

CONCEPTS OF INVENTORY AND RELATED TECHNICAL TERMINOLOGIES: A LITERATURE REVIEW

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ABSTRACT

The majority of firms have sizable inventories, and a sizeable percentage of their funding is allocated to them. It becomes essential to efficiently manage inventory (or inventories) to avoid costs associated with changing production rates, overtime, subcontracting, unnecessary cost of sales, and backorder penalties during high demand periods. Inventory is backbone and key element in any manufacturing business. Inventory is the part of supply chain where goods are moved from one place to another to satisfy the needs. Inventory management aids businesses in determining which stock to order when and in what quantities. Inventory is tracked from product acquisition to sale and the inventory management guarantees that there are consistently enough inventories to fulfill customer orders and proper warning of a shortage, the practice recognizes trends and reacts to them. There were ambiguities in understanding the inventory & related concepts and hence this study was executed to make the concepts clear on Inventory and its management.

Keywords: Inventory, Inventory Management, Inventory Control, SCM, Logistics, Role of Inventory, Supply Chain, JIT, Inventory Types, Inventory Objectives, ABC Analysis, FSN, KPI

1. INTRODUCTION

1.1. WHAT IS INVENTORY?

Inventory is the part of supply chain management (Singh, Singh and Kumari 2020); (D. J. Singh, et al. 2022). Any company's supply chain management (SCM) is built on the foundation of logistics (Singh, Singh and Kumari 2022); (J. Singh 2021) where inventory is the subset of logistics management (Singh, Sarupria, et al. 2019). According to (Jenkins 2020), Inventory is made up of the components, completed commodities, and raw materials it sells or utilizes in manufacturing. Inventory is viewed as an asset in accounting. Accounting professionals utilize stock level information to accurately report values on the balance sheet.

There are many definitions of inventory however a robust definition could be as follows:

“Inventory is the goods or products in physical forms (tangible state) or it is in the intangible form like software that someone (organization or individual) handles with the intention of selling. Inventory can be old or new, usable or non usable, raw materials or unfinished (work-in-progress) or finished goods.”

There are mainly three types of inventory as below (Singh, Singh and Kumari 2020); (D. J. Singh, et al. 2022); (Singh, Singh and Kumari 2022); (J. Singh 2021);(UNLEASHED 2022):

1. Raw Material Inventory: Raw material inventory is the stock that you employ to produce your finished goods.

2. Unfinished Inventory OR Work-In-Progress Inventory: Inventory of semi-finished products that have not yet been completed during production.

3. Finished Goods Inventory: The goods or products that have been finished and are ready for use or sale to the final consumer.

MRO supply and Safety stock are the parts of above types of inventory, though many authors consider maintenance, repair, and operating goods (MRO Goods) and safety stock (additional inventory used during shortage or surges in demand) as the separate types of inventory.

How effectively firm operate its business, treat your customers, and increase sales is determined by inventory management. Inventory management is essential for companies that sell items, from small craft breweries to large wholesalers & wholesalers. Inventory management can be improved by engaging suppliers, developing inventory management system, focused & goal oriented approach towards needs, utilize hand held (mobile) technologies/devices, and utilize real-time data to analyse & make quick proper business decisions (Singh, Singh and Kumari 2022); (J. Singh 2021); (Singh, Singh and Kumari 2020); (D. J. Singh, et al. 2022);(UNLEASHED 2022).

1.2. WHAT IS INVENTORY MANAGEMENT? AND IT'S IMPORTANCE IN BUSINESS?

Inventory management aids businesses in determining which merchandise to order when and in what quantities. Inventory is tracked from product acquisition to sale. To guarantee there is always adequate inventory to fulfill client requests and proper notice of a shortfall, the technique recognizes patterns and reacts to them.

Inventory turns into revenue after it is sold. Inventory ties up cash before it is sold, while being shown as an asset on the balance sheet. As a result, having too much stock is expensive and lowers cash flow. Inventory turnover is one metric for effective inventory management. Inventory turnover is a metric used in accounting to determine how frequently stock is sold over time. A company doesn't want to have more inventory than sales. Dead stock, or unsold stock, can result from a lack of inventory turnover (Jenkins 2020).

Why is Inventory Management Important? Because it helps to ensure that there is rarely too much or too little product on hand, inventory management is essential to a company's health because it lowers the danger of stockouts and erroneous records.

Saves money: By comprehending stock patterns, you may better utilize the stock you already have by seeing how much of each item you have in stock and where it is located. This lowers expenses associated with inventory and reduces the quantity of stock that is unsold before it becomes obsolete. It also enables you to retain less stock at each location (store, warehouse), since you may pull from anywhere to fulfill requests.

Enhances Cash Flow: When you manage your inventory well, you spend money on products that will sell, which keeps the business's cash flow healthy.

Makes Customers Happy: It makes sure that customers get what they want in right away which cultivate loyal patrons.

Inventory Management Objectives

It is important to note that inventory management objectives are closely integrated with organisational objectives as shown in figure-1.

