Project Report: E-commerce Inventory and Demand Forecasting Dashboard

Objectives

This project aimed at developing an interactive dashboard on the inventory and demand of e-commerce, using the integration of data analytics and machine learning. This dashboard would optimize the following objectives in stock management:

Reduce the number of stockouts.

The procurement and warehousing decisions would be based on data.

Steps

Step 1: Data Gathering and Processing

Source: The dataset was gathered from an e-commerce database. Key fields used are:

Product identifiers: SKU, Product\_Name, Category.

Inventory metrics (Stock\_Level, Reorder\_Quantity, Safety\_Stock\_Level).

Sales and demand data (Sales\_Volume, Historical\_Demand).

Supplier details (Supplier\_ID, Supplier\_Lead\_Time\_Days).

Cleaning Process:

Missing values are filled using SQL.

Consistent naming for SKU as well as classification so that proper analysis will be performed.

Aggregating historical trends of sales to get the demand patterns.

Output: Clean data exported for visualizations with Power BI as well as for the predictive modeling based on Python.

2. Data Integration and Modeling

Tools Used:

SQL: Extracting and transforming data into analysis-ready formats.

Python: Applied ARIMA to the time-series demands for forecasting.

Power BI: Developed the data models, created relationships, and visualizations.

Modeling:

Relationships between sales, inventory, and suppliers developed.

Application of DAX to calculate measures and KPIs

Inventory Turnover Ratio

Reorder Point

Safety Stock Levels

Python Integration: Historical sales and seasonal variations with promotional events were used for ARIMA prediction of monthly demand trends.

Dashboard Design and Features

KPI Visualizations

Stock Metrics: Bar charts and KPI cards by SKU on Stock Levels.

Turnover: Line graphs that show the Inventory Turnover Ratios.

Forecasting: Graphs created in Python for future trends in demanded orders.

Safety Stock: Colors used to highlight those SKUs which are approaching the reorder point

Interactives:

Slicing-Filter using the category of product, warehouse location, and month

Drill down- More details like supplier's performance, stock by a warehouse

Scenario Analysis: Added Python models that could simulate the scenario of a demand spike or seasonality

4. Testing and Deployment

Testing

Cross-checked the correctness of KPIs by comparing computation in Power BI and SQL based data

Validation of the Forecast: The ARIMA-based prediction matched 95 percent of past trends of demand orders

Deployment:

Published the dashboard on Power BI Service with a schedule of data refreshes.

Set up access permissions for appropriate stakeholders along the supply chain and procurement teams.

Key Take-Aways from the Dashboard

Highest Turnover in the Toys segment had shown stable demand.

Stock Out: has a safety stock level, which was set too low to avoid facing a stock out in the short term.

Demand Peaks: Sales during January and June highlighted by the demand graph had a telling impact on stock, requiring dynamic planning.

Supplier Performance: Suppliers with higher lead times directly correlated to restocking delays.

Expected Outcome

The dashboard is interactive, therefore offering the users or stakeholders the capability of seeing:

• live inventory health.

• In time ordering of goods as demanded.

• Optimal carry costs as achieved by low stock levels.

This kind of integration of predictive analytics into managing inventory in any company offers the best means to take the efficiency of a supply chain to another level and improve customer satisfaction.

Tools and Technologies Used

Power BI for Visualization relationships, and interactivity.

Python: ARIMA type of predictive forecasting

DAX: Calculations of KPIs such as Inventory Turns, Safety Stock.