9.4: Inventory Control

Boundless: *Finance* "Chapter 18, Section 5, Part 9: Benefits of Inventory Management"

Read this section and explore the fundamentals of inventory management. The benefits to improved inventory management processes are lower costs and improved cash flows. A skill in inventory management is necessary for sound operations.

Benefits of Inventory Management

Improved inventory management can lead to increased revenue, lower handling and holding costs, and improved cash flows.

LEARNING OBJECTIVE

- Discuss the benefits of inventory management

KEY POINTS

- Inventory management is primarily about specifying the shape and percentage of stocked goods.
- Inventory management leads to optimal inventory levels.
- Management of the inventories, with the primary objective of determining/controlling stock levels within the physical distribution system, functions to balance the need for product availability against the need for minimizing stock holding and handling costs.
- Inventory management can also help companies improve cash flows.

TERMS

- **ABC analysis**: The ABC analysis is a business term used to define an inventory categorization technique often used in materials management. It is also known as Selective Inventory Control. Policies based on ABC analysis: A ITEMS, very tight control and accurate records; B ITEMS, less tightly controlled, and good records; and C ITEMS, simplest controls possible and minimal records.
- **holding cost**: In business management, holding cost is money spent to keep and maintain a stock of goods in storage.

FULL TEXT

Inventory management is primarily about specifying the shape and percentage of stocked goods. It is required at different locations within a facility or within many locations of a supply network to precede the regular and planned course of production and stock of materials.

The intent of inventory management is to continuously hold optimal inventory levels. The scope of inventory management concerns the fine lines between replenishment lead time, carrying costs of inventory, asset management, inventory forecasting, inventory valuation, inventory visibility, future inventory price forecasting, physical inventory, available physical space for inventory, quality management, replenishment, returns and defective goods, and demand forecasting. Balancing these competing requirements leads to optimal inventory levels, which is an on-going process as the business needs shift and react to the wider environment.

Management of the inventories, with the primary objective of determining/controlling stock levels within the physical distribution system, functions to balance the need for product availability against the need for minimizing stock holding and handling costs. Inventory management involves systems and processes that identify inventory requirements, set targets, provide replenishment techniques, report actual and projected inventory status, and handle all functions related to the tracking and management of material. This would include the monitoring of material moved into and out of stockroom locations and the reconciling of the inventory balances. It also may include ABC analysis, lot tracking, cycle counting support, etc. All of these practices leads to optimal product storage, helping minimize holding and handling costs.

Inventory management also can help companies improve cash flows. Companies with effective inventory management do not have to spend large capital balances for purchasing enormous amounts of inventory at once. This also saves handling and holding costs.

Boundless: *Business* "Chapter 16, Section 4, Part 2: Inventory Management"

Read this section, which will help you understand how companies keep and manage inventory. There are basic reasons for keeping inventory on hand. The important part is that these reasons are evaluated for the needs of each organization and an inventory management system is created that allows for the highest level of efficiency possible.

Inventory Management

Inventory represents finished and unfinished goods that have not yet been sold by a company.

LEARNING OBJECTIVE

- Explain why and how companies keep inventory

KEY POINTS

- Inventories are maintained because time lags in moving goods to customers could otherwise put sales at risk.
- Inventories are maintained as buffers to meet uncertainties in demand, supply and movements of goods.
- There are four stages of inventory: raw material, work in progress, finished goods, and goods for resale.

TERMS

- **Finished goods**: Goods ready for sale to customers.
- **raw materials**: Materials and components scheduled for use in making a product.
- **Work in process**: Materials and components that have began their transformation to finished goods.

EXAMPLE

- A canned food manufacturer's materials inventory includes the ingredients to form the foods to be canned, empty cans and their lids (or coils of steel or aluminum for constructing those components), labels, and anything else (solder, glue, etc.) that will form part of a finished can. The firm's work in process includes those materials from the time of release to the work floor until they become complete and ready for sale to wholesale or retail customers. This may be vats of prepared food, filled cans not yet labeled or sub-assemblies of food components. It may also include finished cans that are not yet packaged into cartons or pallets. Its finished good inventory consists of all the filled and labeled cans of food in its warehouse that it has manufactured and wishes to sell to food distributors (wholesalers), to grocery stores (retailers), and even perhaps to consumers through arrangements like factory stores and outlet centers.

FULL TEXT

Reasons for Keeping Inventory

In many cases (such as retail), a business must have its product on hand in order to complete a sale. For these companies, the reason for keeping one of each item on hand (in inventory) is that it enables them to make sales and capture revenue. However, many businesses keep more than one of every item on hand and also keep raw materials and unfinished goods on stock in factories. Why do they do this?

There are three basic reasons for keeping an inventory:

- Time: The time lags present in the supply chain, from supplier to user at every stage, requires that you maintain certain amounts of inventory to use in this leadtime. However, in practice, inventory is to be maintained for consumption during variations in lead time. Lead time itself can be addressed by ordering that many days in advance.
- Uncertainty: Inventories are maintained as buffers to meet uncertainties in demand, supply and movements of goods.

- Economies of scale: Ideal condition of “one unit at a time, at a place where a user needs it, when he needs it” principle tends to incur lots of costs in terms of logistics. So bulk buying, movement and storing brings in economies of scale, thus inventory. All these stock reasons can apply to any owner or product.

Managing Inventory

Inventory management is primarily about specifying the location and amount of stocked goods. Optimizing inventory management requires balancing many factors, including:

- Replenishment lead time
- Carrying costs of inventory
- Asset management
- Inventory forecasting
- Inventory valuation
- Inventory visibility
- Future inventory price forecasting
- Physical inventory
- Available physical space for inventory
- Quality management
- Replenishment
- Returns and defective goods
- Demand forecasting

Balancing these competing requirements leads to optimal inventory levels, which is an on-going process as the business needs to react to the wider environment. Optimal inventory levels are those that maximize profit from sales, while minimizing cost from storage, shipping, and working capital deployment.

