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INVENTORY MANAGEMENT OF SELECTED
SHIPYARD COMPANIES IN INDIA

A THESIS

Submitted to

Saurashtra University

for the award of the degree of

Doctor of Philosophy in Management

Submitted by:

Paritosh Verma

Under the Guidance of

Dr Sanjay J. Bhayani

Associate Professor

Department of Business Management (MBA Programme)

Saurashtra University

Rajkot

March 2010

Dr Sanjay J. Bhayani

Associate Professor

Department of Business Management

(MBA Programme)

Saurashtra University

Rajkot

Date:

CERTIFICATE

It is certified that the thesis entitled **"Inventory Management of Selected Shipyard Companies in India"** is a record of research work done by **Mr Paritosh Verma** during the period of study under my supervision and that the thesis has not been formed the basis for the award of any degree, diploma, associateship, fellowship or similar title to the candidate and that the thesis represents independent work on the part of the candidate.

(Dr Sanjay J. Bhayani)

Research Supervisor

DECLARATION

I declare that the conceptual framework of the thesis has been developed based on the detailed literature review as shown in the bibliographical references. I have quoted several statistics, notes, opinions and other information directly from various books, journals, periodicals and other reference material with clear mention of the source of information in the references. Apart from these, all other opinions, hypothesis, remarks, inferences, analysis and interpretations in this thesis are my own and original creations.

I also declare that the work done in the thesis entitled **“Inventory Management of Selected Shipyard Companies in India”** is a record of independent research work carried out by me under the supervision and guidance of Dr Sanjay J. Bhayani, Associate Professor, Department of Business Management (MBA Programme), Saurashtra University, Rajkot.

This work has not been previously submitted for the award of any diploma, degree, associateship or other similar title.

Place: Rajkot
Date:

Paritosh Verma

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(PARITOSH VERMA)

Preface

Materials constitute one of the important factors of production in a business. The term 'materials' refers to the commodities supplied to an enterprise for the purpose of consumption in the process of manufacture or for the purpose of rendering service or for transformation into products. The cost of all such materials form part of the cost of jobs, operations, products or services for which they are utilized.

The term 'inventory' is often used synonymously with materials. The former has, however, a wider meaning and it covers not only the raw materials consumed or utilized in production but also such other items as sundry supplies, maintenance stores, fabricated parts, components, tools, fixtures and other equipments. Finished and partly finished products are also often included under the term 'stores'. The term 'inventory' covers the stock not only of raw materials but also components, work-in-progress and finished goods.

The term inventories applied to all goods that will ultimately be sold. The term merchandise inventory is normally applied to goods held by a trading concern, either wholesale or retail, when such goods have been acquired in condition of resale.

A lot of endeavours are made by the Indian government to develop Indian ship building industry right from 1948. The industrial resolution of 1948 and 1956 pronounce the importance of the ship building industry. Accordingly the shipyards which constructs below 10,000 DWT vessels are to be taken up by private sector. Above 10,000 DWT vessels irrespective of their use must be taken up by the public sector ship building industry. In India, ship building industry gained importance in various contexts of our national socio-economic objectives of industrial growth, supportive role for shipping, employment generation, promotion of its commerce, regional development and developing strong naval force. As on now there are seven shipyards in public sector viz. Mazagon Dock Ltd., (MDL), Hindustan Shipyard Ltd., (HSL),

Garden Reach Ship builders and Engineers Ltd., (GRSE), Garden Reach Ship Builders and Engineers Ltd., (GRSE), Goa Shipyard Ltd., (GSL), Central Island Water Transport Corporation Ltd., (CIWTL), Cochin Shipyard Ltd., (CSL) and Hoogly Dock and Port Engineers Ltd., (HDPE). Out of these HSL and CSL are constructing general cargo vessels, GRSE, MDL and GSL catering to the needs of the Indian Navy. The remaining two units CIWTL and HDPE are constructing only small size vessels.

In India, the ship building industry is spending 55% of the total cost of production on the materials of which about 65 per cent account for the imported materials. Nearly 20,000 items are required to put into the construction of a ship. Majority of these items are not available indigenously and the shipyards tend to buy the same from foreign sources and which involves longer lead times in procuring such materials and ultimately prolonged ship construction cycle time. Here lies the importance of inventory management in ship building industry.

Very little effort was made in research in the area of inventory management. Therefore, the present study seeks to examine the issue with special attention of inventory management of selected shipyard companies. The conclusions, which are going to be made in the study, will be of great use for shipyard industry in the country.