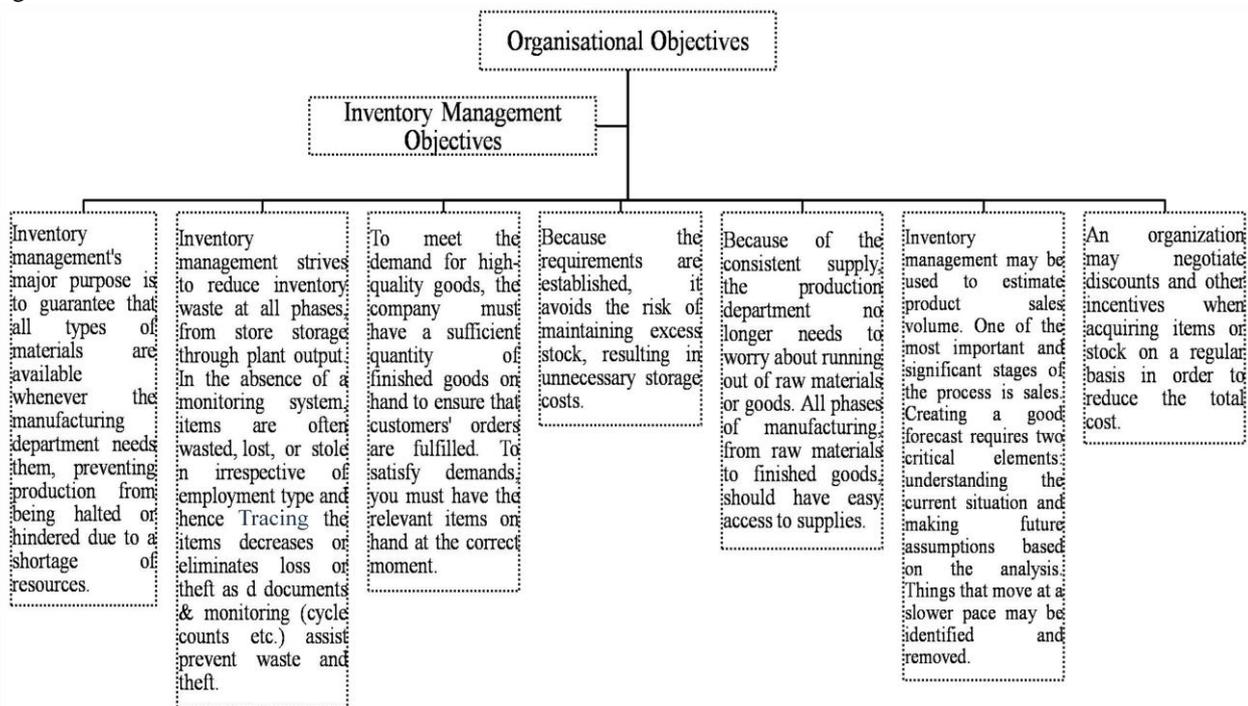


Figure-1: Inventory Management Objectives' Integration with Organisational Objectives

How does Inventory Management Work?

In order to make sure those stocks (raw materials, finished goods, and unfinished products) are used as effectively and efficiently as possible, inventory management keeps track of goods/products, components, and other ingredients across suppliers, stock on hand, production, and sales. Planning and demand forecasting is the integrated part of inventory management as the '**optimal inventory**' is key goal for everyone whether individual or organization.

The demand can be latent, dependent or independent and hence it is always challenging to forecast accurately at 100% however there are means to optimize the forecast to have optimal inventory level across the supply chain. In order to reduce logistical costs and fulfill consumer demand, inventory tracking is a continuous activity.

Optimal Inventory: According to (Lopienski 2021); (Singh, Sarupria and Kushwaha 2019a); (Singh, Singh and Kushwaha 2020b) the optimum product amounts that should always keep in a fulfillment center or centers should indeed be recognized as optimal inventory levels. The probability of frequent inventory problems, such as excessive storage costs and out-of-stock products, is decreased by optimizing inventory levels. If there is excessive inventory, it may be expensive to buy, it can remain on the shelf for too long, and it can eventually go bad as bad inventory acts like a waste (Singh and Kumari November 23, 2020); (Kumari and Singh 2022). However, having insufficient inventory might result in stockouts and backorders, which can lower consumer satisfaction.

Here are a few things to think about when it comes to optimizing inventory levels:

1. Every individual or company will have different thoughts about inventory levels based on their ultimate goals.
2. Depending on demand, each SKU can need a different ideal inventory level (Singh, Singh and Kumari 2020).
3. Optimal inventory levels are subject to rapid fluctuation (monthly, seasonally, and annually as you grow).

Ultimately, inventory optimization becomes increasingly challenging as more items get introduced or volumes are increased or company widens the physical reach.

1.3. WHY IT'S CRUCIAL TO KEEP INVENTORY LEVELS AT HEALTHY LEVELS?

Calculation skills and the capacity to work backwards utilizing past order and inventory data are needed to determine ideal inventory levels. You should also think about when to place a new order for inventory to ensure that it leaves the supplier in time to complete orders as soon as they are placed. Here are three factors to think about along with some best practices for choosing your company's ideal inventory levels (Singh, Singh and Kumari 2022); (J. Singh 2021);(Lopienski 2021).

1. Lead times for inventory production

Understanding manufacturing lead times will enable you to decide when inventory has to be reordered in order to maintain target stock levels consistently. How much inventory it will have and when? It depends on how long it takes your supplier or manufacturer to turn raw materials into finished items after you place an order. When determining product lead time, take the following things in mind (Lopienski 2021); (Singh, Singh and Kumari 2022); (J. Singh 2021):

- Any breaks a manufacturing takes, such closures for the New Year breaks, any festival breaks or any kind of natural calamities, etc.

- The time it takes for inventory to go from the supplier to your warehouse.
- Duration of receiving and storing inventory.

2. Access to safety stock

Safety stock is additional inventory you have on hand for your online store in case of unforeseen events like a sudden spike in demand or delays in production or delivery. You must be aware of the following in order to calculate safety stock (Singh, Singh and Kumari 2022); (J. Singh 2021);(Lopienski 2021):

- The daily maximum
- Maximum lead period
- Daily use on average
- Typical lead time

Use this straightforward safety stock calculator to quickly estimate how much safety stock you have on hand. The economic order quantity (EOQ) formula is a fantastic technique to determine the ideal amount of inventory, including safety stock, to have on hand. Finding the ideal stock level to satisfy consumer demand while minimizing storage expenses for online retailers is easy with the help of EOQ (J. Singh 2021); (Singh, Singh and Kumari 2020); (D. J. Singh, et al. 2022);(Lopienski 2021).

3. Prediction of demand

With the help of effective demand forecasting, businesses will be able to estimate future sales demand and calculate the amount of inventory you will require over a specific time period. Making smarter inventory selections that might affect logistics operations and financials, from storage costs to personnel, depends on your ability to predict demand. Demand projections are rarely 100% correct, but they may enable businesses to gain more understanding of their whole supply chain (J. Singh 2021); (Singh, Singh and Kumari 2020); (D. J. Singh, et al. 2022);(Lopienski 2021).

1.4. FIVE RECOMMENDATIONS FOR PRESERVING IDEAL INVENTORY LEVELS

Because once was already noted, as business supply chain grows, keeping ideal inventory levels becomes more difficult. As customers anticipate rapid order fulfillment, one of the most crucial components of running an online company is maintaining adequate inventory levels. Here are some general best practices for keeping optimal inventory levels. Each online company needs a unique inventory management approach to track inventory effectively (Lopienski 2021).