While accountants often discuss inventory in terms of goods for sale, other organizations (such as manufacturers, service-providers and not-for-profits) also have inventories (fixtures, furniture, supplies, etc.) that they do not intend to sell. Manufacturers’, distributors’, and wholesalers’ inventory tends to cluster in warehouses. Retailers’ inventory may exist in a warehouse or in a shop or store accessible to customers. Inventories not intended for sale to customers or to clients may be held in any premises an organization uses. Stock ties up cash and, if uncontrolled, it will be impossible to know the actual level of stocks, and therefore impossible to control them.

Stages of Inventory

While the reasons for holding stock were covered earlier, most manufacturing organizations usually divide their “goods for sale” inventory into:

- Raw materials: materials and components scheduled for use in making a product
- Work in process (WIP): materials and components that have began their transformation to finished goods
- Finished goods: goods ready for sale to customers
- Goods for resale: returned goods that are salable

9.2 Demand Planning and Inventory Control

Learning Objectives

1. Explain why demand planning adds value to products.
2. Describe the role inventory control plays when it comes marketing products.
3. List the reasons why firms collaborate with another for the purposes of inventory control and demand planning.

Demand Planning

Imagine you are a marketing manager who has done everything in your power to help develop and promote a product—and it’s selling well. But now your company is running short of the product because the demand forecasts for it were too low. Recall that this is the scenario Nintendo faced when the Wii first came out. The same thing happened to IBM when it launched the popular ThinkPad laptop in 1992.

Not only is the product shortage going to adversely affect the profitably of your company, but it’s going to adversely affect you, too. Why? Because you, as a marketing manager, probably earn either a bonus or commission from the products you work to promote, depending on how well they sell. And, of course, you can’t sell what you don’t have.

As you can probably tell, the best marketing decisions and supplier selections aren’t enough if your company’s demand forecasts are wrong. Demand planning is the process of estimating how much of a good or service customers will buy from you. If you’re a producer of a product, this will affect not only the amount of goods and services you have to produce but also the materials you must purchase to make them. It will also affect your production scheduling, or the management of the resources, events, and processes need to create an offering. For example, if demand is heavy, you might need your staff members to work overtime. Closely related to demand forecasting are lead times. A product’s lead time is the amount of time it takes for a customer to receive a good or service once it’s been ordered. Lead times also have to be taken into account when a company is forecasting demand.

Sourcing decisions—deciding which suppliers to use—are generally made periodically. *Forecasting decisions* must be made more frequently—sometimes daily. One way for you to predict the demand for your product is to look at your company’s past sales. This is what most companies do. But they don’t stop there. Why? Because changes in many factors—the availability of materials to produce a product and their prices, global competition, oil prices (which affect shipping costs), the economy, and even the weather—can change the picture.

For example, when the economy hit the skids in 2008, the demand for many products fell. So if you had based your production, sales, and marketing forecasts on 2007 data alone, chances are your forecasts would have been wildly wrong. Do you remember when peanut butter was recalled in 2009 because of contamination? If your firm were part of the supply chain for peanut butter products, you would have needed to quickly change your forecasts.

The promotions you run will also affect demand for your products. Consider what happened to KFC when it first came out with its new grilled chicken product. As part of the promotion, KFC gave away coupons for free grilled chicken via Oprah.com. Just twenty-four hours after the coupons were uploaded to the Web site, KFC risked running out of chicken. Many customers were turned away. Others were given “rain checks” (certificates) they could use to get free grilled chicken later.Joe Weisenthal, “Slammed KFC ‘Scrambling to Source More Chicken,’” *The Business Insider*, May 6, 2009, http://www.businessinsider.com/kfc-2009-5 (accessed December 2, 2009).

In addition to looking at the sales histories of their firms, supply chain managers also consult with marketing managers and sales executives when they are generating demand forecasts. Sales and marketing personnel know what promotions are being planned because they work more closely with customers and know what customers’ needs are and if those needs are changing.

Firms also look to their supply chain partners to help with their demand planning. Collaborative planning, forecasting, and replenishment (CPFR) is a practice whereby supply chain partners share information and coordinate their operations. Walmart has developed a Web-based CPFR system called Retail Link. Retailers can log into Retail Link to see how well their products are selling at various Walmart stores, how soon more products need to be shipped to the company and where, how any promotions being run are affecting the profitability of their products, and so forth. Because different companies often use different information technology systems and software, Web-based tools like Retail Link are becoming a popular way for supply chain partners to interface with one another.

Not all firms are wild about sharing every piece of information they can with their supply chains partners. Some retailers view their sales information as an asset—something they can sell to information companies like Information Resources, Inc., which provides competitive data to firms that willing to pay for it.Donald J. Bowersox and David J. Closs, “Ten Mega-Trends That Will Revolutionize Supply Chain Logistics,” *Journal of Business Logistics* 21, no. 2 (2000): 11. By contrast, other firms go so far as to involve their suppliers before even producing a product so they can suggest design changes, material choices, and production recommendations.

Video Clip

Take a Test Drive of the Tata Nano

http://www.youtube.com/watch?v=3sZitve3SUw

Priced at about $2,500 the Tata Nano is the least expensive car ever produced in the world. To make a safe, reliable car at such a low cost, Tata Motors, an Indian company, sought new, innovative design approaches from its suppliers. The elimination of one of the car's two windshield wipers was one result of the collaboration that occurred between Tata and its supply chain partners.Steven Wingett, "Capro, Saint-Gobain, Denso Win Big with Tata Nano," Automotive News Europe, March 3, 2008, 16.

