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Essay / Assignment Title: Exploring Artificial Intelligence Trends Across Sector through Tableau Visualizations

Programme title: Msc Data Analytics

Name: Sajedh Tabikh

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CONTENTS

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INTRODUCTION

Brief Analysis of the Topic

Retail uses data analytics and data visualization solutions such as Tableau to get the actionable insights. the ability of businesses to perceive customer behavior and sales trends is necessary in order for them to tailor their strategy effectively. According to Gupta et al. (2022), a data story visualized and presented effectively can help business to get decision from complex data in more accessible way. Tableau specializes in creating interactive and shareable dashboards that can help users visualize large datasets, with an eye for identifying patterns that could be valuable to businesses. As data-driven decisions continue to be more critical in retail, companies must use the tools to drive customer targeting, product offerings and inventory management efficiencies. In particular, insights such as seasonal trends of sales and preferences of different customer segments (e.g., gender or age) may help businesses gain a competitive edge in a more and more complex marketplace (Mittal and Raheja, 2024).

Aim and Objectives

The purpose of this report is to identify whether there's significant improvement on retail sales and customers behaviour as well as to find out potentially actionable insights for the retail industry through visualizing tableaus. This report will use the power of tableaus's features to analyse customer buying behaviour and sales performance among different product categories. The particular aims of this report are:

- For analysis of a dataset of retail sales for seasonal trends and product performance (Kosara and Mackinlay, 2021).
- To understand customer demographics (e.g., age, gender) and its impact on sales (Pai et al., 2024).
- To develop an interactive Tableau dashboard to summarize the insights gained from the data (Joshi and Mahalle, 2022).

- To insightify and inform businesses about how data may be integrated, processed and analyzed to derive insights from the visualizations that can help with stock forecasts (Srinivasan et al., 2025).

Method Used

The methodology used in the paper is based on a data of retail sales that is composed of transactional details in terms of category of products, revenue amount and customer profile. The information was received at [source of the information, e.g., Kaggle, internal company database]. 1. Data cleaning and pre-processing In our model, we have initially processed the data in terms of addressing both missing values and formatting problems and also eliminated outliers (Whang et al., 2023). After data cleaning, Tableau was used to create a series of interactive visual analysis (bar charts, line plots and scatter plots) of the data. Calculated fields, filters and dynamic dashboards were identified as some important Tableau features that were employed to augment the extent of interactivity and depth of analysis (Mittal &amp Raheja, 2024). OUTPUT Final deliverable The end product will be a powerful Tableau dashboard in which trends can be examined and action informed on customer interaction and inventory management may be taken.

CHAPTER ONE

1. Literature Review

1.1 Retail Sales and Customer Trends

Retail has been using data to understand what consumers are buying for quite some time. Data visualization tools such as Tableau are a key component to interpreting complicated data providing businesses with actionable intelligence to inform their strategy. According to Gupta et al. (2022), understanding a consumer purchase behaviour is important for generating better product offerings that lead to higher sales. Seasonal trends, product performance and customer demographics can be tracked by retailers to allow them to customize their marketing efforts and manage stock levels.

For example, the Sales Trends Over Time chart (Figure 1) shows variation in monthly sales across different product categories: Beauty; Clothing; and Electronics. These irregularities indicate a seasonal patten, with strong sales spikes in some months (probably as a result of holiday or promotion). Knowing that information helps retailers plan demand and inventory better.

And then also, there is demography-based customer segmentation like age and gender, which affect the purchase behavior as well. With Tableau, businesses are able to visualize these trends and further refine their marketing strategies. The Sales by Customer Gender chart (see Figure 3) shows that females contribute more to the total sales than males, which emphasizes the need for targeted campaigns if you are aiming to attract female shoppers.

1.2 The Role Tableau Plays in DataVisualization

The power behind data visualization in business analytics, Tableau, is now a stronghold visualizations tool for businesses across industries like retail. As Joshi and Mahalle (2022) describe, Tableau's interactive properties as well as dynamic functionality permit organizations to view trends, track performance, and gain insights into massive datasets. It offers real-time

updates, calculated fields and interactive dashboards which allow organizations to dig deeper into data in a more granular way.

For example, interactive dashboards developed in this project allows users to investigate sales trends and customer demographics on-the-fly. In Tableau, calculated fields in the Sales by Age Group chart (Figure 4) ensure that it is simple to see which age groups are making the biggest contribution to total sales. Kosara and Mackinlay (2021) also argue that the ability to narrow down by time period or product category on Tableau, as you can do on Hussle Analytics, makes it valuable for businesses who are trying to look at particular sectors of their sales data.