1. Introduce a Mechanism for Tracking Inventories

Organization can optimize stock control throughout its distribution network by knowing how much of each SKU is present in each location. Such real-time access to stock levels across distribution facilities and sales channels is made possible by inventory tracking systems. Implementing an inventory management system is a proven approach to effectively allocate inventory as supply chain grows because it have complete access to real-time data (Lopienski 2021).

2. Establish the Ordering Points or Re-Order Point

Manual inventory tracking is the last thing any business owner wants to do because there won't be any time left for anything else. When you know what your ideal inventory level is, you may create reorder points to assist automate the ordering process. The minimal level of inventory that indicates when it's time to restock inventory is known as a reorder point. You should take lead times and client demand into account when determining the reorder quantity. A function that will automatically alert you when inventory levels approach a reorder point is also available in the majority of inventory applications (Singh, Singh and Kumari 2020); (D. J. Singh, et al. 2022);(Lopienski 2021).

3. Clearly Communicate With the Vendor

The foundation of effective inventory management is open communication with suppliers about your expectations and the new items timetable. Organization should also be aware of any holidays or other closures that manufacturer may observe, such as closed plants. Utilize and incorporate information about the suppliers' activities into inventory tracking strategy as supply chain heavily depends on suppliers, so keep an eye on how the suppliers are doing over time (Singh, Singh and Kumari 2020); (D. J. Singh, et al. 2022); (Lopienski 2021).

4. Audit the Inventory

Undoubtedly, doing inventory audits and warehouse audits may take a lot of time, especially if you have a lot of goods to maintain manually using spreadsheets. Thankfully, by synchronizing your online store with an inventory storage system or a 3PL's fulfillment technology, executing inventory audits routinely may be automated and digitalized (Lopienski 2021).

5. Implement an Inventory Management and Control System

Distribution network can run at peak efficiency if the appropriate technology supports the supply chain at every level. Company may access all of business inventory, fulfillment locations, sales channels, and clients in one location by integrating SKUs and orders with an inventory management system. An inventory management system is used by many quickly expanding online businesses to track inventory in real time and automate inventory chores to save time and increase accuracy. Inventory management system (IMS) helps to reduce overall inventory & its waste throughout the chain, reduces overall costs, increases the visibility by providing real-time inventory data/information across the supply chain, automated order placements, real-time inventory counts at SKU level, and so on (Lopienski 2021).

As products (goods) go from suppliers through warehouse to customers, it is tracked and controlled during the inventory management process (UNLEASHED 2022). There are five key steps to take:

Buying: It can refer to purchasing goods that will be assembled later or purchasing goods that will be sold as-is.

Production: It is the process of creating your final product from its component pieces. Not every business will engage in manufacturing; wholesalers, for example, could completely omit this stage.

Holding Stock: if necessary, storing your raw materials before being created and your finished products before being sold

Sales: delivering your products to clients and collecting money.

Reporting: Companies must keep track of how much they are selling and how much they are earning from each transaction.

2. INVENTORY MANAGEMENT VERSUS INVENTORY CONTROL

Although they may sound similar, inventory control and inventory management are two different concepts (UNLEASHED 2022). The management of the inventory after having in storage is done through inventory control. This requires intimate knowledge of business inventory; including how much is accessible, where it is located, and what condition it is in. Additionally, it's important to keep inventory expenses low, minimize time spent counting and managing inventory, and make sure that you are storing stock efficiently.

Which comes first, Inventory Control or Inventory Management?

Inventory management encompasses a lot more than just control; it also takes into consideration its supply chain, production, fulfillment, sales, and reporting. Before drilling down to control, almost any organization will need to have an inventory management system in place. Without it, company won't be able to control suppliers, manufacturing, or sales. Then, there are various strategies for improving the storage and sale of goods. One can choose to concentrate on improving buying, control, production, or sales. For instance, depending on prior operational experience, you could wish to consider changes, such as altering the way employees counts stock. Altering procedures to accommodate changes in demand, client gains and losses, and product and order profile changes is another option (UNLEASHED 2022).

3. INVENTORY MANAGEMENT TECHNIQUES

Using some of these standard inventory management strategies may be a wonderful way to take control of your supply, regardless of the size of your company. Here are some to think about:

JIT (just-in-time) Inventory: By retaining as little stock as feasible, JIT avoids the expenses and dangers associated with maintaining a significant volume of stock on hand. Companies employ this technique in an effort to keep stock levels as low as possible before to replenishment. Using a just-in-time (JIT) inventory system (Banton and Boyle 2022), suppliers may place orders for raw materials that are directly in line with production schedules. By only ordering the things they really need for the production process, businesses may cut down on inventory expenses while increasing efficiency and reducing waste. Producing using this technology necessitates precise demand forecasting. Important points to remember as below:

- As a management strategy, the just-in-time (JIT) inventory system increases productivity while reducing inventor and Inventory wastes.
- Just-in-time production is also known as the Toyota Production System (TPS), which was introduced by the carmaker Toyota in the 1970s.
- JIT is typically used with the Kanban scheduling technique to prevent work in progress overflow.
- The JIT manufacturing process relies on dependable suppliers, regular output, excellent craftsmanship, and trouble-free equipment.
- The IBM continuous-flow production method and Motorola's short-cycle manufacturing are other names for the JIT system.
- The JIT manufacturing process reduces warehouse holding cost, more control to manufacture, and also reduces working capital requirements.

ABC Inventory Analysis: By grouping products into several levels, this strategy seeks to find the inventory that is profitable for you. The value of inventory items is calculated using the inventory management approach of ABC analysis based on their significance to the company. Inventory managers classify things according on how ABC prioritizes them based on demand, cost, and risk data. This enables business executives to comprehend which offerings are most essential to the financial performance of their company (Jenkins 2020).

According to sales volume or profitability, "Class A" items are the most crucial stock keeping units (SKUs), followed by "Class B" and "Class C" products. Some businesses could choose for a classification scheme that divides goods into more than just those three categories. The ABC analysis used for inventory management is distinct from the ABC analysis used for cost accounting, also known as activity-based costing. Activity-based costing is a manufacturing technique used by accountants to allocate indirect or overhead expenses, like as wages or utility costs, to goods and services (Jenkins 2020). Table-1 has shown the ABC classes & impacts.

