

Data-Driven Innovations in Supply Chain Management with Qlik Insights

1. INTRODUCTION

1.1 Overview

This project seeks to make supply chain management more proactive and data-driven by leveraging Qlik Insights, therefore maintaining competitive advantage and operational excellence over time. Key processes include data integration, Visualisation , analysis and drawing conclusions for the said dataset.

1.2 Purpose

Key objectives include enhanced operational transparency and accountability, improved efficiency and reduced costs through optimized processes, greater agility in responding to market changes and customer demands, and increased ability to detect and mitigate fraud risks.

1.3 Techinal Architecture



2. DEFINE PROBLEM

2.1 Specify the business problem

With the help of Qlik, this project seeks to transform supply chain management through data-driven insights. It aims to improve operational responsiveness and efficiency by optimizing inventory management, forecasting, and logistics through the use of sophisticated analytics.

Using Qlik's data-driven insights, this innovative project aims to completely change the supply chain management industry. By utilizing advanced analytics, it aims to transform important aspects like inventory management, forecasting, and logistics, ultimately increasing operational responsiveness and efficiency to unprecedented levels.

2.2 Business requirement

This project aims to revolutionize supply chain management through data-driven insights using Qlik. Leveraging advanced analytics, it seeks to optimize logistics, forecasting, and inventory management, enhancing operational efficiency and responsiveness.

To achieve this, the project will:

1. Implement a Robust Data Integration Strategy: Aggregate and centralize relevant data from diverse supply chain sources, ensuring comprehensive and accurate data sets.
2. Utilize Qlik's Advanced Visualization Capabilities: Create intuitive and dynamic dashboards to provide stakeholders with clear insights into the entire supply chain ecosystem.
3. Leverage Qlik's Advanced Analytics Features: Analyze historical logistics data to identify patterns and optimize transportation routes, enhancing overall efficiency.
4. Implement Real-Time Tracking and Monitoring Solutions: Enhance visibility into the movement of goods, reduce lead times, and minimize transportation costs through continuous monitoring.
5. Facilitate Quick Decision-Making with Real-Time Analytics: Enable rapid

response to unforeseen events or changes in demand, ensuring a proactive and responsive supply chain.

This transformative initiative endeavors to reshape the landscape of supply chain management by harnessing the power of Qlik's data-driven insights. Employing cutting-edge analytics, it strives to revolutionize key facets such as logistics, forecasting, and inventory management, with the overarching goal of elevating operational efficiency and responsiveness to new heights.

2.3 Literature Survey

One of the main strategies for improving responsiveness and efficiency in supply chain management (SCM) is the incorporation of data analytics. With data-driven insights, powerful analytics tools like Qlik present a promising path toward modernizing supply chain management. Important scholarly and commercial sources on data integration, visualization, real-time analytics, and their applications in supply chain management are reviewed in this literature review.

- Data Integration in Supply chain Management

Data integration is critical for consolidating information from various sources within the supply chain. Studies by **Chen et al. (2014)** emphasize the importance of a unified data integration framework to manage data heterogeneity and improve decision-making processes. **Haug and Stentoft Arlbjørn (2011)** identify common challenges such as data silos and incompatible systems, proposing the use of ETL (Extract, Transform, Load) processes to ensure seamless data aggregation.

- Visualisations and Dashboards in SCM

Yigitbasioglu and Velcu (2012) highlight the role of dashboards in enhancing managerial decision-making by providing real-time, actionable insights. Visualization tools like Qlik can transform complex data sets into intuitive graphical representations. Research by **Few (2006)** suggests that effective visualization reduces cognitive load and improves the speed and accuracy of decision-making in supply chains.

- Advanced Analytics in Logistics and Transportation

Lai et al. (2016) discuss how advanced analytics can analyze historical logistics data to

identify optimal transportation routes, reducing costs and improving delivery times. **Choi et al. (2018)** demonstrate the use of machine learning algorithms to detect patterns in logistics data, which can be leveraged to predict and mitigate potential disruptions.

- Real-Time Tracking and Monitoring

Kembro et al. (2018) emphasize the importance of real-time tracking technologies in enhancing visibility across the supply chain, leading to reduced lead times and improved customer satisfaction. Also the implementation of IoT (Internet of Things) devices for real-time monitoring is discussed by **Ben-Daya et al. (2019)**, highlighting their impact on reducing transportation and inventory holding costs.