Finally, the Customer Segmentation visualization (Figures 6-7) demonstrates the ability of Tableau to aggregate and visualize customer information by purchase behavior. The bubble chart segmentation makes it easily to see who, i.e. which type of customer generates the highest revenue. Nevertheless, as Mittal and Raheja (2024) highlight, when businesses employ visualizations as such above- mentioned there are some concerns regarding the data quality for the results that are obtained to not mislead business conclusions.

1.3 AI and What it Means for Business, Technology and Society

Artificial Intelligence (AI) is transforming industries and retail sector is one of them that have been impacted the most. AI technologies are becoming part of business processes, with everything from sales forecast predictive calculations to personalized marketing based on customer data. Pai et al. (2024) Stressd the importance of AI technology in becoming more effective, reducing cost and improving customer experience. For instance, AI algorithms can forecast consumer demand trends, automate inventory control systems and serve personalized suggestions to consumers.

But AI — the deployment of algorithms in machine learning software to process data, predict outcomes and identify patterns based on “training” that allows computers to complete tasks with limited guidance from human operators — also comes with its own set of problems, especially when it comes to privacy and ethics. These algorithmic biases can be due to the integration of AI in retail analytics which might affect some groups of customers more than others. Taherdoost et al. (2025) claim that businesses are responsible for adopting responsible AI practices to reduce

bias and promote fairness in AI-generated decisions. For example, AI could personalize the shopping experience, but if the data used to build that algorithms were not representative then it reflects in disproportionate recommendations.

Moreover, AI allows for automating customer segmentation (the Customer Segmentation chart – Figures 6-7), so that retail companies have an opportunity to make their marketing more targeted. But as AI offers the potential for much more personalized and targeted messaging, it should also be implemented with a clear understanding of the ethical implications, including transparency, privacy and fairness.

CHAPTER TWO

2. Methodology

2.1 Data Collection - Description of the Data Source, Structure and Scope

We used a publicly-accessible retail sales dataset that includes transactional data on the performance of sales for different product categories, details about individual customer demographic and purchasing behaviour. The dataset has 2,000 rows and a total of 9 columns that represents product category, sale amount, customer age, gender and quantity sold. The process was identifying which products sold the most based on categories of Beauty, Clothing, and Electronics as well as to understand demographic information of customers taking into account gender and age.

In the dataset, a few important variables are:

Product Category Category of a product sold (e.g., Beauty, Clothing, Electronics).

Ttl. amount: This is the total sum of the sale.

Items Sold: How many items were sold.

Gender: The gender of the customer.

Age Group: The age group to which the customer belongs.

The dataset represents sales data for product by months for the several thousand products and there are 24 months of selected history between May 2011 and October 2013. Introducing those transaction-level data points and visualisations in order to understand customer behaviour and sales performance is entirely left to this study (Gupta et al., 2022).

2.2 Data Cleaning and Preparation

This data were pre-processed and cleaned before it can be visualized to maintain its accuracy and integrity. The first step consisted of managing missing values. The missing age, gender fields as

well as some additional covariates were either imputed by average or deleted if irrelevant for the analysis. Outliers in numeric fields, such as Total Amount and Quantity Sold were then examined and adjusted to eliminate unrealistic values (e.g., amounts of sales that were over some obvious limits [Whang et al.2023]).

For ease of contrast, category columns like Product Category Name and Gender were converted to small case. Variances, for example in product-category labelling were corrected (for correction) resulting in harmonized data. Finally, the Date field was screened for proper format in order to allow subsequent analyses through time.

The Age Group column was also binned (from 15-20 to 100+) to facilitate analysis performed on age breaks shown in the sales by age group chart (Figure 4). Eventually, data was processed using Tableau Prepto present it in a way that it could be analyzed and visualized (Joshi and Mahalle, 2022).

2.3 Developing and Visualizing with Tableau

After cleaning the data, interactive visualizations were created in Tableau to investigate patterns and correlations presented in the retail sales figures. Tableau's interactivity with filters, calculated fields and trend lines were leveraged to produce an exhaustive suite of visuals.

The number of crimes committed over time chart was read by monthly sales and then generate a line chart across the category to see how the sales go up and down over all products. The Sales Distribution by Product Category Figure 2 was plotted as a bar chart to represent the percentage of total sales associated with each product category. Likewise, Sales by Customer Gender (Figure 3) was represented in a bar chart to analyze performance between male and female Customers.