The trend is clearly toward more shared information, or what businesspeople refer to as supply chain visibility. After all, it makes sense that a supplier will be not only more reliable but also in a better position to add value to your products if it knows what your sales, operations, and marketing plans are—and what your customers want. By sharing more than just basic transaction information, companies can see how well operations are proceeding, how products are flowing through the chain, how well the partners are performing and cooperating with one another, and the extent to which value is being built in to the product.

Demand-planning software can also be used to create more accurate demand forecasts. Demand-planning software can synthesize a variety of factors to better predict a firm's demand—for example, the firm's sales history, point-of-sale data, warehouse, suppliers, and promotion information, and economic and competitive trends. So a company's demand forecasts are as up-to-date as possible, some of the systems allow sales and marketing personnel to input purchasing information into their mobile devices after consulting with customers.

Litehouse Foods, a salad dressing manufacturer, was able to improve its forecasts dramatically by using demand-planning software. Originally the company was using a traditional sales database and spreadsheets to do the work. "It was all pretty much manual calculations. We had no engine to do the heavy lifting for us," says John Shaw, the company's Information Technology director. In a short time, the company was able to reduce its inventory by about one-third while still meeting its customers' needs.Carol Casper, "Demand Planning Comes of Age," *Food Logistics* 101 (January/February 2008): 19–24.

Inventory Control

Demand forecasting is part of a company's overall inventory control activities. Inventory control is the process of ensuring your firm has an adequate supply of products and a wide enough assortment of them meet your customers' needs. One of the goals of inventory management is to avoid stockouts. A stockout occurs when you run out of a product a customer wants to buy. Customers will simply look elsewhere to buy the product—a process the Internet has made easier than ever.

When the attack on the World Trade Center occurred, many Americans rushed to the store to buy batteries, flashlights, American flags, canned goods, and other products in the event that the emergency signaled a much bigger attack. Target sold out of many items and could not replenish them for several days, partly because its inventory tracking system only counted up what was needed at the end of the day. Walmart, on the other hand, took count of what was needed every five minutes. Before the end of the day, Walmart had purchased enough American flags, for example, to meet demand and in so doing, completely locked up all their vendors' flags. Meanwhile, Target was out of flags and out of luck—there were no more to be had.

To help avoid stockouts, most companies keep a certain amount of safety stock on hand. Safety stock is backup inventory that serves as a buffer in case the demand for a product surges or the supply of it drops off for some reason. Maintaining too much inventory, though, ties up money that could be spent other ways—perhaps on marketing promotions. Inventory also has to be insured, and in some cases, taxes must be paid on it. Products in inventory can also become obsolete, deteriorate, spoil, or "shrink." Shrinkage is a term used to describe a reduction or loss in inventory due to shoplifting, employee theft, paperwork errors, or supplier fraud.Shari Waters, "Shrinkage," About.com, http://retail.about.com/od/glossary/g/shrinkage.htm (accessed December 2, 2009).

When the economy went into its most recent slide, many firms found themselves between a rock and a hard place in terms of their inventory levels. On the one hand, because sales were low, firms were reluctant to hold much safety stock. Many companies, including Walmart, cut the number of brands they sold in addition to holding a smaller amount of inventory. On the other hand, because they didn't know when business would pick up, they ran the risk of running out of products. Many firms dealt with the problem by maintaining larger amounts of key products. Companies also watched their supply chain partners struggle to survive. Forty-five percent of firms responding to one survey about the downturn reported providing financial help to their critical supply chain partners—often in the form of credit and revised payment schedules.PRTM Management Consultants, "Global Supply Chain Trends 2008–2010," http://www.prtm.com/uploadedFiles/Strategic_Viewpoint/Articles/Article_Content/Global_Supply_Chain_Trends_Report_%202008.pdf (accessed December 2, 2009).

Just-in-Time Inventory Systems

To lower the amount of inventory and still maintain they stock they need to satisfy their customers, some organizations use just-in-time inventory systems in both good times and bad. Firms with just-in-time inventory systems keep very little inventory on hand. Instead, they contract with their suppliers to ship them inventory as they need it—and even sometimes manage their inventory for them—a practice called vendor-managed inventory (VMI). Dell is an example of a company that utilizes a just-in-time inventory system that's vendor managed. Dell carries very few component parts. Instead, its suppliers carry them. They are located in small warehouses near Dell's assembly plants worldwide and provide Dell with parts "just-in-time" for them to be assembled.Sameer Kumar and Sarah Craig, "Dell, Inc.'s Closed Loop Supply Chain for Computer Assembly Plants," *Information Knowledge Systems Management* 6, no. 3 (2007): 197–214.

Dell's inventory and production system allows customers to get their computers built exactly to their specifications, a production process that's called mass customization. This helps keep Dell's inventory levels low. Instead of a huge inventory of expensive, already-assembled computers consumers may or may not buy, Dell simply has the parts on hand, which can be configured or reconfigured should consumers' preferences change. Dell can more easily return the parts to its suppliers if at some point it redesigns its computers to better match what its customers want. And by keeping track of its customers and what they are ordering, Dell has a better idea of what they might order in the future and the types of inventory it should hold. Because mass customization lets buyers "have it their way," it also adds value to products, for which many customers are willing to pay.