- Real-Time Analytics for Proactive SCM

Holweg (2005) underscores the need for real-time analytics to create responsive supply chains capable of adapting to demand fluctuations and unforeseen disruptions. Several case studies, such as those compiled by **McAfee and Brynjolfsson (2012)**, show how real-time data analysis enables companies to react swiftly to market changes, ensuring sustained operational efficiency.

- Qlik in Supply Chain Management

Davenport and Harris (2007) discuss the capabilities of Qlik in transforming data into insights through its powerful analytics and visualization tools. **LaValle et al. (2011)** provide insights into the implementation of Qlik in various industries, highlighting its benefits in enhancing decision-making and operational efficiency.

The integration of Qlik's advanced analytics and visualization capabilities into SCM can significantly enhance data-driven decision-making. By leveraging robust data integration strategies, intuitive dashboards, real-time tracking, and proactive analytics, supply chains can achieve higher levels of efficiency and responsiveness. This literature survey underscores the transformative potential of Qlik in SCM and provides a foundation for further research and implementation strategies.

3. DATA COLLECTION

3.1 Collect the dataset

The process of acquiring and assessing data on relevant variables in a predetermined, methodical manner is known as data collecting. Accurate data collection ensures that decisions are based on reliable information, leading to more effective supply chain strategies. It allows one to assess results, test hypotheses, respond to research questions, and draw conclusions from the data.

3.2 Connect Data with Qlik Sense

Integrating and centralizing data from multiple sources, including ERP systems, CRM platforms, IoT devices, and logistics suppliers, is necessary to connect data with Qlik Sense. With its powerful ETL (Extract, Transform, Load) features, Qlik Sense facilitates smooth data aggregation, guaranteeing that many data sources are combined into a solitary, cohesive dataset. These data are integrated, and then turned into user-friendly, interactive dashboards via Qlik Sense's sophisticated analytics and visualization tools. Through the provision of real-time insights into supply chain operations, these dashboards help stakeholders make well-informed decisions, optimize logistics, estimate demand, and improve the overall responsiveness and efficiency of the supply chain.

4. DATA PREPARATION

4.1 Prepare the Data for Visualisation

Preparing data for visualization is crucial to ensure accuracy, relevance, and clarity in the insights derived. It involves cleaning and structuring the data, removing redundancies, and creating calculated fields that add analytical value. Proper data preparation ensures that the visualizations are based on reliable information, enabling more effective decision-making. It also helps in identifying patterns and trends that might be obscured in raw data, making the final visual representations more intuitive and meaningful for stakeholders.

In preparation for data visualization, several key steps were undertaken to ensure the data was clean, relevant, and structured for analysis.

- First, the two provided datasets were examined: the **DataCoSupplyChain** and the **Tokenized_access_logs** CSV files. Inspection of each table's columns were carried out and necessary changes to optimize the data identified.
- The columns '*Order Zipcode*' and '*Product Description*' from the first table were removed, as these fields were deemed redundant. Following this, associations were performed on the two tables using common columns: '*Product Name*', '*Category*', '*Department*', and '*Date*'.
- Calculated fields added to enhance the dataset's analytical value:
 1. Benefit Margin per Order: Calculated using the formula
$$\text{(Benefit per order/Sales)} * 100.$$

2. Shipment Delay: Calculated as the difference between Scheduled Delivery and Real Delivery dates.

These steps ensured the data was well-prepared for creating insightful visualizations with Qlik Sense.