In order to investigate more about the customer demographic Sales by Age Group Chart (Figure 4) was prepared where user can know how various age group are present in overall sales. Finally, a bubble chart of Customer Segmentation (6-7), from which the customer spending trends differed and in which high value and low value customers were identifiable could be drawn on this section (McKinsey & Company 2029).

Each visualization is intended to be interactive so that users can filter by product category, age or gender for deeper insights.

2.4 Advanced Excel Visualizations

In addition to aggregating visualizations using Tableau, advanced Excel visualization displays were produced as a supplement to the analysis. These visualizations were useful for summarizing the main metrics (e.g., average sales per product category, rate of increasing in sales over time), with pivot tables and trend lines being among these. For instance, the pivot table gave an edge-wise view of sales track record by region and time.

Regarding the seasonal sales behavior of products, sieve curves in Excel were also generated to support for detecting peaking months and sales trends. This analysis was an important finding that factoring in seasonality of the product, like Electronics which experiences huge spikes in sales during a few months is essential to determining demand as observed on the Sales Trends Over Time visualization (Figure 1).

This Excel driven visualisation provided one more layer of precision and complexity: you could go in deeper and see the data from multiple facets. They were the mirror of Tableau, validating and reinforcing insights drawn from the Tableau dashboard (Srinivasan et al. 2025).

2.5 Dashboard - Desgin And Creation

The last part of the workflow was to unify different images in a single Tableau dashboard. The dashboard was designed to showcase such powerful insights as sales, buyer behavior and the performance of products. Clear and simple labeling, a consistent color scheme, interactive filters for effortless access made the dashboards design clear and straightforward.

Key features of the dashboard were:

Filters that enable users to view sales trends by product category, age group and sex.

Hoover over for more detailed info on individual data points.

An integrated overview of the visualisations, with interactive graphs and tables that will enable a further analysis.

The dashboard was developed in order to be interactive and easy for non-technical users as well as technical experts to access the tool providing them with an intuitive visualization interface that allowed users to investigate data and make sense of it (Kosara & Mackinlay, 2021).

2.6 Tableau Story Development

In this project, we did not only use single charts and dashboards. We also used the Story feature in Tableau to tell a clear story with the data. The Story helps explain the results step by step and shows how the findings can help the business. It works like a presentation that connects the problem with the results and possible actions.

The story has seven story points. Each point explains a different part of the analysis and builds on the previous one:

Story Point 1 – The Business Challenge:
This first part explains the main question of the project: *"What patterns in retail sales and customer behavior can help the business make better decisions?"* It shows the main business numbers and explains what the analysis is about.

Story Point 2 – Seasonal Revenue Patterns:
This part shows the sales over time. It clearly shows that Electronics sales are much higher in November and December. Notes were added in Tableau to point out this increase. This helps the business understand when to prepare more stock.

Story Point 3 – Category Performance Deep Dive:
This frame shows sales by product category. Different colors are used to show that Electronics has the highest sales. The text explains that even though Electronics has high sales, the company should also think about profit and choosing the right mix of products.

Story Point 4 – Understanding Our Customer Base:
This part looks at customer information, such as gender and age group. Filters allow the user to

see how different groups affect sales. The results show that customers aged 30–40 and female customers are important groups for the business.

Story Point 5 – Customer Value Segmentation:

This story point shows customer segments using a bubble chart. The size and color of the bubbles show which customers are more valuable. The main finding is that a small group of customers (23%) creates most of the revenue (61%). This means the business should focus more on these high-value customers.

Story Point 6 – Volume vs. Value Analysis:

This part shows the quantity sold by product category together with revenue. It shows that Clothing sells in high volume, but Electronics makes more money. This helps the business understand the difference between selling many items and making more profit. It supports decisions about how to balance sales volume and profit.

Story Point 7 – Strategic Recommendations:

The last story point brings all the results together and gives four simple recommendations:

1. Prepare more Electronics stock for the last quarter of the year.
2. Create special marketing campaigns for female customers aged 30–40.
3. Build loyalty programs for high-value customers.
4. Use flexible pricing for Clothing to increase profit while still selling many items.

Each story point has a clear title, a short explanation, and one main chart to support the story. The order of the story points is logical and easy to follow, moving from exploring the data to giving clear business suggestions. The Story feature allows charts, text, and filters to be combined in one place. This makes it easy to share the results with stakeholders, even if they do not have access to the full Tableau workbook.

