UNIT 2

Inventory Management

2.0 Unit Overview & Description

The unit focusses on the inventory related issues in supply chain and logistics, its function and cost. It also assists to understand different types of inventory cost in any supply chain operation and methods of control techniques.

Knowledge and Skill Outcomes

The unit is expected to impart the following knowledge and skill:

- Understanding of inventory management and supply chain.
- Awareness relating to inventory functions.
- Provides exposure to inventory functionality.
- Understand the reasons for carrying inventories.
- Enables to find inventory related costs.
- Provide ways for inventory controls.

Resource Material

1. Reji Ismail, Logistics Management, Excel Books, New Delhi (2008).
2. Ballou, Ronald H., Business Logistics and Supply Chain Management, Pearson Education.
3. Sople, Vinod, Logistics Management the Supply Chain Imperative, Pearson, New Delhi (2010).

Learning Outcomes

Unit II	Inventory Management	Outcomes
2.1	Inventory management and supply chain.	Explain the relation between inventory management and supply chain.
2.2	Inventory functionality.	Discuss the inventory functions and cost.
2.3	Inventory-related cost.	Identify the different inventory related cost.
2.4	Inventory controls.	Discuss the different cost control techniques of inventory management.

Assessment Plan

Unit II	Topic	Assessment Method	Time Plan	Remarks
2.1	Inventory management and supply chain.	Exercise: T & F		
2.2	Inventory functionality.	Exercise: Q & A, T & F		
2.3	Inventory-related cost.	Exercise: Activity, Q & A, T & F		
2.4	Inventory controls.	Exercise: Activity, Q & A, T & F		

Figure 2.1: Inventory

Figure 2.2: Pharma Retail

2.1 Inventory Management and Supply Chain

Inventory is technically an asset, but it is indirectly taxing on the profitability of the firm. Hence, besides the various activities associated with a lean supply chain, corporation across the world are always finding different methods and techniques to reduce the investments in inventory. With the latest IT tools and communication technologies, it has become comparatively easier than before to size and control this single largest cost spinner in the supply chain. It is probably common sense that inventory should be held only when the benefits to holding inventory exceed the cost of holding it.

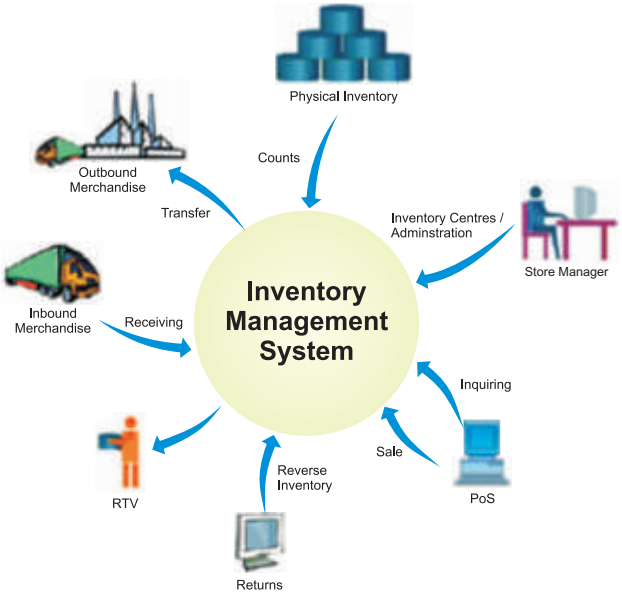

Figure 2.3: Inventory Management System

Figure 2.4: Inventory Liability



2.1.1 Inventory-Asset or Liability

Inventory generally constitutes the second largest item after fixed asset in the financial balance sheet of a manufacturing company. From a financial perspective, inventory is one of the major current assets that can contribute to maximizing the value of the firm and no significant disadvantages are seen in carrying more inventory. But investments in inventory carry cost. Funds invested in inventory cost the firm by way of interest on working capital borrowings from the bank at the current interest rates. Therefore, reduction in inventory will reduce inventory handling and carrying costs. The benefits of inventory reduction will be reflected in terms of increase in profit margins, return on investment (ROI) and economic value addition (EVA).

