Data-Driven Innovations in Supply Chain Management with Qlik Insights

Problem Understanding

Specify Business Problem: This project seeks to revolutionize supply chain management through the application of data-driven insights utilizing Qlik. By leveraging advanced analytics, the aim is to optimize crucial aspects such as logistics, forecasting, and inventory management. The objective is to enhance operational efficiency and responsiveness, driving substantial improvements across the supply chain.

By harnessing Qlik's powerful analytics capabilities, this transformative initiative aims to reshape the supply chain landscape. The project focuses on providing actionable insights to streamline processes, reduce costs, and improve decision-making. Furthermore, it aspires to create a more agile and adaptive supply chain that can swiftly respond to market changes and customer demands. The ultimate goal is to elevate overall business performance and establish a competitive edge in the market.

Business Requirements:

- Implement a robust data integration strategy to aggregate and centralize relevant data from diverse supply chain sources.
- Utilize Qlik's advanced visualization capabilities to create intuitive and dynamic dashboards, providing stakeholders with clear insights into the entire supply chain ecosystem.
- Leverage Qlik's advanced analytics features to analyze historical logistics data, identify patterns, and optimize transportation routes.
- Implement real-time tracking and monitoring solutions to enhance visibility into the movement of goods, reducing lead times and minimizing transportation costs.
- Implement real-time analytics to facilitate quick decision-making in response to unforeseen events or changes in demand, ensuring a

proactive and responsive supply chain.

Literature Survey: The integration of data-driven insights in supply chain management (SCM) has gained substantial attention in recent years, primarily due to advancements in analytics and big data technologies. The use of tools like Qlik has been instrumental in transforming SCM by providing enhanced visibility, predictive capabilities, and operational efficiency.

Data-Driven Supply Chain Management

Several studies highlight the importance of data-driven approaches in SCM [1]. According to Waller and Fawcett (2013), the application of big data analytics in supply chains can significantly enhance decision-making processes by providing real-time insights and predictive analytics. They argue that leveraging big data can lead to more accurate demand forecasting, optimized inventory management, and improved logistical efficiency.

Advanced Analytics and Visualization

The role of advanced analytics [2] and visualization tools like Qlik in SCM is well-documented. Wang, Gunasekaran, Ngai, and Papadopoulos (2016) discuss the benefits of using advanced analytics to analyze and visualize supply chain data. They emphasize that these tools enable organizations to uncover hidden patterns, trends, and insights, which are critical for strategic planning and operational optimization. Qlik's capabilities in creating dynamic dashboards and visualizations are particularly noted for their effectiveness in enhancing stakeholder understanding and engagement.

Optimization of Logistics and Transportation

The optimization [3] of logistics and transportation through data analytics is a critical area of focus. Esper, Defee, and Mentzer (2010) highlight how analytics can be used to optimize transportation routes, reduce costs, and improve delivery times. They provide case studies where companies have successfully implemented data-driven logistics solutions to achieve significant improvements in efficiency and cost reduction.

Real-Time Tracking and Monitoring

Real-time tracking and monitoring [4] solutions are essential for modern supply chain management. A study by Hofmann and Rüsch (2017) explores the impact of real-time data on supply chain visibility. They find that real-time tracking technologies, coupled with advanced analytics, can greatly enhance the ability to monitor the movement of goods, thereby reducing lead times and improving overall supply chain responsiveness.

Proactive and Responsive Supply Chains

The ability to respond proactively to unforeseen events is a key benefit of data-driven SCM [5]. Ivanov, Dolgui, and Sokolov (2019) discuss the concept of a resilient supply chain, which is capable of adapting to disruptions through real-time analytics and decision-making. They argue that data-driven insights enable supply chains to be more agile and responsive, thereby ensuring continuity and minimizing the impact of disruptions.

Social and Business Impact:

Social: The implementation of data-driven innovations in supply chain management through Qlik Insights has significant social implications. By optimizing logistics, forecasting, and inventory management, the project can lead to more efficient use of resources, reducing waste and lowering carbon footprints. This contributes to environmental sustainability and

addresses climate change concerns.

Business: The integration of data-driven innovations in supply chain management using Qlik Insights is poised to have a profound impact on business operations. By leveraging advanced analytics, companies can optimize key aspects of their supply chain, such as logistics, forecasting, and inventory management. This leads to improved operational efficiency, reduced costs, and enhanced responsiveness to market changes.

Both, Social and Business Impact are evident through visulaisations generataed through the aid of QlikSense. These are shown in latter parts of this report.

Data Collection and Extraction

Collection: The dataset [6] used in this project, titled "DataCo Smart Supply Chain for Big Data Analysis," is sourced from Kaggle. It encompasses various aspects of supply chain operations, making it suitable for comprehensive analysis and machine learning applications.

