

## 9.3: Relevant Costs

The costs are usually defined for each item or stock keeping unit (SKU) separately. As a result, the optimal order quantities and the time of order is determined for each item specifically. The relevant costs that we have in any inventory management are as follows:

### Total Purchasing or Acquisition Cost:

This refers to the total purchasing cost of an item in a year (or in a month or a quarter of the year, etc., depending on what our unit of measure is for the time). In some models, this particular cost may not change. This is because the total demand in the year is the same (in those models) and if the price is not changing (that is, there's no quantity discount available from the supplier), the total acquisition cost or purchasing cost will be fixed. As a result, in those scenarios, we ignore this cost from our mathematical model, since we are doing our calculations to find the optimal order quantities and because this is a fixed cost and it does not change based on how much we order every single time, the total acquisition cost or purchase cost in the year will stay fixed.

### Total Ordering Costs:

Ordering cost usually includes the clerical and retrieval expenses. Sometimes, we include the delivery and inspection a part of this cost too. If you have your own manufacturing (instead of buying from an outside supplier), this same cost will be called *setup cost* which we have it in the model that we call Economic Production Quantity (EPQ).

### Total Carrying or Holding Costs:

This refers to the total cost of holding the items as if they were kept in stock for a whole year. Since each item will usually not stay in stock for the whole year, if we are to calculate the total annual holding cost, we will need to find an average number of items that we can find in our stock every time that we check our inventory. For example, if we checked our inventory level for a certain item 20 times during a year, we would most likely get a different number every time. If we take the average of those 20 numbers, that will give us a good estimate of how many units are sitting in our warehouse at all times. Please note that the items come in and go out of our facility as we buy and sell (or use) them. So, the items that we see on the stock each time are not necessarily the same ones sitting there for so long.

The unit holding cost is defined as cost of holding one unit of product for one unit of time. The unit of time is usually one year. But it can be based on a quarter, month, day or any other time unit. The key is to be consistent with the unit of measurement for time wherever in our calculations.

In operations management, we usually calculate the holding cost for each item as a percentage of the item's value. For example, if the value of the item that we are keeping in stock is \$1000 and our inventory holding cost is 20%, this means that if we keep that item for one whole year, it will cost us  $20\% \times 1000 = \$200$  per unit. If the same item sits in our inventory for only a quarter of the year, it will cost of  $(1/4) \times 200 = \$50$  per unit. If we had 10 of this item and they were kept for one whole year, the total annual inventory holding cost would be  $10 \times 200 = \$2000$ .

#### Insight:

*"If the price or the value of the item is higher, the holding cost will be higher. That is one of the main reasons that when companies are dealing with more expensive items, they tend to keep as few units as possible for those items. Sometimes, they keep only one unit just for showing at their store, and they get the customers' orders to deliver the item to them later, or to bring it to the store for customers' pickup later. They could not afford keeping several of those very expensive items in the store, because otherwise, the cost of holding them would be very high."*

The holding cost percentage represents all the costs associated with the facility in which the item is kept as well as any material handling costs within the facility. Basically, you will need to talk to the accountants in our company, if you are in charge of inventory, to get a better sense of the costs and a better idea of this percentage. In this chapter, we will have this percentage given to us in any examples that we have.

Some of the costs included in the holding cost percentage are as follows:

### Cost of capital

This means that when your money is tied to the inventory that you are keeping, you cannot invest that money anywhere else. So, you are losing some sort of an opportunity out there. As a result, the estimation of an interest that you could have gained can give us a percentage which is used as a part of the holding cost percentage.

### Insurances

Since we always need to have insurance for our warehouses, the cost of insurance can be calculated as a percentage for each item. This cost will in turn be used as another part of holding cost percentage.

### Storage costs

As share of the actual cost of owning or leasing the warehouse or the facility in which we hold the inventory and the costs of running the place (e.g., material handling, utilities, etc.) are calculated per item and added to the holding cost percentage.

### Breakage or spoilage

If there is any breakage, theft or spoilage that happens to our stock from time to time, we will need to add that as an additional part of the holding cost.

### Shortage Costs

There could be some penalty or shortage costs if there were uncertainties in the demand. If the demand were higher than what you have available in your inventory, you would have a shortage. This cost is usually a tricky one, since it does not look like a cost for which you lose money out of your pocket right away. But in fact, you are not gaining the money that you could make if you had enough units of the item in demand available. You can also lose the sale to certain customers completely, as they may find substitute products from other companies. In addition, there is a chance for a loss of goodwill in our customers, specially if the shortage happens over and over again. In all these cases, the inventory management tries to monetize the amount of loss to plan more properly for an optimal level of product availability.

---

9.3: Relevant Costs is shared under a [CC BY-NC-SA 4.0](#) license and was authored, remixed, and/or curated by Hamid Faramarzi and Mary Drane.