Product Tracking

Some companies, including Walmart, are beginning to experiment with new technologies such as electronic product codes in an effort to better manage their inventories. An electronic product code (EPC) is similar to a barcode, only better, because the number on it is truly unique. You have probably watched a checkout person scan a barcode off of a product identical to the one you wanted to buy—perhaps a pack of gum—because the barcode on your product was missing or wouldn't scan. Electronic product codes make it possible to distinguish between two identical packs of gum. The codes contain information about when the packs of gum were manufactured, where they were shipped from, and where they were going to. Being able to tell the difference between "seemingly" identical products can help companies monitor their expiration dates if they are recalled for quality of safety reasons. EPC technology can also be used to combat "fake" products, or knockoffs, in the marketplace.

Video Clip

The Basics of RFID and EPC Technology

http://www.youtube.com/watch?v=k-w6ZYIo37E

To understand how EPC and RFID technology can help marketers, watch this YouTube video.

Electronic product codes are stored on radio-frequency identification (RFID) tags. A radio-frequency identification (RFID) tag emits radio signals that can record and track a shipment as it comes in and out of a facility. If you have unlocked your car door remotely, microchipped your dog, or waved a tollway tag at a checkpoint, you have used RFID technology."FAQs," *EPCglobal*, http://www.epcglobalinc.org/consumer_info/faq (accessed December 2, 2009). Because each RFID tag can cost anywhere from $0.50 to $50 each, they are generally used to track larger shipments, such cases and pallets of goods rather than individual items. See Figure 9.8 "How RFID Tagging Works" to get an idea of how RFID tags work.

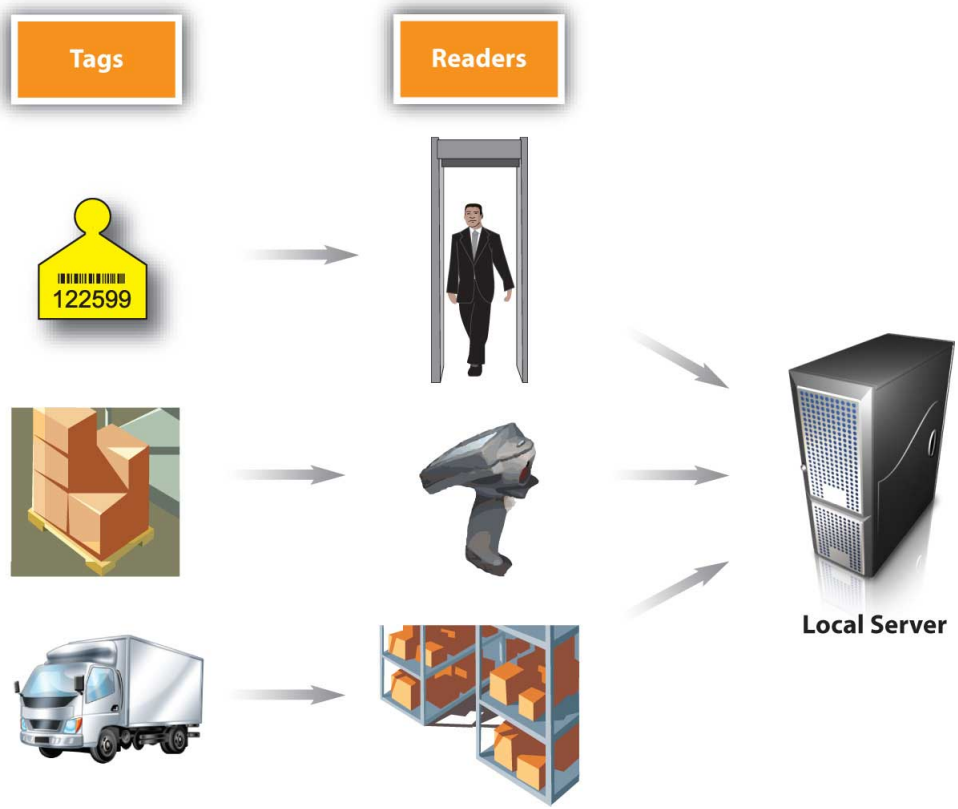


Figure 9.8 How RFID Tagging Works

Some consumer groups worry that RFID tags and electronic product codes could be used to track their consumption patterns or for the wrong purposes. But keep in mind that like your car-door remote, the codes and tags are designed to work only within short ranges. (You know that if you try to unlock your car from a mile away using such a device, it won't work.)

Proponents of electronic product codes and RFID tags believe they can save both consumers and companies time and money. These people believe consumers benefit because the information embedded in the codes and tags help prevent stockouts and out-of-date products from remaining on store shelves. In addition, the technology doesn't require cashiers to scan barcodes item by item. Instead an electronic product reader can automatically tally up the entire contents of a shopping cart—much like a wireless network can detect your computer within seconds. As a customer, wouldn't that add value to your shopping experience?

Key Takeaway

The best marketing decisions and supplier selections aren't enough if your company's demand forecasts are wrong. Demand forecasting is the process of estimating how much of a good or service a customer will buy from you. If you're a producer of a product, this will affect not only the amount of goods and services you have to produce but also the materials you must purchase to make them. Demand forecasting is part of a company's overall inventory control activities. Inventory control is the process of ensuring your firm has an adequate amount of products and a wide enough assortment of them meet your customers' needs. One of the goals of inventory control is to avoid stockouts without keeping too much of a product on hand. Some companies are beginning to experiment with new technologies such as electronic product codes and RFID tags in an effort to better manage their inventories and meet their customers' needs.

Review Questions

1. Why are demand forecasts made more frequently than sourcing decisions?
2. How can just-in-time and vendor-managed inventories add value to products for customers?
3. Why and how do companies track products?

Wikipedia: "Economic Order Quantity "

Read this description of EOQ, which will help you understand the fundamental function of this equation. EOQ is important because it helps minimize the total holding and ordering costs related to inventory. Pay close attention to when this applies in the production process.