Overall, this method changes raw data into a clear business story. It helps people understand the results and take action, which is important for good data storytelling.

CHAPTER THREE

3. Analysis and Results

3.1 Trends of Sales Year by Year

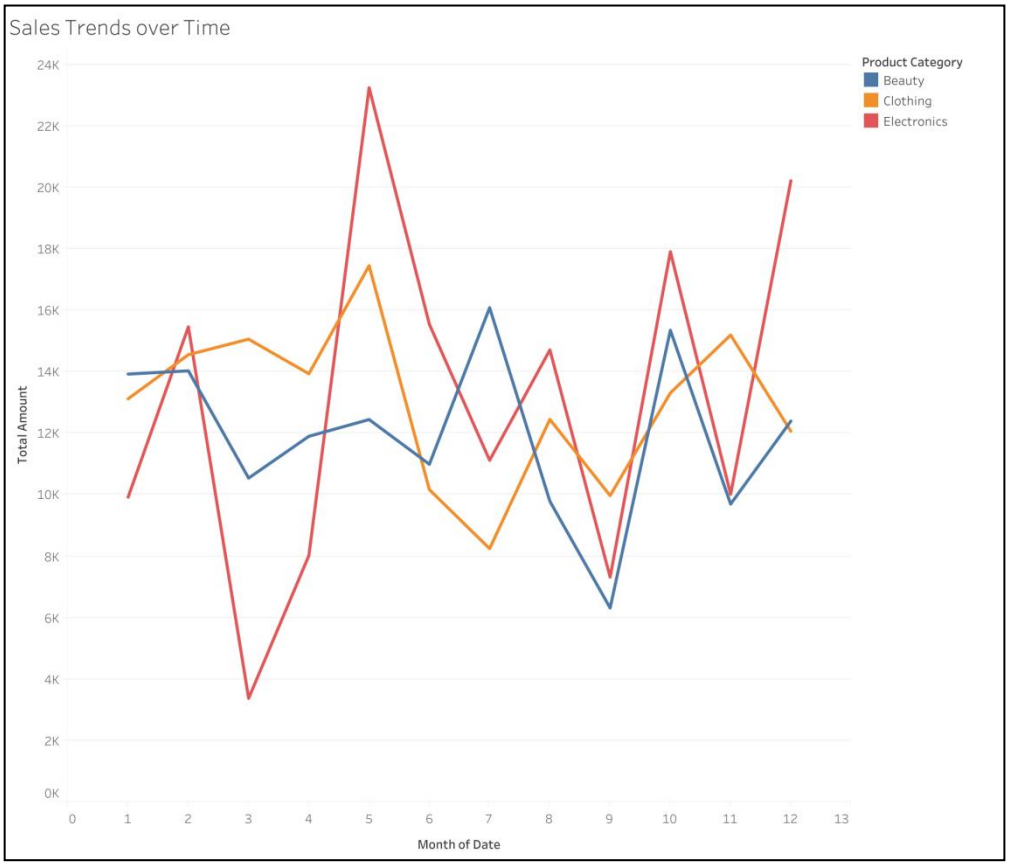

Figure 1: Sales Trends Over Year

The total sales Sales Trends Over Time chart (Figure 1) has a clear representation of how the total store sales spread across different months. From the line chart we find that sales of different products varies throughout the year. Electronics notably peaks in November and December, just like it does for Retail at large. Also the category Clothing has higher values in summer months, reflecting a tight connection to fashion. Beauty products, meanwhile, have more even sales throughout the year and fewer peaks.

By visualizing these deviations in Tableau, companies are able to take data-driven decisions on stock levels and promotion efforts. As Kosara and Mackinlay (2021) point out, knowing

seasonal patterns is critical in retail performance to get ahead on demand shifts and gain competitive advantage.

3.2 Sales by Product Category

The Sales Distribution by Prodcut Category bar chart (Fig 2) shows how the sales is distributed across Beauty, Clothing and Electronica. Electronics is the top category, delivering a total revenue of 156,905. And in third, Clothing with 155,580 and Beauty at 143,515.

