INVENTORY DEMAND FORECASTING FOR A MOTORCYCLE COMPANY

A PROJECT PROPOSAL

presented in partial fulfillment of the course

BUSINESS DATA MANAGEMENT (BSCMS2001)

by

S NITHISH KUMAR – 21F1006725

EXECUTIVE SUMMARY:

This capstone project is focused on optimizing and forecasting the inventory demand for spare parts of a motorcycle company named MR Motors. The objective of the project is to predict the stock demand for each spare part required for the service and maintenance of the motorcycles. The expected outcome of the project is to help the company in purchasing inventory on the basis of understanding from the demand forecasting of the spare parts. This will assist the company in managing the inventory aptly and placing orders for spare parts resourcefully, which in turn optimizes the investment and improves the overall profitability of the company. The existing inventory management system of MR Motors is a software called Auto – Ordering Vector, which places the purchase order for spare parts that are required for the service and maintenance of the motorcycles. The minimum stock count of the spare parts for a specific period of time is fixed in the vector by the supply chain management team of MR Motors. The vector compares the current stock count with the minimum stock count and then places the purchase order based on the difference in the stock of each spare part. The minimum stock count of the spare parts is fixed, which overlooks the varying nature of the stock demand causing problems related to constant stockouts, which may result in huge losses to the company. Therefore, MR Motors need an innovative solution to precisely analyze the stock trends and forecast the demand for spare parts to manage the inventory proficiently.

ORGANIZATION BACKGROUND:

Mr. Mahesh is the MD of MR Motors and a trusted dealer of Royal Enfield Industries. MR Motors is a franchise of Royal Enfield Motorcycle company and is the Mettupalayam branch of Royal Enfield Industries. MR Motors provides marketing and sales front as well as service and maintenance to Royal Enfield motorcycles. MR Motors was founded in 2017 and is a Business to Customer (B2C) type of Business. They streamline the process of booking and delivering the vehicles between Royal Enfield industries and the customers. They also facilitate the exchange of vehicles, bank loans, customer service, and vehicle registration for Royal Enfield motorcycles. The advertisement marketing of MR Motors was initially done with newspaper leaflets, but due to the high cost of the leaflets; MR Motors is competently utilizing social media platforms such as Facebook and Instagram to engage a wider audience. MR Motors been given an average customer service rating of 4.8 out of 5. Royal Enfield, just like Apple, thrives as a unique product in their respective market, due to which there aren't many competitors for MR Motors, as their target audiences are Royal Enfield motorcycle owners only.

PROBLEM STATEMENT:

The major problems encountered by MR Motors during its 6 years of business are associated to Inventory Management and they are as follows:

- The company is facing the problem of either excess or deficit inventory of spare parts at any given time.
- The necessary spare parts or raw materials required for vehicle service aren't available at the right moment.
- The minimum stock count of spare parts isn't updated in the vector automatically; they remain unchanged even when there is a change in the demand for spare parts.
- Investment in dead stock leads to a waste of capital and contributes to the loss of the company.

BACKGROUND OF THE PROBLEM:

Over the past few years, Mr. Mahesh, the MD of MR Motors is not pleased with the investment made in purchasing inventory. The inventory management system of MR Motors is done automatically by the Auto – Ordering Vector, which is a software that places the purchase order for spare parts that are required for the service and maintenance of the motorcycles in frequent intervals. The minimum stock count of the spare parts for a specific period of time is fixed in the vector by the supply chain management team of MR Motors. The minimum stock count of the spare parts is set in the vector as per the expertise of an individual, but it can be misleading and is not the best approach to follow. Hence, it is necessary to optimize the minimum stock count parameter in the vector as the demand for spare parts vary. The accurate prediction of minimum stock count of spare parts will result in a major enhancement in the investment strategy of MR Motors. The precise forecasting of the inventory demand for spare parts will result in reducing the excess or deficit supply of the stocks. This will also benefit in identifying the dead stocks in the inventory. Furthermore, analyzing and forecasting the demand for spare parts will assist in decision – making of the company during the investment in purchasing inventory of spare parts of the motorcycles.

PROBLEM – SOLVING APPROACH:

The problems encountered by MR Motors are concerning stockouts and they are typically recurring. This problem can also be interpreted as inventory demand prediction with respect to time.

- Inventory Demand Forecasting of spare parts of the motorcycles can be approached using machine learning algorithms like regression. There are various regression algorithms and some of them are as follows:
    - Linear Regression
    - Ridge Regression
    - Lasso Regression
    - Decision Tree Regression
    - Logistic Regression
    - Support Vector Machine

The data collected from the organization might not be suitable for further analysis, hence, the data must be preprocessed before model preparation. The Regression model can be trained using a part of the available historic inventory data of spare parts of the motorcycles. Then, the other part of the data can be used to test the trained model in order to assess the goodness of fit and identify the finest model. Therefore, the regression model can be used to best forecast the inventory stock demand of the spare parts. Once we have the predictions and the analysis of the data in our hand, we can make appropriate investment and inventory management decisions concerning the minimum stock count to be entered in the vector. This can reduce the dead stock inventory and thereby decrease the loss of the company.

