

Project Report

Data-Driven Innovations In Supply Chain Management

Introduction

This project presents an SCM Dashboard designed to enhance supply chain visibility and decision-making. The interactive dashboard offers three key functionalities:

- **KPI Monitoring:** Track key performance indicators for sales, orders, and profitability.
- **Customer Analysis:** Gain insights into customer behavior, order trends, and product preferences.
- **Product Performance:** Analyze product profitability, sales trends, and shipping efficiency.

This data-driven approach empowers informed decision-making and optimization across the supply chain. Further sections will detail the dashboard's purpose, functionalities, and technical architecture.

The Problem

The current supply chain management system lacks a centralized platform for real-time data visualization and analysis. This hinders access to critical insights needed to optimize sales, inventory management, customer service, and overall supply chain efficiency. Traditional reporting methods can be time-consuming and provide limited data exploration capabilities.

To address this challenge, the project aims to develop an SCM Dashboard that fulfills the following requirements:

- **Data Integration:** Seamlessly integrate with existing data sources within the supply chain management system for real-time data updates.
- **KPIs and Metrics:** Provide a comprehensive set of key performance indicators (KPIs) covering sales, orders, profitability, customer behavior, product performance, and logistics.
- **Interactive Visualizations:** Utilize interactive and user-friendly visualizations like charts, graphs, maps, and heatmaps to present data insights in a clear and actionable format.
- **Drill-Down Capabilities:** Allow users to explore data further by drilling down into specific areas of interest for deeper analysis.
- **Scalability:** Design the dashboard to accommodate future growth and potential integration with additional data sources.

Literature Survey

Research on SCM dashboards highlights their increasing importance in modern supply chain management. Studies by **Managing supply chain performance using a real time Microsoft Power BI dashboard by action design research (ADR) method** (Akter, S., Raihan U., & Dowlatabadi, H., 2018) demonstrate how effective dashboards can improve visibility, enhance decision-making, and optimize logistics processes. **Supply Chain Management 4.0: A Literature Review and Research Framework** (Abdelkafi, N., & Pero, M., 2018) emphasizes the role of data visualization in facilitating communication and collaboration across different supply chain functions.

This project builds upon existing research by developing a comprehensive SCM Dashboard tailored to the specific needs of our organization. The chosen visualizations and functionalities are informed by best practices in data presentation and user experience design for business intelligence dashboards.

Data Collection and Preparation

Data Source: "DataCo SMART SUPPLY CHAIN FOR BIG DATA ANALYSIS" dataset on Kaggle

Tool: Qlik Sense

1. Data Collection

- Download the data file from Kaggle (CSV format expected).

2. Data Loading in Qlik Sense

- In Qlik Sense, create a new app and navigate to the data tab.
- Click "Add Data" and select the downloaded CSV file.
- Qlik Sense will automatically detect the data schema and initiate loading.

3. Data Preparation (by Sheet)

Sheet 1: KPIs

- **Fields:** Identify relevant fields like "OrderID", "OrderDate", "OrderStatus", "Sales", "Profit", "Discount", "Region", "ProductDepartment".
- **Cleaning:** Address missing values and ensure data consistency (e.g., standardize date formats).

- **Calculated Fields:** Create calculated fields for KPIs:
 - Total Orders: Count of distinct "OrderID" values.
 - Total Profit: Sum of "Profit" for all orders.
 - Average Profit Ratio: Average of ("Profit" / "Sales") for all orders.
 - Average Discount Rate: Average of "Discount" across all orders.

Sheet 2: Customers

- **Fields:** Identify relevant fields like "CustomerID", "OrderID", "OrderDate", "OrderStatus", "Sales", "Product", "Quantity", "ShippingCost", "Country".
- **Cleaning:** Address missing values and ensure data consistency.
- **Calculated Fields:** Create calculated fields for KPIs:
 - Average Order Value: Average of "Sales" for all orders per customer (use "CustomerID" as grouping field).
 - Average Profit per Order: Average of "Profit" for all orders per customer (use "CustomerID" as grouping field).
 - Average Order Quantity: Average of "Quantity" for all orders per customer (use "CustomerID" as grouping field).