Table-1: ABC Classes and Their Impacts

Types	Importance	Percentage of Total Inventory	Annual Consumption Value	Controls	Records
Class A	High Value	10% - 20%	70% - 80%	Tight	High Accuracy
Class B	Medium Value	30%	15% - 20%	Medium	Good
Class C	Low Value	50%	5%	Basic	Minimal

Source: (Jenkins 2020)

It's possible that the Pareto Principle isn't always correct. Analysis, however, reveals that valued goods do lean toward an 80/20 distribution. ABC analysis quickly and easily pinpoints the "sweet spot" where the majority of a company's revenue originates.

ABC Inventory Analysis Formula is as below:

Annual No. of Items Sold * Cost Per Item = Annual Usage Value Per Product

Inventory ABC analysis improves working capital cost management. The knowledge gathered from the research lowers outdated inventory and can increase inventory turnover rate, or how frequently a company has to buy new inventory after selling out of old stock.

Advantages of ABC Analysis

Applying ABC analysis to inventory management can provide a wide range of advantages (Jenkins 2020), including -

- **More effective inventory management:** The research reveals the most popular goods. The corporation can then use its limited warehouse space to maintain lower stock levels for Class B or C items while sufficiently stocking those products.
- **More accurate inventory forecasting:** Accurate sales forecasting may be improved by tracking and gathering data on items with significant consumer demand. In order to raise the company's total revenue, managers might utilize this information to establish inventory levels and pricing.
- **Better Pricing:** A spike in sales for a particular product suggests demand is growing, making a price rise possible while maintaining profitability.
- **Informed Supplier Negotiations:** Class A products account for 70% to 80% of a company's revenue, thus it makes sense to bargain with suppliers for better terms on such items. Try negotiating post-purchase services, down payment reductions, free delivery, or other cost savings if the provider won't agree to decrease prices.
- **Strategic Resource Allocation:** ABC analysis is a method of regularly assessing resource allocation to make sure that Class A goods are in line with consumer demand. Reclassify the product as demand declines to better use staff, resources, and facilities for the new Class A offerings.
- **Better Customer Service:** Service levels rely on a variety of elements, including the amount sold, the price of the item, and profit margins. Offer better service levels for the things that you've found to be the most profitable.
- **Better Product Life Cycle Management:** Accurate demand forecasting and stocking of inventories depend on understanding the stage of a product's life cycle (launch, growth, maturity, or decline).
- **Possession of Expensive Items:** The success of a business is highly correlated with class A inventory. Make it a priority to keep an eye on demand and to maintain good stock levels so that there is always enough of the essential products available.
- **Sensible Stock Turnover Rate:** Through thorough inventory control and data collection, keep the stock turnover rate at sensible levels.
- **Reduced Storage Expenses:** You may lower the inventory carrying costs associated with storing extra inventory by carrying the proper percentage of stock based on A, B, or C classes.
- **Simplified Supply Chain Management:** To lower carrying costs and streamline operations, decide whether it's time to combine suppliers or switch to a single source by doing an ABC analysis on inventory data.

How to Perform ABC analysis?

A Step by step process is provided as below:

- **Identify the Goal:** By managing inventory levels of the appropriate goods based on client sales or production, an ABC analysis can help you achieve one of two goals: decrease procurement costs or increase cash flow.
- **Gather Data:** The annual expenditure for each item is the most typical type of data to gather. Raw purchase dollars are used for this data. You may gather information on the weighted cost, including gross profit margin, ordering, and carrying costs if the calculation is simple.
- **Sort by Decreasing Order of Effect:** Using the ABC analysis technique, rank the cost of each inventory item in decreasing order of impact, starting with the most expensive.
- **Calculate the Impact on Sales:** For each inventory item, get the percentage impact on sales by dividing the yearly item cost by the total cost of all products purchased. When comparing items on the list, you will utilize this percentage or fraction. Here is the equation:

$$\text{Percent Impact} = (\text{Annual Item Cost}) / (\text{Total Sum of All Expenditures}) * 100$$

- **Sort Products into Buy Classes:** Once you've established the classes, focus on contract negotiations, vendor consolidation, changing the strategic sourcing approach, or introducing e-procurement. Making adjustments in these areas can result in considerable cost savings or guarantee the availability of Class A products in stock. Instead than being rigid about the 80/20 rule, adopt a comprehensive perspective.
- **Analysis of Classes:** Schedule reviews to track the success or failure of actions after categories and strategic cost management are set.

FSN Inventory Analysis: It is an inventory management approach called FSN Analysis is based on how quickly items and spare parts are used inside a company. Based on the inventory's pace or rate of usage, consumption rate, and average stay, three categories are created. FSN is an acronym for fast, slow, and non-moving (efinancemanagement.com n.d.).

- **Fast Moving Inventory:** Inventory that switches in and out of stock the quickest and most frequently is considered fast-moving inventory. As a result, these items have the highest rate of replenishment. Less than 20% of the overall inventory is often made up of items in this category.
- **Slow Moving Inventory:** Since the items in this category travel more slowly, their replenishment follows suit. About 30% of an organization's overall inventory falls within this group.
- **Non Moving Inventory:** The last category of this study comprises both the dead stock and the least-moving element of the inventory. After use, replenishment of such goods may or may not take place. As much as 50% of an organization's overall inventory falls into this group.

A few factors are used in FSN analysis to determine the three kinds of commodities in the inventory. Formulas are used to generate numbers that indicate whether a good falls into the fast-moving, slow-moving, or non-moving categories since it is a scientific examination and not dependent on the opinion of a select few people (efinancemanagement.com n.d.).

Average Stay: Number of cumulative days inventory is held/ (Opening Balance of the good + Number of goods received during the period)

Consumption Rate: Total number of goods issued/ Total period

The next step is to calculate the Cumulative average stay and Cumulative consumption rate.

Cumulative average stay: Average stay of the item + Average stay of all goods having an average stay more than itself

Cumulative consumption rate: Consumption rate of the item + Consumption rate of all goods that are consumed faster

Percentage average stay: (Cumulative average stay of the item/ Cumulative average stay of all goods) x 100

Percentage consumption rate: (Cumulative consumption rate of the item/ Cumulative consumption rate of all goods) x 100

Explanation

Three kinds of FSN analysis products are based on cumulative average stay (Hans n.d.); (efinancemanagement.com n.d.):

10% or less of the average cumulative stay is made up of fast-moving products.

20% or less of the average cumulative stay is made up of slow-moving products.

