

Review on Balanced Supply Chain for Better Prediction in Demand

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Abstract

Using artificial intelligence (AI) and machine learning to improve demand forecasting is one of the most promising applications of AI for supply chains. The technology “learns” from past experience and can analyze the multitude of complex relationships and factors that influence product demand. This paper discusses various methodologies involved in supply chain management. AI can source and process data from many different areas and forecast future demand based on external factors. This feeds into supply and demand planning and product development. The overall objective of this project was to examine how AI could be applied to SCM and what benefits this could enclose. By interviewing people working with SCM, problems within the area and desired solutions could be mapped.

Keywords: Supply chain Management, Demand Forecasting, Artificial Intelligence

I. INTRODUCTION

Demand forecasting forms an essential component of the supply chain process. It's the driver for almost all supply chain related decisions. While demand forecasting is undeniably important, it's also one of the most difficult aspects of supply chain planning.

Demand is often volatile making demand forecasting both an art and a science.

Demand Forecasting defined as the process by which the historical sales data are used to develop

an estimate of the expected forecast of customer demand. Demand Forecasting provides an estimate of the of goods and services that customers will purchase in the foreseeable future.

Forecasts of future demand are essential for supply chain management decisions.

Demand forecasts are used in supply chain design, planning as well as in operations.

Demand forecasts are used in various subcomponents of supply chain.

Production: for aggregate planning, inventory control and scheduling,

Marketing: for new product introductions, promotions, and sales-force allocation

Finance: Plant and equipment investment decisions, operating budgeting

Personnel: Workforce planning and resulting hiring and layoff.

Supply Chain Management will be the coordinating point for making alignment corporate strategy with SCM strategy and responsible for implementing the strategy within and outside the organization. In the proposed model, the actions are designed as service requirement rather than piece meal basis. Marketing department, for example, will ask for services which is not limited to implementation of forecast but other value adding (VA) job for supply chain such as coordination of product launching (sourcing to delivery to warehouse), Strategic stock build up etc.

Artificial intelligence delivers several benefits for SCM:

- Data analysis and insight creates actionable business intelligence that drives continual improvement.
- Speed is enhanced throughout the supply chain due to much more efficient supply and demand planning, driven by marketplace factors, consumer needs and other environmental changes.
- Logistics is improved due to optimized warehouse operations and distribution.

- Costs are reduced due to savings in reduced inventory and storage costs, goods being processed more quickly and faster distribution

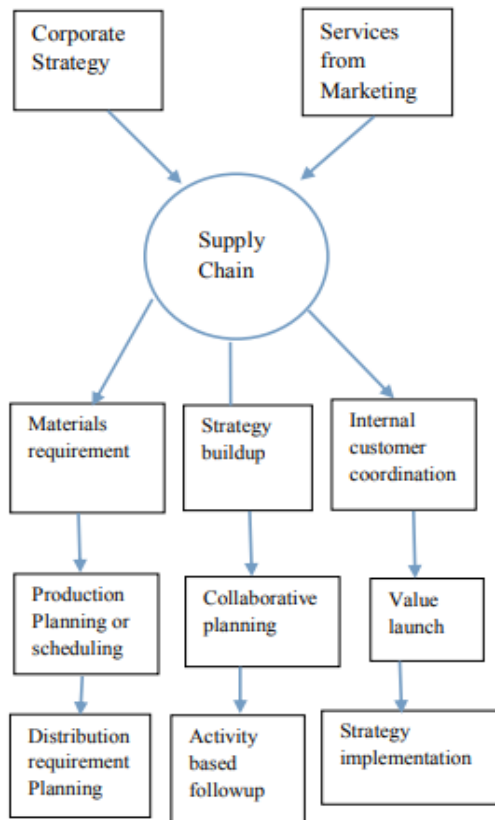


Figure 1: forecasting management model

One area of AI’s potential application that has not yet been fully explored is the emerging management philosophy of SCM, which requires the comprehension of complex, interrelated decision-making processes and the creation of intelligent knowledge bases crucial for joint problem-solving. For example, Eastman Kodak once structured the thinking processes of experienced order pickers and then developed a rule-based expert system to select the optimal order-picking path in a warehouse.

Also, in an effort to synchronise a series of interrelated but different stages of joint demand planning and forecasting processes in the SC, proposed an agent-based forecasting system that has the capability to predict end customer demand through information exchange among multiple SC partners and

learn from the past forecasting experience. As illustrated by these examples, some sub-fields of AI such as expert systems and agent-based systems can be useful for dealing with various aspects (e.g., warehousing, joint demand planning, inventory control) of the SC.

II. LITERATURE REVIEW

[1] This article explains the evolution of marketing management from traditional CRM to analytical CRM to digital CRM. Based on the characteristics of digital CRM, we discussed the new trend and application of CRM.

One of the important trends of marketing management is digitization. The concept of digitization has been imported to many fields and is well known to everyone. However, because of the limitation of digitization’s meaning and expansion, companies have different understandings of it. The meaning of the digital CRM is a digital customer experience that is specially built and customer-oriented. It is a business reform that improves value creation. Current companies not only focus on the effects brought by technologies, but also focus on how the digital business mode makes profits.

