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Corrective Lateral Transshipment Application in a Centralized Inventory System With Random Demand:
Case Study

Elleuch Fadwa
https://orcid.org/0009-0007-6705-7668
Independent Researcher, Tunisia

ABSTRACT

Our research work aims to study the lateral transshipment problem as a mode of cooperation between different retailers who are located at the same level. In the first work, we apply a simulation-optimization approach based on a metamodel to search for the different measures of the initial level of replenishment. Then, by applying a series of simulation experiments by the ARENA software to select the best lateral transshipment policy. This aims to maximize the expected average global gain and minimize the average global Disservice rate. For this, several Transshipment policies will be tested, for example; non-pooling, full pooling and partial pooling policies depending on the selection of physical inventory thresholds.

KEYWORDS

Transshipment Policies, Simulation-Approach, Complete-Pooling, Vendor-Managed Inventory, Supply Chain Management, Partial-Pooling Threshold

1. INTRODUCTION

In a supply chain, the distribution network is the main component through which the flow of products to customers is carried out. In the classic case, the network has three levels: "central warehouse, distribution centers and retailers", the latter being in direct contact with end customers. The problem of managing flows through such a network is obviously complex. First, it depends on the configuration of the network considered. Then, it must integrate the consideration of a multitude of parameters: number of products, demand law, desired service rate and the stock management policy at retailers and distribution centers, supply times, various costs (order, possession, transport and shortage). But, to be more competitive in a complex market, the supply chain can improve its performance by applying coordination between its different retailers, called "transshipment", which organizes stock transfers between sites of the same level, either according to a preventive policy to reduce the risks of shortages in the face of expected customer demands, or according to an emergency policy to resolve the problem of actual shortages. The importance of transshipment continues to increase, especially following the existence of a strategy called Vender Managed Inventory (VMI). According to this strategy, it is the supplier who manages the product stocks at the distributor and thus the procurement decision will be taken by the supplier and no longer by the customer.

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The relationship between suppliers and customers has changed significantly: high quality requirements, product diversification, competitive costs, etc. These constraints have forced companies to seek new ways to improve their performance and better meet customer needs. Companies must question their organizational structures while ensuring a partnership between the different players. To do this, logistics helps improve the flow of flows between all these links from the supplier's supplier to the customer's customer. Logistics' mission is to ensure a dialogue between internal and external players in order to ensure good circulation of physical flows, information flows and financial flows.

Good supply chain management improves the management of physical and digital flows for the company and its customers. A guarantee of quality, competitiveness and compliance, it guarantees the best service at the lowest cost.

The supply chain is a series of internal processes, from placing the order to final delivery to the customer. It is all the steps necessary to transport an ordered product to the consumer. A complete supply chain extends well beyond the company's internal processes. Indeed, it must manage its relationships with its partners (customers, inventory managers, distributors, suppliers, consumers, etc.) On a daily basis, supply chain management is one of the top concerns of business leaders. It involves, step by step, estimating the right added value to bring to the product based on the customer's expectations and your constraints. By being able to offer the best products at the lowest cost, the company uses its supply chain as a real competitive asset. This type of management gives companies better control over inventory costs, the supply of goods and transport costs. Let's go back over the fundamental principles of logistics management, and our advice for improving the functioning of this type of management within your company.

Dehghani and Abbasi (2018) studied a shelf-life-based lateral transshipment policy for the case of perishable products. They transported blood units between hospitals. They developed partial differential equations to derive and solve a joint distribution problem that allowed them to determine the optimal inventory level at each location with transshipment based on inventory age. They also showed that their approach could provide additional cost savings to a similarly structured distribution channel.

A large number of works focus in their research on the type of lateral transshipment, ie. Emergency transhipment or preventive transhipment.

Herer et *al.,* (2002) analyzed the emergency lateral transshipment strategy between two-retailers and found this last can simultaneously improve lightness and agility.

The research work of Archibald et al. (2009) aims to study a storage system, while the decision to place an emergency order from the central warehouse or to use lateral transfer depends on the costs, the time remaining in the warehouse and the distance between retailers. The assumption of instantaneous replenishment time of the central warehouse considerably complicates the mathematical analysis of the network due to the interrelationships between demand, quantities to be transferred and stock in transit. In particular, if the optimal transfer strategy must take into account both stocks on hand and those on order, this implies that the state space must be increased.

Li et *al*., (2013) aim to study the effect of preventive lateral transhipment on the quantities ordered in a two-echelons inventory system.

Paterson et *al.,* (2012) and Noham and Tzur (2014) respectively developed a quasi-myopic approach and a simple heuristic algorithm.

Due to the complexity of the decision space, the exact model will be solved by minimizing the number of retailers to only two. Liao et al. (2014) studied a relationship between lateral transfer with transshipment and emergency orders.

The transfer between retailers is done in a bidirectional transshipment manner to coordinate the transshipped quantities.

Olsson (2015) studied a lateral transshipment policy for a two-retailer inventory system with a positive transshipment lead time.