Today, inventory investment is viewed as a supply chain cost driver rather than as a material asset. Hence, the lean supply chain operating on material requirement planning (MRP), distribution requirement planning (DRP) or the just - in - time (JIT) system is preferred, since it has the maximum inventory turns for reducing cost on inventory investments and enhancing the bottom line and return on investments.

Review Question

I. State whether the following statement is True or False:

1. Inventory is technically an asset, but it is indirectly taking on the profitability of the firm.
2. From a financial perspective, inventory is one of the minor current assets.
3. Reduction in inventory will reduce inventory handling and carrying costs.
4. Inventory management is an ordinary area in logistics operation.

2.1.2 Inventory Functions

Inventory management is a strategic area in logistics operation and has an impact on efficiency and effectiveness of the overall supply chain system. As the cycles of production and consumption never match; goods have to be kept in stock to get over the uncertainties in demand and supply. However, higher inventory levels will affect the bottom line of the company. This is a high risk and high impact area, which has to strike a balance between the two polemic goals of lower cost and a higher level of customer service.

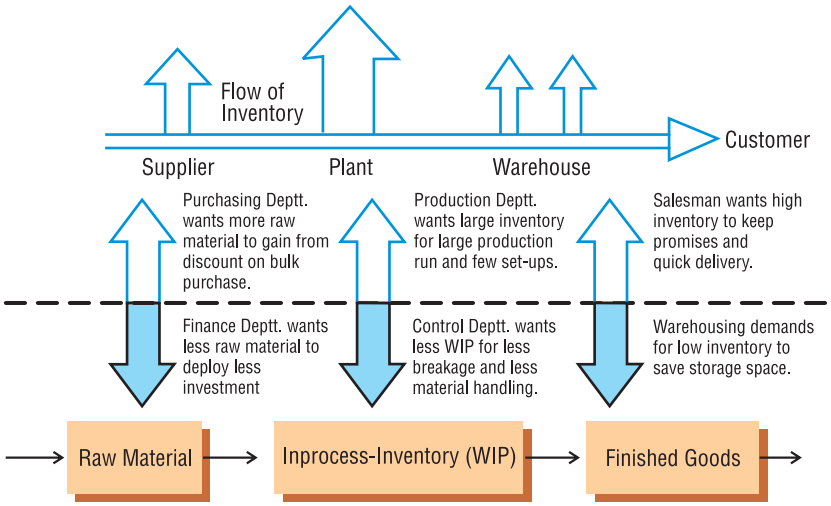

Figure 2.5: Inventory Position in an Organization

Companies block sizable funds in their inventories, which would otherwise have been invested in more productive areas. The general categories of inventory are as follows:

- Raw material and components inventory
- Work in progress inventory
- Finished goods inventory
- Maintenance, repairs and operating supplies inventory
- Pipeline or in transit inventory

Inventories are held in warehouses that have an inescapable accountability for the inventories in their charge. The inventory levels in the company also affect the efficiencies of the other divisions. Inventory acts as a protective cushion for continuous operation in the customer supply chain. The top management views inventory as cash investment and expects to derive profits from it through effective and efficient customer service. Investments in inventory can cause cash flow problems if the inventories are poorly managed by way of inaccurate forecast and excess production. Inventory management is both an art and a science and is concerned with the following:

- Right level of inventory
- Trade off between inventory cost and customer service
- Treating inventory as a liability or asset

The industry will have to manage basically three types of inventories that are held at the various stages of the supply chain of a company. These are:

- Raw materials and components on the procurement side
- In-process or work in progress inventory
- Finished goods inventories



In logistics we are mainly concerned with the finished goods inventories, which again are divided into the following three parts:

- Non-excise paid goods at plant warehouse
- Inventory in transit
- Channel inventory

Inventory blocks capital; that is, investment in inventory cannot be used for creating assets, producing other goods or investing in other productive ventures or projects. Inventory carries the risk of theft, pilferage or obsolescence. However, the nature of risk varies with the enterprise's position in the distribution channel.