This dataset allows for the analysis of structured data across provisioning, production, sales, and commercial distribution activities. By centralizing this diverse information, it supports the application of advanced analytics to optimize various components of the supply chain.

Understanding the Data:

Data Structure

The dataset includes:

1. **Customer Information**: Customer demographics, IDs, and purchase history.
2. **Product Details**: Product IDs, categories, and pricing.
3. **Order Information**: Order IDs, dates, and delivery status.
4. **Sales and Revenue Data**: Sales figures and revenue metrics.
5. **Logistics Data**: Shipment routes, transportation methods, and delivery times.

Data Quality and Preprocessing

To ensure data quality:

- Address missing values through imputation or exclusion.
- Normalize data for consistency.
- Detect and manage outliers.

Key Metrics and Analytical Applications

Key metrics derived from the data include:

- Order fulfillment rate
- Inventory turnover ratio
- Customer satisfaction index
- Transportation cost efficiency

These metrics support descriptive, analytics, enabling businesses to optimize supply chain through Qlik's advanced analytics capabilities.

Data Preparation:

- **Cleaning the data**: This involves removing or correcting any errors or

inconsistencies in the data. This can include handling missing values, removing duplicate entries, and correcting formatting issues.

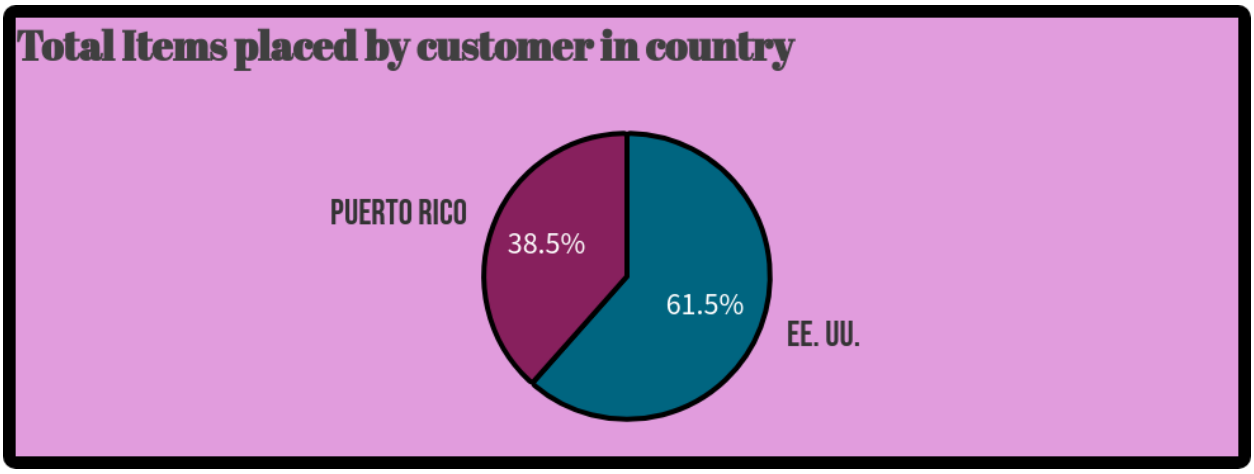
- **Transforming the data**: Data often needs to be transformed into a format that is suitable for visualization. This can include aggregating data, converting data types, and creating new variables or features.
- **Exploring the data**: Before visualizing the data, it's important to explore it to understand its structure and identify any patterns or trends. This can involve calculating summary statistics, creating visualizations such as histograms or scatter plots, and identifying outliers.
- **Filtering the data**: Sometimes it's necessary to focus on specific subsets of data for visualization. This can involve filtering the data based on certain criteria or selecting specific variables of interest.
- **Preparing the data for visualization software**: Depending on the visualization software being used, the data may need to be formatted in a specific way. This can include restructuring the data into tables or matrices, and ensuring that the data is in a format that the software can interpret.
- **Ensuring data accuracy and completeness**: It's important to verify that the data is accurate and complete before visualizing it. This can involve checking for errors or inconsistencies in the data, and ensuring that all necessary data is available for analysis.