(PARITOSH VERMA)

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Chapter-I

Inventory Management

- Meaning and Definition of Inventory
- Meaning and Definition of Inventory Management
- Objectives of Inventory Management
- Motives for Holding Inventory
- Inventory control
 - ABC Analysis of Inventory
 - Fixation of Norms of Inventory Holdings
 - Ordering System of Inventories

The term 'inventory' is nothing but a stock of goods that is maintained to facilitate the continuous production of goods and services. S.E. Bolten observes, "The term 'inventory' refers to the stockpile of the product a firm is offering for sale and the components that make up the products."¹ In other words, it can be said that inventory is composed of assets that will be sold in future in the normal course of the business operations.

Meaning and Definition of Inventory

The dictionary meaning of the word 'inventory' is a "detailed list of goods, furniture, etc." Many understand the word "inventory" as a stock of goods, but the generally accepted meaning of the word 'goods' in the accounting language, is the stock of finished goods only. In a manufacturing organization, however, in addition to the stocks of finished goods, there will be a stock of partly finished goods, raw materials and stores. The collective name of all these items is inventory.

The assets which firms store as inventory in anticipation of need are (1) raw materials, (2) work-in-process (semi-finished goods), and (3) finished goods. The raw material inventory contains in terms that are purchased by the firms from others and are converted into finished goods through the manufacturing process. The work-in-process inventory consists of items currently

being used in the production process. Finished goods represent final or completed products that are available for sale. The inventory of such goods consists of items that have been produced but are yet to be sold. To expand the definitions of inventory to fit manufacturing companies, it can be said that inventory means, “The aggregate of those items of tangible personal property which (1) are held for the ordinary course of business; (2) are in process of production for such sales; and (3) they are to be currently consumed in the production of goods or services to be available for sale.”²

Black, Champion U. Miller, have given a detailed meaning and definition of inventory. It would be of interest to reproduce the language in terms of which they have explained the term ‘inventory’. According to them, “Inventories are expandable physical articles held for resale, for use in manufacturing a product or for consumption in carrying on business activity. Examples are merchandise, goods purchased by the business which are ready for sale:

Finished goods being manufactured for sale by the businesses that are ready goods;

Materials articles such as raw materials, semi-finished products, or finished parts, which the business plans to incorporate physically into the finished products;

Supplies articles which will be consumed by the business in its operations but will not be physically as they are a part of the product.”³

In short, inventory may be defined as the materials which are either in market or usable directly or indirectly in the manufacturing process and it also includes the items which are ready for making finished products by some other process or by comparing them either by the concern itself and/or by outside parties. In other words, the term 'inventory' means the materials having any one of the following characteristics, It may be

- (a) saleable in the market;
- (b) directly useable in the manufacturing process of the undertaking;
- (c) useable indirectly in the manufacturing process of the undertaking; and
- (d) ready to send it to the outside parties for making useable or saleable products out of it.

In the present study raw materials, stores and spare parts, finished goods and work-in-process have been included in the inventories.

Meaning and Definition of Inventory Management

Inventory is called the "Graveyard of business" because it has been a basic cause of the failure of many organizations. Inventories constitute the most significant part of current assets of a large majority of companies. Because of the large size of inventories maintained by the firms, a considerable amount of funds is required to be allowed to them. It is, therefore, absolutely imperative to manage inventories effectively and efficiently in order to avoid unnecessary investment. A firm neglecting the

management of inventories will be jeopardizing its long run profitability and may fail ultimately. So, in order to manage the inventory properly, a need for inventory management arises.

Inventory management is concerned with the determination of the optimal level of investment for each component for each component of inventory and the inventory as a whole, the efficient use of the components and the operation of an effective control and review mechanism. The management of inventory requires careful planning so that both the excess and the scarcity of inventory in relation to the operational requirement of an undertaking may be avoided. Therefore, it is essential to have a sufficient level of investment in inventories.

Inventory management may be defined as the sum total of those activities, which are necessary for the acquisition, storage, sale and disposal, source of material, D. Schall Lawrence and W. Haley Charles observe, "Managing the level of investment in inventory is like maintaining the level of water in a bath-tub with an open drain. The water is flowing out continuously. If the water is let in too slowly, the tub soon gets empty. If the water is let in too fast, the tub overflows. Like the water in the tub, the particular items of the inventories keep on changing, but the level may remain the same. The basic financial problems are to determine the proper level of investment in inventories and to decide how much inventory must be acquired during each period to maintain that level."⁴

L.R. Howard observes: "The proper management and control of inventory not only solves the acute problem of liquidity but also increases the annual profits and causes substantial reduction in the working capital of the firm."⁵

It is a subject which merits the attention of the top level management and influences the decision of the planning and the executive personnel. It is a matter of deep concern to those dealing with production, sales, forecasting, inventory planning, marketing, material handling, finance, product designing, etc.