Review Questions

I. Question and Answer:

1. Write down the important inventory functions in logistics operation.

II. Write True or False against the following statements:

1. The top management views inventory as cash investment.
2. Inventory management is only an art.
3. Industry manage three types of inventory.

2.1.3 Manufacturer

As the manufacturer has to simultaneously keep inventories of raw materials, work in progress and finished goods, the depth of risk is highest among the other members of the supply chain. Inventory commitments of the manufacturer are of a longer period, even though his product lines are narrower as compared to wholesalers or retailers. Inventory commitments are closely related to the investments made in width of the distribution network, unit value of the product, and the nature of demand.

2.1.4 Wholesaler

The Product lines handled by the wholesaler are more than for the manufacturer. The wholesaler's risk is spread over the different products. These different products may face cycling variations in product lines. For seasonal products, the wholesalers purchases the inventory commitments however, the wholesaler does not retain inventory of a longer duration than the manufacturer.

2.1.5 Retailer

The retailer's risk duration is much shorter than for the wholesaler and manufacturer. His commitment to inventory is not deep. Moreover, the risk is spread over a range of products. The retailer basically buys and sells and does not stock the material for a longer duration. He faces the risk of marketing rather than of inventory.

2.2 Inventory Functionality

Irrespective of its location in the supply chain, product inventory essentially serves the following functions:

2.2.1 Balancing Supply and Demand

The production and consumption cycles never matches. The sudden requirement of a product in large quantities may not be fulfilled immediately as the production cannot be taken up so soon. In such a case, the products are manufactured in advance in anticipation of demand and kept in stock for supply during the peak period.

2.2.2 Periodic Variation

For seasonal products the demand is at its peak for a certain period while it is lean for the rest of the year. Production runs in the factory are taken based on the average demand for the year. Excess production during the lean period is kept as inventory to take care of the peak demand. In cases where raw material for manufacturing food products is available seasonally, the products are manufactured and stocked as inventory to meet the demand of the finished products throughout the year.

2.2.3 Scale Economics

Products are manufactured at focused factories to achieve economies of scale. This is done

because of the availability of the latest technology, raw materials, and skilled labour. Hence the produce is kept in stock for distribution to consumption centers as and when it is required. Distribution is done in economical lot sizes for system efficiencies in speed and cost.

In short, inventories provide demand utility for products at the time and places they are required for consumption.

2.2.4 Reasons for Carrying Inventories

Inventory is required for producing finished goods, extending service to customers and to keep the customer's manufacturing operations running. Hence, inventory plays a crucial role in the supply chain of an organization. It helps to keep a smooth flow of products across the supply chain. On the other hand, excess inventory in the supply chain means additional cost for holding inventory, which exceeds the benefits derived from it. The benefits and losses of carrying inventory should be examined in light of the following reasons.

2.2.5 Meeting Production Requirements

Raw material, components and parts are required for producing finished goods. A manufacturing organization keeps stocks of the material to meet the continuous requirements of production. Companies operating on the JIT principle also keep some inventory on hand to meet contingencies. However, these stocks are quantitatively insignificant. The work-in-progress inventory constitutes a major portion of the production related inventory. Reduction in this category of inventory results in inventory related investments in the production process.

2.2.6 Supporting Operational Requirements

To support production operations, inventories are required for repairs, maintenance and operational support. These inventories include spare parts of production machineries, consumables such as lubrication oils and welding rods, chemicals, pallets, and a like. Companies do not have a correct picture of their investments in this category of inventory. Many times excess stock is held to avoid rushing to the market for buying inventory in small quantities in an emergency.

2.2.7 Customer Service Considerations

Product likes equipments, machinery or appliances require replacement of spare parts for trouble-free and smooth operations. Suppliers maintain an inventory of these parts to extend after sales service to their valued clients. Availability of spare parts when required at the customer's end is crucial for customer satisfaction and may be used as a tool for competitive advantage. Maintaining a significant level of inventory and keeping it replenished requires a major investment. This is closely related to the level of customer service offered by the company.