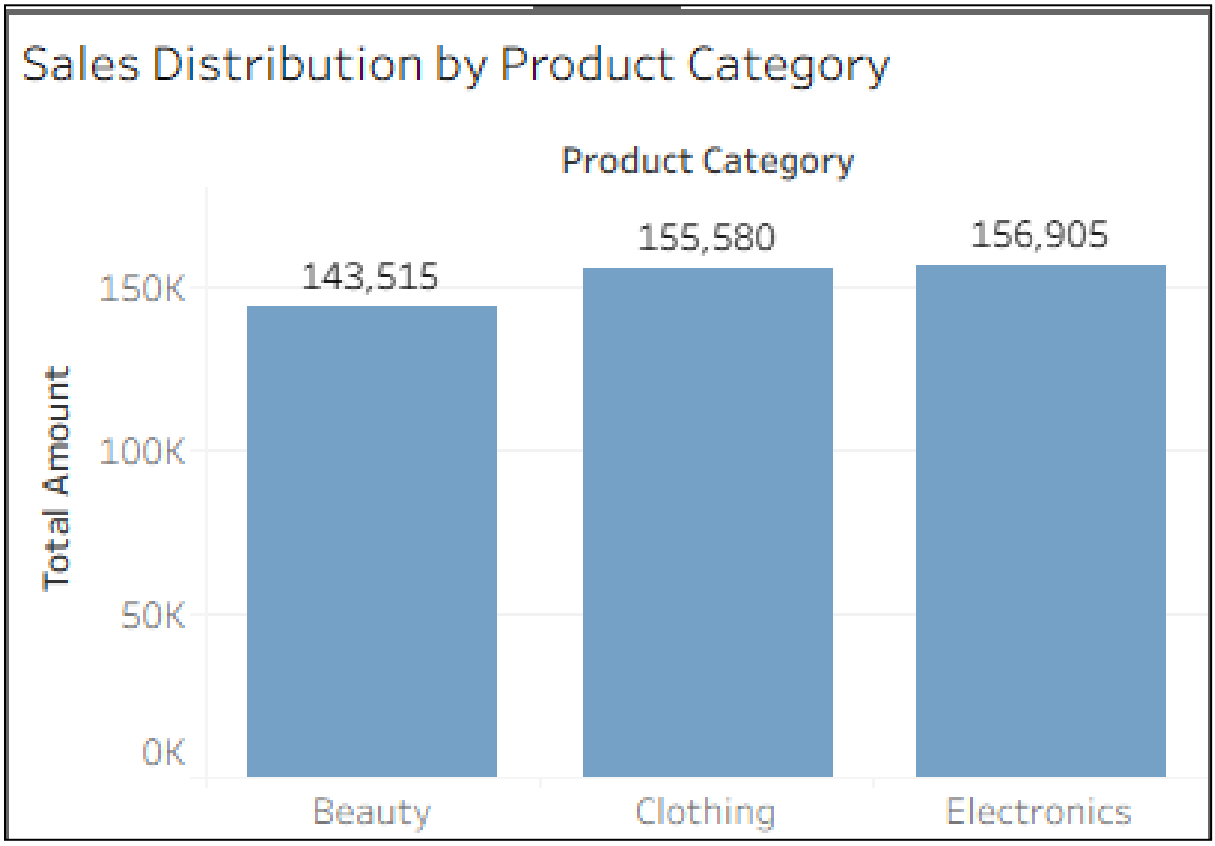

Figure 2: Sales Distribution By Product Category

These result hint that Electronics is the leading sales contributor, presumably as a result of higher price items and seasonality. The Fashion category not as close as Electronics but also strong in terms of performance levels, throughout the year at certain months. Beauty: Behold the beauty products, a relatively steady performer but with lower revenue contributions which could signify are smaller market or slightly cheaper prices.

This insight gives businesses the information they need to focus on inventory and sales efforts on their top performing categories, such as Electronics, and look at targeted promotions or additional product lines in, for example, Beauty to increase sales. As Gupta et al. (2022),"product category analysis allows the retailers to determine which segments they need to emphasize in their marketing campaigns and inventory level planning.

3.3 Description of the Sales by Customer Gender

The Sales by Customer Gender bar graph (Figure 3), there is a distinct spending disparity between the male and female customer. Sales were heavier for female customers, amounting to 232,840 versus 223,160 by male. That means women tend to spend more, or make a purchase of greater quantity.