Inventory management helps to manage stock in such a manner that there are no excessive and inadequate levels of inventories and a sufficient inventory is maintained for the smooth production and sales operation. Thus, the objective of inventory management is to determine the optimum level of inventory.

Objectives of Inventory Management

A fundamental objective of a good inventory management is to place an order at the right time from the right source to acquire the right quantity at the right place and quality. While developing an appropriate level of inventory the following objectives should be kept in mind:

- Investment in inventory should be kept minimum so that undue amount is not locked up in it as investment in inventories involves costs.
- A firm should make effective efforts in buying quantity of raw materials in accordance to its needs.

- Continuous efforts should be made to shorten the production cycle. The longer production cycle runs heavy costs and the risk of the extra inventory investment.
- A firm should maintain inventory to such a level that smooth and unhampered production is ensured without any obstruction.
- A firm should maintain sufficient amount of finished goods to meet the demand of customers regularly because if it is not done then the customers may shift to the competitors, which will amount to a permanent loss to the firm.
- To the extent possible, a firm should try to minimize the possibility of the risk of loss through obsolescence or shrinkage in the market value between the time of purchase of manufacture on the one hand and the time of sale, on the other.
- To serve as a means for the location and disposition of inactive and obsolete items of store.
- To keep all the expenditures within the budget authorization.

Inventory management, therefore, should strike a balance between too much inventory and too little inventory. The efficient management and effective control of inventories help in achieving better operational results and reducing investment in working capital. It has a significant influence on the profitability of a concern.

Motives for Holding Inventory

The question of managing inventories arises when the concern holds inventories. Holding up of inventories involves tying up of the concern's funds and carrying costs. If it is expensive to hold inventories, why do concerns hold inventories? There are three motives for holding inventories.⁶

- (a) Transaction motive;
- (b) Precautionary motive; and
- (c) Speculative motives.

Inventories are held merely for the purpose of carrying on transactions smoothly, and at the same time, ensuring that the cost of ordering is kept minimal. Such a motive is called transaction motive. Sometimes, inventories are increased as a hedge or protection against stock-out when it becomes clear to the management that the lead-time for any particular item is likely to increase or there is a possibility of short supply. This increasing of the safety stock arises from purely a precautionary motive. Lastly, a situation may arise when an all-round price increase is expected due to market demand or due to changes in cost. In such a situation, the company management is keen to hold on to the inventories or increase them in order to get a better price for the finished goods. Such a motive is known as the speculative motive.

Inventory Control

Inventory control refers to a system, which ensures the supply of required quantity and quality of inventory at the required time and at the same time prevents unnecessary

investment in inventories. According to P.K. Ghosh and G.S. Gupta, "Inventory control is concerned with the acquisition, storage, handling and use of inventories so as to ensure the availability of inventory whenever needed, providing adequate cushion for the contingencies, deriving maximum economy and minimizing wastage and losses."⁷

Designing a sound inventory control system is in a large measure of a balancing operation. It is the focal point of many seemingly conflicting interests and considerations, both short-range and long-range.

Inventory control is concerned with keeping the desired inventory level and maintaining it. Its basic objective is to keep an adequate inventory level and maintaining it at the minimum inventory carrying cost. The aim of inventory management, thus, should be to avoid excessive and inadequate levels of inventories. Efforts should be made to place an order at the right time with the right source to acquire the right quantity at the right price and quality.

The efficiency of inventory control affects the flexibility of the firm. Inefficient procedures may result in an unbalanced inventory, sometimes out of stock or overstocked, necessitating excessive investment. These inefficiencies ultimately will have an adverse effect on profits. Turning the situation around, differences in the efficiency of the inventory control for a given level of flexibility affect the level of investment required in inventories. The less efficient is the inventory control, the greater is the

investment required. Excessive investment in inventories increases costs and reduces profits. Thus, the effects of inventory control on flexibility and on the level of investment required in inventories represent two sides of the same coin.⁸

In managing inventories, the firm's objective should be in consonance with the wealth maximization principle. Various types of businesses control inventory for the following purposes to