2.2.8 Hedge Against Future Expectations

To take care of shortages in material availability or an anticipated increase in the prices of products, the customer usually buys in excess of current requirement, stocking a critical material or product, for keeping their operations running without interruptions. This obviously increases the inventory level for a short period. However, in the above circumstances, the benefits derived from keeping excess inventory outweighs its carrying cost.

Figure 2.6: Stock Clearance

Figure 2.7: Medicine as Inventory in Pharma Store



2.3 Inventory- Related Costs

The major portion of the working capital of a firm is blocked in inventory. If the inventory is in excess of the optimum level, more funds will be blocked that cannot be used for other productive purposes, resulting in opportunity loss. Hence these funds are tied up unnecessarily. There are other costs related to inventory. The incidence of those costs will also be higher if inventories are in excess of the optimum level.

2.3.1 Inventory Cost

Inventory blocks funds, funds once blocked cannot be invented in any other productive activities. The lost opportunity cost is not so easy to quantify. However, the cost of blocked funds in excess of the optimum cost is computed in terms of inventory carrying cost discussed below.

2.3.2 Carrying Cost

The second major cost contributor is carrying cost. Funds invested in inventory attract interest charges on working capital borrowed from the bank. The current bank rate of interest on working capital borrowing is 12-15 percent. Thus, the interest charges investment on excess inventory will erode the bottom line.

2.3.3 Ordering Cost

This refers to the cost involved in the ordering process. The paperwork, faxes, phone calls, and so on will add to the inventory related cost.

2.3.4 Warehousing Cost

This is the cost for product holding in the warehouse. Depending on the kind of warehouse (private, public or contract), there will be a cost related to space occupancy based on the duration of storage. This cost varies from 1.5 to 4 percent and may be taken into consideration while computing inventory related costs.

2.3.5 Damage, Pilferage and Obsolescence Cost

Material stored carries the risk of damage, shrinkage and loss of weight. A product also carries the risk of pilferage or obsolescence due to technology change or availability of substitutes. The percentage varies from 0.5 to 2 percent depending on the product.

2.3.6 Exchange Rate Differentials

In case of imported inventories, the valuation is done based on the current currency exchange rates in the market. Any fluctuation may increase or decrease the value of the inventory. Due to exchange rate fluctuations, there is the risk of selling the material at prices lower than the landed cost.

Review Questions

I. Activity:

1. Visit a local retailer and discuss his inventory management idea to discuss in the classroom.
2. In your own house ask your mother how she manages her monthly grocery using inventory functions as a concept.

II. Question & Answer:

1. Write down the important functions of inventory.

III. Write True or False against each statement:

1. For seasonal products the demand is at its peak for a certain period while it is lean for the rest of the year.
2. Inventory helps to keep a tough flow of products across the supply chain.
3. Raw materials, components are parts required for producing finished goods.



2.4 Inventory Controls

The variability in customer demand if not conveyed properly or conveyed with distortion as it travels upstream in the supply chain - the phenomenon is called 'bullwhip effect' - causes either stock outs or inventory pile-ups in the distribution logistics chain. The bullwhip effect is a deformation in information when it goes upstream in the supply chain. The ripple effect of demand volatility results in inventory problems impacting on profitability and customer service of the firm. This happens due to lack of smooth and speedy information flow, resulting in improper coordination and synchronization of actions of supply chain partners.

More precisely, the demand of the customers is put out of shape each time it goes from a one decision point to another. Assuming the demand of the customer is quasi-constant, this deformation appears through the amplification of the first mini-fluctuations. Problems tend to escalate in supply chains where communication is minimal between the supply nodes. The situation can be compared to the small wave in the middle of the ocean that may end up as a tidal wave near the shore.

Review Questions

I. Write True or False against each statement:

1. Inventory blocks funds, funds once blocked cannot be invented in any other productive activities.
2. Carrying cost is involved in the ordering process.
3. Funds invested in inventory attract charges on working capital borrowed from the banks.
4. Warehousing cost is the cost for product holding in the warehouse.