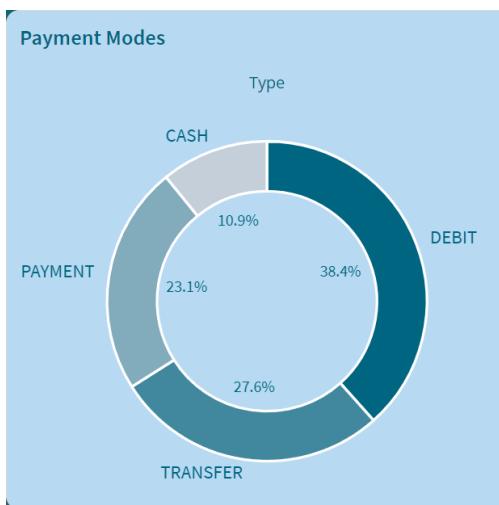
5. DATA VISUALISATION

5.1 Visualisations

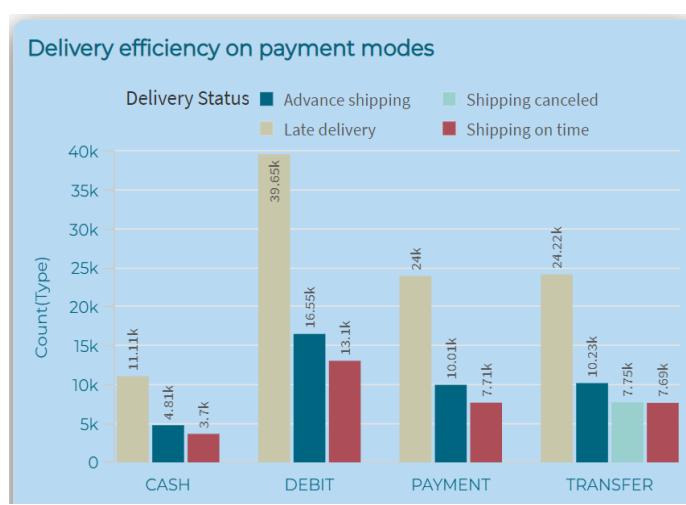
The ability of visualizations to convert complex data into clear, intuitive formats facilitates speedier and more efficient decision-making, which makes them indispensable. In order to facilitate the extraction of actionable insights, they aid in highlighting patterns, trends, and anomalies that may be missed in raw data. Charts, graphs, and dashboards are examples of visual representations that help in communication and collaboration. They enable stakeholders to quickly understand important information and make decisions based on succinct and understandable data presentations. Visualizations essentially fill the knowledge gap between data and interpretation, resulting in more effective and influential analysis.

The following visualisations were performed:

Different Payment Modes



Delivery efficiency on payment modes



Shipment Delay



Top10 regions with late delivery



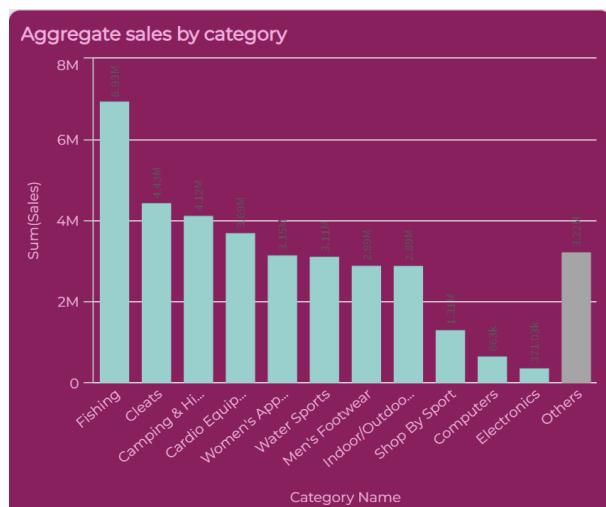
Sales per customer segment



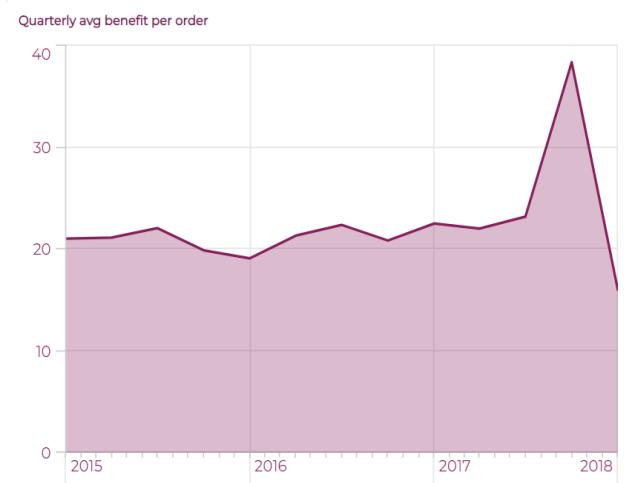
Country-Wise Sales



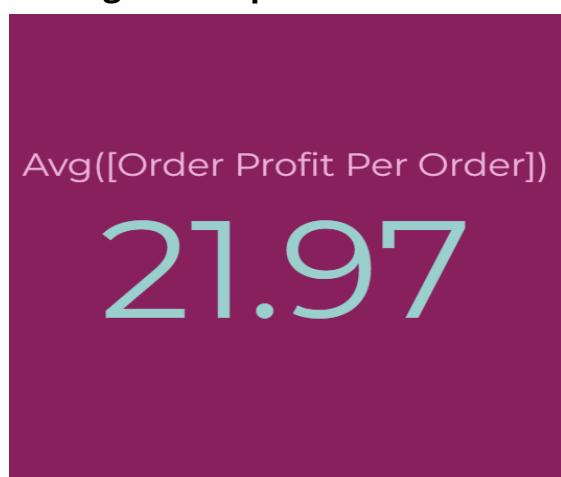
Aggregate Sales by Category



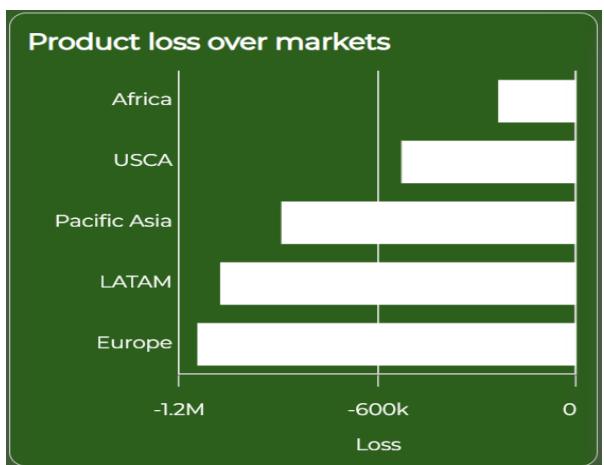
Quarterly Average Benefit per order



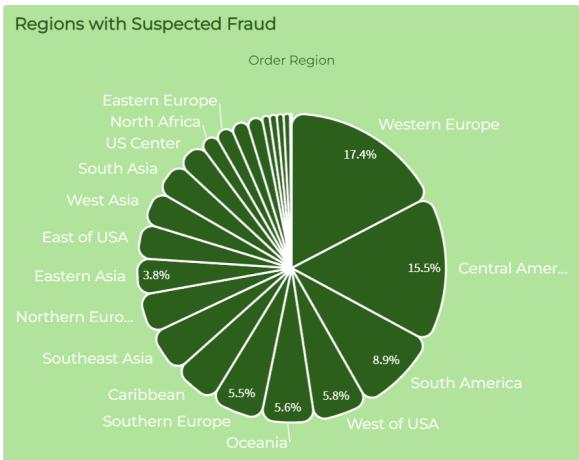
Average Order profit