- ensure a continuous supply of raw materials to facilitate uninterrupted production.
- maintain sufficient stocks of raw materials in periods of short supply and anticipate price changes.
- maintain sufficient goods inventory or smooth sales operations and efficient customer service.
- minimize the carrying cost and time.
- control investment in inventories and keep it at an optimum level
- minimize costs and maximize profits
- control capital investment
- take advantage of favourable raw material price, and
- protection against strikes and work stoppages and acts of God.

to achieve all these the firm should determine the optimum level of inventory and it can be done through the following inventory management techniques:

1. ABC Analysis:

This technique is based on selective control of inventory. Where there are many items in the inventory, it becomes essential to have a value-item analysis (known as ABC analysis) that attempts to relate how the inventory value is concentrated among the individual items and it is also known as Control by Importance and Exception (CIE). As the items are classified according to the importance of their relative value, this approach is also known as Proportional Value Analysis (PVA).

The ABC inventory control technique is based on the principle that a small portion of items in inventory may typically represent the bulk of money value of the total inventory used in the production process, while a relatively large number of items may form a small part of the money value of stores. The money value is ascertained by multiplying the quantity of materials of each item by its unit's price. According to this approach to inventory control, high value items are more closely controlled than low value items. Each item of inventory is given A, B or C denomination depending upon the amount spent for that particular item. 'A' or the highest value items should be under the tight control and under responsibility of the most experienced personnel, while 'C' or the lowest value item may be under simple physical control.

This concept may be made clear with the help of the following:

“A” Category – It consists of items that have a high velocity or speed in usage and have a high unit value. The items included in group A involve the largest investment *i.e.* 70 to 75 per cent of the total value of stock and represent 10 per cent of the total number of items. This category of items requires rigorous control.

“B” Category – It consists of items that include relatively small investment *i.e.* 15 to 20 per cent of the total costs of inventory and 20 per cent to 25 per cent of the total number of items. Hence, slightly lesser time and efforts should be devoted to the control of such items.

“C” Category – It includes those items which are of meagre unit value *i.e.* 5 to 10 per cent of total value of inventories, having a low frequency in usage. These inventories represent 70 to 75 per cent of the total number of items.

The task of inventory management is the proper classification of all the inventory items into one of the above three categories. In brief, it can be prepared as follows:

Inventory reach down between number of items and inventory value under ABC analysis.

Particulars	“A” Items	“B” Items	“C” Items
Control	Tight	Moderate	Loose
Requirements	Exact	Exact	Estimated
Postings	Individual	Individual	Group or none
Check	Close	Some	Little
Control	Exact	Exact	Approximate
Expediting	Regular	Some	No
Safety stock	Low	Medium	Large

It is clear from the above diagram that group-A consists of 10 per cent of total items but the total value percentage is 75 per cent. Hence, effective control should be implemented on it. Group-B includes 20 per cent of total items and 20 per cent of total value. So, general or routine control is necessary for it. Under group-C, the number of times is 70 per cent of total items but their total value percentage is only 10 per cent. Hence, there is no need of effective control but such items can be taken care of by traditional methods of inventory management.

2. Fixation of Norms of Inventory Holdings

The norms of inventories could be set by either the top management, or by the materials department. The top management usually sets monetary limits for investment in inventories. The materials department then has to allocate this investment to the various items and ensure the smooth operations of the concern. It would be worthwhile if norms of inventories were set by the 'Management by Objectives' concept. This concept expects the top management to set the inventory norms in consultation with the materials department.⁹

A number of factors enter into consideration in the determination of stock level for individual items for the purpose of control and economy. Some of them are:

1. The rate of consumption;
2. Lead time for deliveries;
3. Requirements of funds;

4. Storage costs;
 5. Availability of space;
 6. Price fluctuations;
 7. Insurance costs;
 8. Obsolescence risks;
 9. Seasonal consideration of price and availability;
- and
10. Economic order quantity.

Any decision involving procurement storage and usage of items will have to be based on an overall appreciation of the influence of the critical ones among them.

Carrying too much or too little of the inventory is detrimental to the company. If too little inventories are maintained, the company will have to face frequent stock-outs and incur heavy ordering costs. Very large inventories subject the company to heavy inventory carrying costs in addition to unnecessary tie-up of capital. An efficient inventory management, therefore, requires the company to maintain inventories at an optimum level where inventory costs are minimum and at the same time there is no stock-out that may result in loss of sale or stoppage of production. This necessitates the determination of the minimum and the maximum level of inventories.

1. Determination of Minimum Level of Inventory

The minimum level of inventories for their reorder point may be determined on the following basis:

- Consumption during lead time;

- Consumption during lead time plus safety stocks;
- Stock-out costs;
- Customer irritation and loss of goodwill; and
- Production holds out.

