INVENTORY MANAGEMENT

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Introduction

Organisations hold inventory for a variety of reasons such as the savings that may be achieved from bulk buying or to reduce the chances of disruption to manufacturing processes. Having inventory acts as a buffer against uncertain demand and lead times, and may stabilise production throughout the year. Organisations may also hold inventory as a result of advance purchases due to anticipated price increases or potential supply problems. Hence, for many organisations investment in inventory represents a significant asset and so it is important that it is managed efficiently and does not become excessive. Two well-known but contrasting approaches, the economic order quantity (EOQ) and just in time (JIT) are proposed to assist in inventory management. This article will describe the main features of each of these approaches.

Economic Order Quantity (EOQ)

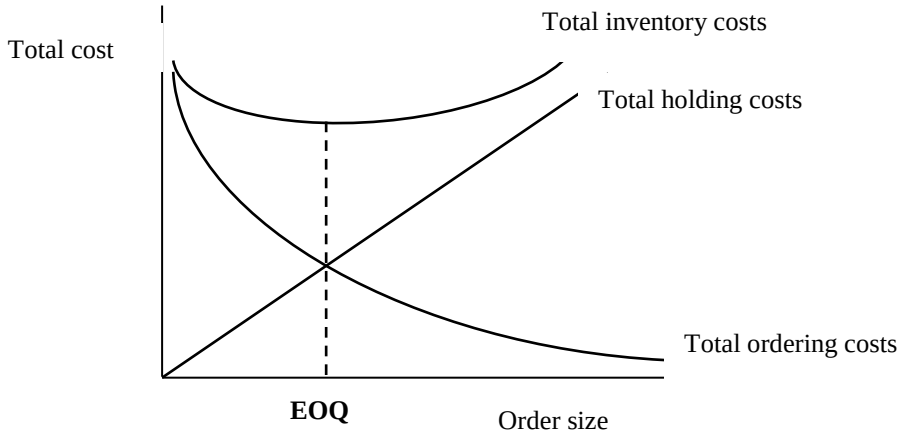
The economic order quantity (EOQ) is a mathematical model that was developed in 1915 by F W Harris. The EOQ formula is:

$$EOQ = \sqrt{\frac{2DO}{H}}$$

Where D = Annual demand for the item
O = Cost of placing one order
H = Cost of holding one item in inventory for one year

The model proposes that there are two main costs associated with maintaining inventory, ordering costs and holding costs. It seeks to establish the optimal inventory order size to reduce these costs thus minimising total inventory costs as shown in Figure 1 below. At the optimal point, where total inventory costs are minimised, total holding costs will equal total ordering costs.

Figure 1: The Economic Order Quantity



A simple example will demonstrate the operation of the EOQ. Ballpoint Limited has a four year contract to supply 2,500 black pens each month to a large customer. The company has calculated that the cost of placing an order for the pens with the manufacturer is €60 and the cost of holding one pen in inventory for one year is €0.001. Use the EOQ to calculate the optimal order size.

EOQ = $\sqrt{\frac{2DO}{H}}$

D = 2,500 x 12 months = 30,000
O = €60
H = €0.001

EOQ = $\sqrt{\frac{2x30,000x60}{0.001}}$ = 60,000

For Ballpoint Limited, to minimise its total inventory costs, the EOQ suggests using an order size of 60,000 pens each time an order is placed.

However, the EOQ model is based on a number of assumptions and these form limitations to its use. If these assumptions do not hold, then using the EOQ will not produce the optimal order size that minimises total inventory costs. The assumptions of the EOQ are shown in Table l.

Table 1: Assumptions of the EOQ

- Demand is certain, constant and continuous.
- Lead time, the time between placing an order and receiving the goods, is known and constant.
- Unit costs are constant and certain.
- The order size is sufficient to cover demand during the lead time.
- Average inventory is equal to one half of the order size.
- Any safety inventory that is maintained remains constant regardless of order size.
- Inventory may be purchased in exactly the quantity that is required.
- Inventory is used evenly over time and falls to zero before being replenished.

Just in Time (JIT) Inventory Management System

Just in time (JIT) inventory management systems are based on a management philosophy that was first developed in the 1970s within Toyota manufacturing plants. At the time when JIT was developed most organisations used a 'push' production flow system whereby production was driven by sales forecasts and inventories accumulated awaiting sale. JIT uses a 'pull' production flow system which takes customer orders as its starting point for the production process. A product is not made until requested by a customer and components are not produced until required by the production process. Inventory levels will be very low with little/no raw material or finished goods inventories but a small amount of work in progress.

JIT originally described the idea of producing goods to match customer demand in terms of delivery time, quantity and quality. More recently it has come to mean a streamlined production system that minimises waste.