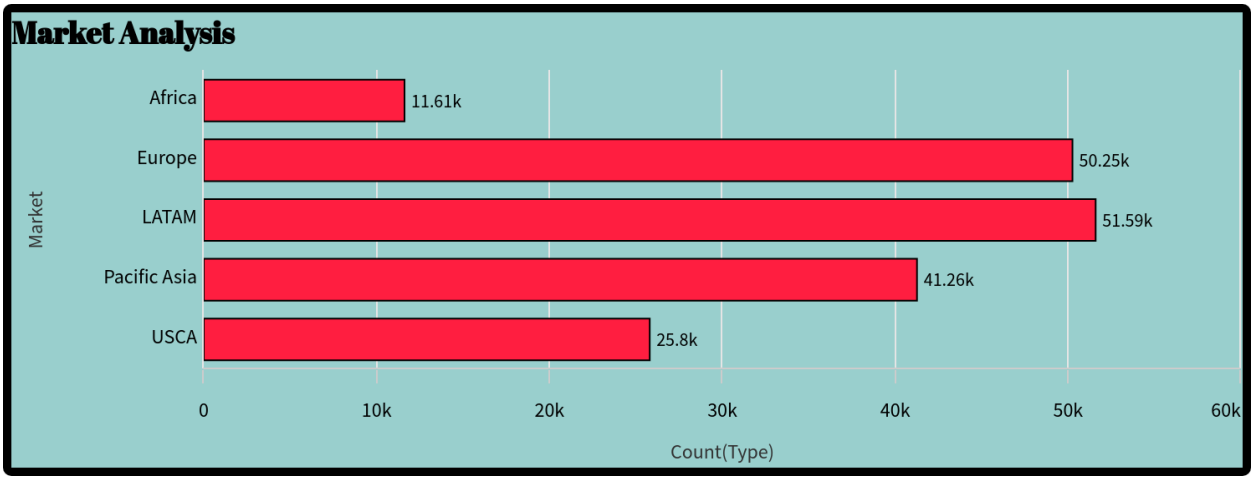
Data Visualisation:

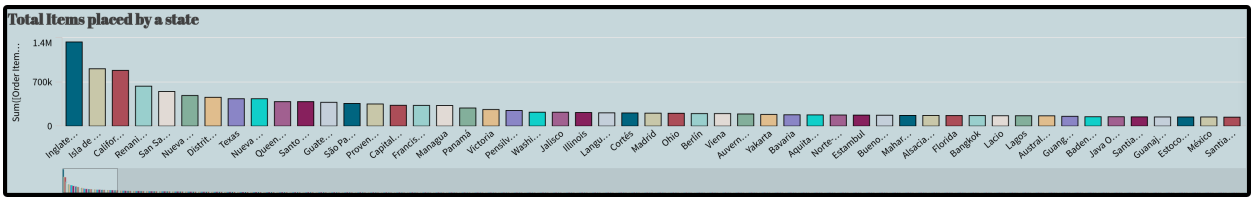
No of Unique Visualisations:

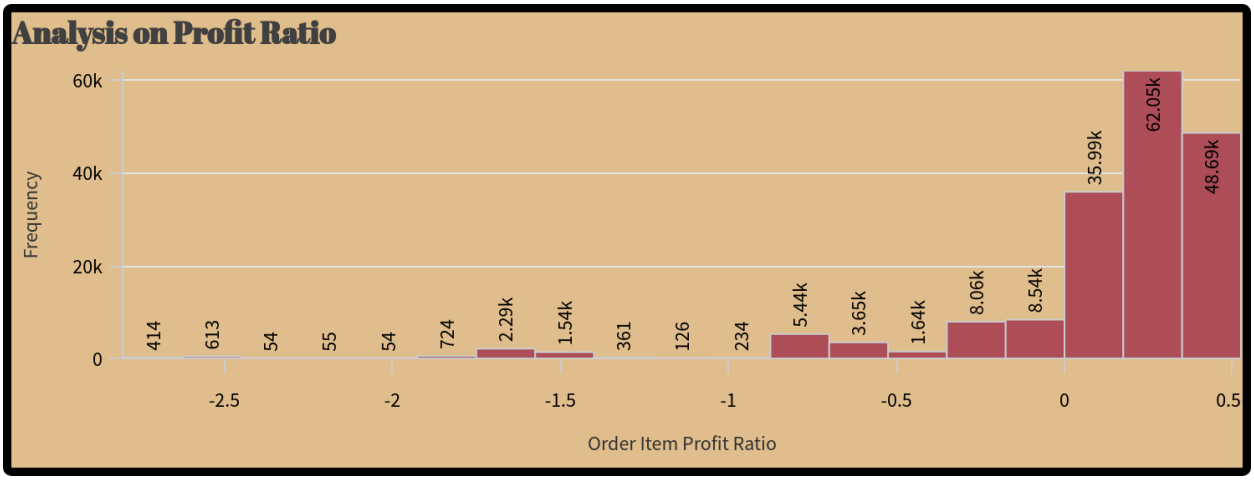
The number of unique visualizations that can be created with a given dataset. Some common types of visualizations that can be used to analyse the performance and efficiency of banks include bar charts, line charts, heat maps, scatter plots, pie charts,]Maps etc. These visualizations can be used to compare performance, track changes over time, show distribution, and relationships between variables, breakdown of revenue and customer demographics, workload, resource allocation and location of banks.