The company which intends to have stock requires sometime processing the order. Time is also required by the supplying firm to execute the order. This period is called 'Lead Time.' To continue production during this period, it is essential to maintain some inventories.

There are sometimes fluctuations in the lead-time and/or in the consumption rate. If no provision is made for these variations, stock-outs may take place-causing disruption in the production schedule of the company. The stock, which takes care of the fluctuation in demand in the wake of the variation in the lead-time and the consumption rate, is known as safety stock. It can be determined on the basis of the past experience of the delays in receiving supplies, fluctuations in the consumption rate, plus other relevant factors such as transport bottlenecks, strikes or shutdowns. In the case of uncertainty, the probabilistic approach may be applied to determine the safety main. To avoid stock-outs out of such eventualities, companies always carry some minimum level of inventories including safety stock. Safety stock provides cushion against expected increased usage or delay in delivery time. Safety stock may not be static for all the times. A change in the circumstances and the nature of industry demand an adjustment in its level.

The study has revealed that most of the companies covered under study determine their minimum level of inventory on the basis of consumption during the lead period, while some of them do so on the basis of consumption during the lead period plus safety stock.

The companies under study maintain safety stock for the variation in the consumption rate for the supply conditions in the goods and for variation in the lead period and variation in the consumption rate. The companies keep the level of safety stock throughout the year.

2. Determination of Maximum Level of Inventory

The study group on bank credit observed that “It is not the function of industry to carry stock in excess of what is required for current operations, as otherwise the industry will be taking over the functions of the traders.” In practice in spite of the consciousness towards this fact, some of the companies carry inventory much more than their current requirements. According to Van Horne, “Inventories should be allowed to increase the resulting savings exceed the total cost of holding the added inventory. The balance finally reached depends upon the estimates of the actual savings, the cost of carrying additional inventory and the efficiency of inventory control.”¹⁰ Other things remaining the same, the firm will go on increasing its inventory, till the opportunity cost of funds is less than the estimated return from investing funds in inventory. Supply of goods also influences the inventory level.¹¹

Generally, any one or more of the following factors may be a primary or secondary consideration for the firm while accumulating more and more of the inventories:

- Future production plans;
- Opportunity cost of funds employed
- Supply conditions of goods;
- Price changes;
- Carrying cost of inventories, such as insurance, interest and rent etc.
- Build discount;
- Bulk transportation costs;
- Import consideration;
- Storage space available.

3. Ordering System of Inventories

In managing inventories, the business enterprise's objective should be in consonance with the wealth maximization principle. To achieve this, the enterprise should determine the optimum level of inventory; sufficient inventories should be maintained, neither excessive nor inadequate.

To manage inventories efficiently and effectively the answer should be sought to the following two questions:

1. How much should be ordered?
2. When should it be ordered?

The first question, how much to order? relates to the problem of determining Economic Order Quantity (EOQ) and is answered with an analysis of the costs of maintaining certain level

of inventories. The second question, when to order? rises because of uncertainty and is a problem of determining the reorder point.

Harvery M. Wagner¹² suggested that one basic problem of inventory control is How much to order? To solve this problem many formulae and models have been developed. All inventory models no matter how complex, address themselves to the problems of timing and magnitude of replenishment. Decisions regarding the problems relating to ordering of inventory are very much affected by ordering and carrying costs. The expenses, which are incurred by the company to acquire inventories, are known as ordering costs. Carrying of inventories includes the following:

- Cost of interest of the money invested in inventories:
- Salaries and wages of staff assigned the duty to look after the receipt, issue and the proper storage of inventories;
- The rent or depreciation of godowns;
- Expenses for the insurance of inventories;
- Loss on account of deterioration and obsolescence;
- Repairs and maintenance charges for equipment used in handling of inventories; and
- Other miscellaneous expenses.¹³

The inventory ordering and carrying costs are inversely related to each other. The ordering system must strike a balance between these two costs so that the total inventory costs (ordering costs plus carrying costs) may be the minimum. There are three important systems of ordering materials; they are:

- Fixed order quantity system, popularly known as Economic Order Quantity (EOQ) system.
- Fixed period order system or periodic recording system or replenishment system.
- Single order and scheduled part deliveries system.

Economic Order Quantity

One of the major inventory management problems to be resolved is how much inventory should be added when inventory is replenished. If the firm is buying raw materials, it has to decide the lots in which it has to be purchased on replenished. If the firm is planning a production run, the issue is how much production to schedule (or how much to take). These problems are called order quantity problems, and the task of the firm is to determine the optimum or economic order quantity (or economic lot size). Determining an optimum inventory level involves two types of costs (a) Ordering Costs, and (b) Carrying Costs. The economic order quantity is that inventory level, which minimizes the total of ordering and carrying, costs.

