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BUSINESS & INNOVATION**

**Essay / Assignment Title: Designing a sales Tableau Dashboard for a
chosen company**

Programme title: MSc Data Analytics

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INTRODUCTION

In today's competitive data-driven business environment the market's survival is crucial. Intuition is leaving the sight as data analytics arises. Since large organizations generate massive amounts of data from their operations, data analytics is a crucial phase for decision-makers in making market predictions or strategic decisions accurately (Alshareef et al., 2021). One of the critical areas in businesses is sales function, where analyzing data in real-time with historical data can greatly improve decision-making, increase customer engagement, and disclose business prospects.

In project focuses on developing an analytical dashboard suite that enables the organization to gain insights into their sales performance contributed to customer behaviors and related operations' consequences. It will support strategic planning, increasing efficiency, and data-induced decision-making processes with selected key performance indicators (KPIs). These dashboards will be the centralized tool for business analysts, sales representatives, sales managers, and executives, providing them the playground to reach historical data on sales performance, customer analysis, profitability, and order fulfillment. With the help of relevant KPIs, such as average order value (AOV), average purchase value, average ship time, gross profit margin, profit per order, sales growth rate, and total revenue, the company can drive better strategic decisions while understanding its sales operations.

This project will consist of a hypothetical company called "BrightStep Solutions" which is in the business of office goods like furniture, office supplies, and related technology. We will assume that the company was built in 2019 as the data collected starts from. The United States is the market for the goods that the company sells and the regions are Central, East, South, and West. The company has its logo to mimic a real company in the market. The company logo and related coloring combinations are demonstrated below. Images are generated by Dall-E (OpenAI, 2024), a deep learning technique used by OpenAI's text-to-image models to create digital images from natural language descriptions, or "prompts".

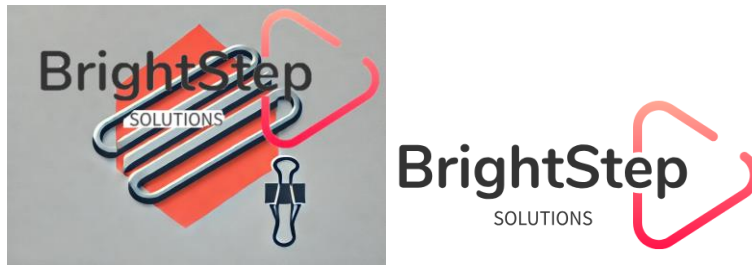


Figure 1: Company logo



Figure 2: Company color distribution example

Our business aims to increase AOV by encouraging customers to purchase more products per transaction through cross-selling or upselling strategies, which will lead to increased profitability.

Average Order Value (AOV)

```
//SUM(Sales) / COUNT(DISTINCT [Order ID])
SUM([Sales])/[Number of Orders]
```

Figure 3: Average order value (AOV) KPI Calculation to measure the average amount of money a customer spends in a single transaction

With this KPI, we will capture customer spending patterns over time. The expectation is to consistently maintain or increase average purchase value by focusing on customer retention, product quality, or pricing strategies.

Average Purchase Value

```
SUM([Sales])/SUM([Quantity])
```

Figure 4: Average purchase value KPI Calculation to track average monetary value of all purchases made during a specified period

We will be expected to reduce average ship time as it can directly impact customer satisfaction. Faster shipping times contribute to better customer experiences by intuition, while long shipping times may hurt customer retention.

Average Ship Time

```
//average time between order date and ship date  
AVG(DATEDIFF('day', [Order Date], [Ship Date]))
```

Figure 5: Average ship time KPI Calculation to measure average time from when an order is placed to when it is shipped to customers

The goal is to maintain or improve gross profit margins by optimizing the selling process with effective discount rates. Higher gross profit margins indicate better financial health and help our company to survive.

Gross Profit Margin

```
(SUM(Profit) / SUM(Sales)) * 100
```

Figure 6: Gross profit margin KPI Calculation to calculate the percentage of total sales revenue that exceeds cost of goods sold

Increasing the profit per order will work together with the gross profit margin by managing pricing strategies while promoting high-margin products at optimal rates.

Profit Per Order

```
SUM(Profit) / COUNTD([Invoice No])
```

Figure 7: Profit per order KPI Calculation to determine the profit generated from each order

The goal is to achieve consistent or accelerating sales growth. Positive growth indicates business expansion and market success while declining or stagnating growth suggests potential issues with market penetration, product offerings, or customer engagement. “Year to compare” represents the desired year comparison for regarding needs.

Sales Growth Rate

```
((SUM([Sales]) / SUM(IF YEAR([Order Date]) = [Year to Compare] THEN [Sales] END)) - 1) * 100
```

Figure 8: Sales Growth Rate KPI Calculation to measure the percentage increase in sales revenue over a specified period

The aim is to increase total revenue as a reflection of successful sales and customer strategies, product offerings, and market demand.

Total Revenue

```
SUM([Sales])
```

Figure 9: Total revenue KPI Calculation to track the total income from all sales actions over a specified period

This KPI will determine if targeted marketing campaigns or personalized offers are needed, to re-engage those customers.

Customers to Churn (days)

```
//Number of days past since the last order of the customer  
IFNULL(({FIXED : MAX([Order Date])) - {FIXED [Customer ID]: MAX([Order Date])}),1)
```

Figure 10: Customers to churn (days) KPI calculation to identify how long it has been since a customer last placed an order

CHAPTER ONE: PROBLEM INDICATION

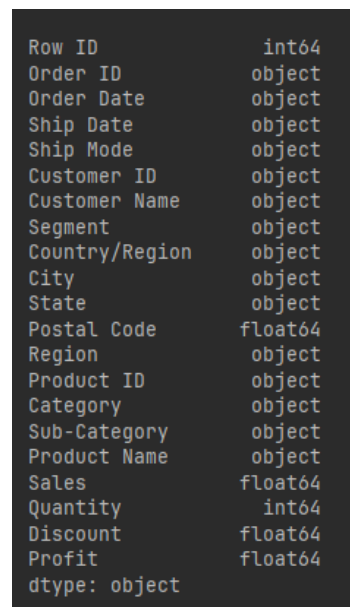
BrightStep Solutions needs to stay active in office goods for the continuity of its business. That requires great sales optimization efforts to improve sales performance. This scope encloses customer behavior understanding, profitability monitoring, and order fulfillment. Sales performance is directly affected by customer engagement by observing purchasing patterns so that we can make effective up-and-cross-selling promotions accordingly. The main target is the office supply business where customer behaviors are also shaped differently than other target groups (Kouvelis, 2024). We need product-level profitability over smarter pricing strategies and optimal discounting rates. Furthermore, tracking order fulfillment and customer reaction KPIs such as average shipping time, and order frequencies will be aiming to improve customer satisfaction and retention.

BrightStep Solutions developed a data analytics department working for sales performance increase. Their department functions are monitoring sales performance against targets, identifying trends and patterns in customer behaviors, uncovering opportunities for revenue growth, and adjusting sales strategies. We are aiming to deliver a robust analytical dashboard series to provide actionable insights. Dashboards not only display indicators and visualize but also address questions and reach different types of audiences (Ioana et al., 2014). Dashboards contribute to a company's success by delivering the right information to the appropriate person at the right moment. This will help our departments with different views. The executive level will see general grasp of the company corresponding to sales, customers, and product sales to understand the development of the revenue. Sales managers and sales representatives will be able to view the sales distribution and performance within different segmentations. On the other hand business analysts will be able to understand insights with interactive features, drilling down into specific metrics, and comparing sales performance across different periods. Decisions based on business activities are enhanced with help of business intelligence tools. By 2022, data analysis will increase the influence on customer interactions for companies (Necochea-Chamorro & Larrea-Goycochea, 2023).

Structured information is needed for companies to extract wisdom from them. To transform the data into insightful representations, BrightStep Solutions should focus on data cleaning, data preprocessing, and feature engineering. The visualization step will need interactions to allow stakeholders to explore their data to derive actionable insights. Data processing parts will ensure data quality and consistency while feature engineering will help us to enhance our models and understanding. The goal is to improve sales performance, by using a combination of data analytics tools, we can break down this problem into stages, each addressing a critical step toward finding a successful solution. These are data preparation, data exploration, modeling, and reporting.

Data Preparation

In this project, data from KokilaSivakumar in 2024 will be used to mimic business trends. The database attributes and their data types can be found below. Among our assumptions, the reporting is done in the year 2022.



