INVENTORY

RELEVANT TO CAT QUALIFICATION PAPER 10

Inventory management is an important part of the working capital management of any organisation. Practical decisions have to be made as to how inventory is going to be managed – which management system should be used, how much inventory should be kept and so on.

Inventory management is also an important part of the CAT Paper 10 syllabus. Within Section B of the exam, inventory management can be examined alongside other areas of working capital, or can be the sole topic of a 20-mark question. It is, therefore, very important that candidates have a good grasp of both the written and numerical aspects of this topic. This article will focus on the main aspects that could be examined within a Section B question.

WHY HOLD INVENTORY?

Inventory which is not in current use is an idle resource, which is costing the organisation money. Therefore, an organisation must have good reason to hold it.

There are many reasons a company will hold inventory (and benefits associated with holding inventory) but some of the most important are:

- to meet ongoing demand from the customer
- to meet an expected rise in demand, eg inventory of ice cream in a corner shop may be built up in response to a heat wave being forecast
- to ensure production is not stopped
- to qualify for bulk order discounts/special promotions from suppliers
- to meet a suppliers requirement for minimum order sizes.

There are, however, costs associated with inventory:

- holding costs, eg the warehousing, cost of insurance, etc
- ordering costs, eg delivery costs
- shortage costs, eg the loss of sales revenue, the loss of customer goodwill and the cost of paying labour even when there are no raw materials to work with
- the purchase price.

FACTORS AFFECTING THE LEVEL OF INVENTORY HELD

In deciding on a level of inventory to be held, the company has to not only weigh up the costs and benefits outlined above, but also consider the liquidity/profitability trade off. If too little inventory is held, it could affect profitability (for example, sales could be lost) but if too much inventory is held, then cash tied up in this inventory could affect a company's liquidity. In order to reduce the investment in inventory and aid liquidity, some companies will demand stage payments from their customers if, for example, the order is a long time in the production process. This approach is commonly used within the building industry; however, it does not work for many companies/industries.

The level and type of inventory held will also depend on the industry sector the company is operating in. A manufacturing company would probably hold high levels of raw materials, work in progress and finished goods, whereas a retail business would hold mainly finished goods.

In a company manufacturing cars, it will be possible to hold raw material inventory for longer than it would be in a company making yoghurt, where the raw materials (ie the milk) will deteriorate very quickly.

The level of inventory held will depend on the size of the organisation. A small family-owned organisation, eg a corner shop, will not have the resources to invest in high inventory levels, nor the space to store lots of inventory. A larger company may not have these problems.

In any exam question which asks for advice on inventory management it is important that you consider the industry and the size of the organisation involved and tailor your answer accordingly.

HOW TO CONTROL INVENTORY

There are two main methods of inventory control within the CAT Paper 10 syllabus: economic order quantity (EOQ) and just-in-time inventory management (JIT).

IN ANY EXAM QUESTION WHICH ASKS FOR ADVICE ON INVENTORY MANAGEMENT IT IS IMPORTANT THAT YOU CONSIDER THE INDUSTRY AND THE SIZE OF THE ORGANISATION INVOLVED AND TAILOR YOUR ANSWER ACCORDINGLY.

MANAGEMENT

IT IS WORTH NOTING THAT THE ECONOMIC ORDER QUANTITY (EOQ) FORMULA DOES NOT HAVE TO BE GIVEN IN THE EXAM (THE DEFINITIONS OF THE TERMS IN THE FORMULA WERE NOT GIVEN IN DECEMBER 2009). THE EOQ MODEL ATTEMPTS TO CALCULATE THE NUMBER OF UNITS THAT SHOULD BE ORDERED EACH TIME AN ORDER IS PLACED, RESULTING IN TOTAL COSTS BEING MINIMISED.

Economic order quantity

There is always a trade off between ordering and holding costs. The greater the size of the order, the fewer orders that will be placed each year, and so the lower the ordering costs. However, the greater the size of the order, the more inventory that will be held and so the higher the holding costs.

This model attempts to calculate the number of units that should be ordered each time an order is placed (the EOQ) which result in total costs (ordering and holding costs) being minimised.

For this model to be applied successfully, there are certain assumptions that have to be made:

- purchase costs are constant
- the suppliers are reliable and therefore the lead time (the time between placing an order and receiving the goods) is either zero or constant
- demand is constant and known.

The formula for the EOQ is:

$$Q = \sqrt{\frac{2cd}{h}}$$

Where Q = the reorder quantity
c = cost of placing one order
d = the annual demand in units
h = the cost of holding one unit per annum – this can be given within a question as either an absolute figure, or as a percentage of the purchase cost (see **Example 1** opposite).

The proof of this formula is outside the syllabus however, it is worth noting that the formula does not have to be given in the exam (the definitions of the terms in the formula were not given in December 2009) and it is therefore worthwhile you learning it.

EXAMPLE 1

The demand for Power's dehumidifiers is 1,250 units per year. The purchase cost is $250 per unit. The cost of placing an order is $50 and the cost of holding one unit for one year is 20% of the cost of purchase.

Substituting the figures into the EOQ formula gives:

$$\sqrt{\frac{2 \times 50 \times 1{,}250}{0.2 \times 250}} = 50$$

The model tells us that if 50 units are ordered each time then the total annual cost of having the inventory is minimised.

During the year 1,250/50=25 orders will be placed (d/Q) and the average inventory levels will be 50/2=25 units (Q/2).

The total annual cost can be calculated as:
ordering costs + holding costs
c x number of orders + h x average inventory level

Using the figures in **Example 1**:
The total annual cost = 50 x 25 + 0.2 x 250 x 25 = $2,500

A common extension of this calculation in exam questions is to introduce a discount for bulk purchases.