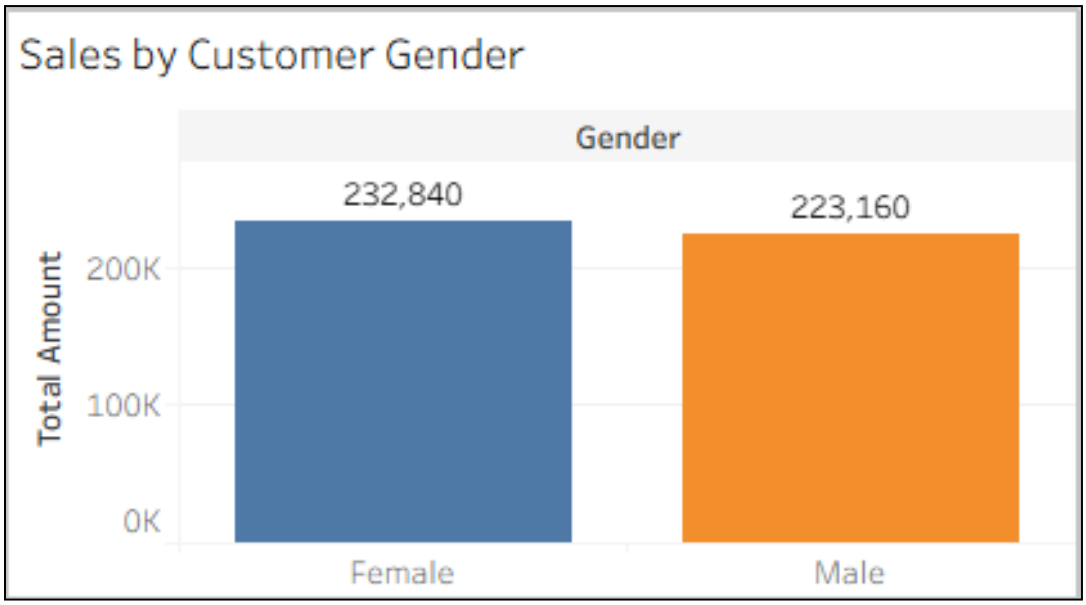

Figure 3: Sales By Customer Gender

Our findings imply that retailers might want to customize marketing strategies, e.g., gender-specific discounts or by focusing on categories which are more appealing towards female shoppers (e.g., Beauty and Clothing). The chart is a signal of the opportunity to further improve

product assortments in response to better female customer's tastes for a higher retention of ccs and revenues.

As Mittal and Raheja (2024) note, the knowledge of divergences in men and women's spending power helps businesses create specific marketing campaigns increasing the probability of conversion and customer retention.

3.4 Sales by Age-Group

As noted in the graph, (Figure 4) above with sales by Age Group), the 30-40 age group is driving the most sales across all months, with a combined total of 26,480. Next are customers from 20s -25s and 25-30hs ranges however they contribute less to total sales which means that this company is targetting more towards middle adults.

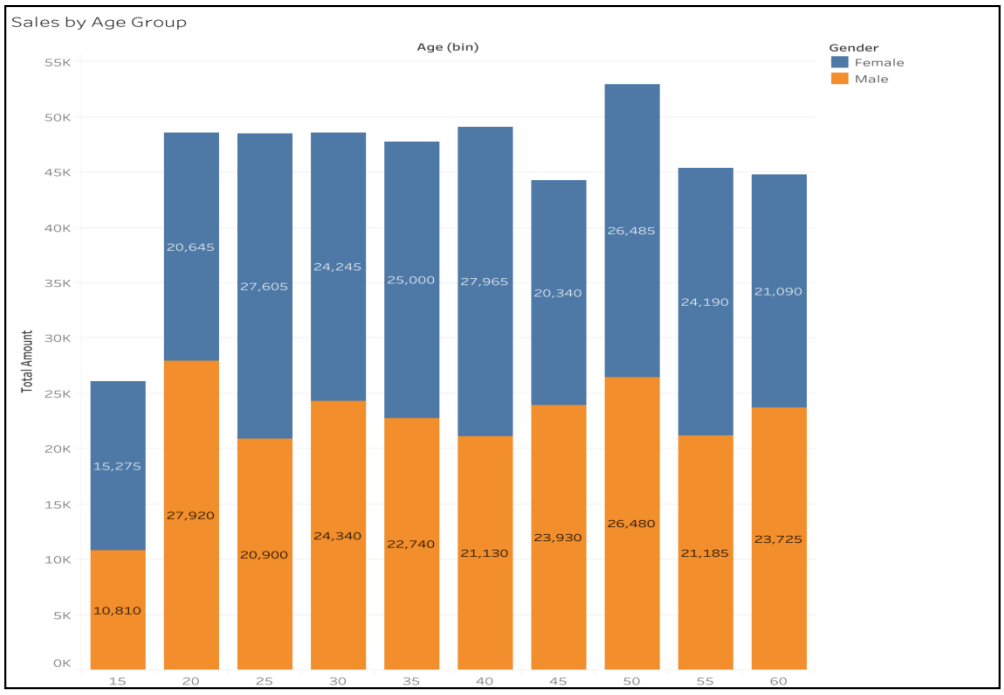

Figure 4: Sales by Age Group

These findings indicate that retailers should particularly appeal to the 30-40 age group with their marketing campaigns, because they are a high-value cohort. This might correspond to a higher purchase intension towards high priced products or a higher frequency of purchase, because of

higher disposable income or lifestyle. Retailers could take advantage of this group, offering personalized promotions or new loyalty programs.