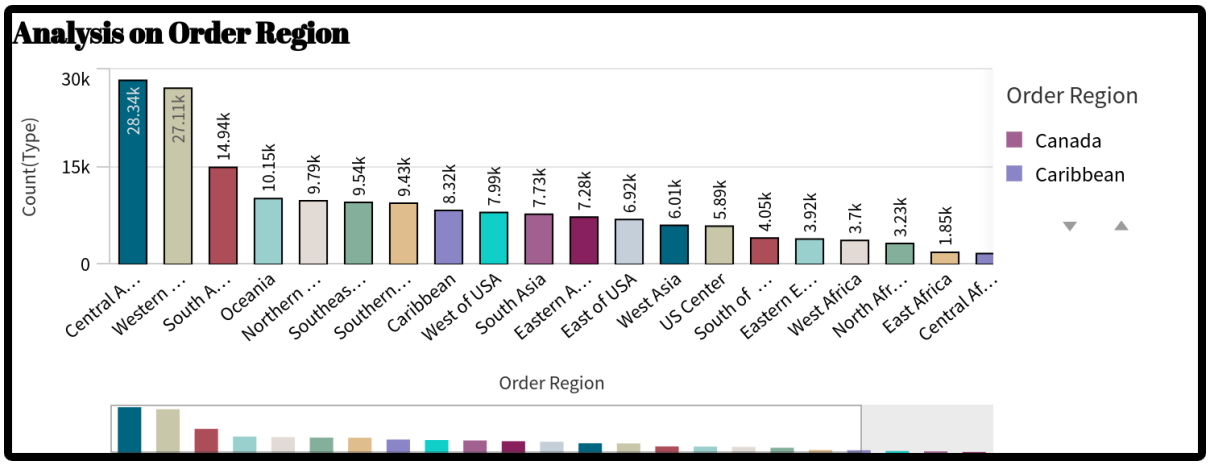
Visualisations:

