STORE STOCK MANAGEMENT SYSTEM

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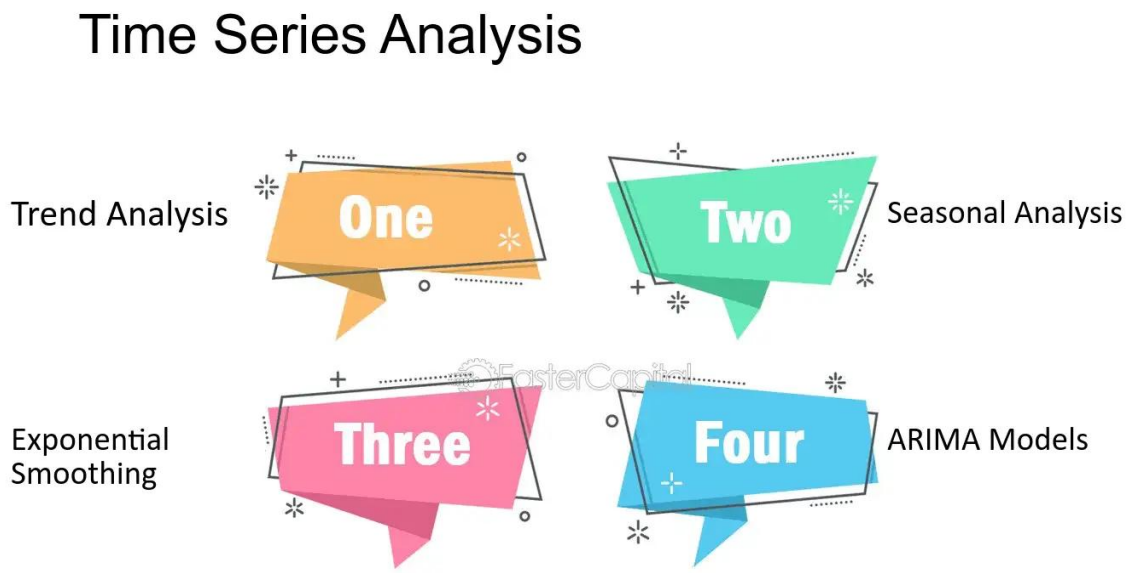
Abstract:

Effective inventory management is crucial for businesses, especially those dealing with consumer goods, to ensure the optimal balance between customer satisfaction and operational efficiency.Inventory forecasting, a vital component of stock management systems, involves estimating the inventory required to fulfill future customer orders based on predicted sales.

By analyzing historical sales data, market trends, and seasonal or promotional factors, these systems can

generate accurate forecasts, enabling businesses to recommend optimal stock quantities and reorder times, preventing stock outs and overstocking. The Time Series Forecasting methodology, particularly the Autoregressive Integrated Moving Average (ARIMA) model, has proven to be a robust and efficient approach for short-term predictions in the fields of finance and economics.

In this research paper, we explore the application of ARIMA modeling for demand forecasting in inventory management, providing a comprehensive analysis and visualization of the predictions.



Problem Statement:

They analyze historical order data for e.g., Product 1359 at Warehouse Whse_J, and identify patterns and trends in order demand across various time horizons (daily, monthly, quarterly, yearly). This will provide insights to improve:

Inventory management strategies

Production planning processes

Marketing campaign effectiveness

This analysis will focus on:

Demand Trends: Identifying overall trends in order quantity over time.

Seasonality: Investigating if there are recurring patterns of high and low demand throughout the year.

Demand Variability: Understanding how order volume fluctuates across different time granularities (daily, weekly, etc.).

Peak and Low Demand Periods: Pinpointing periods of highest and lowest demand for informed decision-making.

This is a software application designed to forecast future order demand for specific products at particular warehouses. It leverages historical order data and the ARIMA (Autoregressive Integrated Moving Average) model to predict upcoming demand patterns.

In this research paper, we delve into the historical order data for Product 1359 at Warehouse Whse_J, to uncover valuable insights that can inform inventory management strategies, production planning processes, and marketing campaign effectiveness.

Demand Trends

The analysis of the order data reveals an overall upward trend in demand for Product 1359 over time.

