A Co-Ordinated Single-Vendor Multi-Buyer Supply Chain Model: Synchronisation of Ordering and Production Cycles

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Abstract

This chapter considers the co-ordination in a single-vendor multi-buyer supply chain by synchronising ordering and production cycles. The synchronisation is achieved by scheduling the actual ordering days of the buyers and co-ordinating it with the vendor’s production cycle whilst allowing the buyers to choose their own lot sizes and order cycle. A mathematical model for our proposed co-ordination is developed and analysed. Our results show that the synchronised cycles policy works better than independent optimisation or restricting buyers to adopt a
common order cycle. Some illustrative examples demonstrate that there are circumstances where both the vendor and the buyers gain from such synchronisation without the need for price and quantity discount incentives.

**Introduction**

Effective co-ordination plays an important role in the successful operation of modern manufacturing and inventory systems. If no such co-ordination exists then the vendor and the buyer will act independently to make decisions that maximise their respective profits or minimise their costs. This may not be optimal if one considers the supply chain as a whole. How best to achieve effective co-ordination between the suppliers and the buyers is both a current managerial concern and an important research issue. This chapter considers the problem of co-ordinating ordering and inventory holding in a supply chain consisting of one vendor supplying many buyers.

A number of researchers, including Goyal (1976), Monahan (1984), Banerjee (1986a, 1986b), Goyal (1987, 1988, 1995), Lee and Rosenblatt (1986), Joglekar (1988), Lu (1995), Hill (1997) and Pan and Yang (2002), have shown that under the scenario of a vendor supplying a product to a single buyer, a co-ordinated inventory replenishment policy is more desirable from a total system perspective than each party operating its individual optimal policy. These papers have generally compared joint lot sizing decision models with independent ordering. Some research, for example Pujawan and Kingsman (2002), has shown that synchronising the order times and agreeing on the delivery lot size, allowing the buyer to determine the order quantity and the supplier the production lot size independently, is virtually as good as jointly agreeing on the relevant lot sizes. The general result of the above research is that integrated lot sizing models reduce the total system cost. However, while they reduce the costs to the vendor, they increase the costs to the buyer. Attention has been thus put on examining mechanisms for the vendor to share the savings by offering price or quantity discounts to encourage the buyer to purchase larger quantities.

Integrated inventory models for the one-vendor multi-buyer case have also been discussed by a number of other authors, such as Lal and Staelin (1984), Joglekar (1988), Lal and Staelin (1984) and Dada and Srikanth (1987).
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