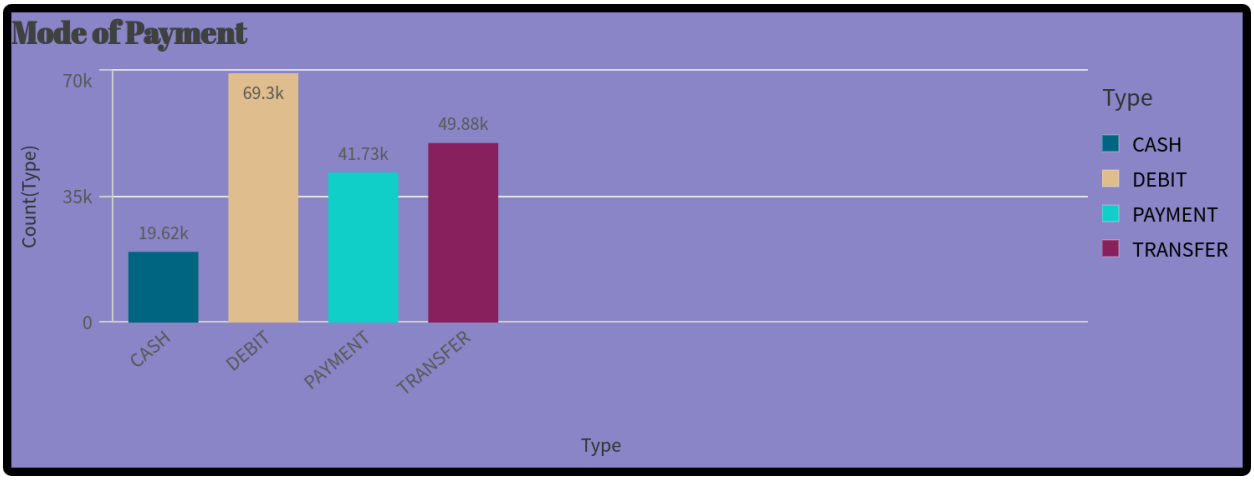




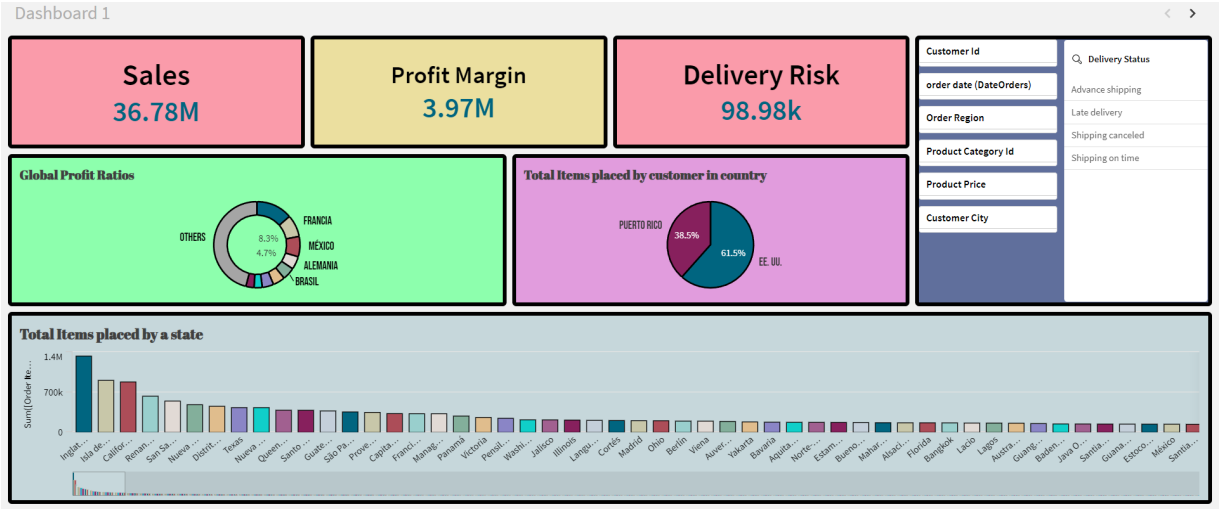

Total Items placed by a state
Sum([Order Item...
1.4M
700k
0

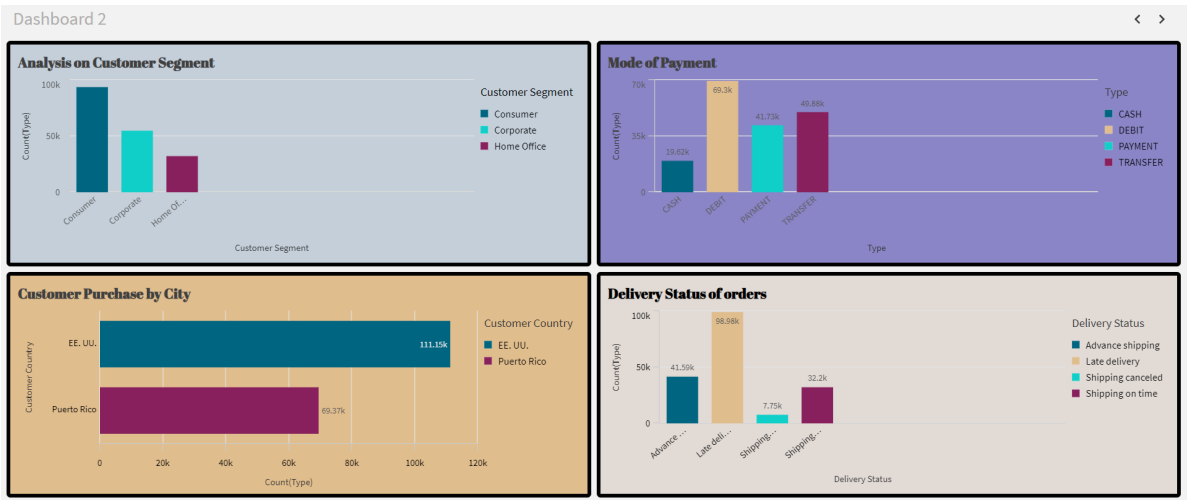

Analysis on Profit Ratio
Frequency
60k
40k
20k
0
414
613
54
55
54
724
2.29k
1.54k
361
126
234
5.44k
3.65k
1.64k
8.06k
8.54k
35.99k
62.05k
48.69k
-2.5
-2
-1.5
-1
-0.5
0
0.5
Order Item Profit Ratio