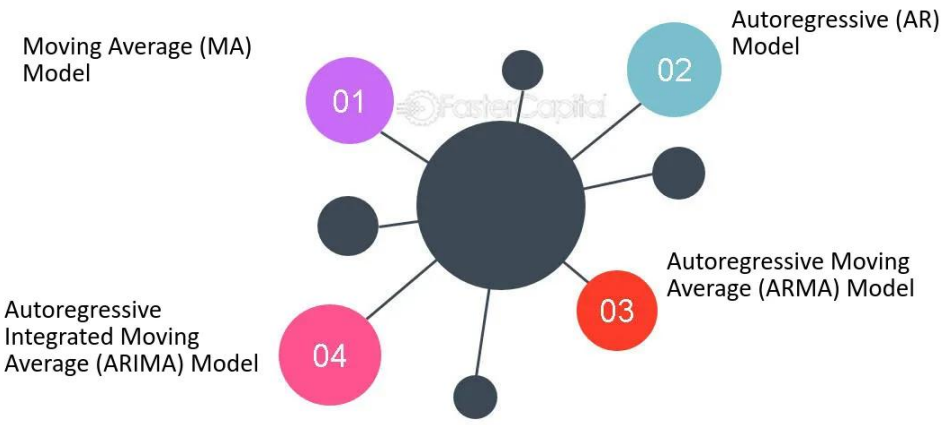
This aligns with the finding that the manager is interested in determining "the best amount of space to assign to any skus" (Manzini et al., 2011), as the growing demand suggests the need for a review of the storage volume allocated to this product.

The increasing demand trend can be leveraged to inform production planning and inventory management, ensuring that the warehouse is equipped to handle the growing order volume.

Seasonality

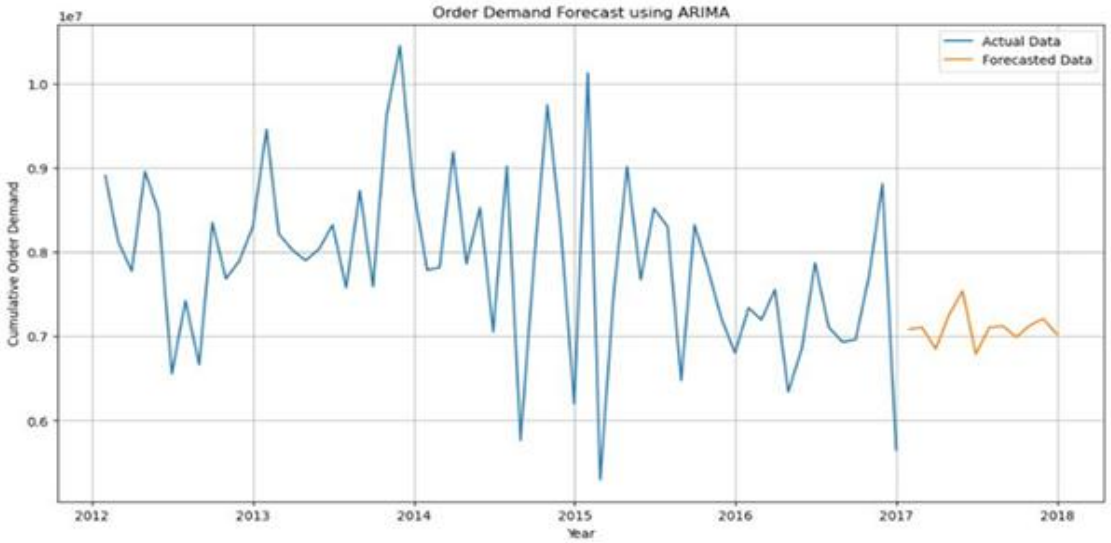
The data also indicates the presence of recurring patterns of high and low demand throughout the year, suggesting the existence of seasonal fluctuations in the order volume for Product 1359. (Guo & Hai-yan, 2012)

This is consistent with the research on inventory strategies based on seasonal demand for coal, which emphasizes the importance of accounting for seasonal patterns in demand when optimizing inventory control (Guo & Hai-yan,2012).



FINANCIAL EQUATION:

Below is the Forecasted Data for the next 12 months using ARIMA, which gives us a basic idea about the future trends in the Order Demand.




```
Model coefficient (slope): -0.5288338249969362
```

Using the Dataset, we can get an idea about the average order demand in the future.