Economic Order Quantity

Overview

Economic order quantity (**EOQ**) is the order quantity that minimizes the total holding costs and ordering costs. It is one of the oldest classical production scheduling models. The framework used to determine this order quantity is also known as **Wilson EOQ Model**, **Wilson Formula** or **Andler Formula**. The model was developed by Ford W. Harris in 1913, but R. H. Wilson, a consultant who applied it extensively, and K. Andler are given credit for their in-depth analysis.

EOQ applies only when demand for a product is constant over the year and each new order is delivered in full when inventory reaches zero. There is a fixed cost for each order placed, regardless of the number of units ordered. There is also a cost for each unit held in storage, commonly known as holding cost, sometimes expressed as a percentage of the purchase cost of the item.

We want to determine the optimal number of units to order so that we minimize the total cost associated with the purchase, delivery and storage of the product.

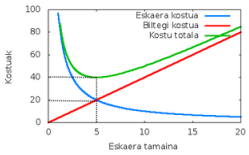
The required parameters to the solution are the total demand for the year, the purchase cost for each item, the fixed cost to place the order and the storage cost for each item per year. Note that the number of times an order is placed will also affect the total cost, though this number can be determined from the other parameters.

Variables

- P = purchase unit price, unit production cost
- Q = order quantity
- Q^* = optimal order quantity

- D = annual demand quantity
- K = fixed cost per order, setup cost (*not* per unit, typically cost of ordering and shipping and handling. This is not the cost of goods)
- h = annual holding cost per unit, also known as carrying cost or storage cost (capital cost, warehouse space, refrigeration, insurance, etc. usually not related to the unit production cost)

The Total Cost function and derivation of EOQ formula



Classic EOQ model: trade-off between ordering cost (blue) and holding cost (red). Total cost (green) admits aglobal optimum. Purchase cost is not a relevant cost for determining the optimal order quantity.

The single-item EOQ formula finds the minimum point of the following cost function:

Total Cost = purchase cost or production cost + ordering cost + holding cost

Where:

- Purchase cost: This is the variable cost of goods: purchase unit price × annual demand quantity. This is P × D
- Ordering cost: This is the cost of placing orders: each order has a fixed cost K, and we need to order D/Q times per year. This is K × D/Q
- Holding cost: the average quantity in stock (between fully replenished and empty) is Q/2, so this cost is h × Q/2

$$TC = PD + \frac{DK}{Q} + \frac{hQ}{2}.$$

To determine the minimum point of the total cost curve, calculate the derivative of the total cost with respect to Q (assume all other variables are constant) and set it equal to 0:

$$0 = -\frac{DK}{Q^2} + \frac{h}{2}$$

Solving for Q gives Q* (the optimal order quantity):

$$Q^{*2} = \frac{2DK}{h}$$

Therefore:

Economic Order Quantity

$$Q^* = \sqrt{\frac{2DK}{h}}$$

Q* is independent of P; it is a function of only K, D, h.

The optimal value Q* may also be found by recognising that[3]

where the non-negative quadratic term disappears for $Q = \sqrt{2DK/h},$ which provides the cost minimum $TC_{min} = \sqrt{2hDK} + PD.$

Example

- Suppose annual requirement quantity (D) = 10000 units
- Cost per order (K) = $2
- Cost per unit (P)= $8
- Carrying cost percentage (h/P)(percentage of P) = 0.02
- Annual carrying cost per unit (h) = $0.16

Economic order quantity = $\sqrt{\frac{2D*K}{h}} = \sqrt{\frac{2*10000*2}{8*0.02}}$ = 500 units

Number of orders per year (based on EOQ) $= \frac{10000}{500} = 20$

Total cost $= P*D + K(D/EOQ) + h(EOQ/2)$

Total cost

If we check the total cost for any order quantity other than 500(=EOQ), we will see that the cost is higher. For instance, supposing 600 units per order, then

Total cost

Similarly, if we choose 300 for the order quantity then

Total cost

This illustrates that the economic order quantity is always in the best interests of the firm.

Quantity Discounts

An important extension to the EOQ model of Wilson is to accommodate quantity discounts. There are two main types of quantity discounts: (1) all-units and (2) incremental.Here is a numerical example:

- Incremental unit discount: Units 1-100 cost $30 each; Units 101-199 cost $28 each; Units 200 and up cost $26 each. So when 150 units are ordered, the total cost is $30*100 + $28*50.
- All units discount: an order of 1-1000 units costs $50 each; an order of 1001-5000 units costs $45 each; an order of more than 5000 units costs $40 each. So when 1500 units are ordered, the total cost is $45*1500.

Design of Optimal Quantity discount Schedules

In presence of a strategic customer, who responds optimally to discount schedule, the design of optimal quantity discount scheme by the supplier is complex and has to be done carefully. This is particularly so when the demand at the customer is itself uncertain. An interesting effect called the “reverse bullwhip” takes place where an increase in consumer demand uncertainty actually reduces order quantity uncertainty at the supplier.

Other Extensions

Several extensions can be made to the EOQ model developed by Mr. Pankaj Mane, including backordering costs and multiple items. Additionally, the economic order interval can be determined from the EOQ and the economic production quantity model (which determines the optimal production quantity) can be determined in a similar fashion.

A version of the model, the Baumol-Tobin model, has also been used to determine the money demand function, where a person's holdings of money balances can be seen in a way parallel to a firm's holdings of inventory.