If a company buys in large quantities the cost of carrying inventory will be high because of the high investment involved; on the other hand, if purchases are made in small quantities, frequent orders with corresponding high ordering costs will result in high cost. Therefore, the quantity to be ordered at a given time must be determined by balancing two costs, *viz.*, the acquisition cost and the cost of carrying inventories. Buying in large quantities

may decrease the unit cost of ordering but this saving may be more than-off set by the cost of carrying inventory in stock for a longer period of time. Taking into consideration both the points is necessary to ascertain the quantity, called the “Economic Ordering Quantity”, which can be most economical for the company.

The EOQ model attempts to determine quantity to be ordered at a time so as to optimize the cost of carrying and holding inventory and also ensuring availability of that item whenever needed. The most economic size of the order is determined by considering the cost of carrying the inventory, its purchasing, and its ordering costs and usage rate. The EOQ model is based on the following assumptions:

- The usage of a particular item for a given period (usually a year) is known with certainty and that the usage rate is even throughout the period.
- That there is no time gap between placing an order and getting its supply.
- The cost per order of an item is constant and the cost of carrying inventory is also fixed and is given as a percentage of average value of inventory.
- That there are only two costs associated with the inventory, and these are the cost of ordering and the cost of carrying the inventory.

- Given the above assumptions, the EOQ model may be presented as follows:

$$EOQ = \sqrt{\frac{2U \times P}{S}}$$

where,

EOQ = Economic Ordering Quantity.

U = Annual Consumption (units) during the year.

P = Cost of placing an order

S = Annual cost of storage of one unit.

The graphic presentation: The economic order quantity can also be shown graphically. Figure 1.1 illustrates the EOQ function.

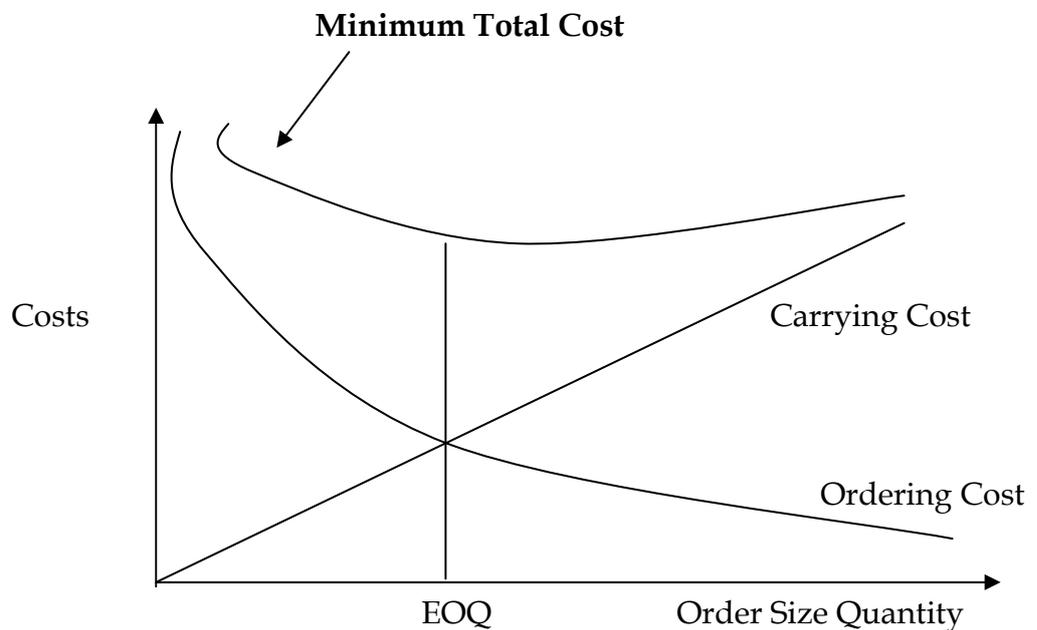


Figure 1.1 - Economic Order Quantity Function

In the above figure, costs – carrying, ordering and total are plotted on vertical axis and horizontal axis is used to represent the order size. We can analyze that total carrying costs increase as the order size increases and the ordering costs decline with the increase in the order size because the larger order size means the less number of orders. The total costs decline in the first instance, but they start rising when decrease in average ordering costs is more than off-set by the increase in carrying costs. The economic order quantity occurs at the point where the total cost is minimum.