Sheet 3: Products

- **Fields:** Identify relevant fields like "ProductID", "Product", "Price", "Profit", "ShipDate", "ScheduledShipDate", "ShippingType", "Quantity".
- **Cleaning:** Address missing values and ensure data consistency (e.g., standardize date formats).
- **Calculated Fields:** Create calculated fields for analysis:
 - Profit Ratio per Product: Average of ("Profit" / "Sales") grouped by "ProductID".

Data Visualizations

Sheet 1: KPIs

- **KPIs:** Create KPI objects to display:
 - Total Orders
 - Total Profit
 - Average Profit Ratio (%)
 - Average Discount Rate (%)
- **Pie Charts:**
 - Order Status Breakdown: Pie chart showing the distribution of orders across different statuses (e.g., "Completed", "Pending", "Cancelled") using "OrderStatus" as the dimension.
 - Sales by Market: Pie chart showing the distribution of sales across different markets using "Market" as the dimension.
- **Bar Graphs:**
 - Order Region vs. Sales: Bar chart comparing order volume (number of orders) and total sales across different regions (using "Region" as the dimension).
 - Sales by Department: Bar chart comparing total sales for each product department (using "ProductDepartment" as the dimension).

Sheet 2: Customers

- **Donut Chart:**
 - Best Selling Products: Donut chart showing the top-selling products based on total quantity sold (using "Product" and "Quantity" for calculation).
- **Treemap:**
 - Order Statuses Over Time: Treemap visualizing the distribution of order statuses ("OrderStatus") over time.
- **Map:** Consider two functionalities:
 - Customer Heatmap: Heatmap on a world map showing customer concentration by country.
 - Shipping Routes: Map visualizing shipping routes between origin and destination points for orders.

Sheet 3: Products

- **Scatter Plot:**
 - Product Price vs. Profit Ratio: Scatter plot with "Price" on the Y-axis and the calculated "Profit Ratio per Product" on the X-axis to identify potential pricing strategies based on profitability.
- **Stacked Area Graph:**
 - Real vs. Scheduled Days of Shipment: Stacked area graph comparing "RealShipDate" with the planned "ScheduledShipDate" to identify potential delays or inefficiencies in fulfillment.

- **Line Chart:**
 - Monthly Sales Trend: Line chart showing monthly sales trends over time to inform forecasting and inventory planning.

- **Treemap:**
 - Shipping Type by Quantity: Treemap visualizing the distribution of "ShippingType" used for different quantities of items shipped ("Quantity"). This can help analyze the effectiveness of different shipping methods for various product volumes.

Dashboard

Responsiveness:

- **Device Compatibility:** The dashboard will be designed using Qlik Sense's responsive layout options. This ensures elements automatically adjust and optimize their presentation based on screen size.
- **Sheet-Specific Considerations:**
 - **Sheet 1: KPIs:** Utilize KPI objects and simple charts (pie charts, bar graphs) that scale well on smaller screens. Consider adding drill-down capabilities for KPIs to allow deeper exploration on larger devices.
 - **Sheet 2: Customers:** The donut chart (best-selling products) and heatmap (customer concentration) might require adjustments for optimal viewing on mobile devices. Interactive filtering by country can be employed for focused analysis on smaller screens.
 - **Sheet 3: Products:** The scatter plot (price vs. profit ratio) might require zooming functionalities for detailed exploration on mobile devices. The treemap (shipping type by quantity) can be simplified to display broader categories on smaller screens.

Design:

- **Color Scheme:** A color palette with high contrast will be chosen to ensure readability across all visualizations and devices. Color-blind friendly palettes will be considered for accessibility.
- **Layout and White Space:** Each sheet will maintain a clear and organized layout with sufficient white space between elements. Titles and labels will be concise and easy to understand on all devices.
- **Interactive Elements:** All sheets will incorporate interactive features like hover tooltips to reveal data details on hover and filters to allow users to focus on specific areas of interest.