Row ID	int64
Order ID	object
Order Date	object
Ship Date	object
Ship Mode	object
Customer ID	object
Customer Name	object
Segment	object
Country/Region	object
City	object
State	object
Postal Code	float64
Region	object
Product ID	object
Category	object
Sub-Category	object
Product Name	object
Sales	float64
Quantity	int64
Discount	float64
Profit	float64
dtype:	object

Figure 11: KokilaSivakumar/Sales dataset column names with corresponding data types

During the database investigation, we found that some orders don't have postal codes. These rows are eliminated from our table to maintain reliable information. Therefore, we eliminated these rows to reduce the noise in our modeling. Once data is retrieved, Python with Pandas is used for data cleaning and preparation to handle missing data as well as understand the overview.

```

Row ID      0
Order ID    0
Order Date  0
Ship Date   0
Ship Mode   0
Customer ID 0
Customer Name 0
Segment     0
Country/Region 0
City         0
State        0
Postal Code  11
Region       0
Product ID   0
Category     0
Sub-Category 0
Product Name 0
Sales        0
Quantity     0
Discount     0
Profit       0
dtype: int64

```

Figure 12: `print(df.isnull().sum())` Python code output, gives the count of null values

```

count      Row ID  Postal Code  ...  Discount  Profit
mean    4997.500000  55245.233297  ...    0.156203   28.656896
std      2885.163629  32038.715955  ...    0.206452   234.260108
min         1.000000   1040.000000  ...    0.000000 -6599.978000
25%      2499.250000  23223.000000  ...    0.000000    1.728750
50%      4997.500000  57103.000000  ...    0.200000    8.666500
75%      7495.750000  90008.000000  ...    0.200000   29.364000
max      9994.000000  99301.000000  ...    0.800000  8399.976000

[8 rows x 6 columns]

```

Figure 13: `print(df.describe())` Python code output, gives the statistical information about the dataset before removing the rows with null values

```

count      Row ID  Postal Code  ...  Discount  Profit
mean    4993.886207  55245.233297  ...    0.156375   28.463592
std      2883.738990  32038.715955  ...    0.206501   234.122107
min         1.000000   1040.000000  ...    0.000000 -6599.978000
25%      2497.500000  23223.000000  ...    0.000000    1.727100
50%      4993.000000  57103.000000  ...    0.200000    8.643600
75%      7489.500000  90008.000000  ...    0.200000   29.315200
max      9994.000000  99301.000000  ...    0.800000  8399.976000

[8 rows x 6 columns]

```

Figure 14: `print(df.describe())` Python code output, gives the statistical information about the dataset after removing the rows with null values

Data Exploration

After cleaning data, the next step is exploring trends that give us insights into how sales are distributed among profit and quantity correlations. Outliers are not disregarded since they need to be included in our environment for better accuracy, but simply shown for analysis considerations. They will just be knowledgeable for the company during their sales activities such as discounting or promoting.

Measurements of the data source are discount, quantity, sales, and profit. To understand the fluctuations in these attributes, we will be investigating the scatter plot of each measurement combination under one graph. Scatter plots are graphical visualizations of two variables and their correlations (Tableau, 2024b).

Customer Segment, category, and ship modes are cumulative pieces of information that can give us differentiation between customer behaviors. To view that we present time series graphs throughout each attribute. Time series will help us to see the patterns, trends, and relations by visualizing how our measures act during time periods. Outliers and seasonal patterns will arise throughout the represented time (Tableau, 2024a).

Regional distribution of sales for bigger markets is represented under treemap graph. Visualizing hierarchical data with the help of nested rectangles which represent a category in a part-to-whole relationship. It helps us to compare quantities and their volumes with categories contributing to the overall dataset which will help us to identify the largest contributors in our scope (Tableau, 2024c).

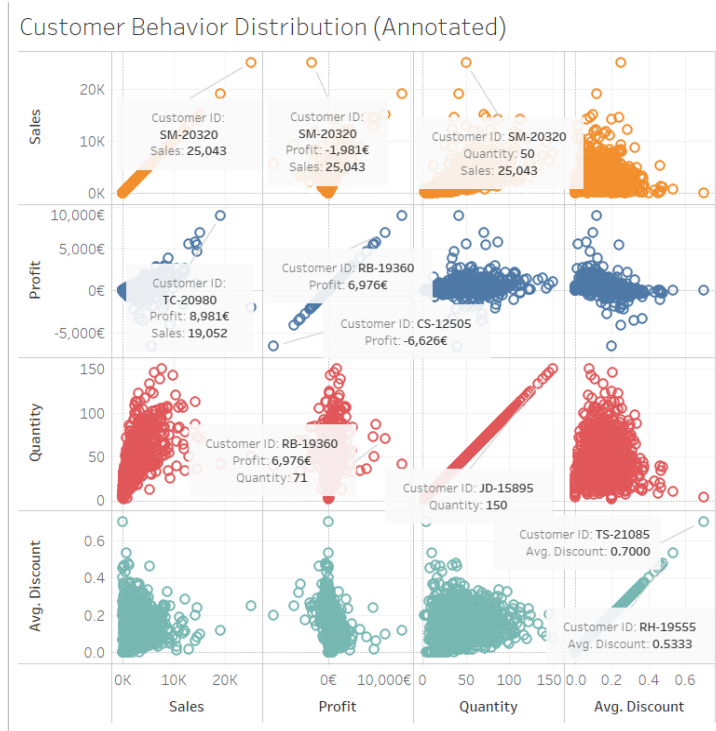


Figure 15: Annotated outliers, in a scatter plot of quantity, profit, and sales

Due to data exploration, we constructed a scatter plot with a summation of sales, profit, and quantity attributes whereas the average discount is taken into account. We granulated the visual with customer ID's so that each data point will be customer-based behavioral representatives. This scatter plot emphasizes the outliers in self-graphed ones, that the smallest or biggest values are not harmonious with the general tendency of our data. In the figure above, the outliers are annotated so that customers should be handled with extra care and attention.

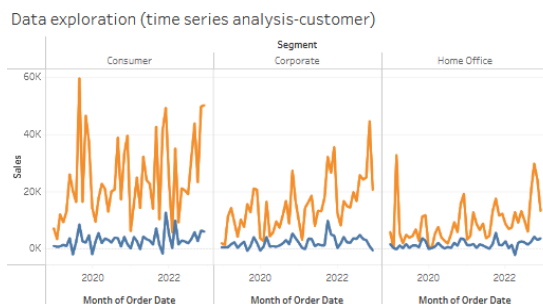


Figure 16: Time series exploration of data in a line graph of dual synchronized axis for sales and profit under customer segment attribute

A time series graph will explain the customer segment behaviors under specified timelines. We can observe that sales-wise consumers have more orders than any other segments even though the profit is not as high as sales cumulatively. Where the home office segment spends less (except in the coronavirus era of 2019) but the profit margin is higher than the other segments.

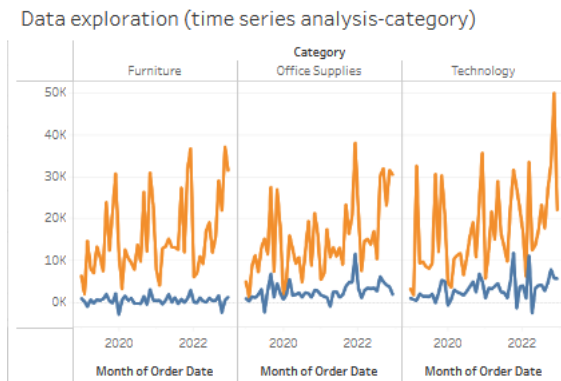


Figure 17: Time series exploration of data in a line graph of dual synchronized axis for sales and profit under product category attribute

We can observe that furniture is a seasonal category whereas technology is a trending one. Therefore our company policies should be shaped accordingly.

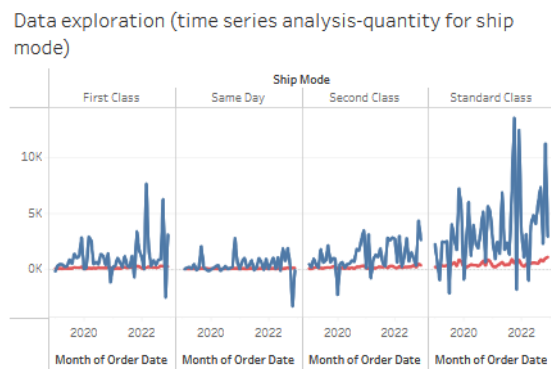


Figure 18: Time series exploration of data in a line graph of dual synchronized axis for profit and quantity under different shipping modes attribute

Under normal circumstances, the profit is expected to be as high as the quantity increases. However, this line graph shows us the fluctuations that should be integrated into the customer behavioral considerations of our company.