70% or less of the typical cumulative stay is made up of non-moving commodities.

Fast-moving products only account for 10% or less of the whole inventory's cumulative average stay, according to the categorization. In other words, they travel through the inventory with the greatest speed. This explanation can be viewed on the other hand as below:

The three groups will be as follows based on the cumulative consumption rate:

Fast-moving goods have a consumption rate of 70% or less.

Products with a 20% cumulative consumption rate move slowly.

Non-moving items have a cumulative consumption rate of 10% or less.

As a result, it is clear once more that according to the categorization, fast-moving items are those that are eaten the quickest. Non-moving items have the lowest rates of consumption.

Cross-docking: A method called cross docking practically removes the need to keep inventories. When goods are transported to a warehouse, they are promptly processed and prepped for shipping; frequently, they are reloaded onto other trucks parked at the same warehouse. Cross docking speeds up the transportation process, but it shouldn't omit procedures like quality assurance and inventory management (dearsystems.com 2017). It still needs a great deal of cautious handling and preparation. Using this technique, keeping inventory is almost unnecessary. Deliveries are made to a warehouse, where they are quickly sorted and made ready for shipping. At the same warehouse, they are often reloaded into more trucks and sent out right away for distribution. There are advantages and disadvantages of cross-docking as below:

Advantages:

- Cross-docking helps to bring efficiency through quick and speedy process for distributing goods.
- Cross-docking helps to reduce warehouse cost through drastic reduction in inventory cost
- Cross-docking helps to decrease the Lead Time through faster & more efficient product movement till delivery to the final consumer
- Cross-docking helps to reduce labour cost by avoiding paper, system and physical work for put-away, etc.

Disadvantages:

- Many suppliers may not be able to do cross docking
- Inefficient for low turnover business
- Increased Cost of Trucks and Docks
- High-Cost of Precise Organization

Cycle Counting: This method entails counting a limited portion of goods on a particular day rather than performing a full cycle counting (stock taking). Using this technique, you may frequently verify that the inventory levels displayed in your inventory management system are accurate. The strategy for workers to audit inventory is frequently prepared by warehouse managers and supply chain experts. The most effective inventory management strategies provide exceptionally accurate stock records and low transaction error rates without interfering with staff members' crucial duties. Regular cycle counting is a crucial auditing method

for managing inventory counts, regardless of whether a firm utilizes periodic or perpetual inventory techniques to maintain its inventory.

Numerous businesses regularly count their physical inventory as part of their yearly financial accounting procedures. To do a complete physical inventory count, large businesses with thousands of goods frequently suspend operations for up to a week or more. Cycle counting is a method of inventory management that enables you to count the goods in a specific section of a warehouse without pausing work to do a full physical inventory.

Utilize the inventory cycle count accuracy formula to calculate inventory record accuracy (IRA) as below:

IRA = Matched inventory / No. of items counted

According to (Schwarz 2021) Cycle counting is used to find and correct any irregularities in inventory records. Understanding your performance, whether it is improving, and how you do in comparison to industry standards is beneficial in any process. The IRA number is a popular KPI in this context. This formula may be modified to represent either a sum of units or dollars. Use the following calculation for dollars or units:

IRA = $[1 - \frac{\text{the sum of the absolute variance}}{\text{No. of the sum of the total inventory}}] \times 100$

Example: Calculate the IRA as follows, for instance, if the system count was 325 and the physical count was 300:

IRA = $[1 - (25/325) \times 100] = 92.30\%$

Bulk Shipments: This method is predicated on the notion that purchasing in bulk is less expensive. The approach is excellent if a company is confident that its goods will sell, but it can present problems if demand unexpectedly shifts. Bulk shipping is the movement of products in large quantities that are often unpackaged and put directly onto a vessel. Because of this, these commodities are transported in a piece often the ship's hold that serves as the container without any packing or protective wrapping (tradegecko.com n.d.).

This approach is predicated on the idea that buying and shipping products in bulk is usually always less expensive. One of the most used methods in the sector, bulk shipment, can be used for products with strong consumer demand. The drawback of bulk shipping is that you will have to spend more money storing the inventory, but this will probably be made up for by the money you save by buying things in large quantities and selling them off quickly (tradegecko.com, Chapter-3: Inventory Management Techniques n.d.).

Advantages of Bulk-shipments

- Highest likelihood of success
- Lower shipping expenses result from fewer shipments.
- Works effectively for dependable commodities with long shelf life and predictable demand

Disadvantages of Bulk-shipments

- Highest possible capital risk
- A rise in storage holding costs
- It's challenging to change rapidly when demand changes

Backordering: When a consumer puts an order for merchandise that isn't yet available, it's called a backorder. Learn more about the effects of backordering on inventory management. Allowing clients to place orders even when you don't have enough inventories on hand is known as backordering. Backordering is used by businesses when a sudden rise in sales causes things to sell more quickly than they can be stocked. Retailers all over the world utilize it as a standard procedure when they see a spike in demand (ZOHO n.d.).

Backordering boosts revenue for your company and keeps clients from patronizing rivals. When a customer orders or makes a purchase for inventory stock that is not yet available, it is known as an inventory backorder. Inventory backorders can happen when all of your safety stock has been sold and your products have run out owing to unexpectedly high demand.

Customers may even be content to purchase your goods even when company don't have any in stock; for certain companies, backorders are seen as a guarantee of sales, especially if you have a committed clientele that is ready to wait for your goods. Backorders, on the other hand, come with no assurance that clients won't cancel the order, leaving your company holding the stock that was bought to fill these backorders. Companies run the risk of having to spend time and money refunding payments if prepayment is received before the order is finished and the supplier is unable to supply it or there are further delays. Customer dissatisfaction and unfavorable word-of-mouth have the ability to further harm your company.

Consignment Inventory: Using this method, a consignor—typically a wholesaler—can deliver their products to a consignee—typically a retailer—without the consignee having to pay for them in advance. The products are remaining the property of the consignor, and the consignee only pays for the items when they are actually sold. This sounds fantastic, but there are serious hazards involved. In a supply chain arrangement known as consignment inventory, a product is sold by a retailer, but ownership is held by the supplier up until the goods is sold. Unsold goods may be returned since the retailer does not technically purchase the inventory until it has been sold. The consignment model frequently sells seasonal, perishable, or pre-owned goods.

