towards sustained growth and market leadership. The future is bright for the Superstore, provided it continues to leverage data-driven insights for strategic decision-making.

Appendix

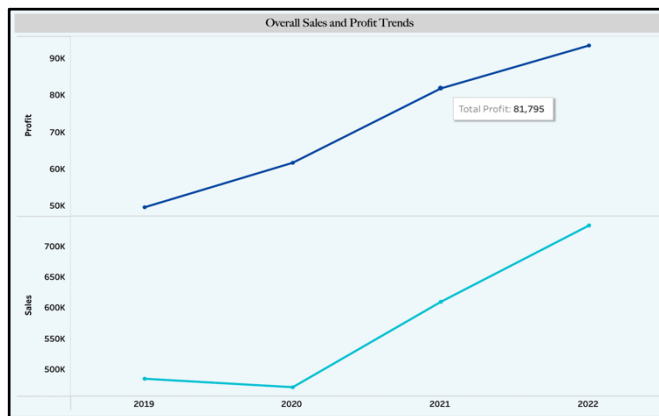


Figure 1: Overall Sales and Profit Trend

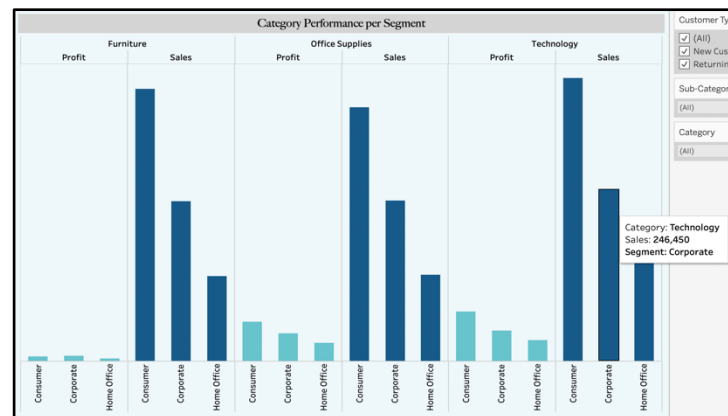


Figure 2: Category Performance per Segment

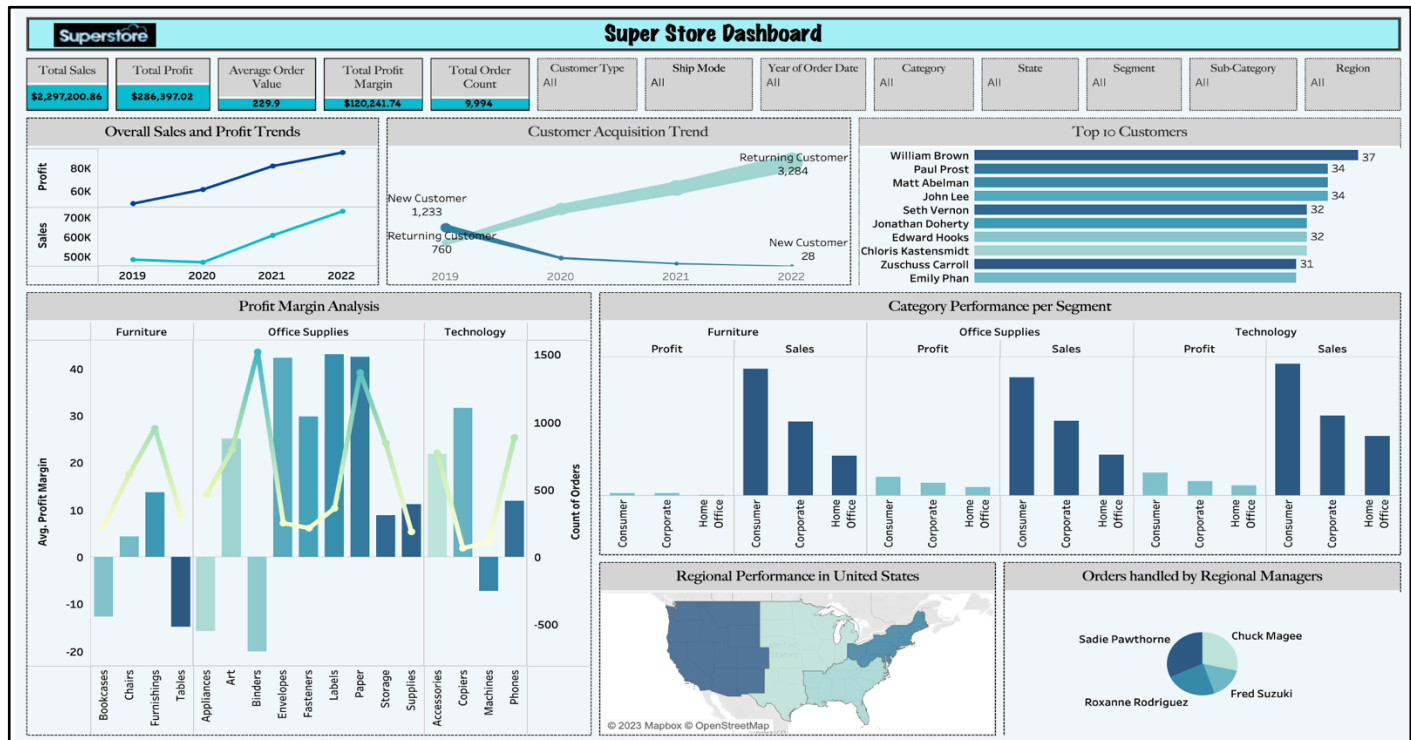