Data exploration (geographical distribution)

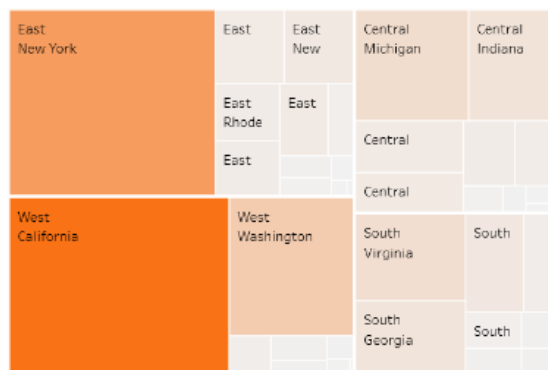


Figure 19: Regional exploration of data in a treemap graph for sales profit under detail of city attribute

The treemap of geographical distribution of sales by cities under states. We can monitor that the East has the highest sales area whereas the West has the top-selling city.

Modeling And Reporting

Every company has different needs and tailored solutions, even though they share similar performance indicators. Besides our KPIs, considered in the introduction, we need to control our system with detailed performance indicators and checkpoints. To be able to study our business and customers, we need to describe our other indications which will help us to control our KPIs; AOV, average purchase value, average ship time, customers to churn (days), total revenue, sales growth rate, gross profit margin, profit per order. These metrics collectively provide insights into customer habits, operational efficiency, and overall financial health.

ge Monthly Quantity Sold

```
{ FIXED [Category],MONTH([Order Date]) : SUM([Quantity]) }
```

Figure 20: Calculation of average monthly quantity sold by category of any month

urchase Frequency (days)

```
//Average Purchase Frequency = Total Purchases (count) / Number of Unique Customers (count)

{FIXED [Customer ID]: AVG([LifeSpan of Customers (days)]/COUNTD([Invoice No]))}
```

Figure 21: Calculation of average purchase frequency (days) to determine how frequently a customer buys from us

Average Purchase Value

```
SUM([Sales])/SUM([Quantity])
```

Figure 22: Calculation of average purchase value to calculate how much a customer spends on our products

Customer Lifetime Value (CLV)

```
/*
CLV estimates the total revenue a business can expect from a single customer account.
CLV=Average Purchase Value*Average Purchase Frequency (years)*Customer Lifespan (years)
*/
{FIXED [Customer ID]: [Average Order Value (AOV)]*
    (AVG([Average Purchase Frequency (days)]/365)*
    (AVG([LifeSpan of Customers (days)]/365))}
```

Figure 23: Calculation of customer lifetime value (CLV) to track a customer's spending throughout their duration in our ecosystem

The life span of customers (days) calculated field created to acquire this information. This calculation needs to be altered for one-time customers whose first and last orders are on the same day we count them as single-day customers.

LifeSpan of Customers (days)

```
IF {FIXED [Customer ID]: MAX([Order Date])-MIN([Order Date])}=0 THEN 1
ELSE {FIXED [Customer ID]: MAX([Order Date])-MIN([Order Date])} END
```

Figure 24: Calculation of the lifespan of customers

Target Shipping Times

```
IF [Ship Mode] = 'Same Day' then 1
ELSEIF [Ship Mode] = 'First Class' then 2.5
ELSEIF [Ship Mode] = 'Second Class' then 3
ELSE 5 END
```

Figure 25: Calculation of target shipping times; the promised delivery times by our policies

Our dataset has some groups that have hierarchical meanings and usages that can give us intricate insights. The product categories are named categories that have main and sub-category breakdowns. Customer information of segment-based individual details. Location hierarchy from country to postal codes and also details for orders. These four hierarchical groups represent different datasets that a bigger company may have in different table structures.

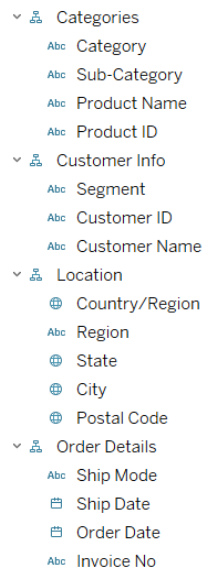


Figure 26: Hierarchies in the dataset

Attribute Name	Attribute Detail	Data Type	KPIs
Category	The product category	Text	
City	The city where the customer is located	Text	
Country/Region	The country of the customer	Text	
Customer ID	A unique identifier for each customer	Text (Unique)	
Customer Name	The name of the customer	Text	
Invoice No	The invoice key for a specific order	Text	
Order Date	The date when an order was placed	Date	
Postal Code	The postal code of the customer	Text	
Product ID	Unique identifier for each product	Text (Unique)	
Product Name	The name of the product	Text	
Region	Geographic region of the customer (Central, East, South, West)	Text	
Segment	Customer segment (Consumer, Corporate, Homeoffice)	Text	
Ship Date	The date the order was shipped	Date	
Ship Mode	The method of shipping used (Same day, First Class, Second Class, Standard Class)	Text	
State	The state in which the customer resides	Text	
Sub-Category	A more granular product category	Text	
Average Order Value (AOV)	The average value of an order made by a customer	Decimal	yes
Average Purchase Value	The average value of a purchase made by a customer	Decimal	yes
Average Ship Time	The average time taken to ship an order	Decimal (days)	yes
Discount	The discount offered on an order	Decimal	
Exceeded Target for Shipping	Indicates whether the order was shipped within the target time	Boolean	
Gross Profit Margin	The gross profit margin percentage	Decimal	yes
Number of Orders	The total number of orders placed by a customer	Integer	
Profit	The profit generated from the sale of products	Decimal	
Profit Per Order	The profit generated per order	Decimal	yes
Quantity	The number of units sold in a transaction	Integer	
Sales	Total sales generated from the orders	Decimal	
Sales Growth Rate	The percentage change in sales over time	Decimal	yes
Target Shipping Times	The target shipping time for orders	Decimal (days)	
Total Revenue	The total revenue generated from sales	Decimal	yes
Units Sold	Total units sold in a transaction or over a period of time	Integer	
Churn Customer Specification	Dividing customers to find out if we can help them to make another order or not	Text	
Average Monthly Quantity Sold	The method to find month base average volume of quantity sold	Decimal	
Average Purchase Frequency (days)	The average time between customer purchases showing regularity and engagement	Decimal	
Average Purchase Value	The typical spending amount per purchase	Decimal	
Customer Lifetime Value (CLV)	The estimated total revenue from a customer throughout their relationship with us	Decimal	
Customers to Churn (days)	The number of days from a customer's last purchase	Integer	yes
LifeSpan of Customers (days)	The duration from a customer's first purchase to their last	Integer	

Figure 27: Column details of the dataset after feature engineering

CHAPTER TWO: SOLUTION FINDINGS

Business intelligence (BI) tools provide us with a way to process, analyze, and visualize large volumes of data to support decision-making and optimize business operations. To be able to choose the best option for our company, our business analysts (BA) researched analytic tools that can help us visualize and discover our data. Monitoring the performance of BrightStep Solutions is crucial to survive in modern time markets. Business Intelligence (BI) includes a wide array of concepts and functionalities that are needed for our modern data-driven decision-making organization. At its core, self-service business intelligence (SSBI) strengthens non-technical users to independently create reports and conduct analyses without heavy reliance on IT specialists (Goossens, 2022). BI activities include various levels of data analysis, from basic report creation to complex data visualization and advanced analytical techniques. Collaboration features in BI tools facilitate knowledge sharing and refinement of insights across teams. Furthermore, visualization and reporting capabilities stand out as key functions of BI, enabling users to interact with data through dashboards and reports, thereby deriving actionable insights. Together, these elements form a comprehensive framework that enables organizations to leverage their data assets effectively, fostering a culture of informed decision-making and continuous improvement (Passlick et al., 2023).

The user-friendly interfaces of many BI systems, featuring drag-and-drop functionalities, have democratized data analysis within organizations, enabling non-technical staff to conduct ad-hoc evaluations without extensive programming knowledge. By leveraging these powerful BI and analytics tools, businesses can optimize their operations, enhance their decision-making processes, and harness data-driven insights to achieve superior performance in today's competitive landscape (Eden et al., 2023).

