Inventory Control and Replenishment of Multi-Product Multi-Echelon Based on Time Cost Under JMI Environment

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ABSTRACT

Joint managed inventory is an advanced supply chain inventory management tool, which will effectively tackle the complicated problem between the inventory cost of supply chain and service level. The research on inventory model and its' control under JMI environment is a hot issue at present. In this paper, the authors deeply discuss the question of the inventory time costs about the multi-product and multi-echelon control model and its' replenishment strategy under JMI environment. With considering the foundation of JMI and time cost, the authors propose the multi-product multi-echelon inventory cost control model under time cost. Then formulate corresponding replenishment strategy. At last, through a numerical example, the authors discover that the multi-product multi-echelon joint inventory management based on time cost can effectively reduce the total inventory costs and improve the competitiveness of the entire supply chain.

Keywords: *Jointly Managed Inventory (JMI), Multi-Product Multi-Echelon, Replenishment, Supply Chain, Time Cost*

1. INTRODUCTION

With the continuous developing of the theory and practice about supply chain management inventory, joint managed inventory as a new supply chain inventory management mean arising at this moment. It is developed on the basis of

VMI and unified power, responsibility, profit balance and risk-sharing between the upstream and downstream enterprises' inventory management mode. JMI emphasis on the node enterprise in the supply chain to join in the cooperation, map out an inventory plan at the same time. It makes each node enterprise in the supply chain

consider from mutual coordination and keep the forecast of demand in different enterprises consisting in order to slack the "bullwhip effect". At present, many scholars doing a lot research on the mode of JMI and the replenishment strategy. However, the research literature of time cost are scarce and most of them just introduces the concept of joint managed inventory, do not give a specific mathematical model to optimizing and rarely consider the effect of time cost to inventory costs. Most of the arguments are confined to a single product or two echelon hypothesis, but actually operation of the enterprise often involves the multi-product inventory management. So this paper which aiming at multi-product multi-level inventory management not only has theoretical meaning, but also practical application value.

Gumus (2009) and Gunerist (2009) study the framework of multi-echelon supply chain cost management under the stochastic fuzzy environment, then demonstrate its' efficiency with a numerical example. T. Cheong (2012) proposes a control model of perishable commodities' joint inventory and transportation and make an overall discuss on perishable commodities' joint inventory management and transportation. Aachen (1986) studies the multi-product joint replenishment problem in the inventory system. He consider the multi-product based on the traditional EOQ model and solve the numerical example with the help of optimize algorithm, proving that the model can effectively reduce the total supply chain inventory cost. Yousefi (2012) studies the multi-objective multi-product inventory model, the first objective is minimize the total ordering costs and storage costs; the second objective is to lowest the total costs of transportation. The author comes out the transportation costs independent from the order costs and assumes that the costs of transportation has nothing to do with the time. Eventually he uses three kinds of algorithms for its solution. Zhou (2013) propose the joint inventory management model of a multi-product multi-echelon and

analyze the different effects on the total costs of the different replenishment strategies, using actual data to simulate and demonstrate the effectiveness of the model and the feasibility of joint replenishment strategy. H.S adjady (2012) researchs a two level multi-product inventory management model, which takes the open of equipment and operation costs into account, then use the Lagrange Heuristic Algorithm to solve this problem. Xiang-tong Qi (2011) takes the dynamic multi-product batch joint replenishment problem into account, investigating some industries such as livestock, chemical, illustrates the inventory quantity presents as bulk forms with the production and uses the DPA and ADH algorithm to simulate the model, demonstrates the validity of model. Ju Zhao (2009) studies the problem of multi-product replenishment on a single manufacturer and a single retailer supply chain, revealing that the enterprise cooperation has a great influence on the total inventory costs of multi-product and putting forward a strategy of delay payment to guarantee the feasibility of cooperation. Hua-ming Song (2011) considers a joint managed inventory problem which the distribution is unknown and the lead time is controllable, research results show that the joint managed inventory can effectively reduces the overall supply chain inventory cost comparing with the independent managed inventory. Chun-hua Feng (2011) discusses the joint replenishment problem under multi-vendor mode. From the view of supplier homogeneity and heterogeneity, analysis the total inventory costs and the optimal replenishment policy in two different conditions. Then explore the role of third-party logistics in the joint managed inventory for further step. Yang, Felix and Kumar (1986) deliberates the supply chain inventory costs of multi-supplier, a single warehouse and multi-retailer under the limited inventory and transportation ability. And uses the genetic algorithm to solve the numerical example, the results demonstrate the effectiveness of the genetic algorithm to optimize the replenishment strategy. Arpita Roy, Shib Sanker Sana

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