DEMAND FORECASTING IN SUPPLY CHAIN MANAGEMENT USING PREDICTIVE ANALYSIS

AFFILATION
MRS. S. DEEPIKA[1], S. SRIMATHI [2]
MRS. S. DEEPIKA,
ASSISTANT PROFESSOR,
DEPARTMENT OF B. COM BUSINESS ANALYTICS
PSGR KRISNAMMAL COLLEGE FOR WOMEN, COIMBATORE, INDIA.
deepika@psgrkcw.ac.in

S. SRIMATHI,
UG SCHOLAR, B.COM (BUSINESS ANALYTICS),
PSGR KRISHNAMMAL COLLEGE FOR WOMEN, COIMBATORE, INDIA.
srimathi826@gmail.com

ABSTRACT: Demand forecasting is basically the action of prediction or estimation of demand during a particular period of time. The aim of this process is to find the range of demand and to make preparation accordingly. As a result, the organization will be able to lay out their inventory levels. It also helps the organization in making decisions in pricing as well as the expansion process. The process aims to find the relationship between attributes. The algorithm used to find the results are Linear regression and K-Means.

KEY WORDS: Demand forecasting, Decision making, Prediction.

I. INTRODUCTION

Supply chain management (SCM) links a firm with its customers, suppliers and other members of the supply chain system, including transportation and warehousing companies.[5] Supply chain management (SCM) has been considered as the most popular operations strategy for improving organizational competitiveness in the twenty-first century.[1] Demand forecasting is basically the action of prediction or estimation of demand during a particular period of time. Presenting products with a shorter life cycle, intense competition among enterprises and the highest level of customer satisfaction, have forced organisations to invest more on their supply chain. The goal of supply chain management is for members in the organisations to work together and build a partnership with each other to increase the competitive advantage of the supply chain as a whole. [9] The process of finding the range with the help of given data. The basic aim of this process is to find the relationship of variables to find the demand. It can also be classified on the basis of time i.e.; the demand can keep changing and it can be classified on the basis of time. The process is to find the demand by comparing two related variables. The attribute selected are quantity of items sold during the given year and the estimated period of time for manufacturing the good. The comparison done during the usage of Linear Regression algorithm is to find the relationship between quantity sold and estimated time of manufacturing. The entire process is performed in the tool Python. Python is one of the tools that has a lot of algorithms to deal with. Linear regression and K-Means are 2 algorithms that are being used. Linear regression is to find the relationship between quantity sold and estimated time of manufacturing and K-Means is to cluster the same products having similar range of demand. The final results would help any organizations to make decisions in inventory planning, pricing of the product, expansion of business, etc.

II. REVIEW OF LITRATURE

Over the last decade, supply chain management (SCM) has been studied extensively, and its importance to practitioners and academics has received a high level of recognition. However, despite major investments in SCM and supply chain integration (SCI), recent surveys indicate that businesses are struggling to achieve competitive advantage due to SCI. While there is enormous information on SCM, little is known about the supply chain management integration (SCMI) problems and possible solutions that could be identified. [7].

Thus, the purpose of this paper is to examine the existing research in an effort to understand the concept of "supply chain management." Various definitions of SCM and "supply chain" are reviewed, categorized, and synthesized. Definitions of supporting constructs of SCM and a framework are then offered to establish a consistent means to conceptualize SCM. [6].

Increasingly, supply chain management is being recognized as the management of key business processes across the network of organizations that comprise the supply chain. While many have recognized the benefits of a process approach to managing the business and the supply chain, most are vague about what processes are to be considered, what sub-processes and activities are contained in each process, and how the processes interact with each other and with the traditional functional silos. [4].

A management construct cannot be used effectively by practitioners and researchers if a common agreement on its definition is lacking. Such is the case with the term "supply chain management"—so many definitions are used that there is little consensus on what it means.[8].

An accurate analysis of the supply chain serves several purposes and is more a continuous task than one-time effort. In today's fast changing business environment, although a supply chain partnership is intended for a longer duration, supply chains keep evolving and changing to accommodate best to the customers' needs. In the beginning or when a specific supply chain is analysed for the first time in its entirety the result can be used as a starting point for improvement processes as well as a benchmark for further analyses. While the initial analysis itself often helps to identify potentials and opportunities it may well be used for target-setting.[3].

"Demand analysis" refers largely to the study of commodity demands by consumers, most usually based on aggregate data but occasionally, and more so recently, on cross-sections or even panels of households.[2]

III. METHODOLOGY

ALGORITHM 1:

LINEAR REGRESSION

A linear regression is an algorithm, that is used to find the relationship of attributes, as the word linearity means. The relationship that is graphically represented. In Linear regression algorithm, by using the attributes: quantity sold and estimated time of manufacturing, the result is if the two variables represent the proportion of variance in the dependent variable. With the help of "R-squared value". The graphs explain the relationship between these selected variables. The KDE graphs represent the distribution of a numeric variable.