Tableau is a powerful visualization tool that allows us to dynamically create and adjust graphs that help us to conclude. It has an easy interface that our data analysts can learn easily. On the other hand, Power BI is also inspected by our business analysts. They concluded that using it could be easier if we were using more Microsoft products. We need to track our performance at a glance which will increase our versatility and agility. Our BA department chose Tableau which

promises ease of use with friendly drag-and-drop functionality and less coding needed. Where Tableau needs less SQL as it has an integrated vizQL server, PowerBI uses DAX queries which need more knowledge in data pulling steps. The interfaces of each product differ with visual elements, even though the main aims of both of them are similar. Our business values the marketing actions that can easily be informed by Tableau where PowerBI needs extra tools like Power Automate to integrate this step into our operations. Collaboration features seem like they both satisfied our BA department that both of them showed that their capabilities are equally usable by us.

CHAPTER THREE: DASHBOARD DESIGN

Data visualization is transforming raw data into visual representations so that we can identify patterns, trends, and anomalies that might otherwise be neglected. We need to understand the usage of visualizations before introducing them to our users. Each technique has its unique advantages and disadvantages (Tableau, 2024f), making it suitable for different types of data and purposes (Tableau, 2024e). Every company has its own culture and reasons to have their way of business actions. That is why it is important to understand the reasons behind what is visible.

A well-chosen color scale is essential for creating memorable and impactful branding, for supply businesses where trust, creativity, and professionalism are key. The color palette of burnt orange, red, and grey highly fits our values. These analogous colors create a warm, welcoming atmosphere that is also exciting and engaging (Wade, 2024). Together, these colors form a cohesive and aesthetically pleasing foundation for our office supply business that seeks to appeal to a wide customer segments. To complement the warmth of the primary colors, accent combinations of red and gray add energy to the brand's identity. Light gray provides a neutral background that maintains a clean and balanced appearance, preventing the striking red from becoming overpowering. This combination of orange, red, and gray strikes the perfect balance, and reinforces the business's dynamic but also reliable image.

Visualization Elements:

Logos, parameters, filters, legends, notes, and annotations are used to enhance the understanding of each graph and increase the readability of the visuals. The dimensions of the logo will vary depending on its importance to the audience. For example, the executive level may view the dashboards with outsiders so the logo needs to be in a bigger portion whereas the company departments will be using the dashboards in their daily operations which is known by them. Since 1643*861px is our company screens' dimensions, our dashboards will be generated accordingly.



Figure 28: Company logo used in dashboards

Parameters are tuning elements in our dashboards that can help the viewer arrange what they need to view. They can answer their questions accordingly so that the reports can be to the point they need them to be.

Time from last purchase
Use this parameter for customer retention number filtering

Top Customers

Top Products List

Figure 29: Different parameters that are used in dashboards

Name

Properties

Data type	Display format
Integer ▼	2021 ▼

Current value	Value when workbook opens
2,021	Current value ▼

Allowable values

☐ All
 ☐ List
 ☒ Range

Range of values

<input checked="" type="checkbox"/> Minimum	2,019	<input checked="" type="radio"/> Fixed
<input type="checkbox"/> Maximum	100	<input type="radio"/> When workbook opens
<input type="checkbox"/> Step size	1	<input type="button" value="Add values from ▼"/>

Figure 30: Year to compare parameters in the executive report

Edit Parameter [Time from last purchase]

Name

Time from last purchase

Properties

Data type

Integer

Display format

20

Current value

20

Value when workbook opens

Current value

Allowable values

☒ All
☐ List
☐ Range

Figure 31: Details of time from last purchase parameter in customer analytics

Edit Parameter [Top Customers]

Name

Top Customers

Properties

Data type

Integer

Display format

10

Current value

10

Value when workbook opens

Current value

Allowable values

☒ All
☐ List
☐ Range

Figure 32: The number of top customers to be filtered is going to be determined by this parameter which's details are shown

Edit Parameter [Top Products List]

Name
 Top Products List

Properties

Data type: Integer
 Display format: 10

Current value: 10
 Value when workbook opens: Current value

Allowable values
☒ All ☐ List ☐ Range

Figure 33: The number of top products list limiter parameter details

Another element that plays a crucial role in reporting for us is filters. These will help our users to view data in yearly periods since we care about the increase in revenue indicators, it is also important for the visibility of the changes.

Region: (All), Central, East, South, West
 Year of Order Date: (All), 2019, 2020, 2021, 2022

Figure 34: The filters of the region of the single selection button to filter and order date year with how it is shown under the single selection dropdown filter

Ship Mode: (All), First Class, Same Day, Second Class, Standard Class

Figure 35: Single selection filter for shipping mode slices

To be able to get to know the meanings of colors, we will be using legends that can also be a filtering element in our reporting process.

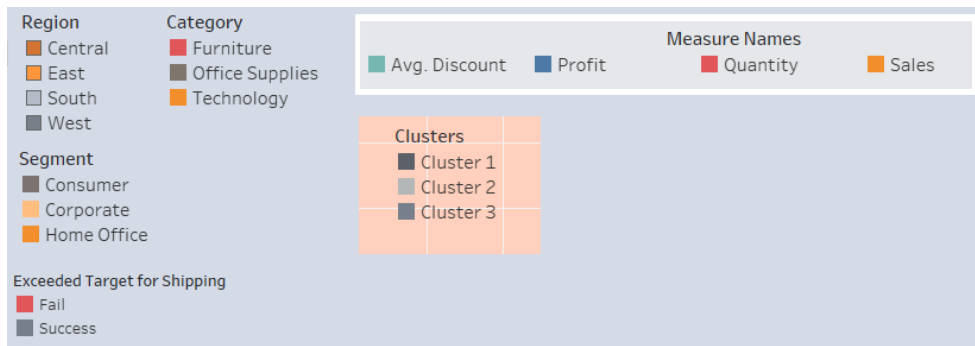


Figure 36: Every legend used in the dashboard at a glance with color choices that are used in different dashboards for eliminating the misunderstanding

Between the data units and operational units, the concepts can be understood and used in different ways. To eliminate this misconception, we will be using titles, notes, and annotations. This will help the audience with easy reading and augmented usage.

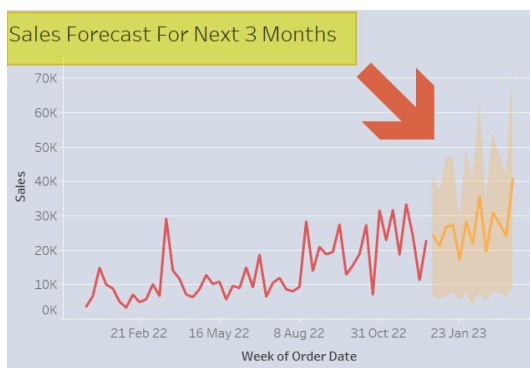


Figure 37: The title showing that the forecast is done for 3 months to the audience

*You can use segments and categories as filter for dashboard

Figure 38: The information note that gives directions on how to use the corresponding view

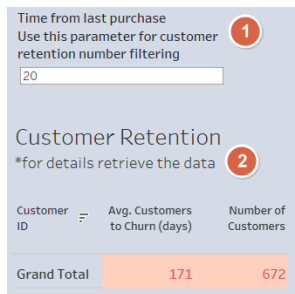


Figure 39: The parameter name (1) with directions on usage as well as the note (2) to let the audience know how to reach details

Graphs and Usages:

Bar Charts: Each bar's length corresponds to a certain category's value. Even people who don't have much experience with data analysis can easily see the differences between bar lengths. Even though differences are not so big this graph will help us to realize the categorical differences in their performances.

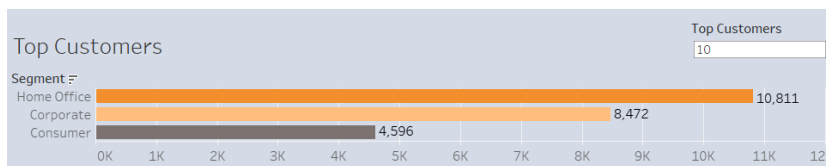


Figure 40: Top 10 customer's order category distribution

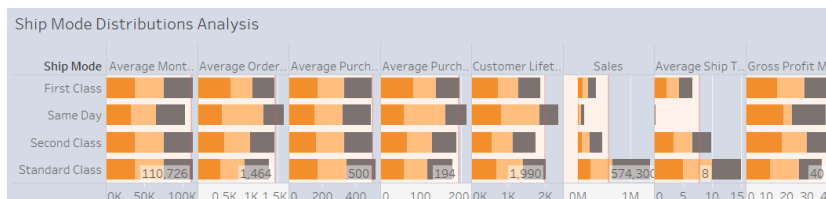


Figure 41: The deviations in KPIs under shipping mode

Bullet Graphs: One type of bar chart that is intended to be more readable and compact is the bullet graph. They are made up of a scale, an area that shows the predicted performance, a goal value, and a marker that shows the actual number. They work well for comparing performance to objectives and for rapidly presenting important metrics like delivery rates of promised versus the actual durations per shipping mode as shown below.

