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Supply Chain Analytics and Optimization

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Abstract: *This paper presents the design and implementation of a data analytics system for supply chain management and optimization using data visualization and analytical techniques. The system analyzes historical supply chain data, including demand patterns, supplier performance, inventory levels, and logistics operations to improve decision-making. The architecture integrates data collection, preprocessing, transformation, and visualization layers using tools like Microsoft Excel and Power BI. The proposed framework helps organizations optimize inventory, reduce operational costs, enhance delivery efficiency, and improve overall supply chain performance*

Keywords: Supply Chain Analytics, Inventory Optimization, Logistics Management, Demand Forecasting, Power BI, Data Visualization, Business Intelligence

I. INTRODUCTION

In today's competitive business environment, efficient supply chain management plays a crucial role in ensuring customer satisfaction and profitability. Organizations must manage inventory, suppliers, transportation, and demand variability effectively. Traditional methods often fail to provide real-time insights, leading to inefficiencies such as stockouts or overstocking.

II. SYSTEM DESIGN

The system design focuses on building an efficient, modular, and scalable architecture. The overall system is divided into multiple layers, including:

• Data Collection Layer: Responsible for gathering supply chain data from datasets including inventory records, supplier details, order history, and transportation data. The data is stored in structured formats such as Excel or CSV files.

• Data Cleaning Layer: Handles missing values, removes duplicate records, and standardizes data formats for consistency.

• Data Transformation Layer: Converts raw data into structured formats and creates calculated fields such as total rentals per genre, average demand rate, inventory turnover ratio, and time-based aggregations.

• Computation Layer: Processes the transformed data to calculate key performance indicators (KPIs), including: Inventory turnover rate ,Order fulfillment rate ,Average delivery time Supplier efficiency , Demand variability

• Visualization Layer: Displays interactive dashboards using Power BI. Various visualizations such as bar charts, line graphs, pie charts, KPI cards, and slicers are used to represent supply chain performance, trends, and comparisons.

III. METHODOLOGY

Microsoft Excel was used as the primary data source and preprocessing environment. After preprocessing in Excel, the dataset was imported into Power BI where an interactive multi-page dashboard was created. Key performance indicators were visualized using line charts (demand trends over time), bar charts (supplier performance and product category analysis), donut charts (inventory distribution and order status breakdown), scatter plots (delivery time vs. supplier efficiency), and card visuals for headline KPIs. Slicers and filters were implemented for Region, Product Category, Supplier, Order Status, and Time Period, enabling detailed drill-down analysis for end users.

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Fig. 1. Power BI Dashboard Displaying AI Tool Performance

IV. RESULT AND DISCUSSION

The Power BI dashboard provided clear insights into supply chain performance and operational efficiency. High-demand products and high-performing suppliers were identified based on order volume and delivery efficiency, while underperforming products and suppliers were also highlighted. The dashboard enabled comparison across different product categories and suppliers. It also helped in understanding demand trends, delivery patterns, and peak order periods. The visual representation made it easier for users to interpret complex data and analyze inventory utilization, supplier performance, and overall supply chain efficiency effectively.

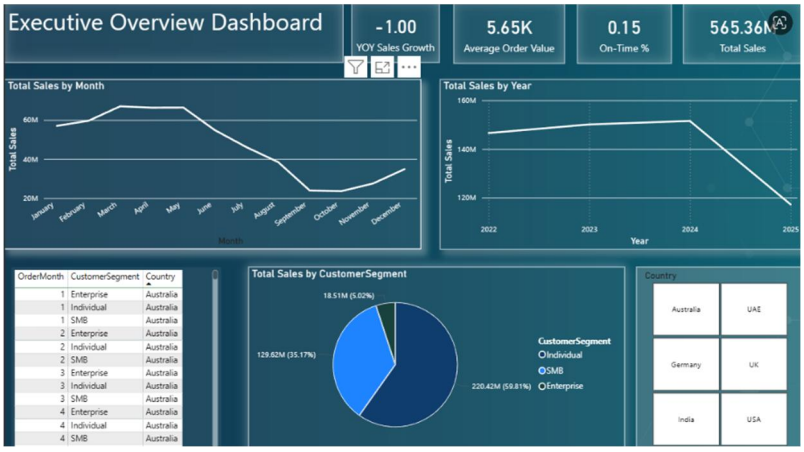

Fig. 2. System Architecture for AI Tool

V. CONCLUSION

This paper demonstrates how Microsoft Excel and Power BI can be effectively used to analyze and optimize supply chain operations. The proposed Supply Chain Analytics Dashboard provides a structured approach for data collection, processing, and visualization.

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