[2] The researcher utilized secondary data, including digital libraries, online databases, journals, conference papers, etc. to review SCM research papers in different aspects. This exploratory study reveals the evolution of SCM in various industries, including manufacturing and service industries, and its future trends. This paper highlights chronological prospective of SCM in terms of time frame in different areas of manufacturing and service industries. There are several attempts made by researchers and practitioners to appropriately define SCM. Amidst fierce competition in all industries, SCM has gradually been embraced as a proven managerial approach to achieving sustainable profits and growth. This is accomplished primarily by focusing on the whole SCM process to deliver the right products or services

[3] In this paper, we describe the demand management process in detail to show how it can be implemented within a company and managed across firms in the supply chain. We examine the activities of each sub-

process; evaluate the interfaces with corporate functions, processes and firms; and provide examples of successful implementation. Demand management is the supply chain management process that balances the customers' requirements with the capabilities of the supply chain. With the right process in place, management can match supply with demand proactively and execute the plan with minimal disruptions. The process is not limited to forecasting. It includes synchronizing supply and demand, increasing flexibility, and reducing variability.

[4] Effective supply chain management is a critical component of any company's ability to meet consumer demand. Disruptions to the supply chain disturb the normal flow of goods and materials and, as a consequence, expose firms to operational and financial risks. *Managing Supply Chain Risk and Vulnerability*, a book that both practitioners and students can use to better understand and manage supply chain risk, presents topics on decision making related to supply chain risk

III. METHODOLOGYIES SURVEYED

Forecasting Methods

Forecasting methods fall into four categories

1. Qualitative: The forecasts are based on the human judgement and opinion. Market research falls in this category.
2. Time Series: These methods use historical demand data of an item.
3. Causal: Causal forecasting uses data of multiple variable to forecast demand of an item.
4. Simulation: Simulation methods use what if questions and come out with forecasts. The underlying models for whatif analysis are time series or causal models. Even a hybrid model can be used for simulation.

When quantitative methods are used for forecast, the effort is to isolate systematic component and random component using the available data. The systematic component gives the expected value and the variation around the expected value happens in the future periods due to the random component.

Static and Adaptive Methods of Forecasting

In a static method, a single forecasting model is applied to the currently available data to derive forecasts for all the future periods for which forecasts are to be generated. In adaptive methods, as new data arrives, the new data is incorporated into the forecasting model to derive forecasts for future periods from then on.

Time series methods: In static methods, estimates of level, trend, and seasonal factor are derived using the past data. These three factors give the forecast of the systematic component for future periods.

Adaptive methods: Moving average is an adaptive method. Exponential smoothing is also an adaptive method. Holt model is trend-corrected exponential smoothing model. Winter's model is a trend- and seasonality corrected exponential smoothing model.

Measures of Forecast Errors: An estimate of the forecast error is to be given along with the forecast of an expected value. As actual values are realized, a forecast error can be calculated and managers perform error analysis to satisfy themselves that the current forecasting method is accurately predicting the systematic component of demand. Contingency plans have to be put in place to account for the predicted forecast error.

AI is known for its ability to think like humans, act like humans, think rationally, and act rationally. Thus, with respect to these distinctive features, AI can be further classified into a number of sub-fields: (1) artificial neural networks (ANN) and rough set theory ("thinking humanly"); (2) machine learning, expert systems, and GAs ("acting humanly"); (3) fuzzy logic ("thinking rationally"); and (4) agent-based systems ("acting rationally"). These sub-fields are discussed below.

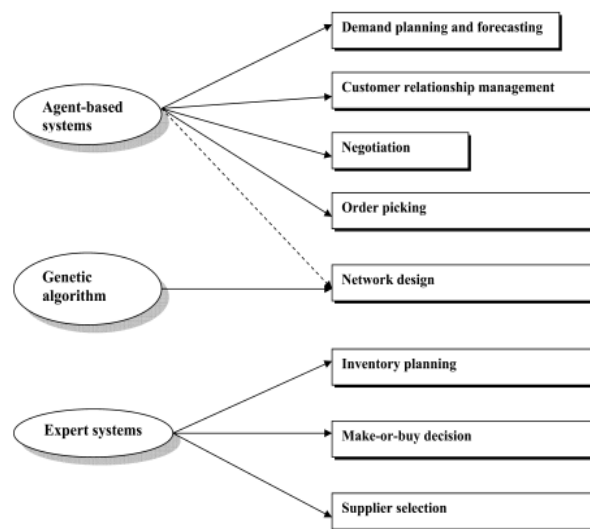


Figure 2. Link between popular AI tools and their SCM applications areas.

IV. CONCLUSION

The practice of forecasting in the mentioned is limited though there are enormous opportunities to use this managerial technique along with the SCM strategy. Competitive situation always ask for change rapidly and this would be the continuous process for sustainable growth. Forecasting could be used in other than direct materials requirement such as spare parts, office stationary etc which are untapped area in the organization. Organization can be more effective by eliminating non value added activities from the concerned department.

A forecasting engine with machine learning, just keeps looking to see which combinations of algorithms and data streams have the most predictive power for the different forecasting hierarchies

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