Figure 3: Super Store Dashboard

Showcasing working version of the dashboard:

Here, I have selected Customer Type as Returning Customer, Order Date from 2021-2022, Category as Technology, Segment as Corporate, Region as West and East.

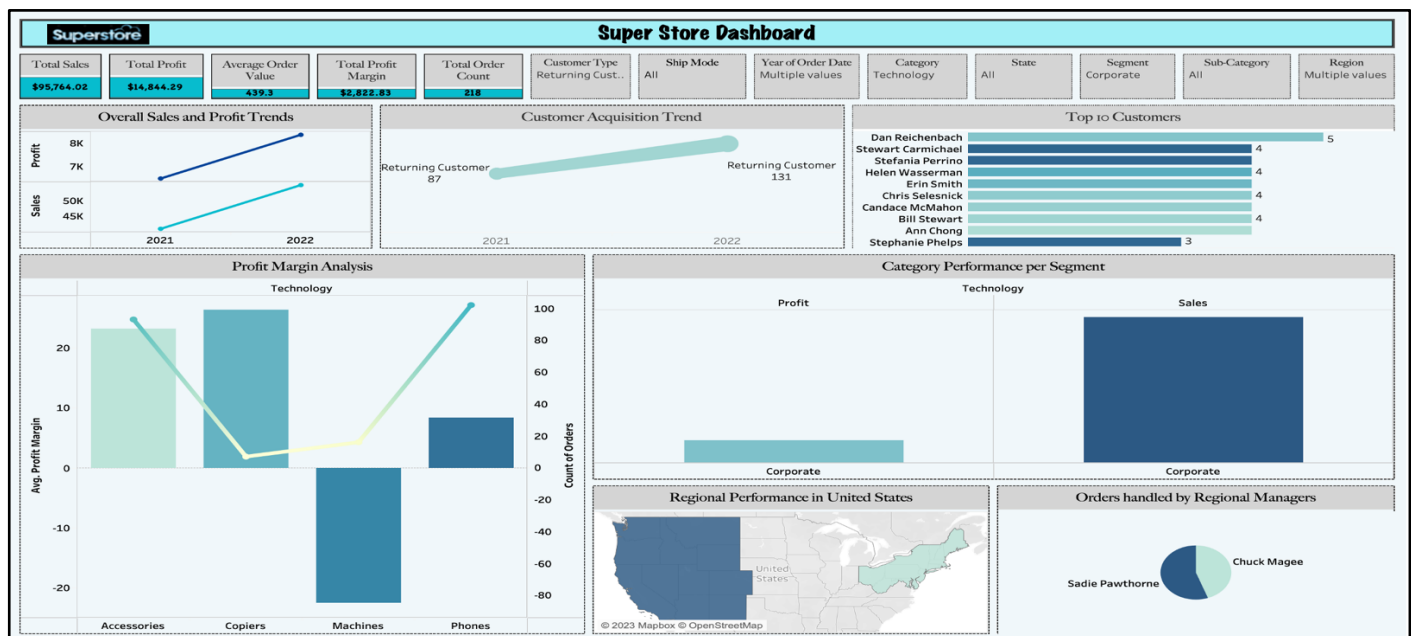


Figure 4: Interactive Dashboard

References

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