For an organisation, the introduction of a JIT inventory management system may bring many advantages but there are also some disadvantages that need to be considered before deciding to adopt this approach. Table 2 summarises the advantages and disadvantages of a JIT inventory management system.

Table 2: Advantages and Disadvantages of JIT inventory management

Advantages	Disadvantages
Seeks to eliminate waste in all stages of the manufacturing process by minimising/eliminating inventory, defects, production delays and breakdowns.	By minimising/eliminating inventory there is a risk of production delays or unfilled customer orders.
Builds a strong relationship between buyer and supplier.	Buyer relies on supplier to ensure that the best price is obtained for goods. There may be difficulties if the supplier seeks to increase price.
Buyer benefits from lower inventory management costs.	Inventory management costs are transferred to the supplier.
Focuses greater attention on quality control resulting in less scrap, re-working and set up costs. It also facilitates smooth production flow reducing/eliminating queues and idle time.	Buyer relies on supplier to consistently deliver high quality goods.

There are a number of requirements that facilitate the introduction and successful operation of a JIT system and these are briefly explained below and shown in Figure 2 (shown on page 4).

1. *Geographic concentration* – It is important to have a short transport distance between supplier and company plants to ensure materials and parts are received as quickly as possible.

2. *Dependable quality* – The company must always be able to rely on receiving high quality materials and parts from suppliers so that there is minimal disruption to the production process.

3. *Manageable supplier network* – The company should try to maintain minimal, manageable number of suppliers and agree long term contracts with them to build strong working relationships.

4. *Good transportation system* – Transportation of materials and parts from suppliers to the company must be agreed and reliable so that deliveries may easily be prescheduled to fit with production.

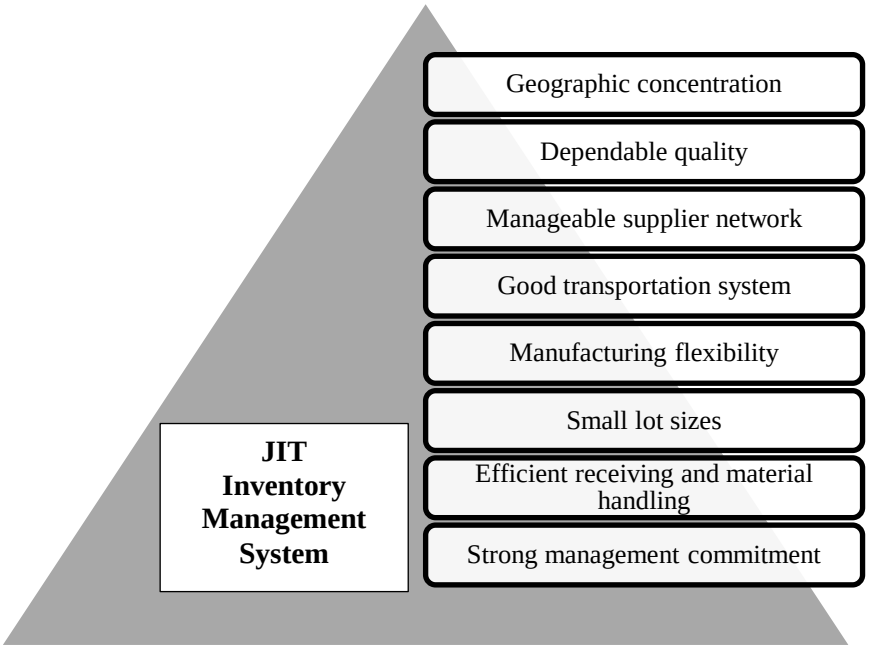
5. *Manufacturing flexibility* – By being able to react quickly to produce whatever parts are required maximises production capability minimising waste and inventory.

6. *Small lot sizes* – Building the capability to produce smaller batches of product will ensure that inventory is reduced or eliminated.

7. *Efficient receiving and material handling* – If little or no inventory is maintained there will be no need for formal receiving areas thus providing more production space. This will allow a company to design its manufacturing facility to ensure that materials and parts are delivered as close as possible to the production area.

8. *Strong management commitment* – For JIT to be successful it is vital to have support from top management during the transition period and to ensure that necessary resources may be obtained.

Figure 2: Requirements for a JIT inventory management system



(Source: Adapted from Van Horne & Wachowitz, 2008)

Conclusion

Inventory management is an important aspect of many businesses and various tools, techniques and approaches may be applied to assist in managing inventory. The EOQ and JIT inventory management system are two contrasting approaches. The EOQ is a mathematical model used to compute the optimum order size that will minimise total inventory costs. However, it is based on a number of assumptions that must hold for the optimum order size to be calculated. On the other hand, a JIT inventory management system aims to reduce or eliminate inventory, streamline production and reduce waste. While it has a number of advantages there are also some disadvantages of this system. In addition, for a JIT inventory management system to be successful there are a number of requirements that an organisation must have in place.