ALGORITHM 2:

K-MEANS

By using the k-means algorithm, with the attributes: quantity sold and estimated time of manufacturing, the result is 3 types of clusters based on the demand of the particular product. In the elbow graph, the number of clusters are found. The demand analysis graph shows the different clusters. Each cluster showing the different kind of demand of the particular products. Namely, high demand, moderate demand and low demand.

WORKFLOW:

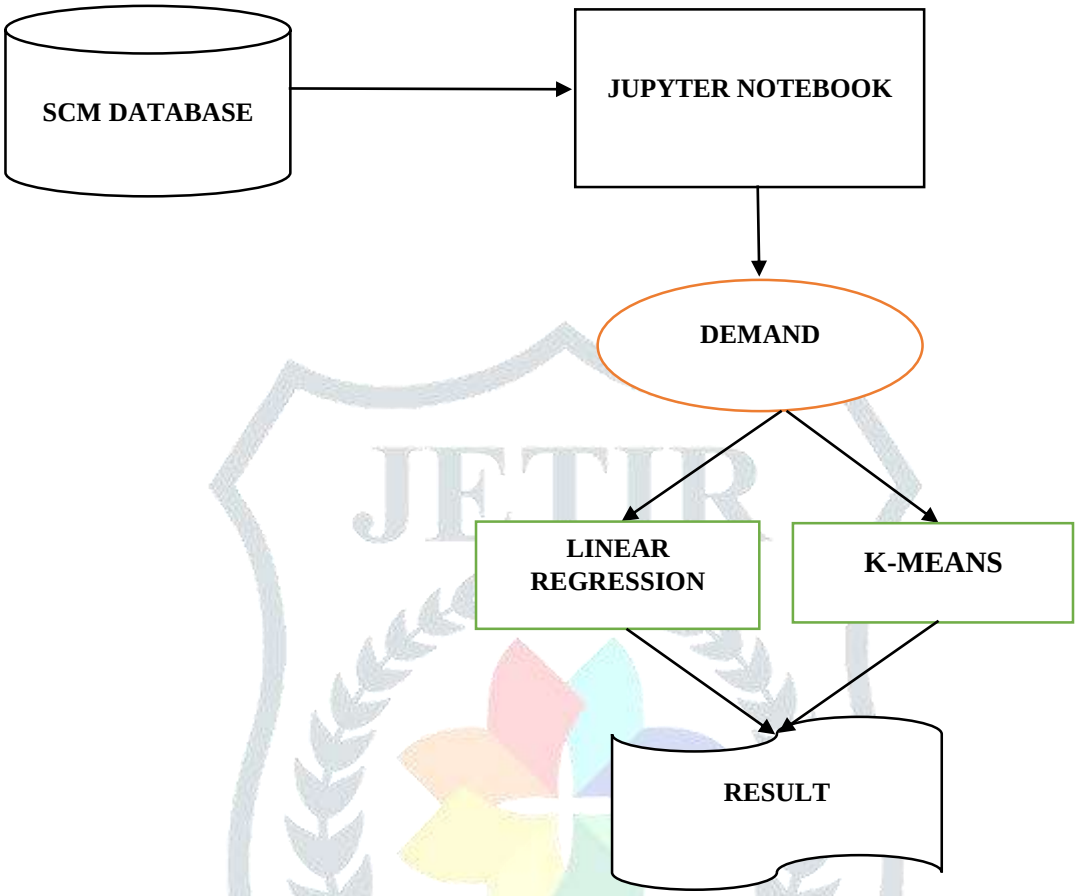

Fig 3.1: Workflow of the process

The above diagram represents the workflow starting from the database to using the algorithms and showing the appropriate results. Hence, the concept of demand is being analyzed for future forecasting. The relationship as well as the clustering are being performed. The tool used is python in jupyter notebook. The algorithms used are Linear Regression and K-Means.