Retailers may give clients a wider selection of products and put a larger emphasis on sales thanks to the concept, which is especially useful when customer demand is unsure. The store reduces their financial risk by carrying the item on consignment because they don't have to pay for it until it sells.

Consignment inventory models may be risky for suppliers because they are not paid until stores sell their product. However, the provider has a considerable advantage since they can expose their goods to more potential customers. A crucial component in a consignment arrangement is inventory management. Contracts often refer to the supplier as the consignor and the retailer as the consignee. Stock that is owned by the supplier becomes stock held by the retailer through the process of consumption. Consignor and consignee should first agree on mutually beneficial procedures. They should, for instance, outline any commission that the retailer may charge the supplier as well as how long the consignee will be allowed to hold any unsold goods before returning them to the consignor.

Vendor Managed Inventory (VMI): It is an inventory management technique where a product's supplier, often the manufacturer, is in charge of making the most of the inventory that a distributor has on hand. A tried-and-true inventory approach called vendor managed inventory (VMI) was created to simplify order fulfillment and inventory management. By coordinating corporate goals and streamlining processes for all parties, it enhances cooperation between distributors and suppliers. Since replenishment frequencies are crucial to integrated inventory models' efforts to lower supply chains' overall costs, several research have failed to mathematically describe this cost. By altering the demand and supply gaps, a third-party logistics provider may also be used to guarantee that the buyer has the necessary amount of inventory (Sadeghi, Mousavi and Niaki 2016); (TrueCommerce 2016).

Point-of-sale and demand prediction data from suppliers and customers are combined by VMI solutions. Additionally, they consider pre-established parameters including service levels, inventory turn objectives, and minimum and maximum shelf presence. This is how it goes:

- A distribution partner provides data (known as a Product Activity Report) to the VMI system. This report includes information on product transfers, sales, and inventory levels (on hand, on order, in transit).
- Based on important variables and established goals, the VMI platform analyzes the data and provides a recommended inventory replenishment order.
- The recommendations are examined and approved by the provider.
- Following that, the VMI platform sends an electronic data interchange (EDI) format purchase order (PO) to the supplier and a PO acknowledgement to the distribution partner.
- The order can be dispatched when the partner accepts the PO.

Monitoring and Reporting Ongoing

When supply chain partners start utilizing VMI (TrueCommerce 2016), they decide on shared goals like:

- Inventory movement
- Minimum and maximum shelf presence for various items and product lines
- Fill rates and stock-to-order ratios
- Replenishment Periods
- Costs of transactions

The VMI platform keeps track of actual activities by comparing measures to those goals. All parties have instant access to data, enabling the provider to respond rapidly to changes in sales patterns. The inventory system also notifies all parties of measurements that are outside of permitted bounds or data anomalies (such as missing or incomplete data) that are found.

Relationships with VMI may be advantageous for wholesalers, distributors, suppliers, and retailers alike. The supplier is often the VMI client using a VMI platform. Downstream partners provide the system access to real-time data as well as the shelf presence specifications it needs to generate replenishment suggestions (TrueCommerce 2016).

- Nearly all significant suppliers and retail outlets in the consumer packaged goods (CPG) sector take part in VMI initiatives.
- Eighty percent of the top fifty suppliers in the electrical sector are engaged in a VMI program. One or more suppliers participate in VMI with 66% of the top 100 distributors.
- Over half of the top 100 distributors in the market for heavy-duty truck components participate in VMI with one or more suppliers, and at least 20 of the major suppliers in the sector have active VMI programs.

VMI Advantages for Suppliers

The following benefits for suppliers are provided by VMI and collaborative replenishment solutions (TrueCommerce 2016):

- Improve supply chain planning to strengthen ties with distribution partners
- Make that partners receive the appropriate product kinds and amounts.
- By expanding merchants' product selections and removing stock-outs, you may boost sales (usually by 5% to 25% or more).
- Streamlining order processing and getting rid of order mistakes, product returns, and emergency orders will save operational expenses.

Economic Order Quantity (EOQ): The optimal order quantity to reduce inventory expenses, such as holding costs, shortfall costs, and order costs is called an economic order quantity, or EOQ. Ford W. Harris created this production-scheduling concept in

1913, and it has since been improved. Demand, ordering, and holding expenses are all considered constant in the calculation. There are 3 key points to remember in economic order quantity model as below:

1. The economic order quantity (EOQ) is the amount of inventory that a firm should order in order to minimize its overall expenditures for ordering, receiving, and storing inventory.
2. Conditions where demand, ordering, and holding costs are stable throughout time are the optimal ones for using the EOQ formula.
3. The economic order quantity has a number of key drawbacks, one of which is the assumption that customer demand for the company's goods would remain stable over time.

This formula demonstrates the precise amount of inventory a business should order to cut holding and other costs as below: The formula of calculating EOQ is as below:

$$Q = \sqrt{\frac{2DS}{H}}$$

where:

Q = EOQ units

D = Demand in units (typically on an annual basis)

S = Order cost (per purchase order)

H = Holding costs (per unit, per year)

FIFO and LIFO: FIFO refers to the practice of moving the oldest stock first. According to the last in, first out (LIFO) theory, since prices are continually rising, the inventory that was most recently acquired is the most costly and thus sells first. It is important to note that –

- Since businesses often produce their items using their oldest inventory first, FIFO is the most sensible option.
- The Last-In, First-Out (LIFO) approach is predicated on the idea that the most current or most recent unit to enter inventory gets sold first.
- The oldest item of inventory is supposed to be sold first according to the First-In, First-Out (FIFO) technique.
- For many businesses, LIFO is not feasible since they wouldn't keep their older merchandise lying around in stock.

4. WHAT ARE INVENTORY COSTS?

You can make better selections if you are aware of your inventory expenses. Ordering costs, carrying costs, and shortfall costs are the three main kinds of inventory expenses.

Ordering inventory costs

This is the cost associated with preparing and sending a purchase order to a supplier. This would be used to calculate your inventory's EOQ. Examples of ordering expenses include:

- Cost of creating a purchase order or purchase requisition
- Cost of the work necessary to examine products with receipts
- Cost of processing fees on an order's supplier invoice
- Cost of preparing and issuing a payment to the vendors

Inventory Carrying Costs

The costs associated with holding unsold products are known as carrying costs. This covers both real expenses like handling, storage, and insurance as well as intangible expenses like depreciation, the cost of wear and tear, and opportunity costs. Carrying expenses typically account for 20% to 30% of an organization's overall inventory expenditures.