II. Question & Answer:

1. Explain in brief, the different inventory cost used in inventory management.

III. Activity:

1. Visit a small manufacturing unit in your city / town to collect the different inventory cost data of its product so that it can be discussed in the classroom.



2.4.1 Selective Control Techniques

In these methods the degree of control varies with the importance of the item in the supply chain. The following are the various methods in practice that are commonly used in industries.

2.4.1.1 ABC Analysis

This relates to the annual usage cost of a particular item. A detailed analysis of inventory may indicate that only 10 percent of items generally account for nearly 70 percent of usage value. Another 20-30 percent of items may account for 20 percent of usage value and the balance 60-70 percent account for the remaining 10 percent of usage value. The items are classified as per the usage value. While items in class A are less in number, they cost approximately 60-70 percent of the total cost of the inventory. Class B items cost 20-30 percent of the total inventory cost, whereas class C items are in greater numbers, yet carry less than 10 per of the cost of the entire inventory. In short, this is a financial evaluation for ranking and comparison of inventories. The objective of the classification is to know which item should receive the most attention. An item in class A should have your perpetual attention, while a class C item may be reviewed with less periodicity than class B items.

The ABC inventory classification method is thus used to categorize inventory into groups

based upon certain activity characteristics. It is the process of classification of products as per the level of importance in terms of their relative criteria such as purchase or sales volume. Examples of ABC classification include:

- ABC by velocity (times sold)
- ABC by sales in rupees
- ABC by quantity sold or consumed
- ABC by average inventory investment
- ABC by margin

ABC classification is used to develop inventory planning policies, set count frequencies for cycle counting slot inventory for optimized order picking and other inventory management activities. It can be described as a technique that is used in a business sense for denoting a categorization of a large volume of data into groups. These groups thereafter can be marked as A, Band C. This means that activities that are considered high on priority are classified as A, those with a lesser priority are grouped under B and the group of activities that are last on the list of priority are classified as C.

ABC Analysis Template

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A = 70% (7 Items), B = 85% (6 Items), C = (37 Items), Total 50 Items

Item	Consumtion Qty	Cost/Unit	Amount	Acc Amount	ABC Class
R-005	5,200	320.00	1,664,000.00	1,664,000.00	A
R-041	5,000	200.00	1,000,000.00	2,664,000.00	A
R-036	2,000	325.00	650,000.00	3,314,000.00	A
R-016	2,000	320.00	640,000.00	3,954,000.00	A
R-008	2,500	200.00	500,000.00	4,454,000.00	A
R-050	2,346	200.00	469,200.00	4,923,200.00	A
R-014	1,400	325.00	455,000.00	5,378,200.00	A
R-030	2,000	200.00	400,000.00	5,778,200.00	B
R-025	900	325.00	292,500.00	6,070,700.00	B
R-032	4,500	50.00	225,000.00	6,295,700.00	B
R-024	2,000	100.00	200,000.00	6,495,700.00	B
R-003	450	325.00	146,250.00	6,641,950.00	B
R-009	3,000	44.00	132,000.00	6,773,950.00	B
R-013	1,300	100.00	130,000.00	6,903,950.00	C
R-027	400	320.00	128,000.00	7,031,950.00	C
R-019	600	200.00	120,000.00	7,151,950.00	C
R-010	2,000	50.00	100,000.00	7,251,950.00	C

Figure 2.8: ABC Technique to Control Inventory



2.4.1.2 VEO Analysis

This relates to Vital, Essential and Desirable status of the inventory item. As the term implies, certain parts and items are considered to be vital for meeting operational requirements and this aspect is taken into consideration while making the forecast.

The modified version of this is ABC-VED analysis that takes into consideration both value and the critically of the item. High-value and critical items are under continuous review and ordered in low quantities, while low-value, least critical items are periodically reviewed and ordered in large quantities with lower safety stock requirements.

2.4.1.3 SAP Analysis

Scarce, Available and Plenty status of inventory item is used for planning & forecasting of inventory requirement. The ordered quantity is governed by the scarcity factor. The limitations in supply or obsolescence of an item in the near future will be guideline for procurement policy decision.