IV. RESULT

ALGORITHM 1:

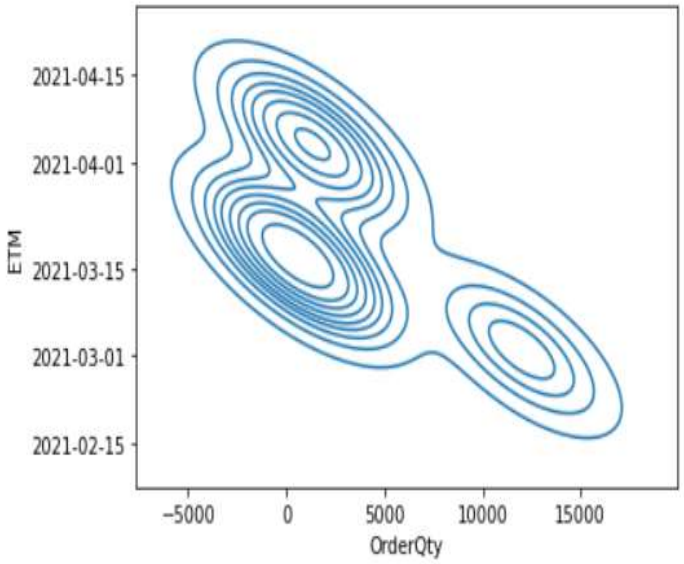

Fig 4.1: KDE Graph

The above KDE graph represents the quantity sold in the x-axis and estimated time of manufacturing in the y-axis. This is to visualizing the distribution of observations in a dataset.

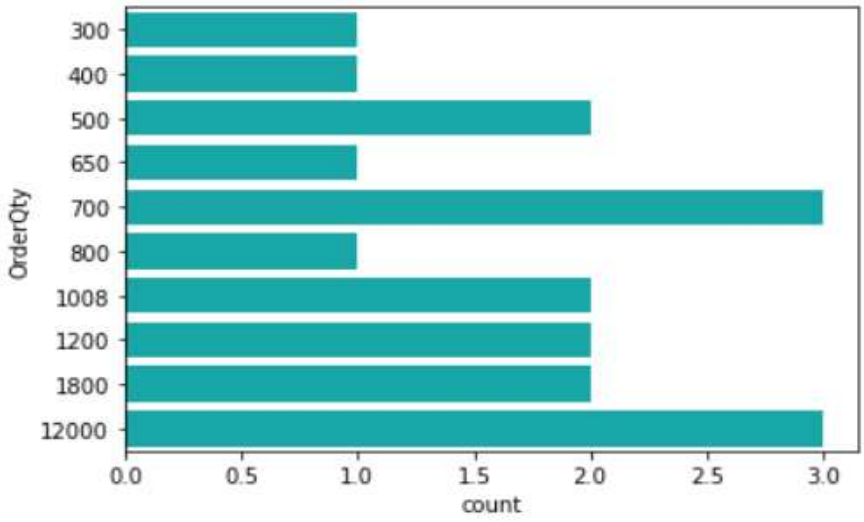

Fig 4.2: Bar plot

The order quantity has been taken at y axis and it shows the increase and decrease in the attribute it helped to predict the upcoming years.

ALGORITHM 2:

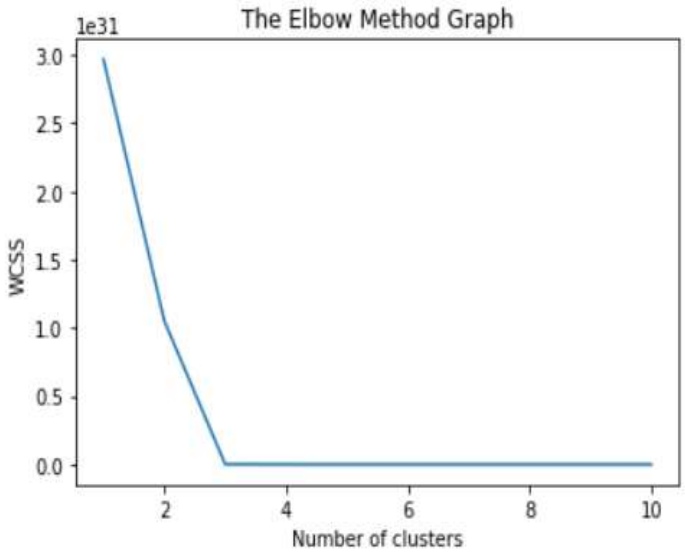

Fig 4.3: Elbow Method Graph

The above elbow graph represents the no. of clusters that would be displayed. By using the attributes: quantity sold and estimated time of manufacture, there is a possibility of forming 3 clusters. The different clusters are found by the estimated time of manufacturing. Each of the clusters represent different period of time. The different cluster's centroids are found in the graph by using the estimated time of manufacture.