Periodic Reordering System

In this system as the name suggests order is placed after a fixed period for the quantity by which the inventory level has come down from a predetermined level called as the periodic reordering system or replenishment level. This system is more popular as Re-Order point. “It is determined on the basis of the requirement of materials during the review period and lead time plus safety stock. The review period is decided keeping in view the terms of the suppliers regarding the minimum quantity, etc., and the average consumption rate of the firm. On the review date, order for the required amount is placed to bring the inventory to the predetermined level.”¹⁴

Single Order and Scheduled Part – Deliveries System

This system as a single order covers an enterprise's requirements of materials for a longer period, say, for six months or one year, with the instructions to supply material in a number of instalments at a stipulated time or at specified intervals. This system ensures continuous supply of materials. The concern has not to incur high ordering and carrying costs, nor make heavy investment in inventory; it is also spared with the inconvenience of arranging for storage space etc. in fact the concern enjoys the economies of scale from bulk order.

Evaluation of Inventory Management Performance

All efforts of the company management to control inventory should aim at keeping various components of inventory at economical levels and in proper proportions. Inventory may be divided into the following categories on the basis of the functions it performs:

- Raw materials,
- Work-in-process,
- Finished goods,
- Stores and Spares.

Some of the above components are prone to a high degree of control whereas others may not be controlled easily. The stock of raw materials and stores and spares can be reduced to a level where it does not hamper the production process. The amount of work-in-process is, generally, determined by the length of the

production cycle. The market forces and the nature of the industry determine the stock of finished goods.

Some of the above components of inventory are fast moving while others are moving slowly. If unduly large funds are blocked in slow moving segments, it will not only place a financial burden but also affect adversely the liquidity of the working capital of an engineering company. Therefore, for efficient control of inventory, company management must try to allocate limited funds to each component of inventory in an optimal manner.

Significance of Study

As we have now approached the twenty-first century, inventory management will assume increasing importance in the industrial world. To date, only the most progressive manufacturing firms realize that materials availability, engineering, purchasing, specifications and fabrication costs are all factors which ultimately contribute to total material cost. Progressive firms also realize that all factors which affect material cost should be coordinated and controlled by a system-oriented inventory management approach, if the total materials cost is to be minimized. The factors just mentioned, coupled with the fast increasing use of computer-based information systems, increasing international business activity and growing materials shortages highlight the importance and opportunities for sophisticated management in this area.

Inventory management has a significant role in the Indian economy. In several industries more than 50 per cent of the total cost of the product or the job is generally the cost of materials alone. The shipyard industry is one of them. Unfortunately, the importance of proper materials management has not been fully realized in India and very little attention has so far been paid to the task of controlling investment in materials through the application of various scientific techniques. In contrast, advanced countries of the West and Asian countries like Japan have made gain strides in the successful use of inventory management techniques.

In view of the above reasons, it has become all the more important to study inventory management of the Shipyard Industry of India.

Shipyard Industry

The shipbuilding industry in India has a chequered history throughout centuries. It declined almost to the point of extinction during foreign rule and revived after the establishment of national government in India (Sahai. IM, 1971). In India, ships building and shipping industries have had an unbroken tradition exceeding over 6,000 years dating back to Mohonjodara and Harappan period. It takes us to distant past when art of building ships had reached high degree of development, centuries before it had a beginning in other parts of the then known world. The oldest evidence is supplied by the *Rigveda* (1500 B.C.) that contains several references about the construction of ships in India in those

age-old centuries (V.C.S. Sastry, 1962). The Maurya period, which roughly coincides with the Indian campaign of Alexander the great (327 B.C.) saw considerable development in this industry. The industry was flourishing, its output and employment potential also was very high. According to Strabo (60 B.C. to 19 A.D.) for example, Alexander constructed fleet with the help of Indian artisans, from pine cedar and other trees obtained from the forest in the territory of King Poras.

During the days of Moghalas, the imperial Nowwara (Flotilla) was a sight to be seen. Akbar the great, had a flotilla of 3000 vessels; the boats required to be furnished by the Jageerdars were extra.

There were a number of shipbuilding yards, the most important being at Hoogly, Balasur, Murgangi, Chilmiri, Jessori, and Karibari. Abul Fazal said that in the province of Sindh, the Sarkar thatta alone could provide 40,000 vessels ready for hire. Under Shivaji, the Marathas built a formidable fleets. He established shipbuilding yards first at Kolava, Suvarna Durg, and Vijaya Durg, and later at Bombay in 1735. In addition to these, there were six other managed by Parsi forms, ships built at these yards weighed from 600 tonnes to 1,300 tonnes.

