

Perspectives on Supply Chain Coordination through Vendor Managed Inventory

Abstract

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Abstract

Companies have realized that they control only a small part of their value chains, so the opportunities for improvement are quite limited. As a consequence, the success of a firm will depend on its ability to integrate with other participants in the chain responsible for physical, information and financial flows. Recent literature in the field of supply chain management (SCM) often concerns the coordination of different stages in the supply chain (SC) by employing a multitude of strategies and mechanisms. A number of coordination mechanisms have been explored by researchers. In our study, I have concentrated on one such mechanism viz., vendor managed inventory (VMI).

In their reviews of VMI literature Marques et al. (2010) and Govindan (2013) highlight some research gaps in the extant literature: impact of presence of multiple buyers in a VMI SC, role of price enhancing effects like advertising on the system performance and approaches to handle demand uncertainty while designing VMI systems. In my dissertation I have focused on these areas.

I have first analyzed VMI systems with a single supplier and multiple buyers from an operational viewpoint. Different lot sizing approaches have been explored and conditions in which one may be favorable to the other have been identified. This would lead to optimal decision making in the SC and also help in establishing long-term commitment of all the members involved.

The role of the service fee, which the supplier often charges from the buyer for managing the latter's inventory, is explored next. It is shown that the said fee transforms an apparently uniform wholesale pricing regime into a buyer specific wholesale pricing regime, which works to the benefit of the supplier. Some constraints that may enable the buyers to safeguard their respective

interests were analyzed. Analysis suggested that more cost efficient buyers would prefer an operating cost constraint (which limits the total service related payment to the supplier), while less cost efficient buyers would prefer a net profit constraint (which protects their profits post VMI implementation).

Subsequently, I focus on the role of demand enhancing effects like national level advertising by the supplier and sales effort by the retailers on the profitability of the SC under the assumption of supplier Stackelberg leadership. It is shown that changes in market related parameters had a significant influence on the performance of the system. It was also observed that the pricing decisions were less sensitive to changes in production related parameters. However, changes in these parameters could significantly influence the inventory policy. The impact of coupling together asymmetric parties into a common system as well as the effect of the presence of a relatively stronger retailer in the system was also explored.

The benefit of integrated production, inventory, transportation and emission related decision making is analyzed next. The model developed incorporated the environmental policy parameters like emission tax and emission upper limit to arrive at optimized mode of operation. It is shown that using VMI enabled SC coordination, businesses can reap economic rewards, and at the same time they can reduce their greenhouse gas emissions. Implications for policy makers have also been discussed.

Lastly, I developed an approximate model to determine the optimal replenishment policy of a single vendor multiple buyer VMI system under stochastic demand. In order to establish the validity of the results obtained using the said approximation, a detailed simulation study was carried out. Levers available to the parties to control or monitor the arrangement were also

analyzed. The factors that, in the long run, would help in making the mechanism successful have been highlighted.

In essence, my work highlights the need to explore the myriad options available to achieve SC coordination through VMI, and adopt the one that can help all the members involved in establishing a sustainable mutually beneficial relationship.