Product Loss over the markets



Regions with suspected fraud



Top customers causing Fraud

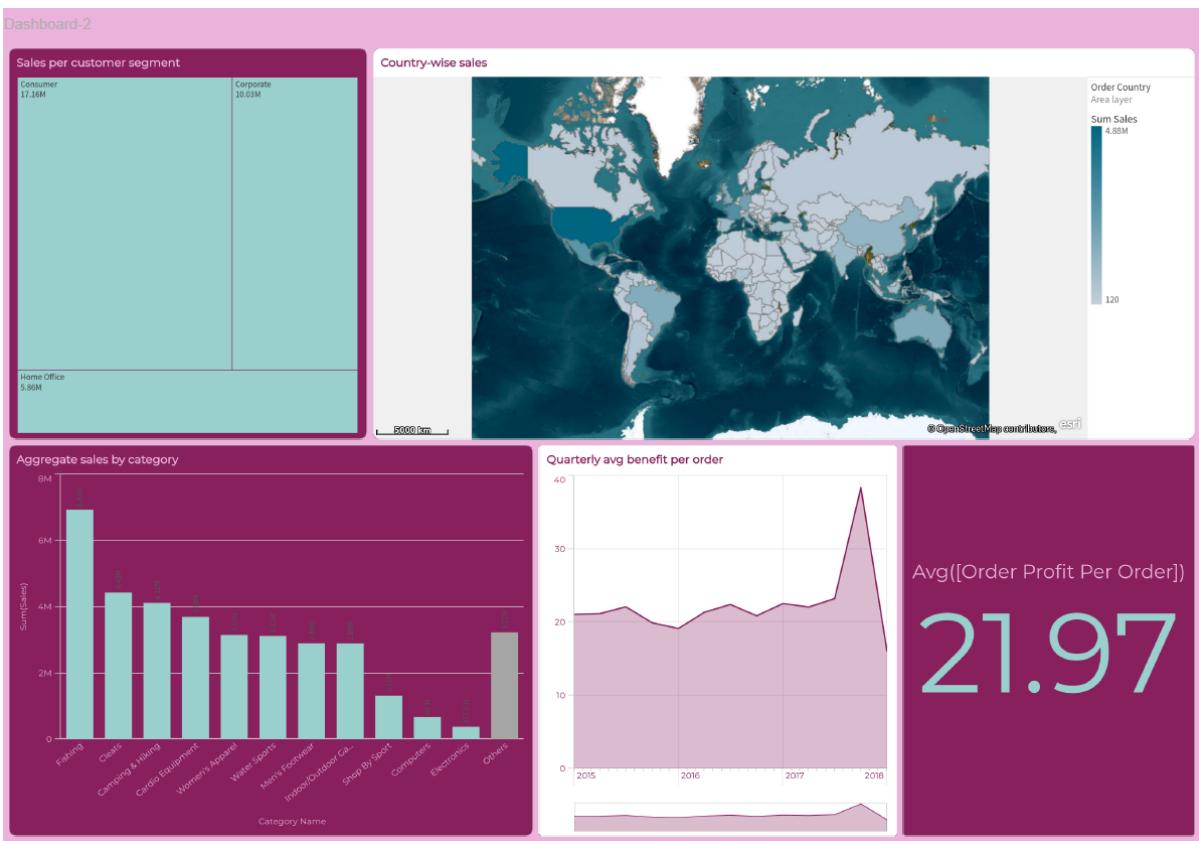


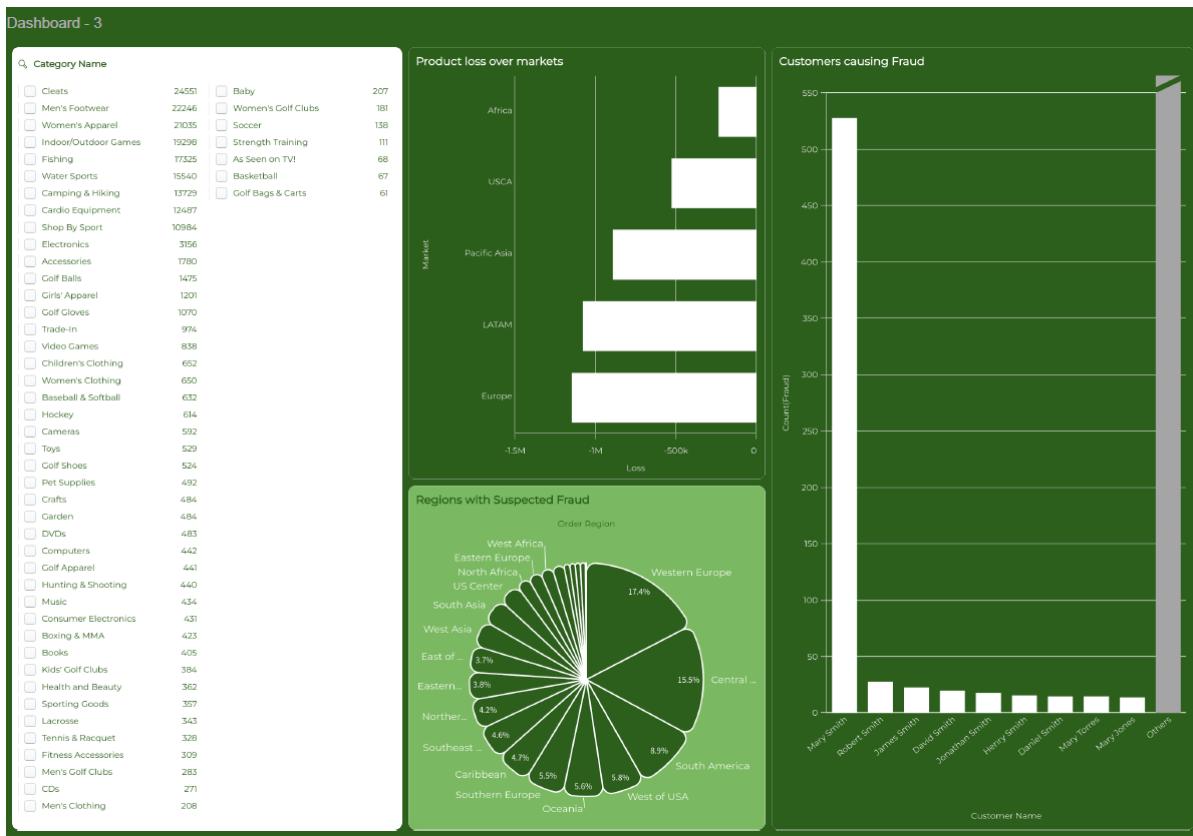
6. DASHBOARD

6.1 Responsive and Design of Dashboard

A dashboard is a single interface that presents important metrics and data points in a visual manner for rapid and simple examination. It gives customers instant insights and a summary of important data, enabling them to effectively track progress, keep an eye on performance, and make data-driven decisions. Dashboards make use of a variety of visual components, including tables, graphs, and charts, to show data in an understandable and user-friendly way that makes it possible for stakeholders to quickly assess results, spot patterns, and identify problems. Dashboards improve visibility and expedite decision-making processes within organizations by centralizing critical data.

The following Dashboards werer created:





7. REPORT

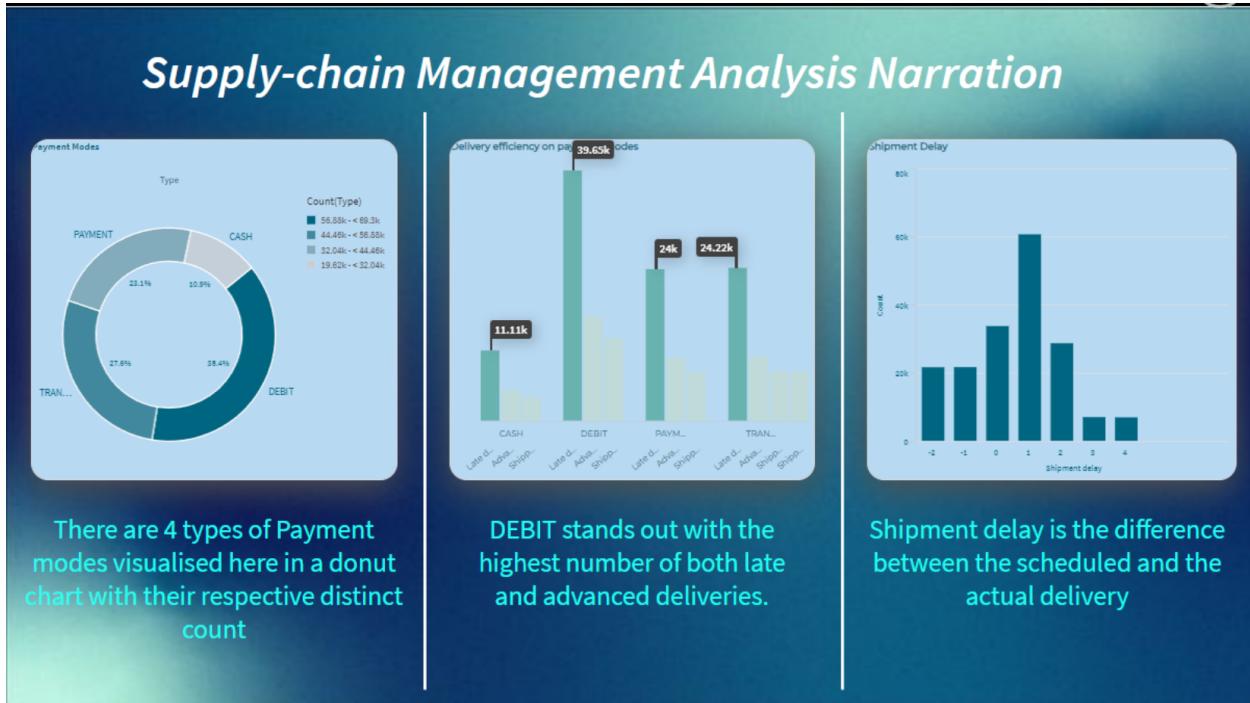
7.1 Report Creation

In Qlik, storytelling entails creating a story around data visualizations to effectively convey insights and influence choices. To produce a coherent narrative, this technique combines interactive dashboards, charts, and graphs with textual descriptions, pictures, and other multimedia components.

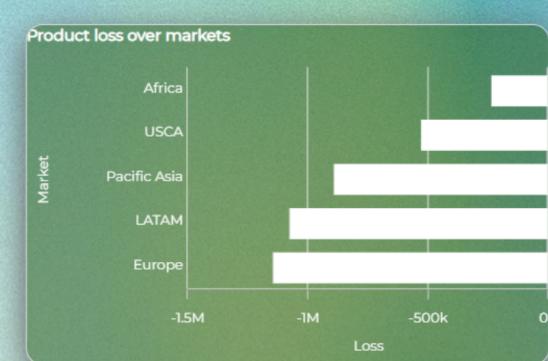
The Qlik "Stories" feature facilitates storytelling by enabling users to take snapshots of data visualizations and organize them in a way that presents the information logically. To emphasize important discoveries, patterns, and relationships, these images can be annotated and paired with more background information.

Users may turn difficult data into engaging narratives that connect with stakeholders by utilizing Qlik's storytelling feature, which makes it simpler to comprehend the significance of the data and the necessary actions. This method improves data

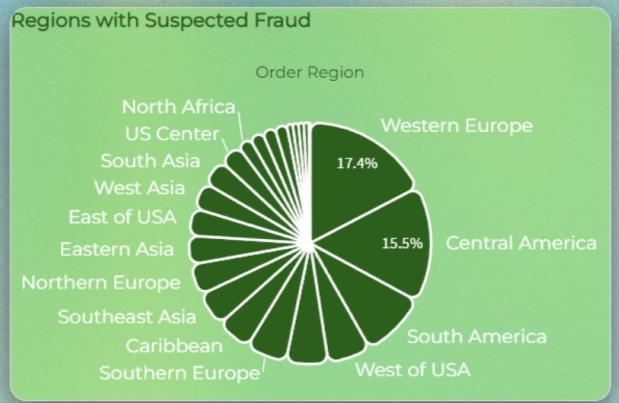
comprehension not just but also fosters engagement and drives strategic initiatives within the organization.



The following sheet presents an analysis of the United States of America, which has the highest sales, amounting to 4.88M.



The benefit per order was observed to determine the product loss over the different markets across the world. One of the reasons for product loss in supply chain management could be Fraud.



Fraud refers to dishonest conduct aimed at obtaining an unfair advantage, resulting in financial loss or damage to the company. Fraud in the supply chain can manifest in various forms and can be perpetrated by different actors, including suppliers, employees, customers, and third-party service providers.

8. PERFORMANCE TESTING

8.1 Amount of Data Rendered

The term "Amount of Data Rendered" describes the amount or volume of data that has been loaded into a database, software program, system, or other data processing or storage environment. It is a gauge of the volume of data that has been effectively processed and made accessible for the system's use, analysis, and manipulation.

DataCoSupplyChainDataset
Type
Days for shipping (real)
Days for shipment (scheduled)
Benefit per order
Sales per customer
Delivery Status
Late_delivery_risk
Category Id
Category Name
Customer City