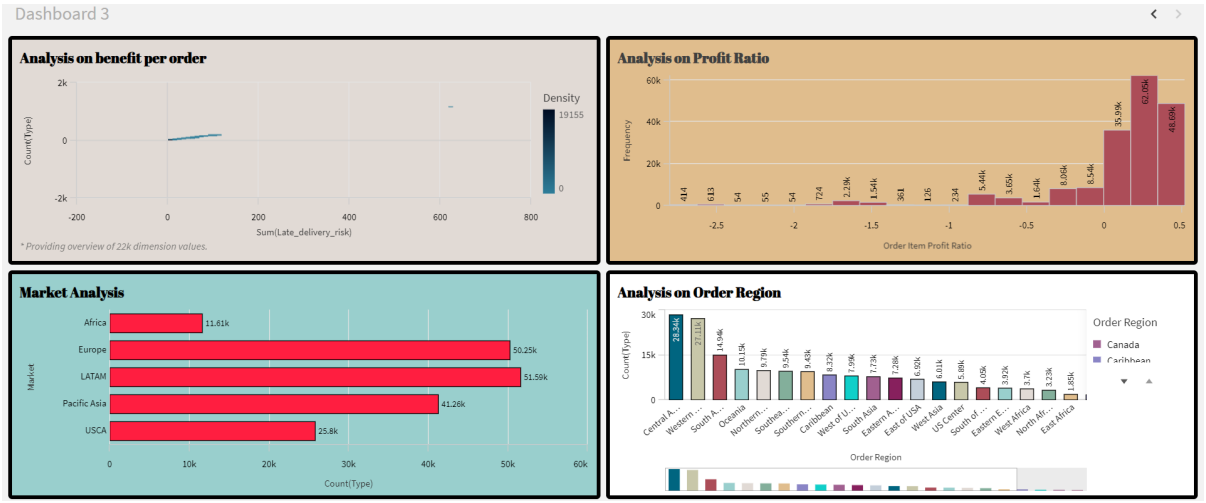

Analysis on Order Region
Count(Type)
30k
15k
0
28.34k
27.11k
14.94k
10.15k
9.79k
9.54k
9.43k
8.32k
7.99k
7.73k
7.28k
6.92k
6.01k
5.89k
4.05k
3.92k
3.7k
3.23k
1.85k
Central A...
Western ...
South A...
Oceania
Northern ...
Southeas...
Southern...
Caribbean
West of USA
South Asia
Eastern A...
East of USA
West Asia
US Center
South of ...
Eastern E...
West Africa
North Afr...
East Africa
Central Af...
Order Region
Order Region
Canada
Caribbean


Mode of Payment
Count(Type)
70k
35k
0
19.62k
69.3k
41.73k
49.88k
CASH
DEBIT
PAYMENT
TRANSFER
Type
Type
CASH
DEBIT
PAYMENT
TRANSFER

Dashboard:


Dashboard 1
Sales
36.78M
Profit Margin
3.97M
Delivery Risk
98.98k
Customer Id
order date (DateOrders)
Order Region
Product Category Id
Product Price
Customer City
Delivery Status
Advance shipping
Late delivery
Shipping canceled
Shipping on time
Global Profit Ratios
OTHERS
FRANCIA
MÉXICO
ALEMANIA
BRASIL
Total Items placed by customer in country
PUERTO RICO
EE. UU.
Total Items placed by a state


Dashboard 2
Analysis on Customer Segment
Customer Segment
Consumer
Corporate
Home Office
Mode of Payment
Type
CASH
DEBIT
PAYMENT
TRANSFER
Customer Purchase by City
Customer Country
EE. UU.
Puerto Rico
Delivery Status of orders
Delivery Status
Advance shipping
Late delivery
Shipping canceled
Shipping on time


Dashboard 3
Analysis on benefit per order
Density
Analysis on Profit Ratio
Market Analysis
Africa
Europe
LATAM
Pacific Asia
USCA
Analysis on Order Region
Order Region
Canada

Story:

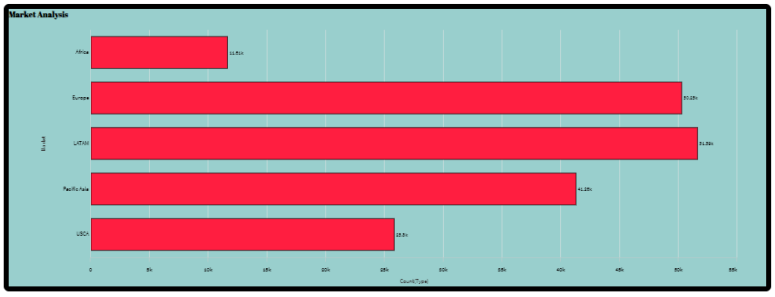
A data story is a way of presenting data and analysis in a narrative format, with the goal of making the information more engaging and easier to understand. A data story typically includes a clear introduction that sets the stage and explains the context for the data, a body that presents the data and analysis in a logical and systematic way, and a conclusion that summarizes the key findings and highlights their implications.

Supply Chain Management Analysis Story

Sales	Profit Margin	Delivery Risk
36.78M	3.97M	98.98k

No. of Sales done in Asian Countries	Sales 109.8k	Sales 1.15M	No. of Sales done in US Country
Profit Margin taken in Asian Countries	Profit Margin 13.04k	Profit Margin 131.1k	Profit Margin taken in US Country
Delivery Risk faced in Asian Countries	Delivery Risk 306	Delivery Risk 3.25k	Delivery Risk faced in US Country

