CHAPTER – 1

INTRODUCTION

Certainly the oldest and most commonly known of all the inventory models is the one called the optimal economic lot size (EOQ) model. It makes a good starting point for the analysis of inventory problems. Various extensions of this model have been developed (39). Normally an Organization needs a number of items to be procured from the same supplier. The simple EOQ model becomes rather cumbersome to implement for large inventory systems because each item requires the calculation of optimum order cycle and order quantity. One of the fundamental assumptions inherent in the derivation of the basic economic order quantity is that the items are maintained under independent control. This assumption is likely to be inappropriate under any of the following circumstances :

1. Several items are produced on the same equipment, in which case coordination of run quantities may significantly reduce set-up (ordering) costs.

2. Several items are purchased from the same supplier, in which case coordination may allow use of 'group' quantity discounts.

3. Several items share the same transportation facility, in which case coordination may result in transportation economies (e.g. full car loads).

There are frequent occasions where the coordination of replenishment orders for a selected group of items can lead to significant savings in the costs of replenishment. A number of authors have discussed methods of coordinating items for replenishment purposes. Brown (3) grouped items into families and established a coordinated policy for the deterministic case. Maxwell (26) illustrated that, when one takes account of set-up times, the determination of feasible, let alone an optimal production schedule for a number of items on a production facility is a non-trivial task.

The problem of using multiple suppliers to replenish a single stock item has not received as much attention as the single supplier problem. Considerable research is still needed, and there are several interesting areas that can be explored :

1. The mean and standard deviation of the lead time distribution when more than two suppliers are used and replenishment orders are placed at the same time.

2. Determining whether the reduction in reorder level can offset differences in purchasing prices.

For deterministic demand situations, we have developed some models which help us to determine the optimum portion into which the replenishment order should be split when multiple suppliers are used (6, 7, 8, 9, 10).

In chapter 3, we present the case of single item, multiple supplier system of inventory control. Here we determine the quantity of the item to be procured annually from each supplier and also how much is to be ordered with all the suppliers simultaneously at each order so that the total cost consisting of procurement cost, ordering cost and inventory carrying cost is minimized (6).

In chapter 4, we discuss the case of single item, multiple supplier; alternate ordering policy. By alternate policy, we mean that we place an order with one supplier at a time. The ordering is done in such a manner that in a cycle length of $T = \sum_{i=1}^{n} t_i$, each of the n suppliers gets an order for an amount Q_i^* (i=1,2,...n) once and only once. The amount Q_i^* ordered from the ith supplier lasts for the time period t_i.

We have developed a model which minimizes the total procurement cost, ordering cost and inventory carrying cost (7). In chapter 5, we consider inventory control under multi item, multi supplier system (8). Many a times, an organization can procure a number of items from some set of suppliers. In such a case, it would be better if we coordinate the items if all the items can be procured from each of the suppliers. Thus we find out the quantity of each item to be procured annually from each supplier and how much to be ordered in each order so that total cost of procurement, inventory carrying cost and ordering cost is minimized.

In chapter 6, the case of multi item, multi supplier; alternate supply is discussed (9). Here by alternate supply, we mean that the order is placed for all the items with one of the suppliers at a time. In a cycle length of $T = \sum_{i=1}^{m} t_i$ all the m suppliers get orders for all the n items once and only once.

In chapter 7, we present multi item, multi supplier, coordinate ordering policy with base period T (10). In this model, the cycle length of item i(i=1,2,...n) is made to depend on its usage rate. The cycle length of item i is expressed as $m_i T$, where m_i is an integer and T is the base period. Both

m_i's (i=1,2,...n) and T are found optimally. Thus we place an order for item i(i=1,2,...n) after a time interval of length $m_i T$.

In chapter 8, stock control under uncertainty is considered. Normally the demand for items is uncertain in real life. Even the lead time with suppliers could be uncertain. Sculli et. al. (33) have discussed stock control with two suppliers having normally distributed lead times. They found out the distribution of the time between arrivals of two replenishment orders when the orders are placed, one with each supplier, at the same time. We have calculated the reorder levels when the demand is probabilistic and lead time with the two suppliers is fixed. If the lead time with the suppliers is L_1 and L_2 ($L_1 \geqslant L_2$), we place on order for Q_1^* with the 1st supplier having lead time L_1 as soon as inventory touches the reorder level r_1 and place an order for Q_2^* with the 2nd supplier when inventory touches the reorder level r_2.

Finally in chapter 9, we make some comparisons among the models developed. We have shown that the total annual cost in case of single item, multi supplier; alternate ordering policy is less than the total annual cost for single item, multi supplier system of inventory control. We have also shown that the optimum total annual variable cost in case of multi item, multi supplier; alternate supply is less than the optimum total annual variable cost of multi item, multi supplier system of inventory control.