Malakooti (2013) has introduced the multi-criteria EOQ models where the criteria could be minimizing the total cost, Order quantity (inventory), and Shortages.

ids355: Operations Management Wikispace: "Chapter 12: Inventory Management"

Read this chapter summary. Pay close attention to the types of inventory control and the EOQ model. This source is useful because of the detailed information provided related to the function of inventories, reasons for inventory management, and types of inventory control that is useful. Answer the questions at the end of the summary. Compare your results with the authors

Ch.12 Inventory Management

Inventory is a stock or storage of goods.

Different types of Inventory:

- **Raw materials and purchased parts**
- **work in process (WIP)**
- **finished goods inventories or merchandise**
- **maintenance and repairs (MRO) inventory**
- **goods-in-transit to warehouses or customers (pipeline inventory)**

Nature and Importance of Inventory
Inventories are necessary for a firm to operate efficiently and almost all business transactions involve the delivery of a product or service in exchange for currency. For this reason, inventory management is a very important part of core operations activities. Most retail businesses and wholesale organizations acquire most of their revenue through the sale of merchandise (inventory). In order for business and supply chains to run effectively, and efficiently they must meet all the listed requirements for effective inventory management. Some of the main concerns are the level of customer service and the cost of ordering, storing, and carrying inventory. Therefore, in order to be a successful and profitable company, inventory management must be managed wisely.

There are certain requirements that must be taken into consideration during the inventory management process. These requirements are: keep track of the inventory, have a reliable forecast of demand, knowledge of lead times and lead time variability, reliable estimates of inventory holding costs, ordering costs, and shortage costs, and have a classification system for inventory items.

Some important Functions of inventories include –
1. to meet anticipated customer demand (to meet the *anticipation stocks*, average demand)
2. to smooth production requirements (create *seasonal inventories* to meet seasonal demand)
3. to decouple operations (eliminate sources of disruptions)
4. to protect against stock-outs (hold *safety stocks* to prevent the risk of shortages)
5. to take advantage of order cycles (buys more quantities than immediate requirements – cycle stock, periodic orders, or order cycles)
6. to hedge against price increases (purchase large order to hedge future price increase or implement volumn discount)
7. to permit operations (Little's Law: the average amount of inventory in a system is equal to the product of the average demand rate and the average time a unit is in the system)
8. to take advantage of quantity discounts (supplies may give discount on large orders)

For company's management, the most important reasons for having an inventory management system is to:
1. track existing inventory
2. know what quantity will be needed
3. know when these items will be needed
4. know how much items will cost

There are two types of inventory control used- Perpetual and Periodic. In a perpetual inventory system (usually used in supermarkets or department stores), a continuousflow of inventory count is tracked using a point of sale (POS) check out system. This system is perfect for companies to manage what is sold and reorder when a reorder point is reached. Another advantage of this system is its ability to account for shrinkage (theft) and inventory turnover. The periodic system (used in smaller retailers) is used to take a physical count of inventory at periodic intervals to replenish the inventory. This system would be most beneficial for companies that do not have products with UPC or bar codes, such as nuts and bolts and are purchased in large quantities at a time. In this case, someone on a line would monitor the level of the bin and notify a manager when an order would need to be placed.

Economic Order Quantity Models– the order size that minimizes annual costs (3 types)

1)Basic economic order quantity model (EOQ)

- used to identify a fixed order size that will minimize the sum of the annual costs of holding inventory and ordering inventory

Assumptions:

1. Only one product involved

2. Annual demand requirements are known

3. Demand is spread evenly throughout the year so that the demand rate is reasonably constant

4. Lead time does not vary

5. Each order is received in a single delivery

6. There are no quantity discounts

2)Economic production quantity model (EPQ)

- the batch mode of production is widely used in production; the reason for this is that capacity to produce a part exceeds the part's usage or demand rate (the larger the run size, the fewer the number of runs needed and, hence, the lower the annual setup cost; as long as production continues, inventory will continue to grow; (see formulas below)

Assumptions:
1. Only one item is involved

2. Annual demand is known

3. Has a constant usage rate

4. Usage occurs continually, but production occurs periodically

5. The production rate is constant

6. Lead time does not vary

7. There are no quantity discounts

3) Quantity discount model

- **Price reductions for large orders offered to customers to induce them to buy in large quantities; If quantity discounts are offered, the buyer must weigh the potential benefits of reduced purchase price and fewer orders that will result from buying in large quantities against the increase in carrying costs caused by higher average inventories; The buyers goal is to select the order quantity that will minimize total cost (see total cost formula below);**

Equations to know:

Annual carrying cost = (Q/2)*H [Q = Order quantity in units, H = Holding (carrying) cost per unit]
Annual ordering cost = (D/Q)*S [D = Demand, S = Ordering cost]
Total cost (TC) =(Q/2)*H + (D/Q)*S

- **Total cost curve is U-Shape**

Length of order cycle = Q/D

EPQ= square root[(2DS)/H]*square root[p/(p-u)]
p=production or delivery rate
u=usage rate
Reorder Point: ROP=d*LT
d=demand rate(units per period/day/week)
LT=lead time(same units as d)
EOQ=square root of (2DS)/H

Inventory point-of-sale (POS) systems, which record items at time of sale electronically, can help make forecasting more accurate. Knowing the lead time of a product, which is the time interval between ordering and receiving the order, is crucial to the success of a business. Long lead times impair the ability of a supply chain to quickly respond to changing conditions, such as changes in the quantity demanded, product or service design, and logistics.

1. Which one is *NOT* a function of inventory? (pg. 543)
a. meet anticipated customer demands
b. smooth production requirements
c. decouple operations
d. protect against stock outs
e. they are all functions of inventory

[reveal-answer q="257029"]Show Answer[/reveal-answer]
[hidden-answer a="257029"]

(answer e.)