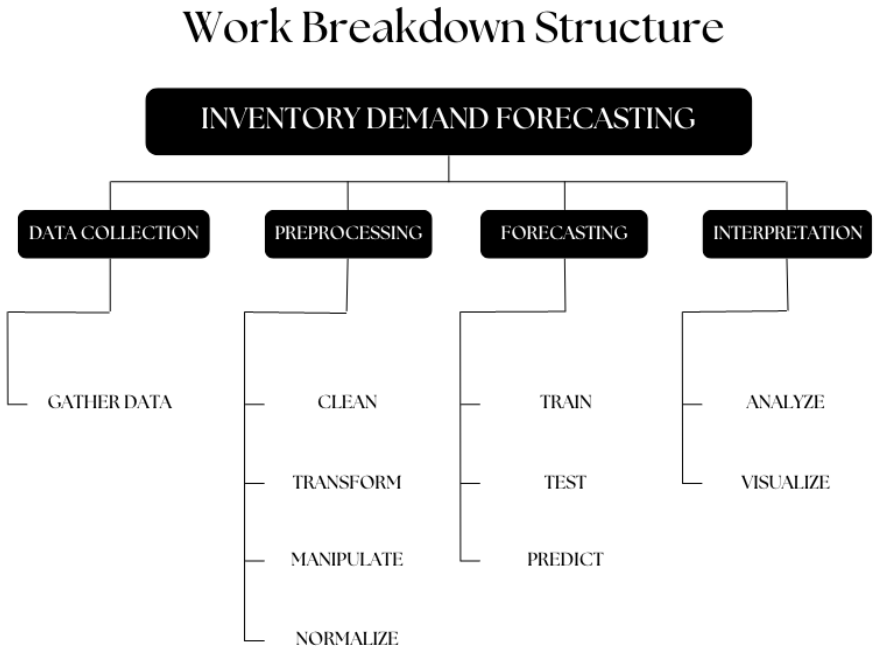
- Inventory Demand Forecasting of spare parts of the motorcycles requires time – series data on stock demand for each spare part accumulated over a period of time. After preprocessing the data, it can be partitioned into training and testing datasets to train and test the Linear Regression models. The features of the dataset must contain the following:
    - Opening Stock
    - Closing Stock
    - Demand

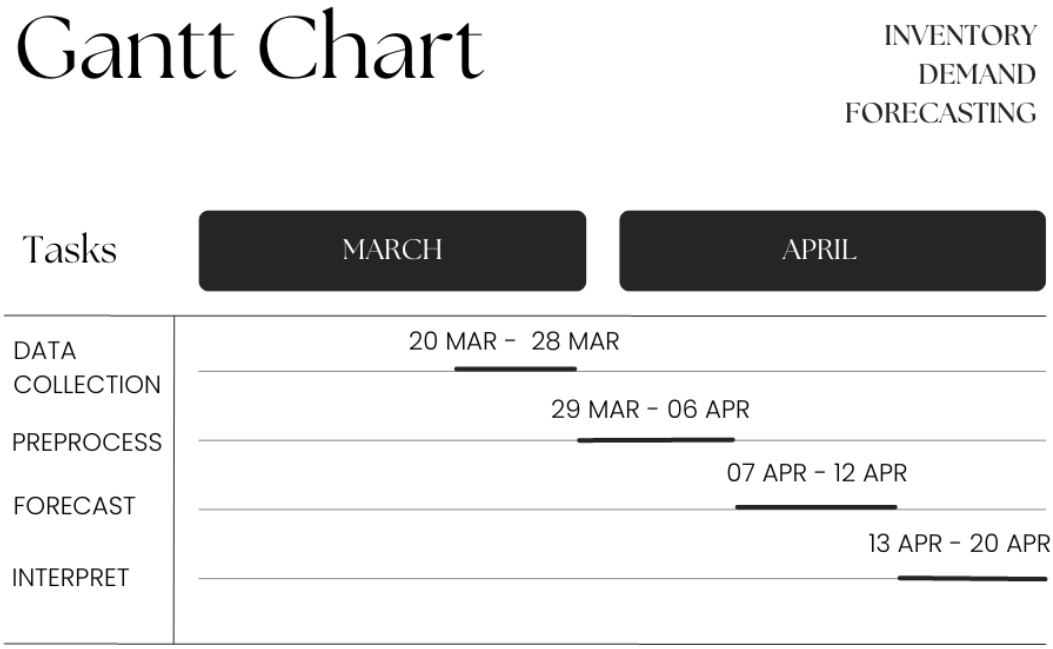
  These are the most important features that are necessary for the prediction of the demand for spare parts. The intended data will be collected from MR Motors. This data will be utilized to train and test the ML model. More the data, better the model.
- Inventory Demand Forecasting of spare parts of the motorcycles requires certain tools in order to carry out the analysis and the prediction of inventory demand for spare parts from the data and they are as follows:
    - Microsoft Excel
    - Google Colab
    - Python libraries
        - Numpy
        - Matplotlib
        - Scipy
        - Sklearn
        - Pandas

  These are the necessary tools that are required to preprocess, forecast, visualize and interpret the data to build an efficient model.

EXPECTED TIMELINE:

The expected timeline of the project can be visualized in terms of the following Work Breakdown Structure (WBS) and Gantt chart





EXPECTED OUTCOME:

The expected outcome of this project is to accurately forecast the demand for spare parts of the motorcycles, which in turn will help Mr. Mahesh to make decisions regarding purchasing inventory and manage inventory systematically and not have to place orders with the intuition of an individual, rather based on the machine learning model, which will optimize the ability of the Auto – Ordering Vector. The integration of the machine learning model with the vector will further enhance the productivity of the software without any human intervention. This project will help the company in purchasing inventory on the basis of understanding from the demand forecasting of spare parts of the motorcycles. Furthermore, the machine learning algorithm will learn the trends in the data and provides dynamic output concerning the demand, unlike the existing system. This will assist the company in managing the inventory properly and placing orders for spare parts efficiently, which in turn optimizes the investment and improves the overall profitability of the company. Thereby, saving a lot of capital and decreasing the chance of stockouts in terms of excess or deficit inventory. Therefore, Mr. Mahesh doesn't have to worry about investment strategy concerning inventory stock demand as the model optimizes and maximizes the profit of the business.