2.4.1.4 FSN Analysis

Fast, Slow or Normal determines the consumption pattern of an item. However, a consumption pattern where the production run is slowed down for various reasons may not give a realistic picture for procurement action.



In all these control techniques, the degree of control varies with the importance of items. For example, for the A class vital, scarce and fast-moving items perpetual reviews are recommended, while for B class essential, medium-moving items periodic reviews will be OK. In the case of C class desirable, slow-moving items and the periodicity of review will be longer.

Review Questions

I. Question & Answer:

1. Discuss various selective control techniques used to manage inventory.

II. Write True or False against each statement:

1. ABC relates to the annual usage cost of a particular item.
2. VED analysis relates to valuable, easy and demanded status of the inventory items.
3. SAP is understood as the ordered quantity governed by the scarcity factor.

2.5 Case Study

When Toyota decided to set up the plant to deliver in MUV Quails, it had realized the price sensitivity of the Indian auto market dominated by Mahindra & Mahindra and Tata. It was a challenge to produce vehicles at a competitive price. Toyota observed the logistics cost of

the Indian Auto Industry and decided to use this weapon against competitors. Mitsui & Co provided complete logistic solutions to Toyota world-wide. This company decided to implement the J IT concept in India for Toyota and to achieve this they found a partner in TCI Ltd. and a new company was born "Transystem Logistics International Ltd".

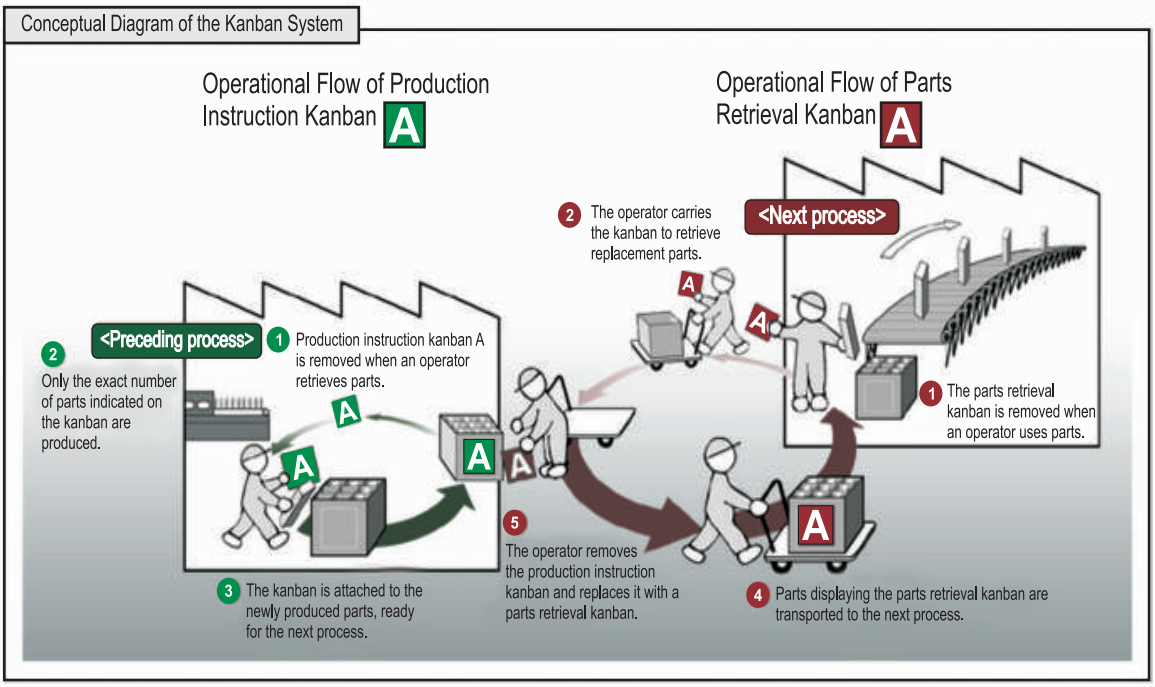

Figure 2.9: Kanban - A Japanese Technique to Manage Inventory in Production

Toyota implemented JIT inventory management wherein it receives its supplies from its vendors spread all over the country on a daily basis. It uses the 'mixed loading' concept, where a single truck is loaded with all components supplied by different vendors, considering the daily production requirements. As a result, the company is able to run almost zero inventories for its production line. It has also managed to do away with the uncertainty in transportation by appointing a dedicated transporter for the overall movement. The TRM supply chain is characterized by:

- Collection of material through "milk run" across all vendors located in different parts of the country at hub centers where checking, consolidation and stacking is done.
- Main route vehicle moves from the hub to the TRM plant carrying all 'milk run' collection.
- Bulk movement is direct from vendors to the TRM plant.
- All vehicles run as per a predetermined time schedule.
- Vehicles are provided with a hydraulic loading ramp.
- All drivers give status calls twice daily about their location. In case of an eventuality, they seek instructions to ensure goods reach on time.



Toyota Logistics System being operated through TRANSSYSTEM had lead to reduce average inventory level just under two days (as compared to 30 days), zero-defect delivery 99.8 per cent on time and reduced to customer plus a quality service that helps the company to build long-term relations with their customers.

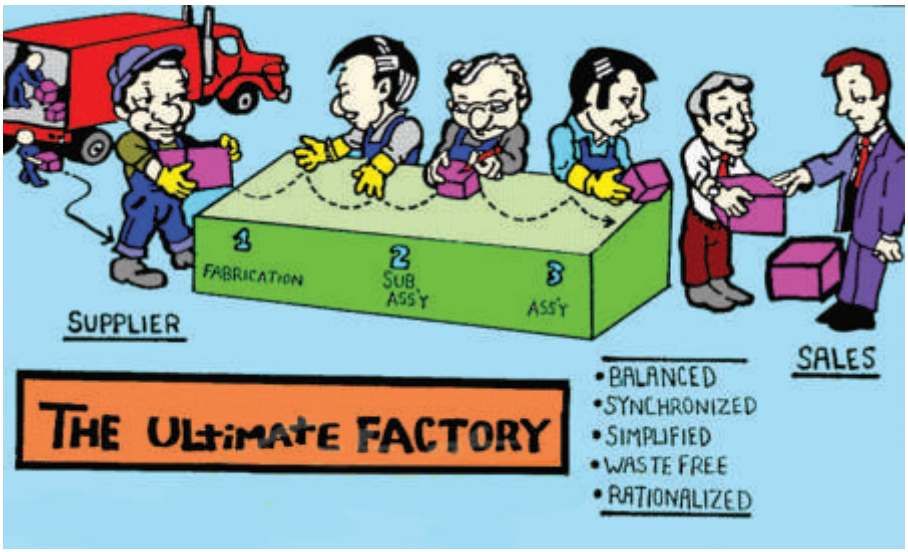

Figure 2.10: Supply Chain of Inventory in a Factory



2.6 Summary

The unit discusses inventory management and its relation with supply chain. Inventory is considered as asset or liability. it has been explained and understood through inventory functions and different cost. The unit also explains the inventory control technique and its types.

2.7 Exercise

1. Is Inventory an asset or liability? Discuss.
2. What is the function of inventory? Explain.
3. Write down the different types of inventories that are held at the various stages of the supply chain of a company.
4. How do manufacturer of any product manages inventories in his set-up?
5. Discuss what are the important inventory functionality?
6. Why do inventories are carried? Give reasons.
7. Discuss the cost components involved in carrying and holding the goods.
8. ABC, VED are selective control techniques used to improve inventory management. Explain.

2.8 Practical

1. Discuss the case study of Toyota Kirloskar Motors Ltd. in the classroom and tell students how to improve inventory management.
2. Visit a warehouse of any product in your city / town and prepare a note on inventory cost involved in the product so that it can be discussed in the classroom.
3. Visit a Pharma Store and prepare a note on selective control technique like ABC & VED used by the store for its product to discuss in the classroom.