C H A P T E R - I

Introduction

Since the 1950's, Business Organizations have gradually developed a remarkable trend towards careful future planning, using analytical techniques. Again, of all classes of business management problems, production planning and logistics problems have received the greatest amount of attention in the course of development of industrial operations research, Simultaneously, academic institutions such as Universities and other research groups have shown a greatly expanding interest in the development of new methods for dealing with industrial problems. The large number of articles, which are being currently published, demonstrates a widespread concern with different aspects of inventory and productions management.

The problems of procuring raw materials, planning, scheduling and controlling production in the face of uncertain market conditions, maintaining reasonable levels of inventories and of choosing the channels of distribution properly are almost universal in manufacturing organizations. The management has to decide on the optimum mix of the sources of procurement, production locations in the various factories and of the distribution network. The company strives to determine the optimum mix to ensure the attainment of the organizational goal, which is, for a private sector organization, profit maximization or cost minimization as the case may be.

The optimization processes involved in various production inventory problems deal with certain tangible costs, like ordering, procuring and manufacturing costs and certain intangible costs, like the costs of shortage, of carrying the inventory, of not being able to provide good customer service etc. These costs are frequently difficult to ascertain. In particular, exact determination of customer service level isnot possible because of a large number of intangible factors which are difficult to evaluate. However, it should be possible to develop reasonable indeces by taking into account other more tangible factors which admit of objective evaluation.

Again, Business organizations are typically faced with the problem of having to take decisions in the face of a variety of uncertainties and so, there arises the need to strike a balance amongst conflicting objectives within the framework of the organization itself. In the models, which we would develop in the later chapters of this dissertation, many such conflicting objectives should be considered, as would be relevant to the different situations visualized.

In this dissertation we have attempted to develop integrated production inventory systems which would minimize the total costs of carrying inventory, of having to maintain a certain service level and the cost of production fluctuations. For this purpose we have considered two single stage models, one utilizing service time (Chapter 3) and the other utilizing emergency policies (Chapter 6), and two multi stage models based on two different types of information flow (Chapters 4 and 5) with service time, smoothing etc. One of the objectives of using the concepts of service time and emergency policies is that they help to bring down the inventory carrying cost at any particular stage without affecting the service level.

Most traditional inventory models work under the assumption that unsatisfied demand is either totally back logged or lost altogether. This is equivalent to making the extreme assumption that delay indelivery has either no effect on the realized demand or leads to total loss of sales.

However, a far more realistic assumption would be to build up a functional relationship between the delivery performance and the amount of demand which is backlogged. Following Hanrsmann [68, 69] we have used this concept in the model developed in chapter 3. Here the service time helps to reduce the level of average inventory, thereby bringing down the inventory carrying cost while, however, reducing also the revenue. We have shown how to find an optimum balance between the two conflicting interests of increasing the revenue and decreasing theinventory carrying cost. The optimum service time comes out as an output of the optimization.

In Chapters 4 and 5 we have considered a cascaded production - inventory system comprising a sequence of manufacturing operations separated by in-process inventories. Certain service times are assumed to be available at each stage and our problem is to choose these service times so that the total cost incurred by the system is minimized. The cost models have been developed under two types of information flows, serial and parallel. For serial information system each inventory stage works against demand generated by the following inventory stage. For parallel information system, however, each inventory stage works against final customer demand, materializing at the output point of the system - i.e. the finished goods stock point. We have shown that the serial information system is more sensitive to changes in the demand distribution than the parallel flow. For the serial flow, changes in the demand pattern cause progressively larger variations in the rate of production successively back in the chain. This multiplier effect is not realized in the parallel information flow. Also in any particular stage, the variations are much larger for series system than for the parallel one.

In Chapter 6 we consider a continuous review inventory policy which has provisions of placing emergency orders in addition to regular ones. Emergency orders arrive faster than the regular orders but they cost much more. However, using emergency ordering policy, considerable reduction in the inventory carrying cost is possible, without effecting the service level. We have specified when it would be optimal for the firm to go for emergency policies and what its reorder rules should be.