[/hidden-answer]

2. When dealing with inventory, the Little's Law is used for? (pg. 544)
a. counting inventory
b. quantifying pipeline inventory
c. preventing shortages in inventory
d. all of the above
e. none of the above

[reveal-answer q="39933"]Show Answer[/reveal-answer]
[hidden-answer a="39933"]

(answer b.)[/hidden-answer]

3. Which of the following are functions of inventory that management is concerned with? (P.544)
a. Make sure you never run out of inventory
b. Make decisions about how much to order
c. Make sure there is enough space available for all the inventory
d. Make decisions about when to order
e. both b and d

[reveal-answer q="229301"]Show Answer[/reveal-answer]
[hidden-answer a="229301"]

(answer e)[/hidden-answer]

4. Which of the following best describes lead time? (pg. 547)
a. The time that sales are at a profit
b. The time that the company is ahead of it's competitors
c. The time interval between submitting and receiving the order
d. The time it takes to record items at time of sale
e. none of the above

[reveal-answer q="568890"]Show Answer[/reveal-answer]
[hidden-answer a="568890"]

(answer c)

[/hidden-answer]

5. Which costs is associated with keeping items in inventory? (pg. 547)
a. Holding costs
b. Ordering costs
c. Shortage costs
d. A and B
e. All the above

[reveal-answer q="407105"]Show Answer[/reveal-answer]
[hidden-answer a="407105"]

(answer A)[/hidden-answer]

6) Which is the most commonly used measure of managerial performance. Pg. 542
a. Capital structure
b. ROI(return on investment)
c. Demand
d. Inventory costs
e. Forecasting

[reveal-answer q="402500"]Show Answer[/reveal-answer]
[hidden-answer a="402500"]

Answer: b[/hidden-answer]

7) What are independent-demand items? Pg. 542
a. Items that are ready to be sold and used
b. Components of products rather than finished products
c. Special order items
d. Products that appeal to a certain demographic of customers
e. Seasonal demand items

Answer: a

8) Which of the following is not a function of inventory? Pg. 543
a. To meet anticipated customer demand
b. To smooth production requirements
c. To protect against stock-outs
d. To know lead times and lead time variability
e. To hedge against price increases

[reveal-answer q="68520"]Show Answer[/reveal-answer]
[hidden-answer a="68520"]

Answer: d[/hidden-answer]

9) Which inventory counting system keeps track of removals from inventory on a continuous basis? Pg. 545
a. Two-bin system
b. Periodic system
c. Perpetual system
d. Online system
e. Operations system

[reveal-answer q="267372"]Show Answer[/reveal-answer]
[hidden-answer a="267372"]

Answer: c[/hidden-answer]

10) The economic order quantity model (EOQ), identifies: Pg 550
a. Production of batch items or lots
b. A constant usage rate
c. Units received incrementally during production
d. Fixed order size by minimizing the sum of annual costs of holding and ordering inventory.
e. Total cost of all orders produced annually

[reveal-answer q="43214"]Show Answer[/reveal-answer]
[hidden-answer a="43214"]

Answer: d[/hidden-answer]

11. Which of the following (is/are) types of inventory?
a. Tools and Supplies
b. Maintenance and Repair (MRO)
c. Pipeline
d. Finished Goods
e. all of the above are inventories

[reveal-answer q="966626"]Show Answer[/reveal-answer]
[hidden-answer a="966626"]

a nswer e. Pg551[/hidden-answer]

12. A perpetual Inventory system takes a physical count of inventory on which of the following intervals?
a. Fixed intervals
b. Annual intervals
c. Periodic intervals
d. A and B
e. A and C

[reveal-answer q="22439"]Show Answer[/reveal-answer]
[hidden-answer a="22439"]

answer a Pg 554[/hidden-answer]

13. When the amount on hand reaches a predetermined minimum, which inventory system orders a fixed quantity?
a. Good organization
b. Perpetual inventory
c. Organized inventory
d. Periodic inventory
e. A and C

[reveal-answer q=”488516″]Show Answer[/reveal-answer]
[hidden-answer a=”488516″]

answer b Pg 554[/hidden-answer]

14. Effective inventory management estimates all of the following costs except:
a. Transaction cost
b. Shortage cost
c. Secretary cost
d. Holding cost
e. all of the above

[reveal-answer q=”758222″]Show Answer[/reveal-answer]
[hidden-answer a=”758222″]

answer c Pg556[/hidden-answer]

15. The risk of stock-out increases as?
A. The amount of safety stock increases
B. The amount of safety stock decreases
C. The amount of safety stock remains constant
D. Safety stock has no effect on stock-out
E. none of the above

[reveal-answer q=”634045″]Show Answer[/reveal-answer]
[hidden-answer a=”634045″]

Answer: B pg 572[/hidden-answer]

16. Which of the following are NOT part of the basic functions of inventory systems that management should be concerned with (p 553) ?
a. what quantity will be ordered
b. tracking existing inventory
c. how inventory will be delivered
d. when to order additional inventory
e. none of the above

[reveal-answer q=”406489″]Show Answer[/reveal-answer]
[hidden-answer a=”406489″]

Answer: c[/hidden-answer]

17. Which inventory system is the best method to prevent inventory theft/loss?
a. Perpetual Inventory System
b. Periodic Inventory System
c. Both are equally good
D. none of the above
E. Studies are inconclusive regarding which is the best method

[reveal-answer q=”944283″]Show Answer[/reveal-answer]
[hidden-answer a=”944283″]

Answer: a pg554[/hidden-answer]