Performance Testing

Data Rendering Optimization:

- **Data Subsets and Filtering:** Leverage Qlik Sense's filtering capabilities to ensure only relevant data is rendered for each visualization. This minimizes load times and improves dashboard performance, especially on devices with limited resources.
 - **Sheet 1 (KPIs):** Pre-filter the data to display KPIs based on a specific timeframe (e.g., current month, quarter, year) or relevant regions/departments. Users can further refine the view using additional filters provided on the sheet.
 - **Sheet 2 (Customers):** Default view might display top customer segments or a specific geographic region. Users can leverage filters to explore data for individual customers, product categories, or order statuses.
 - **Sheet 3 (Products):** Initially focus on a specific product category or timeframe. Users can explore data for individual products, price ranges, or shipping types using the provided filters.
- **Conditional Formatting:** Implement conditional formatting to highlight critical data points within visualizations. This helps users focus on relevant information without rendering excessive data elements.
- **Visualization Choice:** Select chart types that are efficient in data rendering. Avoid complex visualizations with numerous data points, especially for mobile device viewing. Consider using features like chart summaries or data aggregation for initial overviews.

Data Filter Utilization:

- **Strategic Filter Placement:** Place filters on each sheet in a way that is intuitive and encourages exploration. Consider using a combination of global filters impacting all sheets and sheet-specific filters for focused analysis.
- **Clear Filter Labels:** Ensure filter labels are clear, concise, and easy to understand. Use icons or visual cues to enhance filter usability.
- **Contextual Filter Options:** Provide a range of filtering options relevant to the data displayed on each sheet. This allows users to filter by date ranges, regions, product categories, order statuses, or other relevant dimensions.
- **Interactive Exploration:** Enable users to interact with filters and observe how their selections dynamically update the visualizations across all sheets. This fosters data exploration and discovery of insights.

Conclusion

This documentation has outlined the development process for an SCM Dashboard built with Qlik Sense. The dashboard leverages data from the "DataCo SMART SUPPLY CHAIN FOR BIG DATA ANALYSIS" dataset on Kaggle to provide real-time insights and facilitate data-driven decision-making across various supply chain functions.

The documented functionalities include:

- **KPIs:** Monitor key performance indicators related to sales, orders, and profitability.
- **Customer Analysis:** Gain insights into customer behavior, order trends, and product preferences.
- **Product Performance:** Analyze product profitability, sales trends, and shipping efficiency.

The dashboard prioritizes user experience through:

- **Interactive Visualizations:** Utilize clear and informative charts, graphs, maps, and heatmaps.
- **Responsive Design:** Optimized layout for optimal viewing across various devices.
- **Data Filtering and Exploration:** Empower users to focus on specific areas of interest and discover insights.

By implementing the strategies outlined in this document, the SCM dashboard can serve as a valuable tool for supply chain managers to:

- **Improve Visibility:** Gain real-time insights into key performance metrics across the supply chain.
- **Optimize Decision-Making:** Utilize data-driven analysis to identify areas for improvement and make informed decisions.
- **Drive Efficiency:** Enhance operational efficiency and optimize resource allocation within the supply chain.

This project establishes a foundation for a data-driven approach to supply chain management. As the organization gathers more data and expands its data sources, the dashboard can be further enhanced to incorporate additional functionalities and cater to evolving information needs.

Future Considerations:

- Integration with additional data sources within the supply chain management system.
- Development of predictive analytics capabilities to forecast future trends and potential risks.
- Implementation of drill-down functionalities for deeper analysis within specific data points.

By continuously developing and refining the SCM dashboard, the organization can leverage the power of data visualization and analytics to achieve continuous improvement and gain a competitive edge in its supply chain operations.