Extending **Example 1**, you are now told that the supplier offers a discount of 2% for any order quantity greater than 60 units.

This discount will directly affect not only the purchase price per unit but also the holding cost per unit (as in this case the holding cost is calculated as a percentage of the purchase price).

THE JUST-IN-TIME (JIT) METHOD DOES NOT JUST CONSIDER RAW MATERIAL INVENTORY, BUT ALSO WORK IN PROGRESS AND FINISHED GOODS. THE CONCEPT IS THAT THERE IS A CONTINUOUS FLOW THROUGH RAW MATERIALS WAREHOUSING, THROUGH THE PRODUCTION PROCESS, INTO FINISHED GOODS AND STRAIGHT OUT TO THE CUSTOMER.

The way to approach this type of question is to calculate the total costs at the EOQ and then at any higher level at which the discount applies. The total cost will include the ordering and holding costs as before and also the purchase price as this will now alter with the discount given.

Total cost at EOQ:

		$
Purchase price	1,250 x $250	312,500
Ordering costs	(50 x $25) as before	1,250
Holding costs	0.2 x 250 x 25 as before	1,250
Total costs		315,000

You then calculate the total cost at the higher order level at which a discount applies, ie order level of 60 units, with a discount on the purchase price of 2%.

The new purchase price per unit will therefore be 98% x $250 = $245 and the new holding cost per unit will be 20% of this new purchase price, ie 0.2 x $245 = $49.

		$
Purchase price	1,250 x $245	306,250
Ordering costs	Number of orders (1,250/60) x$25 per order	520
Holding costs	Average inventory (60/2) x $49 per unit (the new holding cost)	1,470
		308,240

What can be seen from these calculations is that if an order is made for 60 units, although the total holding cost has increased, the reduction in total ordering and purchase costs outweighs the increase in holding costs, and Power should place orders of 60 units each time, to minimise total costs.

The EOQ method of inventory management is sometimes referred to as the scientific approach. It is a useful tool, but the assumptions make it impractical for some companies, eg if demand can not be predicted accurately.

In cases such as this, companies may use another approach to inventory control. The other main method within the CAT Paper 10 syllabus is the just-in-time (JIT) inventory management system.

JUST IN TIME

The JIT does not just consider raw material inventory, but also work in progress and finished goods. The concept is that there is a continuous flow through raw materials warehousing, through the production process, into finished goods and straight out to the customer.

The inventory orders and production schedules are based on customer demand – goods are made in response to customer demand. Inventories of raw materials, work in progress and finished goods will be kept as low as possible so holding costs will be kept to a minimum. However, the trade off is that very many small orders for raw materials will be made and therefore ordering costs will be very high.

If the system is going to operate efficiently, certain conditions must apply:

- The company has to have a reliable supplier, with whom they have a good working relationship, who is preferably close by. This will allow the company to order materials and know that the goods will arrive promptly. Many companies will try and have one supplier for a particular component of raw material, to try and strengthen the supplier relationship.

- Quality must be a priority.
  - As so little inventory is held, there are no 'spares', therefore the raw material must be good enough to take straight into the production process – if it is faulty then production will cease. In order to obtain the higher quality input, higher purchase costs may arise.
  - The quality of the work in progress must be consistently high. If partially completed units have to be thrown away due to substandard workmanship, this will lead to delays in fulfilling customer demands. Ensuring the quality of work in progress should result in reduced wastage costs.
- The workforce needs to be flexible. Depending on customer demand, the workforce may need to increase or decrease their working hours, or be skilled enough and willing to work on different parts of the production process. A flexible workforce should lead to increased labour productivity.
- The premises should be laid out in such a way that the time taken to transfer goods from raw material inventory holding to the production process and into finished goods inventory holding is minimised. This should result in reduced lead times.

It is important that candidates not only learn the theory behind JIT but can also apply the concept to a scenario. In December 2009, candidates were asked whether a JIT system would be suitable for a particular company. Candidates needed to read the scenario and ascertain whether or not the conditions for JIT were met. It is no good considering if just one or two of the conditions are met. A company may have a very reliable supplier, but if the work force is not willing to expand and contract their working hours as required, then the JIT approach will not work.

In practice, EOQ and JIT are by no means the only methods of inventory management. For example, some companies may adopt a periodic review system – inventory levels are reviewed at fixed time intervals, eg on the last day of every month, and the quantity of goods required to bring inventory levels back to where they were at the beginning of the month are then ordered. Although these are not examined within the CAT Paper 10 syllabus, it should aid candidates understanding of inventory control if they are aware that companies have more than two options when deciding on an inventory control system.

Companies do not have to choose one method of inventory control either. For example, a shop may use a JIT approach for fresh vegetables that deteriorate quickly but an EOQ approach for tinned vegetables which have a longer shelf life.

CONCLUSION

In a Section B question, candidates need to be able to not only perform the calculations, but also have a thorough grasp of the written elements of inventory control and be able to apply their knowledge to a simple scenario. I hope that this article helps you with all of these elements.

IT IS IMPORTANT THAT CANDIDATES NOT ONLY LEARN THE THEORY BEHIND JIT BUT CAN ALSO APPLY THE CONCEPT TO A SCENARIO. IN DECEMBER 2009, CANDIDATES WERE ASKED WHETHER A JIT SYSTEM WOULD BE SUITABLE FOR A PARTICULAR COMPANY. CANDIDATES NEEDED TO READ THE SCENARIO AND ASCERTAIN WHETHER OR NOT THE CONDITIONS FOR JIT WERE MET. IT IS NO GOOD CONSIDERING IF JUST ONE OR TWO OF THE CONDITIONS ARE MET.