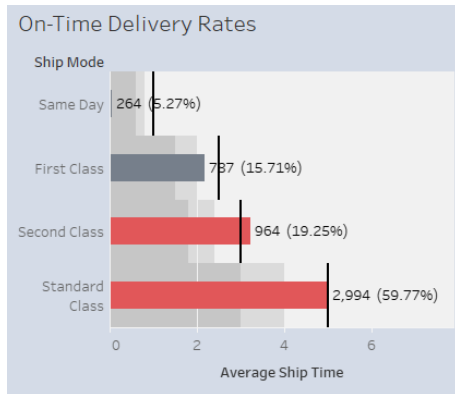


Figure 42: Bullet graph of shipping information

Histograms: A single numerical variable's frequency distribution can be seen using histograms. Although the bars are arranged into bins, they resemble bar charts. Histograms are useful for determining if a distribution is normal, skewed, or bimodal. Histograms are frequently employed in data exploration and statistical analysis, which we will be using to retrieve the data on purchase frequencies to understand our customers' habits.

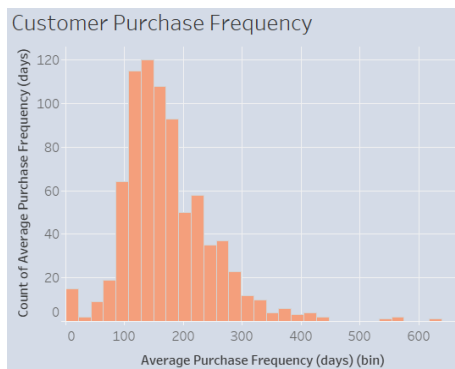


Figure 43: Histogram of purchase frequency average per customer

Box-and-Whiskers Plots: The distribution of numerical data can be summarized with the use of box-and-whisker graphs. They display a dataset's median, quartiles, and outliers. Because of this, they are especially useful for determining how data is distributed, comparing distributions, and spotting extreme values, which will be used to understand demand satisfaction metrics under our operations.

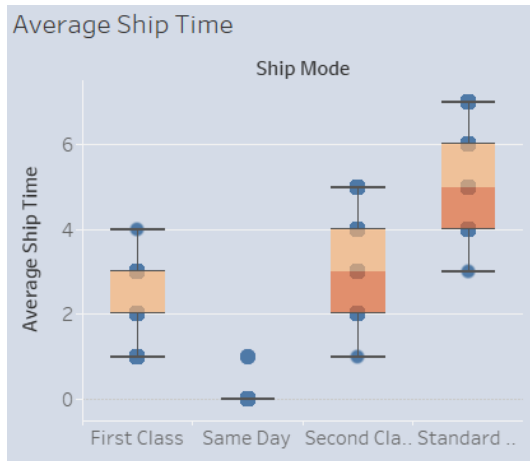


Figure 44: Average shipping time distribution on box-and-whiskers graph by modes

Text Tables: Text tables use rows and columns to display data in a tabular fashion. They are utilized to create cumulative info tables and present raw data. We will use this type as KPI cards and a general view of what the overall numbers are so that the related department can grasp the main points before diving deep into time-wise or other breakdowns.

Yearly Overview KPI Cards									
Total Revenue	Number of Orders	Number of Customers	Average Order Value (AOV)	Customer Lifetime Value (CLV)	Profit	Gross Profit Margin	Profit Per Order	Avg. Discount	Average Ship Time
733,215	1,687	693	435	682	93,439€	12.74%	55.39€	0.16	3.91

Figure 45: An executive point of view current years KPIs are listed at a glance

Cumulative KPI Cards				
Sales Growth Rate	Number of Customers	Average Order Value (AOV)	Gross Profit Margin	Average Ship Time
2.77%	793	458.6	12.47%	3.96

Figure 46: An executive point of view total KPIs are listed at a glance

Total Revenue	Number of Orders	Sales Growth Rate	Average Order Value (AOV)
2,297,201	5,009	* 0	459

Figure 47: In the sales department filtered year's KPIs are listed at a glance with a note of *(about sales growth rate changes)

Gross Profit Margin	Profit	Profit Per Order
12.47%	286,397€	57.18€

Figure 48: For the sales numbers profitability in chosen year's KPIs are listed at a glance

Customer Lifetime Value (CLV)	LifeSpan of Customers (days)	Number of Customers
641.5	999.5	793.0

Figure 49: Customer analytics by the chosen years KPIs are listed at a glance

Customer Retention		
*for details retrieve the data		
Customer ID	Avg. Customers to Churn (days)	Number of Customers
Grand Total	171	672

Figure 50: Customers who need to engage listed according to the of the last order date

	Order Date			
	2019	2020	2021	2022
Total Revenue	484,247	470,533	609,206	733,215
Profit	49,544€	61,619€	81,795€	93,439€
Number of Orders	969	1,038	1,315	1,687
LifeSpan of Customers (days)	1,117	1,033	1,019	1,057
Average Order Value (AOV)	500	453	463	435
Average Purchase Frequency (days)	185	166	162	176
Average Purchase Value	63.88	58.97	61.93	58.77
Gross Profit Margin	10.23%	13.10%	13.43%	12.74%
Avg. Discount	15.83%	15.56%	15.47%	15.65%
Average Ship Time	4.00	4.02	3.95	3.91

Figure 51: To be able to view the general situation according to desired insights yearly KPIs are listed to depict the differentials

Highlight Tables: They are a particular kind of text table where color gradients represent various values. When looking for patterns and trends, highlight tables can be a useful tool. They are designated to show the distribution of values across a grid and can be used to identify hot spots and cold spots. Without legends, it is easy to point out the volume variety in the tables that we try to compare.

Category	Segment		
	Consumer	Corporate	Home Office
Furniture	391,049	229,020	121,931
Office Supplies	363,952	230,676	124,418
Technology	406,400	246,450	183,304

Figure 52: Highlighted table for sales on category breakdown vs customer segments

Top Performing Products				Top Products List
				10
Product Name	Segment			Grand Total
	Consumer	Corporate	Home Office	
Canon imageCLASS ..	32,900	17,500	11,200	61,600
Fellowes PB500 Ele..	14,489	7,118	5,847	27,453
Cisco TelePresence ..			22,638	22,638
HON 5400 Series Ta..	17,384	3,505	981	21,871
GBC DocuBind TL30..	13,096	6,727		19,823
GBC Ibimaster 500 ..	17,122	761	1,141	19,025
Hewlett Packard La..	4,200	5,400	9,240	18,840
HP Designjet T520 I..	18,375			18,375
GBC DocuBind P400..	11,977		5,988	17,965
High Speed Automa..	12,118	4,913		17,030

Figure 53: Table of top-performing products with customer segment division

Maps: They can be used to show the distribution of measurements with spatial patterns. Maps are essential for understanding spatial relationships about patterns, resource allocation, and planning. Which shows us the data spread in different forms like magnitude, color, or clusters.