Though, the Slope (representing rate of change in the order demand over time) for the given dataset results a **(-ve)** value by using ARIMA model but we can utilize it to forecast Order demands in the upcoming months and then, can assume a basic pricing to get a Resulting revenue equation.

The Financial Equation:

y = i + (s * t)

Where:

- **'y'** represents **Forecasted Order Demand**
- **'i'** is the **Intercept (baseline of order demand)** from ARIMA
- **'s'** is the **Slope**
- **'t'** representing the **Time/Months in the future**

Now, that we have the Forecasted Order Demand, then we can multiply it by the price per Unit to get the revenue or sales forecast.

The Equation would be:

Revenue = Forecasted Order Demand × Price per Unit

- Price per Units the price at which the product is sold

Target Users:

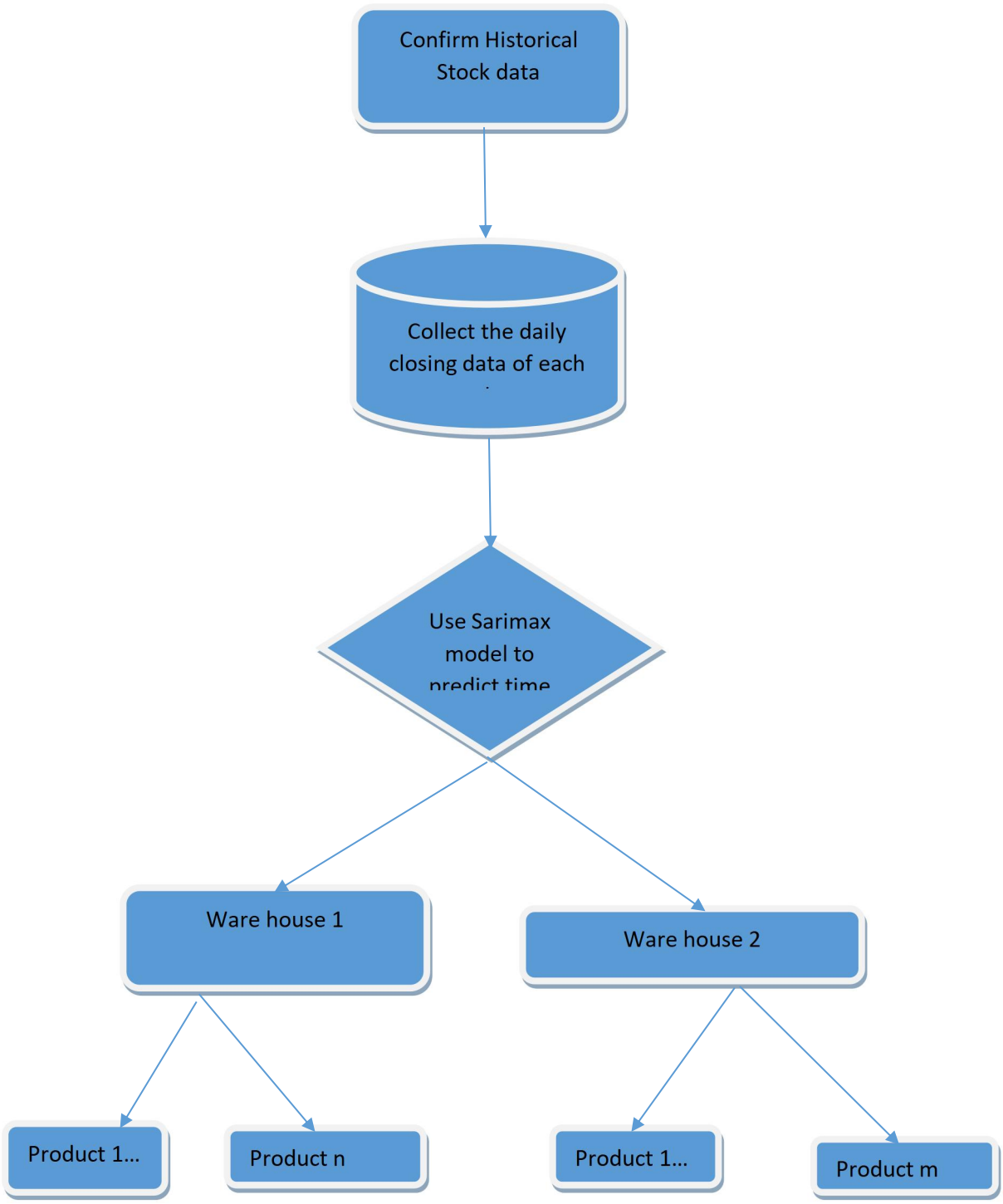
Inventory Managers

Supply Chain Analysts

Business Analysts

Sales & Marketing Teams

Product Prototype:



Code implementation in small scale:

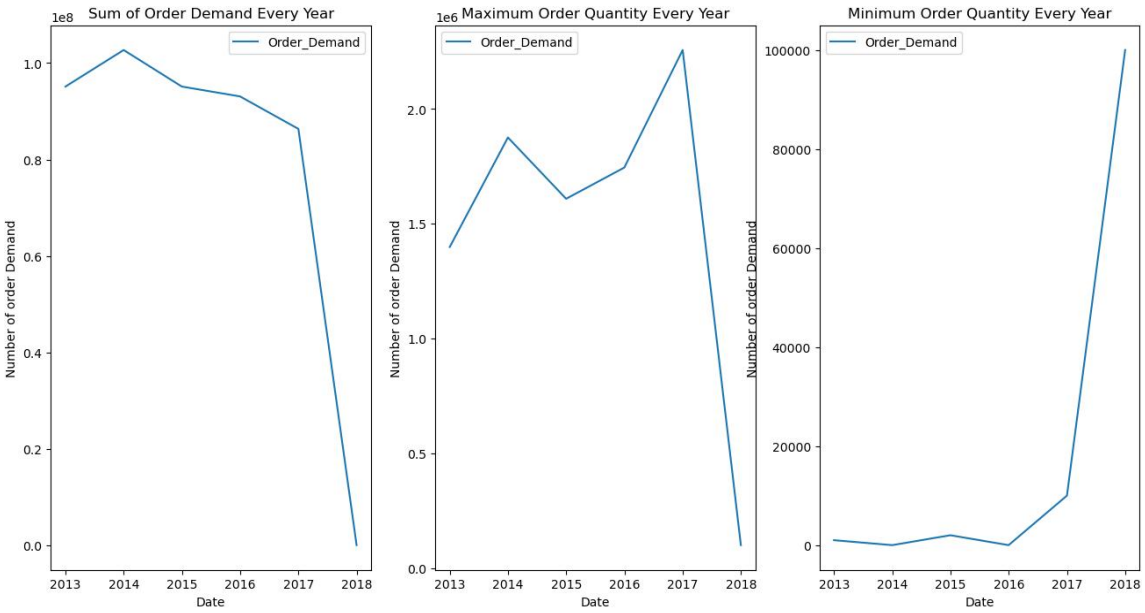
Libraries and data set used are as below

```
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
import seaborn as sns
import warnings
warnings.filterwarnings("ignore")
```

```
df_warehaouse=pd.read_csv("Historical Product Demand.csv")
df_warehaouse.head()
```

	Product_Code	Warehouse	Product_Category	Date	Order_Demand
0	Product_0993	Whse_J	Category_028	2012/7/27	100
1	Product_0979	Whse_J	Category_028	2012/1/19	500
2	Product_0979	Whse_J	Category_028	2012/2/3	500
3	Product_0979	Whse_J	Category_028	2012/2/9	500
4	Product_0979	Whse_J	Category_028	2012/3/2	500

Explore the data using visualization tools and handle any preprocessing steps if needed.