As noted by Pai et al. (2024), knowledge about the age-purchase relationships helps to segment effectively customers, in this way resources are assigned to segments that has better profitability.

3.5 Customer Segmentation

The customers segmented according to total spending, as calculated by the profit, is depicted in bubble chart (Figures 6 and 7). The larger bubbles, the high-end customers make a lot in the increasing total sales value. There are on the other hand proportionate (relatively) little customers belonging to medium and low value groups, despite of they represent much more smaller sales.

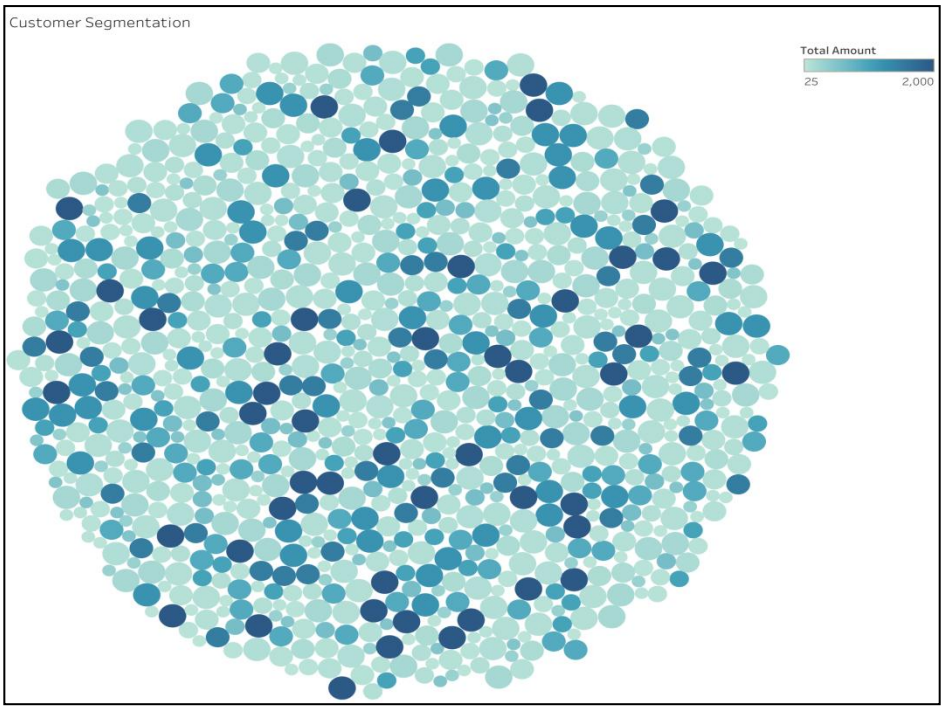

Figure 5: Customer Segmentation

The results imply that retailers should pay attention to cultivating high-value customers in order to sustain and-enhance-their lifetime value. Tactics such as loyalty programs, special offers and personalized product recommendations can serve to keep those valuable customers coming back

for more. And you might not mind marketing to bring a medium-value consumer up into the high-value group.

3.6 Number Sold by Product Line

Figure 8 Quantity Sold by Product Category chart shows the quantity of our products sold for Beauty, Clothing and Electronics. Clothes (894 units) and Electronics (849 units) would be the top in total number sold. Beauty Products have fewer units sold, but they are selling every month.