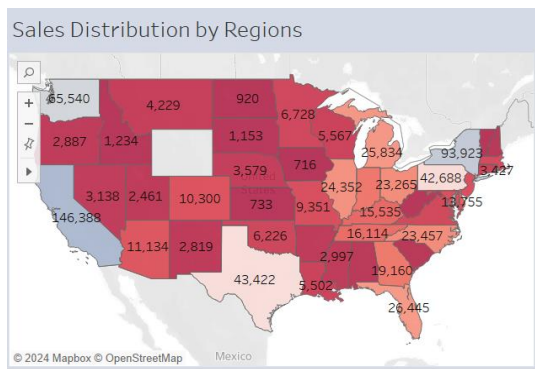


Figure 54: Color-based map for sales distribution

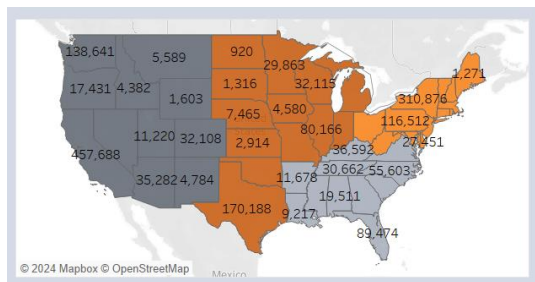


Figure 55: Cluster of the region-based map for sales distribution

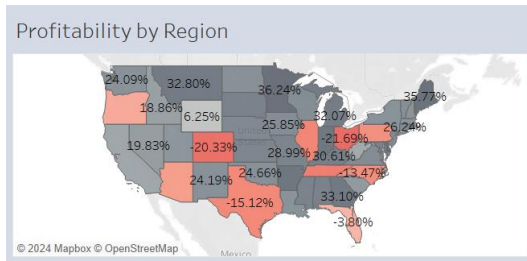


Figure 56: Color-based map for profit distribution

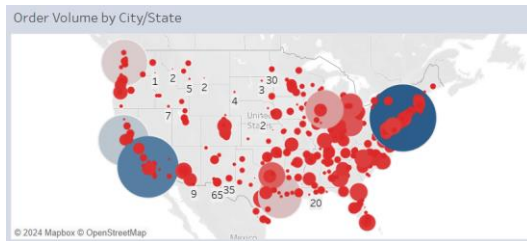


Figure 57: Magnitude-based map for order volumes per cities

Line Graphs: Line graphs are used to visualize the relationship between two variables over time.

We will use them to track trends and correlations and also to compare different categories.

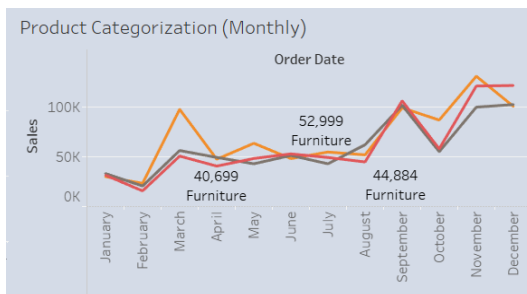


Figure 58: Monthly product category sales spread of line graph

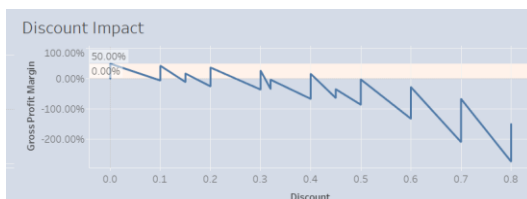


Figure 59: Analysis of gross profit to determine the optimal gap according to discount rates

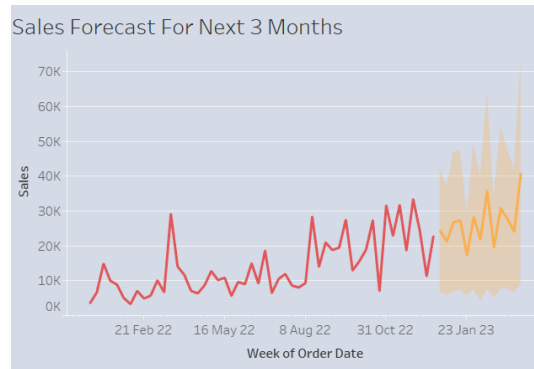


Figure 60: Weekly forecasting line chart constructed with exponential smoothing technique on sales

Describe Forecast									
Options Used to Create Forecasts									
Time series: Week of Order Date									
Measures: Sum of Sales									
Forecast forward: 13 weeks (26 December 2022 – 20 March 2023)									
Forecast based on: 27 December 2021 – 19 December 2022									
Ignore last: 1 week (26 December 2022)									
Seasonal pattern: 13 week cycle									
Sum of Sales									
Initial	Change From Initial			Seasonal Effect		Contribution			
26 December 2022	26 December 2022 – 20 March 2023			High	Low	Trend	Season	Quality	
24,332 ± 17,593	16,402			20 March 2023	1	23 January 2023	1	100.0%	0.0% Ok

Figure 61: The previous graphs forecasting details

Describe Forecast

SummaryModels

All forecasts were computed using exponential smoothing.

Sum of Sales

			Quality Metrics					Smoothing Coefficients		
Level	Model Trend	Season	RMSE	MAE	MASE	MAPE	AIC	Alpha	Beta	Gamma
Multiplicative	Additive	Multiplicative	7,228	5,375	0.78	45.8%	960	0.030	0.101	0.331

Figure 62: The previous graphs forecasting model explanation

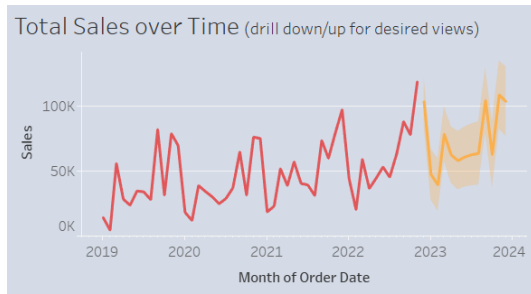


Figure 63: Yearly seasonal trends with forecasting line chart constructed with exponential smoothing technique on sales

Options Used to Create Forecasts

Time series: Month of Order Date
 Measures: Sum of Sales
 Forecast forward: 13 months (December 2022 – December 2023)
 Forecast based on: January 2019 – November 2022
 Ignore last: 1 month (December 2022)
 Seasonal pattern: 12 month cycle

Sum of Sales

Initial	Change From Initial	Seasonal Effect		Contribution		Quality
December 2022	December 2022 – December 2023	High	Low	Trend	Season	
103,259 ± 18,670	0	November 2023 37,518	February 2023 -31,547	0.0%	100.0%	Ok

Figure 64: The previous graphs forecasting details

All forecasts were computed using exponential smoothing.

Sum of Sales

Model			Quality Metrics					Smoothing Coefficients		
Level	Trend	Season	RMSE	MAE	MASE	MAPE	AIC	Alpha	Beta	Gamma
Additive	None	Additive	9,526	7,178	0.61	17.8%	891	0.296	0.000	0.000

Figure 65: The previous graphs forecasting model explanation

Treemaps: They are type of a hierarchical chart that is used to visualize hierarchical data, with the usage of color schemes, labels, or tooltips they can provide deeper information. It is effective for us to emphasize the most sold categories and highly profitable ones.

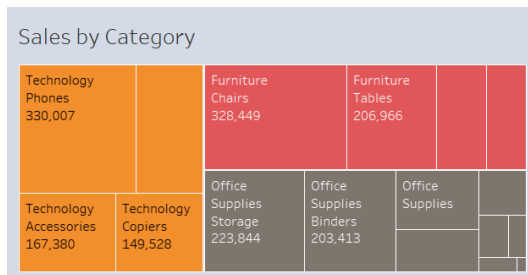


Figure 66: treemap of sales by sub-categories in categories, which are hierarchical sets

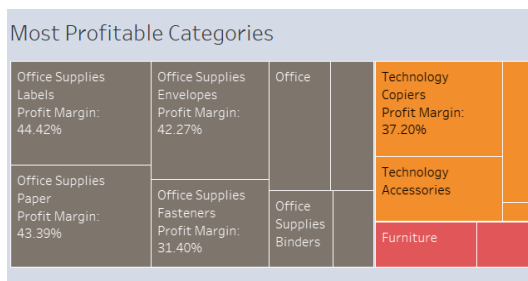


Figure 67: Treemap of categories according to their profitability

Scatter Plots: They help us to visualize the relationship between two numerical variables. They are often used to identify correlations between variables. Scatter plots can be effective for identifying patterns, outliers, and trends in data.