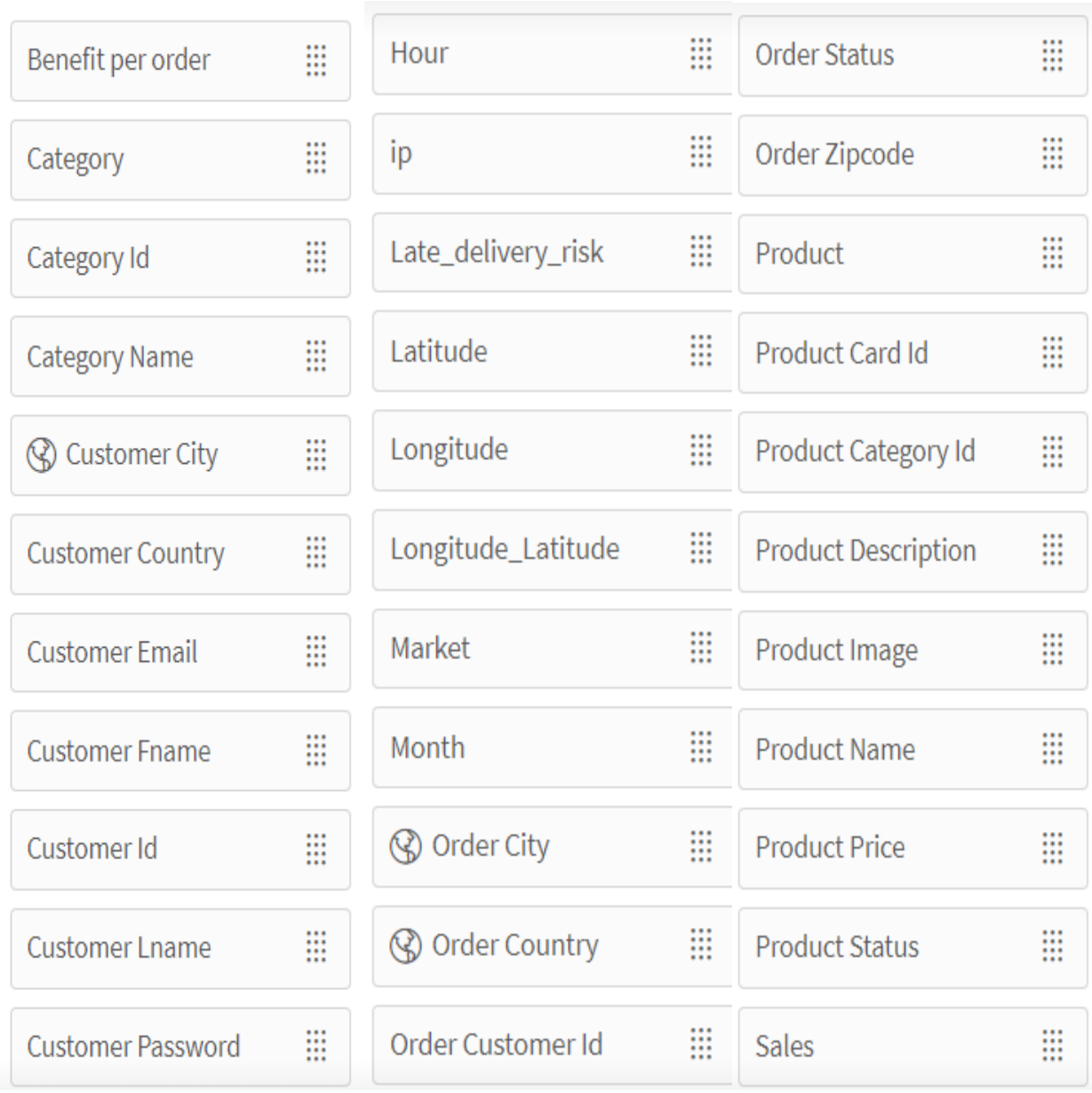
Global Market Analysis



- Conducting a market analysis across Africa, Europe, LATAM(Latin America), Pacific Asia and USCA (United States and Canada) enables businesses to gain strategic insights.
- Regional economic landscapes, consumer behaviors, and market dynamics.
- This comprehensive assessment supports informed decision making tailored marketing strategies and targeted expansion efforts to capitalize on diverse opportunities within each distinct market.

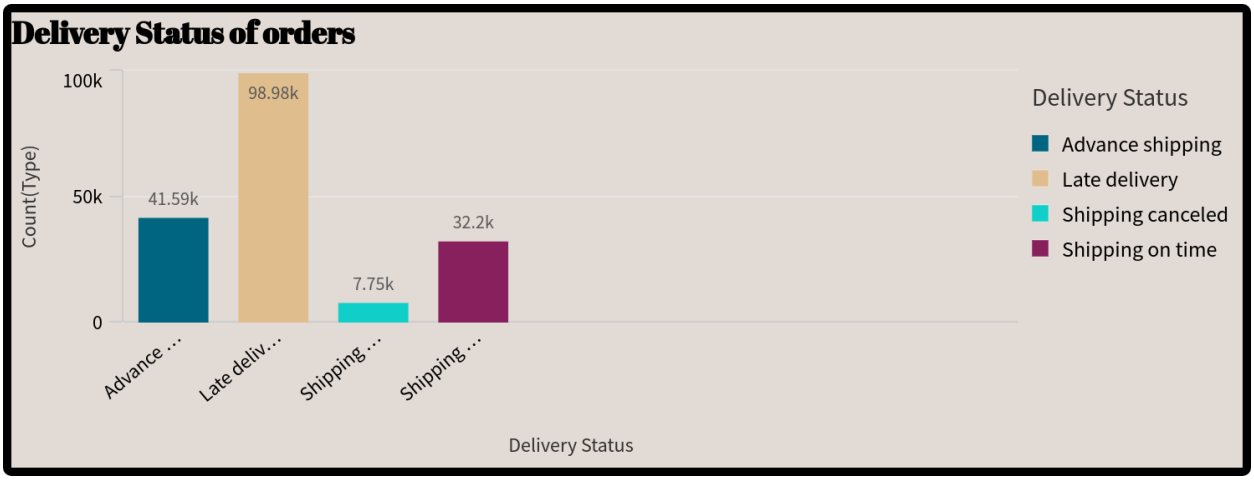
Performance Testing:

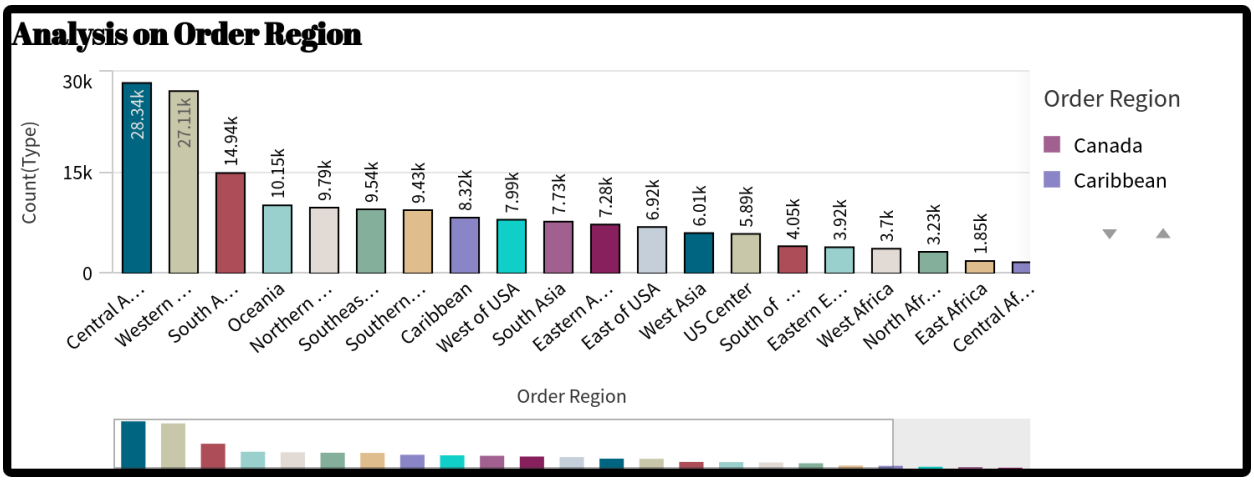
Amount of Data Loaded: "Amount of Data Loaded" refers to the quantity or volume of data that has been imported, retrieved, or loaded into a system, software application, database, or any other data storage or processing environment. It's a measure of how much data has been successfully processed and made available for analysis, manipulation, or use within the system.



Utilisation of Data Filters:

"Utilization of Filters" refers to the application or use of filters within a system, software application, or data processing pipeline to selectively extract, manipulate, or analyze data based on specified criteria or conditions. Filters are used to narrow down the scope of data, focusing only on the relevant information that meets certain predefined criteria.





No. Of Visualisations:

- Global Profit Ratios
- Total Items placed by customer in country
- Total Items placed by a state
- Analysis on customer segment
- Mode of payment
- Customer purchase by city
- Delivery status of orders
- Analysis on benefit per order
- Analysis on profit ratio
- Market Analysis
- Analysis on order region

References:

1. Waller, M. A., & Fawcett, S. E. (2013). Data science, predictive analytics, and big data: A revolution that will transform supply chain design and management. Journal of Business Logistics, 34(2), 77-84.

2. Wang, G., Gunasekaran, A., Ngai, E. W. T., & Papadopoulos, T. (2016). Big data analytics in logistics and supply chain management: Certain investigations for research and applications. International Journal of Production Economics, 176, 98-110.

3. Esper, T. L., Defee, C. C., & Mentzer, J. T. (2010). A framework of supply chain orientation. The International Journal of Logistics Management, 21(2), 161-179.

4. Hofmann, E., & Rüsch, M. (2017). Industry 4.0 and the current status as well as future prospects on logistics. Computers in Industry, 89, 23-34.

5. Ivanov, D., Dolgui, A., & Sokolov, B. (2019). The impact of digital technology and Industry 4.0 on the ripple effect and supply chain risk analytics. International Journal of Production Research, 57(3), 829-846.

6. https://www.kaggle.com/datasets/shashwatwork/dataco-smart-supply-chain-for-big-data-analysis/data