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Importance of Inventory in Supply Chain

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Abstract: ***Inventory is the backbone of any supply chain organization. An enterprise with a well - organized supply chain may significantly reduce majority of the expenses connected to that chain, which contributes to a greater profit and customer Satisfaction. However, when optimization starts at the inventory level, based on forecasted or available demand and customer data, the functioning of the supply chain can be made more efficient.***

Keywords: Inventory management, supply chain, cost reduction, customer satisfaction, optimization

1. Introduction

Optimization brings all considerations together in a comprehensive plan that delivers the desired performance at minimal cost. Inventory optimization in the supply chain is focused on improved planning and stocking of inventory to deliver the desired level of customer service at minimal cost within any limits or restrictions that exist Quantities and delivery priorities are to be fixed in accordance with factors such as customer priority classes, type of customer domain and other such real time requirements.

1.1 Optimization

A survey recently published by global management consultancy McKinsey, entitled the "Supply Chain Pulse, " highlighted the ongoing changes in the ways companies are managing goods flow processes, including sourcing new materials, manufacturing, and distribution, as it relates to global trade and commerce, which tallies $32 billion annually across goods and services. Optimization deals with maximizing the output from a large number of input variables that exert their
relative influence on the output.

1.2 Optimization Statistics

A key focus in the survey was on managing inventories, with 68% of respondents indicating that optimizing inventory levels over the next three years is viewed as a top priority for supply chain executives. But that finding came with the caveat that there is uncertainty among supply chain executives in that they are unsure how inventory management strategies will change over that time, with 22% planning to increase inventory; 29% planning to revert inventory back to lower inventory levels; 24% planning to keep inventory constant; and 26% planning to reduce inventory below pre - pandemic levels.

1.3 Inventory Optimization

The basic idea behind inventory optimization is simple control inventory levels to fulfil set service levels while reducing the amount of working capital held in inventory that is not being used efficiently. Lead time, shipping, daily usage, and economical reorder numbers are all factors to consider. To ensure proper stock availability, supply chain managers use this data to compute ideal stock levels and reorder points. They can also use techniques like the ABC analysis approach to categorize inventory selectively, which sets inventory levels based on sales volume and value.

Inventory Optimization Overview
In supply chain terminologies, the environment is described by using three terms:

1) **Supply**: The expected supply lead time and its accounted variability.
2) **Demand**: Two aspects are to be focused. The expected demand is a forecast of how much demand can be expected. The other demand is how long the customers are willing to wait for the products.
3) **Costs**: These are the expenses incurred by the supply chain owner in running the distributed network.

2. Challenges with Inventory

A vast number of challenges hinder the process of inventory optimization. These challenges must be overcome using appropriate technologies and algorithms and sufficient data. Some of the common problems faced include:

Fluctuating demand: The needs of customers are always changing. Having too much inventory could result in an obsolete inventory that cannot be sold, while keeping too little inventory could prevent you from fulfilling customer requests. Ordering tactics for essential items, as well as technologies for creating and executing an inventory strategy, can all help to accommodate for fluctuating demand.

Dealing with Customer Groups based on Priority:
Supply chain often have certain groups of customers who may be considered a greater priority over the rest. Such a classification leads to hierarchy of customers with the customer group at the summit of the hierarchy having the maximum need of satisfaction. Thus, there should exist a system such that this is possible.

Inadequate Order Management: Preventing overselling of products and running out of inventory is one of the most prevalent problems to good inventory management. One may reliably estimate client orders by using historical and seasonal data trends.

Expansion of Inventory Nodes: As the supply chain plans to diversify its business, a greater number of inventory nodes start emerging into the picture and it is necessary to extend support to all such nodes.

Lack of Sufficient Software: Inventory management software must interface with existing business process platforms to expand to accommodate complicated logistics. Choosing from hundreds of inventory management solutions and understanding a slew of features that necessitate training and continuous assistance is a difficult undertaking. The above - mentioned challenges form a mere subset of the problems that obstruct the goal of inventory optimization. The technology of Decision Optimization can find its application in Inventory Optimization. Since the former offers a best - possible solution to a multi - way solvable problem such as Inventory Optimization, by modelling the latter as an optimization problem, an efficient solution can be generated to solve the latter.

3. Optimization in Inventory Allocation

The aim here is to club the concepts of decision optimization and inventory optimization such that the former is used to implement a solution for the latter.

Decision Optimization and Machine Learning work hand in hand in the field of supply chain. While Machine Learning deals with analyzing historical transactions, store location details, social media advertisements and responses, weather impacts, etc, Decision Optimization benefits from this analysis performed and uses the results to predict and provide optimal inventory conditions to the supply chain operator. Hence, by stacking together individual Decision Optimizers to solve various specific purposes, an effective model can be created which contributes to the solution of optimal inventory allocation. The proposed model is a generic one. It aims to achieve optimal inventory allocation of items based on their forecasted demands. These demands are then grouped according to customer priority into customer demand priority classes. This function can be either done manually or done by a Machine Learning model such as customer segmentation/classification model provided that sufficient data is available for such demand forecast and group classification. Once the demand is distributed among the customer classes, each of these customer classes at any node is assigned a priority. This priority signifies the importance and necessity of that customer group to the supply chain operator. Higher the priority (1 being the highest priority group), higher is the requirement of satisfaction of such group customers.

Formulate the objective function in terms of these decision variables which must be maximized/minimized. This function is a weighted sum of the allocation to be achieved to each group and its corresponding priority/transfer cost. Separate DO models for each module are then programmed. Modules include intra - node allocation module, inter - node allocation module and transportation module. These models are then compounded to provide the result along with objective scores and transportation costs.

4. Conclusion

The system does the determination and calculation to determine optimal inventory allocation quantities as per the request of the user. The system thus is very beneficial for planning a supply chain inventory distribution and has support for numerous multiple customer groups with different customer priorities along with support for large number of nodes. The use of Decision Optimizer enhances the solution model and makes it very efficient in terms of performance as well as well as scalability. However, the processing time of the model is subject to the input workload and increases with the size of the data to be analyzed. The model can also serve as the base podium on which further constraints and costs can be inculcated to build a more complex model which can solve a larger problem.

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