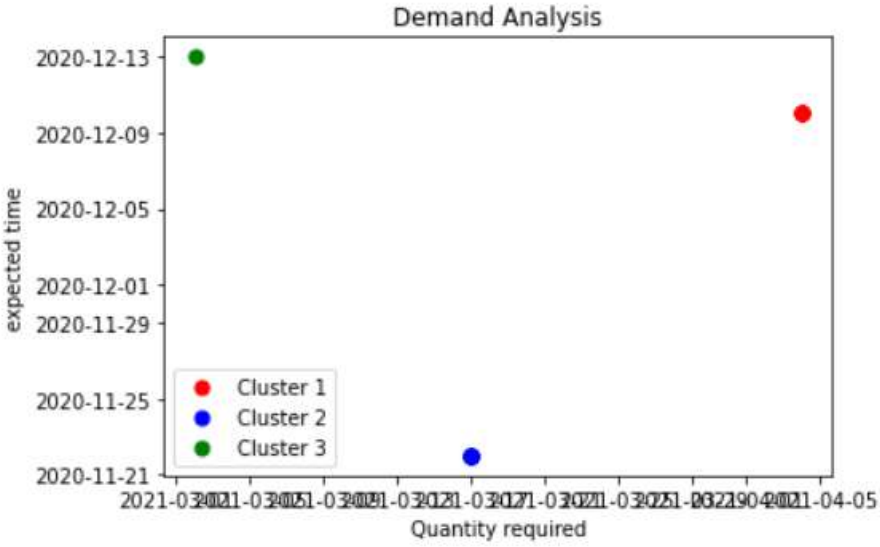

Fig 4.4: Scatter Graph

This scatter graph represents the demand analysis by representing the quantity sold and estimated time of manufacturing. There are 3 different clusters represented according to the elbow graph.

FINDINGS

- The value of order quantity has been fluctuating, so in the future it might range from 2.5 to 3.5.
- As the elbow graph shows the number of clusters found. The future demand can be analysed by the clusters that are found from the K-Means algorithm.

V. CONCLUSION

This paper represents the patterns of the demand of the particular product, by estimating the demand using the Quantity of goods sold and estimated time of manufacturing. In the Linear Regression algorithm, the relationship of the above-mentioned attributes is being analyzed, and the result is if the two variables represent the proportion of variance in the dependent variable. With the help of "R-squared value". The graphs explain the relationship between these selected variables. By using the k-means algorithm, the result is 3 types of clusters based on the demand of the particular product. Thus, this paper explains the demand patterns and it will help the organizations in decision making and other aspects like pricing and expansion of business, etc.

FURTHER WORK:

The further work can be of to find the exact values of the demand of the upcoming year. The result could show the exact range of demand. It lays a strong foundation for great predictions for business expansion and for preparing an organization's long-term goals.

REFERENCES

[1] Angappa Gunasekaran, Kee-hung Lai, TC Edwin Cheng Omega *36 (4), 549-564, 2008*

[2] lAngusDeaton*, Princeton University. Name of the book: Hand book of Econometrics. Chapter 30: Demand Analysis

[3] Christopher S¨urie and Michael Wagner ,1. Department of Production & Supply Chain Management, Darmstadt University of Technology, Darmstadt, Germany. 2. Corporate Materials Management, Paul Hartmann AG, Heidenheim, Germany. Name of the book: Supply Chain Management and Advanced Planning.

[4] Croxton, Keely L.; García-Dastugue, Sebastián J.; Lambert, Douglas M.; Rogers, Dale S. **Source:** The International Journal of Logistics Management, Volume 12, Number 2, 2001, pp. 13-36(24). **DOI:** https://doi.org/10.1108/09574090110806271

[5] Handfield, R.B., & Nichols, E.L. Jr. (2002). Supply chain redesign - transforming supply chains into integrated value systems. New Jersey: Prentice-Hall.

[6] John T. Mentzer , William DeWitt , James S. Keebler, Soonhong Min, Nancy W. Nix , Carlo D. Smith , Zach G. Zacharia. Name of the book: Defining Supply Chain Management. First published: 10 May 2011.

[7] Kabossa A.B. Msimangira (Northern Melbourne Institute of TAFE, Australia), Sitalakshmi Venkatraman (Northern Melbourne Institute of TAFE, Australia) Name of the Article: Supply Chain Management Integration: Critical Problems and Solutions. DOI: http://doi.org/10.31387/oscm0160101

[8] Martin Christopher, Emeritus Professor of Marketing and Logistics, Centre for Logistics and supply chain, Management Cranfield University, UK. Name of the book: Logistics and Supply chain Management. Pearson UK, 24-Mar-2016 - Business & Economics

[9] Mentzer, J.T., DeWitt, W., Keebler, J.S., Min, S., Nix, N.W., Smith, C.D., & Zacharia, Z.G. (2001). Defining supply chain management. Journal of Business Logistics, 22 (2), pp. 1-25.