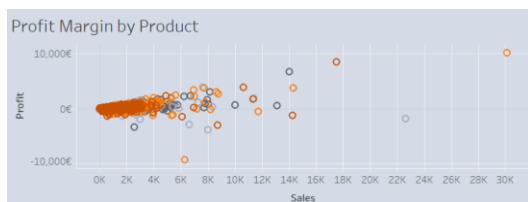


Figure 68: Analysis of profitable products per category

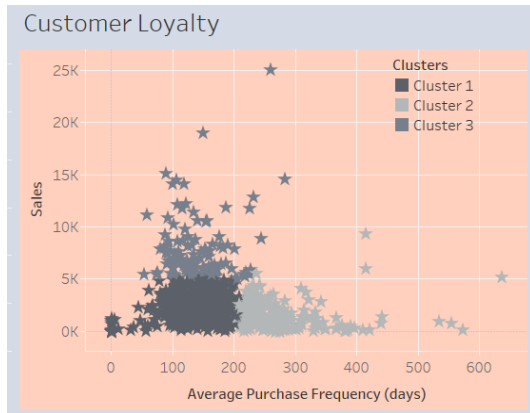


Figure 69: Customer clustering to determine their stands in three clusters

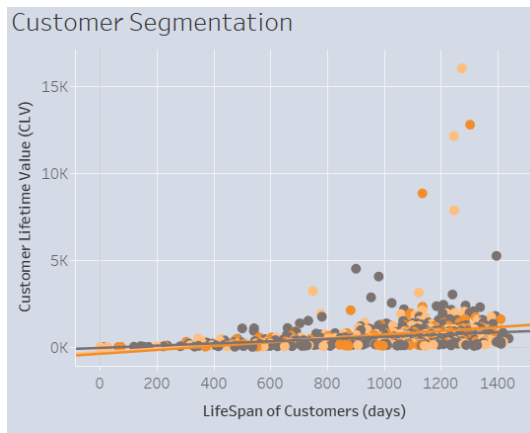


Figure 70: Customer value due to their stay in our ecosystem analysis to their segments

These visualizations make it easy to identify patterns and understand the KPIs' mode of operations as well as the related details.

Dashboard Outputs:

Our dashboards will be sharing a systematic schema of colors, layout, labels, filters, legends, and paths that everyone in the company can understand same thing at a fast pace. The most important part is where to start reading the dashboard as described by Hichert & Faißt, in 2022, from the left top corner to the right bottom corner. And their standards are implemented in our visuals accordingly. Only in our Executive level reports the logo is the biggest and takes part in the left upper corner whereas in other front office reports, they are on the right bottom corner, and the back office report like the data exploration dashboard, that formatting is neglected. Title shares the first row with other general idea-giver elements, like filters or legends if they are applicable

for generality of the views. If filters and legends are specifically acting on separate views, then they are added in their container or any adjacent part that the layout allows. KPI cards are placed under title (left top corner after the title's container), to put the highlights on the main improvements. The layout for the views are conducted with two rows that general context is given in the first row and the second row is more detailed understandings of the reports. Filters are located in the left top corner that can be accessible easily. Easy breakdown or cumulate buttons appear for the user to move through the data groups.

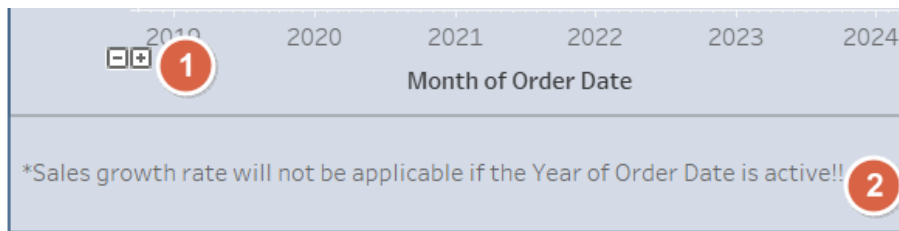


Figure 71: Interactive elements for drill-down-and-up (1) and notes (2) to guide the audience

Executive Dashboard for an overview of how the company conducts throughout the year that report is viewed. We assumed that the year is 2022 because of the maximum order date in the dataset. The cumulative KPI cards are increasing the intensity of the report for Yearly Overview KPI cards by giving life details of our company. The stress in numbers is put to regional, category base, and forecasting distribution of sales to comprehend the past, today, and future of BrightStep Solutions.

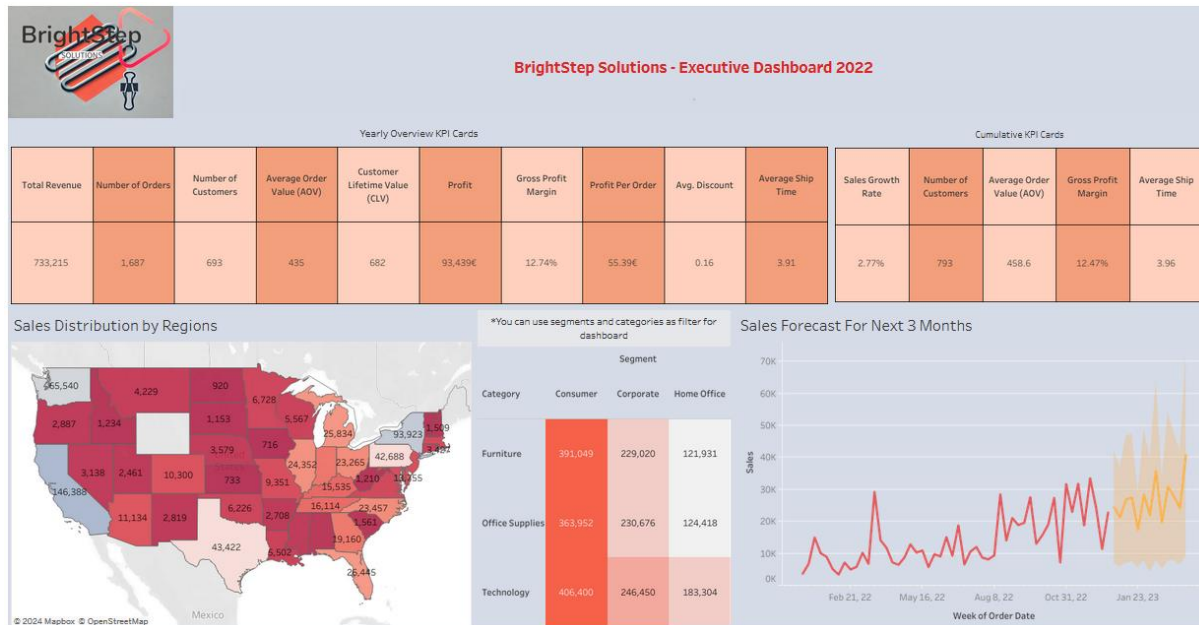


Figure 72: Executive Dashboard visual

Sales Performance Dashboard is designed to find order counts, revenue collected, and sales volumes to focus on the overall crucial metrics and trends. We need to relate the categorical sales with customer behaviors of different demographics. This dashboard is a wider view of sales where the chief level is needed to track.

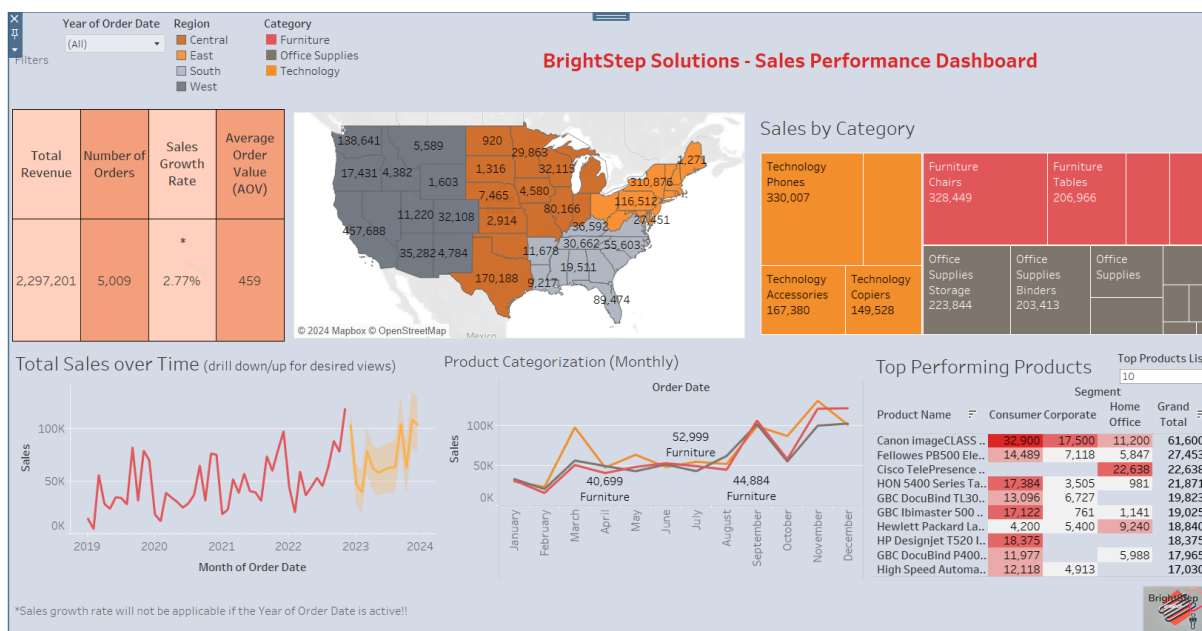


Figure 73: Sales Performance Dashboard visual

The Profitability Dashboard is designed to give a further analysis than the Sales Performance metrics so that the operation teams can analyze and act on customers one by one within the general policies of the company. Profit margins by product show the special products that don't need promotion as well as the products that can harm our business. The discount impact graph gives us the optimal discounting rate scale when the sold products can still stay in the desired profit margin.