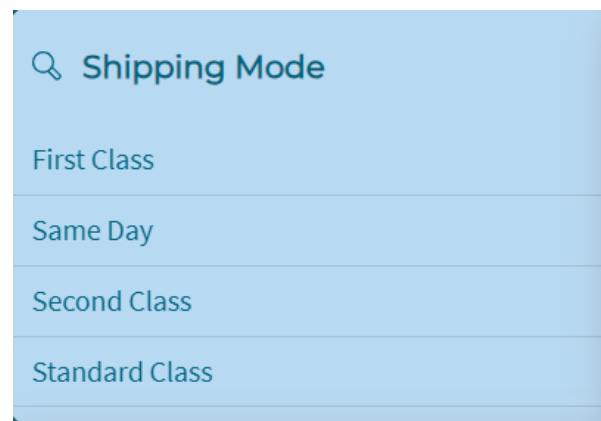
Customer Country
Customer Email
Customer Fname
Customer Id
Customer Lname
Customer Password
Customer Segment
Customer State
Customer Street
Customer Zipcode
Department Id

Department Name	Customer City_GeoInfo
Latitude	Order City_GeoInfo
Longitude	Order Country_GeoInfo
Market	Month
Order City	Hour
Order Country	ip
Order Customer Id	url
order date (DateOrders)	Benefit Margin per order
Order Id	Shipment delay
Order Item Cardprod Id	
Order Item Discount	
Order Item Discount Rate	
Order Item Id	
Order Item Product Price	
Order Item Profit Ratio	
Order Item Quantity	
Sales	
Order Item Total	
Order Profit Per Order	
Order Region	
Order State	
Order Status	
Product Card Id	
Product Category Id	
Product Image	
Product Name	
Product Price	
Product Status	
shipping date (DateOrders)	
Shipping Mode	

8.2 Utilization of Data Filters

The term "Utilization of Filters" describes the practice of using or utilizing filters in a pipeline, software program, or system to extract, alter, or analyze data in a targeted manner according to predetermined standards. Filters are used to focus solely on pertinent data that satisfies predetermined criteria, hence reducing the scope of the data.

In our dashboards 'Shipping mode' and 'Category' name has been used as filters.



A screenshot of a dashboard interface showing a filter section titled 'Category Name'. Below the title is a table listing 20 categories and their corresponding counts. The table is organized into three columns. Each row contains a checkbox, the category name, and its count. A horizontal scrollbar is visible at the bottom of the table.

Category Name				
<input type="checkbox"/> Cleats	24551	<input type="checkbox"/> Trade-In	974	<input type="checkbox"/> Golf...
<input type="checkbox"/> Men's ...	22246	<input type="checkbox"/> Video Ga...	838	<input type="checkbox"/> Hunt...
<input type="checkbox"/> Wome...	21035	<input type="checkbox"/> Children'...	652	<input type="checkbox"/> Musi...
<input type="checkbox"/> Indoor/...	19298	<input type="checkbox"/> Women's...	650	<input type="checkbox"/> Cons...
<input type="checkbox"/> Fishing	17325	<input type="checkbox"/> Baseball ...	632	<input type="checkbox"/> Box...
<input type="checkbox"/> Water ...	15540	<input type="checkbox"/> Hockey	614	<input type="checkbox"/> Book...
<input type="checkbox"/> Campin...	13729	<input type="checkbox"/> Cameras	592	<input type="checkbox"/> Kids'
<input type="checkbox"/> Cardio ...	12487	<input type="checkbox"/> Toys	529	<input type="checkbox"/> Heal...
<input type="checkbox"/> Shop B...	10984	<input type="checkbox"/> Golf Shoes	524	<input type="checkbox"/> Spor...
<input type="checkbox"/> Electroni...	3156	<input type="checkbox"/> Pet Supp...	492	<input type="checkbox"/> Lacro...
<input type="checkbox"/> Accessori...	1780	<input type="checkbox"/> Crafts	484	<input type="checkbox"/> Tenn...
<input type="checkbox"/> Golf Balls	1475	<input type="checkbox"/> Garden	484	<input type="checkbox"/> Fitne...
<input type="checkbox"/> Girls' App...	1201	<input type="checkbox"/> DVDs	483	<input type="checkbox"/> Men'
<input type="checkbox"/> Golf Glov...	1070	<input type="checkbox"/> Compute...	442	<input type="checkbox"/> CDs

8.3 No. of Visualisations

- Different Payment Modes
- Delivery efficiency on payment modes
- Shipment Delay
- Top10 regions with late delivery
- Sales per customer segment
- Country-Wise Sales
- Aggregate Sales by Category
- Quarterly Average Benefit per order
- Average Order profit
- Product Loss over the markets
- Regions with suspected fraud
- Top customers causing Fraud