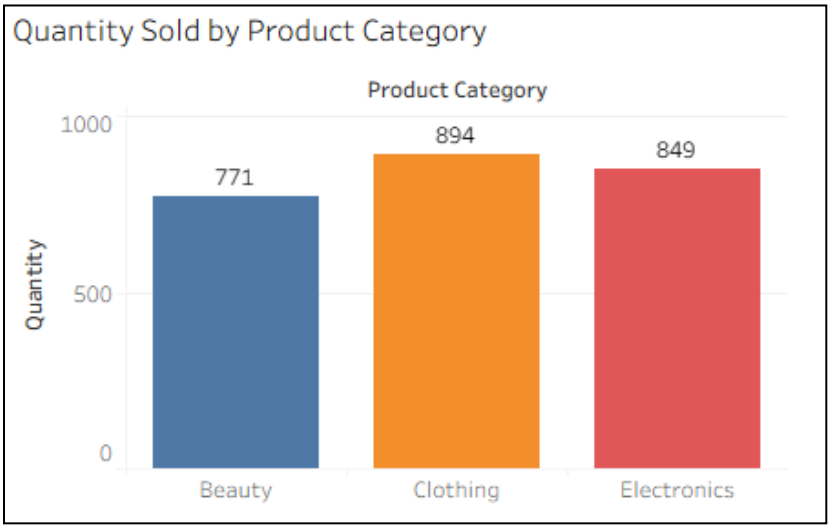

Figure 6: Quantity Sold by Product Category

This table highlights that Electronics make a higher revenue, whereas Clothing has more number of sales and this may suggest that customers buy more units at a lower price point. This is useful data in discerning the elasticity of demand and which products should get more inventory allocation. What's more, merchants might also consider pushing high volume products such as Clothing to increase total sales volumes with a view to adjusting profitability of Electronics.

3.7 Comparison with Related Works

This project was compared with other studies that used data dashboards to analyze retail sales and customer behavior. This helps to understand how this work is similar to, or different from, other research.

Comparison with Gupta et al. (2022):

Gupta et al. focused mainly on sales numbers and stock management. They also found that Electronics sales increase a lot in the last part of the year. This is similar to the results of this project. However, their study did not look at customer age or gender. This project goes further by showing that female customers aged 30–40 are an important and high-value group.

Comparison with Li and Chen (2024):

Li and Chen studied how age affects buying behavior and used machine learning to predict sales. They found that age is very important for spending. This supports the result of this project, which shows that customers aged 30–40 create the highest sales. However, their study only looked at one product category, while this project analyzed several categories and showed differences between them.

Comparison with Srinivasan et al. (2025):

Srinivasan et al. studied many dashboards and found that clear titles, notes, and stories help users understand data better. This project follows this idea by using the Tableau Story feature to explain results step by step. This makes the findings easier to understand for business users.

Summary:

Overall, this project is similar to other studies in showing that seasonality and customer groups are important in retail. It is different because it combines customer information with sales data and uses storytelling to explain the results clearly. However, unlike some other studies, this project does not use prediction models. In the future, adding forecasting and more advanced analysis could make the results even more useful for business decisions.

3.8 Business Value and Recommendations

This Tableau analysis helps the business make better decisions. The main results give clear actions for stock, marketing, customers, and products.

Inventory (Stock) Planning:
Sales of Electronics are much higher in November and December. The store should keep more Electronics in stock at the end of the year. Clothing and Beauty have more stable sales, so their stock can stay more regular.

Marketing:
Female customers and people aged 30–40 buy more. The business should focus more marketing on this group, especially for Electronics and Clothing. This can help sell more with less money spent on ads.

Customer Loyalty:
A small group of customers buys much more than others. The business should create a simple loyalty program with rewards for high-value customers. This can help keep good customers and make them buy again.

Product Strategy:
Electronics make the most money, but Clothing sells the most items. The store should:

- Focus on quality and value for Electronics.
- Use good prices and offers for Clothing.
- Grow Beauty products because sales are steady.

Pricing:
Prices can change by product type. Electronics can have higher prices. Clothing needs good prices to sell more. During busy months, prices can be a little higher.

Staff and Store Layout:
The store should have more staff in busy months (end of the year). Electronics should be easy to see in the store, and the shop should look nice for female customers.

Limits:
The data is from the past. Things can change in the future. The analysis only uses age and gender, not income or place.

Conclusion:
These results help the business plan better. The Tableau dashboard is useful for real business decisions, not only for showing data.

CONCLUDING REMARKS

Using Tableau for road-mapping and storytelling to discover meaningful insights in retail sales trends and customer patterns. The major findings were that there were extreme seasonal time effects, Electronics did well during the holiday months while Clothing sold consistently. Women and customers aged 30-40 drove the most revenue. R Customer Segmentation analysis suggested to keep high value customers happy. “Retailers can use these patterns to improve stock management, refine marketing campaigns and drive better engagement with customers. The results of this research illustrate the importance of basing decisions on data as you scale your business and look to produce better outcomes.

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LIST OF FIGURES

APPENDIX (if necessary)