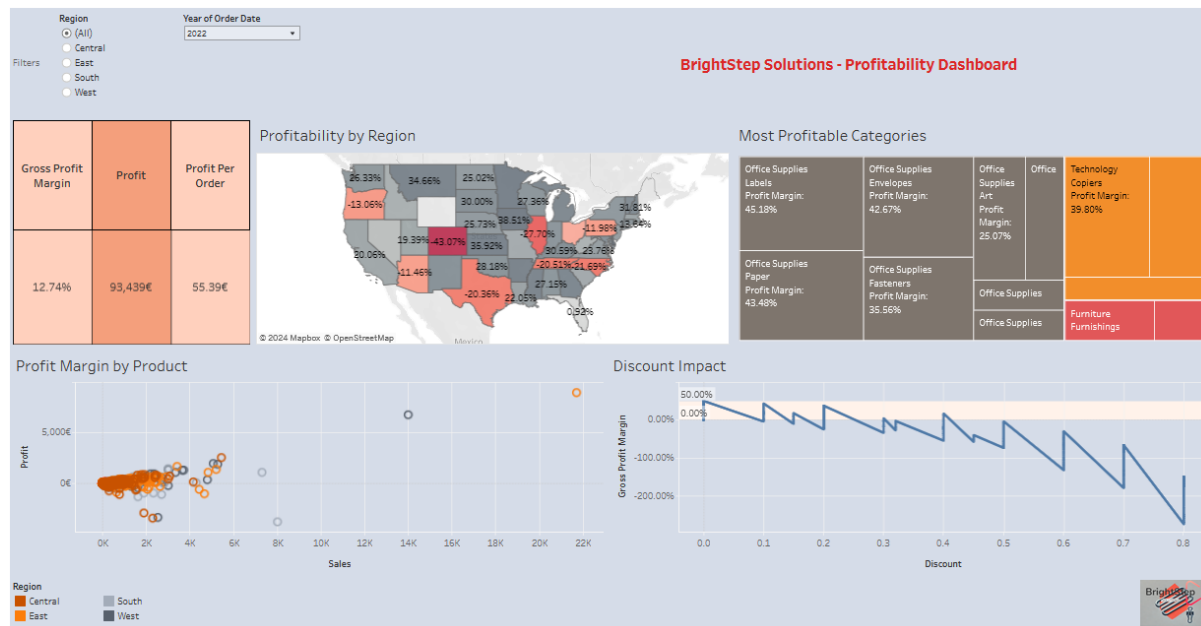


Figure 74: Profitability Dashboard visual

Customer Analysis Dashboard is designed to identify customers at risk of churning and target the effective ways to the worth groups by turning these insights into actionable decisions. This report is shared with teams to implement targeted retention strategies, such as offering discounts to at-risk customers or improving customer loyalty for those with little lifespans within the threshold determined.



Figure 75: Customer Analysis Dashboard visual

Order Fulfillment Dashboard is dedicated to understanding the end of the sales process that can answer if we are fulfilling our responsibilities to deliver them at the promised time, and how successful we are in reaching out to our customers. The sales department can measure how well do we do according to our sales operations.

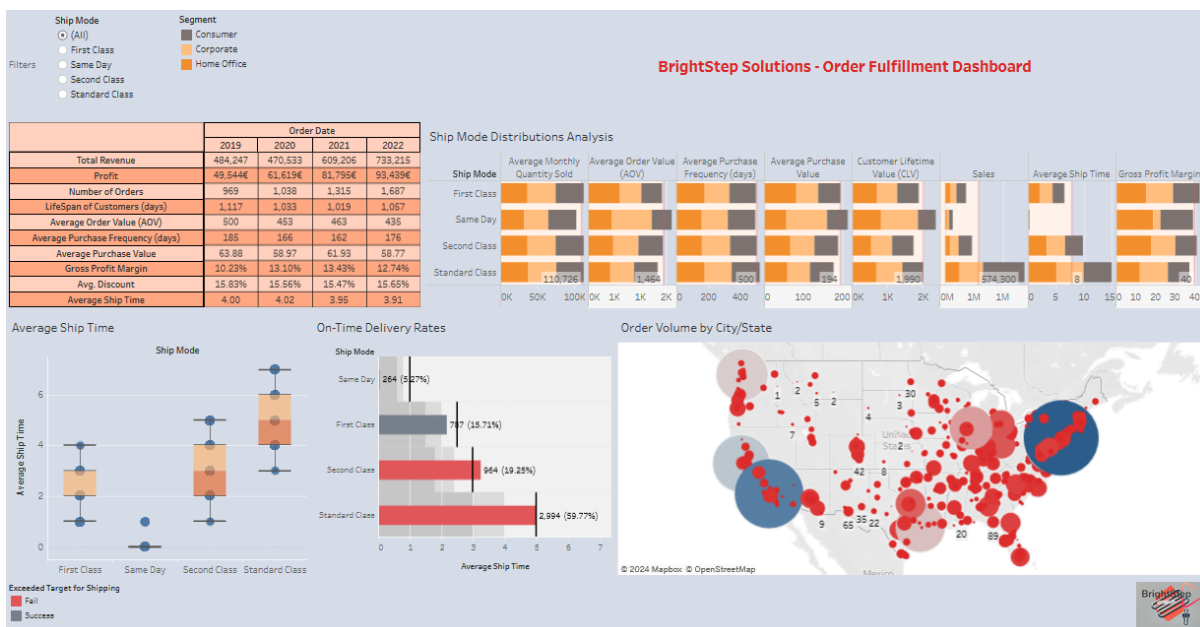


Figure 76: Order Fulfillment Dashboard visual

The Data Exploration dashboard is an exploratory data analysis process for business and data analysts that can help the company to improve our daily actions as well as give decisions on products, markets, and customers that can lead us to new opportunities. It shows the outliers, and trends that can answer what-if questions for decisions had so far.



Figure 77: Data Exploration Dashboard visual

CONCLUDING REMARKS: DISCUSSION

In conclusion, BrightStep Solutions presented a suite of dashboards to determine the company's status in the market to address the sales performance increase opportunities and threats. The use of visualizations supports decision-making processes with an easily readable comprehensive framework combined with habitual branding concepts. The focus of the dashboard will be on essential sales KPIs that provide a holistic view of the sales function's performance. These KPIs will represent related information as calculated in the ecosystem. The main aim is to capture the customer habits on their purchases, choosing the thresholds for the right promotions for increasing revenue so that the company can be more profitable.

In addition to these facilitator elements, a deeper investigation is always needed either in product, customer, or any other sub-categorical base. Even though the main idea is to give many insights at a glance, some details may be lost in the comprehension. By nature, our dashboards will need maintenance as our business changes, such as furniture lost sales to technology due to the contemporary needs of the customers.

Automated processes can help our colleagues receive action-based suggestions with the help of machine learning and further predictive analytics to improve corporate success. Each user in our ecosystem can create personalized alerts to receive if one product or customer needs to be specified attention accordingly. These improvements will not only enhance the usage among departments but also increase the company's worth with strategic growth opportunities. Data-driven organizational culture will support our improvements among other competitors in office supply businesses. By providing a clear and intuitive visualization of critical sales metrics, the dashboard will empower users to make informed decisions that align with the organization's goals.

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APPENDIX

My dashboard is published to Tableau Public under this link:
<https://public.tableau.com/app/profile/birce.sari/viz/DesigningasalesdashboardinTableauforachosencompany/ExecutiveDashboard?publish=yes>

Python code behind the cleaned data

```
import pandas as pd

df = pd.read_csv(filepath_or_buffer='sales(1).csv',
                 low_memory=False, on_bad_lines='skip', encoding="ISO-8859-1")

print(df.columns.tolist())
print("\n")
# print(df.head(5))
# print("\n")
print(df.dtypes)
print("\n")
print(df.count())
print("\n")
df = df.dropna()
print(df.count())
print("\n")
print(df.shape)
print("\n")
print(df.isnull().sum())
print("\n")
print(df.describe())
print("\n")

df.to_csv(path_or_buf='Final_SalesData_Revised.csv', index=False)
```

Figure 78: The Python code used for the data-cleaning process