18. Which of the following listed is/are function(s) of POS(point-of-sale) system?
a. record actual sales electronically
b. provide forecast of what items will most likely to attract customers and increase sales
c. calculate sum of total sales
d. a&b
e. all of above

[reveal-answer q=”341115″]Show Answer[/reveal-answer]
[hidden-answer a=”341115″]

Answer: d, pg. 555[/hidden-answer]

19. Which one of these assumptions do NOT qualify to create an ideal situation to use the Basic EOQ Model?
a. there are no quantity discount
b. there is only one product involved
c. demand requirements are unknown
d. lead time does not vary
e. none of the above

[reveal-answer q=”748601″]Show Answer[/reveal-answer]
[hidden-answer a=”748601″]

Answer: c, pg. 559[/hidden-answer]

20. Which one of these factors are NOT a determinant of the reorder point?
a. rate of demand
b. acceptable stock-out risk level to management
c. lead time variability
d. All of above are determinants of reorder point.
e. None of the above are determinants of reorder point

[reveal-answer q=”359241″]Show Answer[/reveal-answer]
[hidden-answer a=”359241″]

Answer: d, pg. 571[/hidden-answer]

21. “A physical count of items in inventory made at periodic intervals”, refers to _?
a. periodic system
b. perpetual inventory system
c. two bin system
d. universal product code
e. point of sale

[reveal-answer q=”110096″]Show Answer[/reveal-answer]
[hidden-answer a=”110096″]

Answer: a, pg. 553[/hidden-answer]

22. Which of the following is NOT a function of inventories?

a) to meet anticipated customer demand
b) to smooth production requirement
c) to work more closer with suppliers to coordinate shipments
d) to take advantage of order cycles
e) all of the above

[reveal-answer q=”358612″]Show Answer[/reveal-answer]
[hidden-answer a=”358612″]

Answer: c, pg. 549[/hidden-answer]

23. What is an inventory a stock or store of ?

a) ideas
b) goods
c) shipments
d) networks
e) a and b

[reveal-answer q=”173328″]Show Answer[/reveal-answer]
[hidden-answer a=”173328″]

Answer: b, pg. 549[/hidden-answer]

24. Which of the following is NOT an order size model?

a) basic economic order quantity model
b) economic production model
c) quantity discount model
d) single period model
e) none of the above

[reveal-answer q=”186548″]Show Answer[/reveal-answer]
[hidden-answer a=”186548″]

Answer: d, pg. 559[/hidden-answer]

25. Which is not an requirement for effective inventory management?

a) a system to keep track of the inventory
b) A reliable forecast of demand
c) effective transportation analysis
d) knowledge of lead times
e) a classification system

[reveal-answer q=”257592″]Show Answer[/reveal-answer]
[hidden-answer a=”257592″]

Answer: C, pg. 553[/hidden-answer]

26. Which of the following **is** a function of inventory?
a) To smooth production requirements
b) To meet anticipated customer demand
c) Decouple operations
d) both a and b
e) all of the above

[reveal-answer q=”394542″]Show Answer[/reveal-answer]
[hidden-answer a=”394542″]

Answer: E, pg. 551-552[/hidden-answer]

27. Which of the following (is/are) a result of a company’s failure to manage their inventory properly?
a) Decline in Level of customer service
b) Increase in Ordering,carrying, and storage costs
c) Stock-outs or overstock
d) both a and c
e) all of the above are results of improperly managing inventory

[reveal-answer q=”944316″]Show Answer[/reveal-answer]
[hidden-answer a=”944316″]

Answer: E, pg. 553[/hidden-answer]

28. Little’s Law states**:**
a) The average amount of inventory in a system is constant.
b) The average amount of inventory in a system is equal to the product demand rate and time in the system.
c) The average amount of inventory in a system is equal to last year’s forecast.
d) The average amount of inventory cannot be predicted.
e) All the above

[reveal-answer q="182699"]Show Answer[/reveal-answer]
[hidden-answer a="182699"]

Answer: B, pg. 552[/hidden-answer]

29. Which of the following is/are acceptable inventory counting systems**?**
a) Perpetual
b) Normal
c) Periodic
d) both a and b
e) both a and c

[reveal-answer q="300818"]Show Answer[/reveal-answer]
[hidden-answer a="300818"]

Answer: E, pg. 553-554[/hidden-answer]

30. Which of the following is NOT a requirement for manager to effectively managing inventories?
a) Income from operations must equal income from financing activities
b) Have a reliable forecast of demand that include an indication of past forecast orders
c) Know lead times and lead time variability
d) Have a classification system for inventory items
e) all of the above

[reveal-answer q="314100"]Show Answer[/reveal-answer]
[hidden-answer a="314100"]

Answer: A, pg. 553[/hidden-answer]

CC licensed content, Shared previously

- Benefits of Inventory Management. **Provided by**: Boundless. **Located at**: https://www.boundless.com/. **License**: *CC BY-SA: Attribution-ShareAlike*
- Invenotry Management. **Provided by**: Boundless. **Located at**: https://www.boundless.com/. **License**: *CC BY-SA: Attribution-ShareAlike*
- Demand Planning and Inventory Control. **Provided by**: Saylor Academy. **Located at**: https://saylordotorg.github.io/text_principles-of-marketing-v2.0/s12-02-demand-planning-and-inventory-.html. **License**: *CC BY-NC-SA: Attribution-NonCommercial-ShareAlike*
- Economic Order Quantity. **Provided by**: Wikipedia. **Located at**: https://en.Wikipedia.org/. **License**: *CC BY-SA: Attribution-ShareAlike*
- Inventory Management. **Provided by**: Wikispaces. **Located at**: https://ids355.wikispaces.com/. **License**: *CC BY-SA: Attribution-ShareAlike*