Inventory Shortage Cost

This charge, which results from an out-of-stock scenario, is also known as stock out expenses. This might include quantifiable expenses like the price of expedited shipment, purchasing at the last minute from a different source, or margin loss on unfinished transactions. These also include difficult-to-measure expenditures like diminished client trust or lost business, vacant positions for staff, and diminished goodwill.

5. INVENTORY MANAGEMENT SOFTWARE AND ITS CHARACTERISTICS

Inventory management software is a program that streamlines the processes needed to efficiently maintain inventory, manage reordering, and update accounting data. It automates some parts of inventory and warehouse management. When creating a system for monitoring and controlling your inventory, especially as your firm grows, inventory management software is a need. How inventory management software functions is seen below (Uzialko 2022):

- Utilizing inventory management software gives you complete insight into the entire inventory, enabling you to keep the right quantities of each item while still fulfilling requests.

- Through interfaces with important systems like accounting software and point-of-sale solutions, inventory management software automates crucial operations and lowers the possibility of human mistake.
- Your industry and the conditions of your company's everyday operations will determine the functionality you require in inventory management software.

Software for managing inventory levels, orders, sales, and delivery is called inventory management software. It may be used to construct a work order, bill of materials, and other documents connected to production in the industrial sector. To prevent product overstock and outages, businesses utilize inventory management software. It is a tool for organizing inventory data, which was previously often kept in hard copy or spreadsheet form (Wikipedia n.d.). Whether it is a store, manufacturer, or warehouse, inventory management software may simplify the process of inventory control while tracking all incoming and exiting items. Users can get a complete picture of the current inventory, even if it is dispersed across several sites, with the help of competent inventory software and thorough inventory management procedures that are updated in real-time (Uzialko 2022).

The following characteristics of inventory control software (Uzialko 2022):

- **Point of sale integration:** Whether a product sells in a physical shop, online or through another sales channel, merchants may automatically track this information with the aid of integration with their point of sale system. The point of sale system immediately updates the inventory management system when a product is scanned or checked out in an online cart, accounting for the transaction in real time. When used in conjunction with automatic reordering, this function enables businesses to make sure they always have enough inventories to rapidly complete requests.
- **Inventory catalog:** For merchants, it's critical to be able to categorize inventory not just by unit type but also by distinctive qualities like size, color, and other qualities.
- **Automated reordering:** It's crucial to place additional orders when your stock is on the verge of running out, especially for your best-selling goods. A lot of inventory management systems allow for automated reordering; all you need to do is specify your minimum quantities for each item, and when they are reached, the system will create a purchase order and send it to your supplier so they can replenish your stock level. Based on previous sales data, intelligent inventory management systems may also automatically optimize your reordering points and quantities per item to maintain the appropriate levels of inventory.
- **E-commerce integrations:** The majority of merchants today offer their products through all types of sales channels, including online marketplaces like Amazon, physical shops, and e-commerce websites. In order to avoid unintentionally trying to satisfy more orders than you have stock, it is essential that your inventory software tracks sales across all channels. Having integrations with your e-commerce channels can assist you avoid encountering this issue.

Since they must track both raw inputs and completed items, manufacturers typically have more sophisticated demands. Bowman lists the following as essential characteristics that enable manufacturing inventory management:

- **Product cost analysis:** Tools for product cost analysis help you keep track of your raw materials, finished goods, and reorder the essential parts when they fall below minimum levels. They also assist in forecasting your labor costs and operating costs, such as those associated with the purchase and maintenance of machinery. Find a method for managing your inventory that can produce a bill of materials with a breakdown of all these expenses.
- **Forecasting:** To estimate future order management requirements, previous production and sales data are analyzed. This process is known as forecasting. This procedure's accuracy can be increased with the use of a forecasting tool. Your data will be analyzed by software with a forecasting capability to identify the best reordering points, recruiting suggestions, and even shift schedules needed to hit your goals and keep expanding.
- **E-commerce integrations:** Previously, only retailers used e-commerce, but more manufacturers are now doing so. Even if they don't currently sell to consumers directly online, manufacturers should look for inventory software with e-commerce integration because they could use it to streamline sales to their retail clients or even expand to include another sales channel in the future.

The last point is that warehouse inventory management is a particular subset of wider inventory management software and has important factors of its own.

- **Barcoding:** Warehouse management systems employ barcoding to track the movement of goods into and out of storage facilities. Items may be scanned in as they are received, scanned as they are moved to a specified aisle and bin, and scanned once more when they are ready for shipping. This allows workers to trace all movements automatically. Barcoding may be done in a variety of ways, including batch barcoding for low-cost, high-volume commodities and serial tracking for expensive, high-ticket items. Some barcoding functions may be performed using a basic QR reader on a Smartphone, which eliminates the expense of scanning gear.
- **RFID Capabilities:** You can trace movement without scanning technology if you attach RFID tags to the objects in your warehouse. It is not necessary for a worker to manually scan things in and out since RFID tags and readers strategically positioned around the warehouse allow products to be tracked automatically when they are in close contact to a reader. This also streamlines order administration and removes the possibility that a worker may forget to scan an item, leading to its loss.
- **Integrations in inventory management:** Although warehouse management is a part of a larger inventory management plan, the two should be combined. The majority of providers offer this option, so look for a warehouse inventory management system that can be effortlessly linked with your bigger inventory management software.

6. WHAT DOES AN INVENTORY MANAGEMENT KPI MEAN?

In inventory management, key performance indicators (KPIs) are metrics that support stock monitoring and decision-making. KPIs are important in inventory management because they provide data on turnover, sales, demand, costs, process effectiveness, relationships, and more. Inventory management systems make it simple for a company to monitor KPIs. KPIs in inventory management systems can show development, areas where processes need improvement, or successful areas.