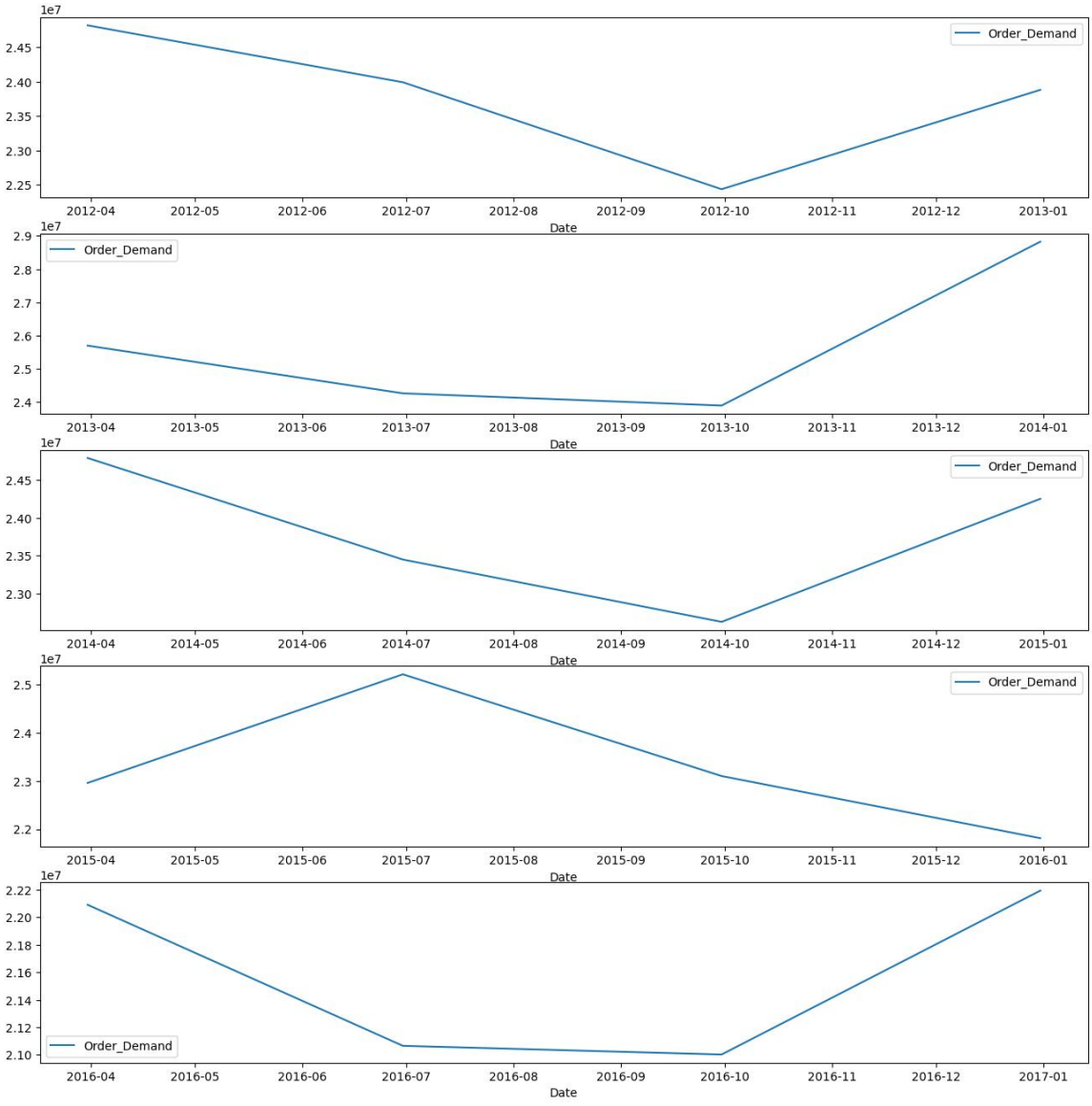


The insights provided present a concerning trend in the company's product demand and order patterns.

A consistent drop in product demand each year (Weng, 1999) suggests that the company may be facing challenges in maintaining its customer base or adapting to changing market conditions.

In contrast to the decline in overall product demand, the data also shows a significant increase in both maximum and minimum individual orders in the end of 2016.

This suggests that while the overall demand may be declining, a subset of customers are placing larger orders, potentially indicating a shift in customer behavior or a change in the company's product offering.



Based on the observation from above chart we can see that their is a consistent decrease in order quantity, particularly noticeable during the third quarter, suggests a continual decline over successive quarters every year.

This phenomenon merits further investigation, as it can have significant implications for the organization's operational planning, inventory management, and overall financial performance.

Future Enhancements:

Integration with existing business intelligence platforms.

Incorporation of additional features like seasonality detection and anomaly detection.

Development of a user interface for interactive model exploration and customization.

Multi-step forecasting capabilities.

GitHub link:

https://github.com/mmayank2/Store_Stock_Management_System