Different metrics are used by businesses to evaluate inventory management for various business operations. By grouping KPIs by type of operation, leaders can concentrate on areas that require improvement. Leaders can implement process modifications and monitor their improvement by identifying problem areas. These metrics include:

Operational KPIs	Receiving KPIs	Sales KPIs
1. Lost Sales Ratio 2. Perfect Order Rate 3. Average Inventory 4. Inventory Carrying Cost 5. Customer Satisfaction Score 6. Fill Rate 7. Order Cycle Time 8. Gross Margin Percent 9. Stock-Outs 10. Service Level 11. Lead Time 12. Dead Stock Percentage 13. Inventory Accuracy	1. Time to Receive 2. Put away time 3. Supplier Quality Index	1. Inventory Turnover Ratio 2. Day of Inventory on Hand 3. Sell-through Rate 4. Stock to Sell Ratio 5. Back Order Rate 6. Accuracy of Forecast Demand 7. Rate of Return 8. Revenue per Unit 9. Gross Margin by Product 10. Cost per Unit 11. Product sales OR Sales Revenue

7. FORMULAE TO CALCULATE KPIS IN INVENTORY MANAGEMENT

Operational KPIs:

1. Lost Sales Ratio = $(\text{No. of Days Product is Out of Stock} / 365) \times 100$
2. Perfect Order Rate = $[(\text{No. of orders delivered on time} / \text{No. of orders}) \times (\text{No. of orders complete} / \text{No. of orders}) \times (\text{No. of orders damage free} / \text{No. of orders}) \times (\text{No. of orders with accurate documentation} / \text{No. of orders})] \times 100$
3. Average Inventory = $(\text{beginning inventory} + \text{ending inventory}) / 2$
4. Inventory Carrying Cost = $[(\text{Inventory Service Costs} + \text{Inventory Risk Costs} + \text{Capital Cost} + \text{Storage Cost}) / \text{Total Inventory Value}] \times 100$
5. Customer Satisfaction Score = $(\text{No. of positive responses} / \# \text{ total responses}) \times 100$
6. Fill Rate = $[(\text{No. of total items} - \text{No. of shipped items}) / \text{No. of total items}] \times 100$
7. Order Cycle Time = $(\text{Time Customer Received Order} - \text{Time Customer Placed Order}) / \text{No. of Total Shipped Orders}$
8. Gross Margin Percent = $[(\text{Total Revenue} - \text{Cost of Goods Sold}) / \text{Total Revenue}] \times 100$
9. Stock-Outs = $(\text{No. of Items Out of Stock} / \text{No. of Items Shipped}) \times 100$
10. Service Level = $(\text{No. of Orders Delivered} / \text{No. of Orders Received}) \times 100$
11. Lead Time = $\text{Order Process Time} + \text{Production Lead Time} + \text{Delivery Lead Time}$
12. Dead Stock Percentage = $(\text{Amount of Unsellable Stock in Period} / \text{Amount of Available Stock in Period}) \times 100$
13. Inventory Accuracy = $(\text{No. of Counted Items that Match Record} / \text{No. of Counted Items}) \times 100$

Receiving KPIs

1. Time to Receive = $\text{Time for Stock Validation} + \text{Time to Add Stock to Records} + \text{Time to Prep Stock for Storage}$
2. Put away time = $\text{Total Time to Stow Received Stock}$
3. Supplier Quality Index = $(\text{material quality} \times 45\%) + (\text{corrective action} \times 10\%) + (\text{prompt reply} \times 10\%) + (\text{delivery quality} \times 20\%) + (\text{quality systems} \times 5\%) + (\text{commercial posture} \times 10\%)$

Sales KPIs:

1. Inventory Turnover Ratio (ITR) = $\text{Cost of Goods Sold (COGS)} / \text{Average Inventory}$
2. Days of inventory on hand = $(\text{average inventory for period} / \text{cost of sales for period}) * 365$
3. Sell-through rate = $(\text{No. of Units Sold} / \text{No. of Units Received}) \times 100$
4. Stock to sales ratio = $\text{Inventory Value} / \text{Sales Value}$
5. Backorder Rate = $(\text{No. of Delayed Orders due to Backorders} / \text{Total No. of Orders Placed}) \times 100$
6. Accuracy of Forecast Demand = $[(\text{Actual Demand} - \text{Forecasted Demand}) / \text{Actual Demand}] \times 100$
7. Rate of return (ROR) = $[(\text{Final Value} - \text{Initial Value}) / \text{Initial Value}] \times 100$
8. Revenue per unit = $\text{total revenue for period} / \text{average units sold for period}$
9. Gross margin = $[(\text{net sales} - \text{cost of goods sold}) / \text{net sales}] \times 100$
10. Cost per unit = $(\text{Fixed Costs} + \text{Variable Costs}) / \text{No. of Units Produced}$
11. Product sales OR Sales Revenue = $\text{gross sales revenue} - \text{sales returns} - \text{discounts} - \text{allowances}$.

Inventory KPI and Metrics Benefits

Inventory metrics and KPIs are useful because they establish a way to assess and make progress in a business. Without measurements, businesses are unable to set or achieve goals. The right KPIs influence behavior, output, and decision-making.

KPIs and inventory metrics can also offer the following advantages (Luther 2020):

- It boosts revenues and sales.
- It makes the company financially viable.
- It increases customer satisfaction and relationships.
- It improves the company's reputation
- It boosts both employees and operational productivity.
- It lowers the operating expenses.
- It fixes problems with the supply chain.
- It links inventory management to business objectives and strategy.
- It makes sure that marketing and goods are successful.

CONCLUSION

In accounting, inventory is seen as an asset and hence Inventory management is essential to a company's profitability, but many small businesses lack effective management techniques when it comes to the products they sell. Some companies don't keep enough inventories, which prevents them from providing enough products to meet customer demand. This frequently drives customers away, sometimes permanently and sometimes to another business. However, many companies take the opposite approach and overstock inventory "just in time." Although firm will always have the products your customers want, this tactic runs the risk of making your company lose money. In addition to using up valuable cash flow, excess inventory is more expensive to store and track. Between these two extremes, effective inventory management resides. While achieving an effective inventory management process needs more time and preparation. To manage inventory from a physical and accounting standpoint, the business needs an inventory control system. Replenishment based approach on dynamic optimal levels; an inventory management system makes sure that the next order placed is the right size for both the customers and the company. KPIs & metrics are important tools to manage & control inventory effectively. Large inventories are kept by most businesses, and a considerable portion of their capital is devoted to them. In order to reduce expenditures related to shifting production rates, overtime, subcontracting, needless cost of sales and backorder penalties during high demand periods, inventory management becomes crucial. Any manufacturing company's inventory is its lifeblood and most important component and hence it has to be managed strategically to avoid capital blockage if it is not sold or obsolete.

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