Seven generations of master builders of a single Parsi family of Lowjee and Nassarjee Wadia had been the head builders of ships in Bombay Building Dock continuously from 1736 to 1837. They were the regular suppliers of various types of ships to the English and other nations. The battleship 'Asia' built by Nowrojee

and Cursetjee in 1824 was flagship of Admiral Bcordington, in the Battle of Navarian. At this battle, the Anglo-Greek units destroyed the entire Turkish and Egyptian fleets.

In 1829, the first steamship 'HUGHLINDSAY' was built in this dock and within a decade, the iron ship the 'Planet' was constructed and launched at Bombay. In Calcutta docks, over 35 vessels were built between 1717 and 1800, aggregating 17,020 tonnes.

Simultaneously the construction of typical Indian ships made of various timbers continued as usual. The decline of Indian shipbuilding began after 1840 and no large ships were built since. On one side, the Indian enterprise was struggling to assert itself and on the other, there were vested interest of much mightier forces to curb and crush Indian efforts. The unequal pattern of the struggle and concern over the consequences were reflected in a nationalist press and heard in the parliament house. In the words of Mahatma Gandhi, Indian shipping industry "had to perish so that the British shipping might flourish". India had been throughout history a ship building nation. Since the days of Indus Valley Civilization to advent of British rule, the Indian seafarers had been known for their spirit of adventure, and Indian ships for their excellence and elegance, Indian shipbuilding and ship repair industry had provided support to the allied powers during the tow world wars. Under foreign domination, the ship building industry suffered a serious set back. At the same time of transfer of power in 1947 ship building in Indian was a languishing

industry. Even during those dark days, some Indian industrialists of vision and will power continued relentless war against vested interest to save the industry from a complete collapse. Indian shipbuilding industry is being resurrected on foundation laid down by those pioneers.

Ship building in India is not a new industry but has long history. Long before the European powers came to India, Indian mariners had carried India's trade with South-east Asia and established a thriving trade partnership with east and west. The East India Company recognizing the excellence and durability of ships built in India established several shipbuilding yards in India. Between 1800 A.D. and 1840 A.D. a large number of naval crafts and merchants were built in the shipyards. However, the increase of power and entrenched authority of the British rule in India brought about accelerated decline in Indian ship-building and shipping industry to serve the interest of their own relevant industries.

The economic significance of shipbuilding industry lies in the fact that it generates substantial direct employment and also support to a large number of auxiliary industries and too together offer a big economic and employment potential. To the extent, Indian ship owners buy Indian built ships, it saves the country's large amount of foreign exchange. Considering the employment generation potential, along with its impetus on the development of the ancillary industry, the ship building industry has to play a vital role in the overall national economic growth.

Shipbuilding industry in India on modern lines dates back to eighteenth century when Mazagaon Dock Limited (MDL) was established in the then Bombay, The MDL was taken over by the Government of India in 1969.

The second shipyard Garden Reach Shipbuilders and Engineers Limited was setup in 1884 and taken over by the Government of India in 1960. Hooghly Dock and Port Engineers Limited was setup in Calcutta in 1901 and taken over by the government of India in 1984. The Hindustan Shipyard Limited, Visakhapatnam was setup in 1941 by Sri Walchand, Halchand and taken over by Government of India in 1952. Goa Shipyard Limited was established in 1967. Cochin Shipyard Limited the youngest Indian shipyard and which builds largest Indian vessels was set up at Cochin by the government in 1972. Central Inland Water Transport Corporation Limited was established at Calcutta in 1967. After independence, Government of India has taken a number of steps for the augmentation of shipbuilding and ship repair industry commensurate with overall national objective and priority. The main thrust of developmental activities during the Ninth Five Year Plan aims at upgradation of technology and productivity, modernization of ship repair facilities, creation of national ship design and research centre, additional thrust on ancillary development and initiating research and development work.

Shipbuilding is a unique industry, which is both capital and labour intensive. Huge amounts of investments are necessary to

setup facilities of shipbuilding. Unlike process industries, shipbuilding involves deployment of sizeable labour force and managerial personnel. The government has invested significant amount of money in this priority sector. In the Indian shipbuilding scenario, public sector occupies a predominate role. The shipbuilding industry has been reserved for the public sector in terms of Industrial Policy Resolutions of 1948 and 1956. However, the private sector is allowed to construct “mechanized sailing vessels” up to 10,000 dwt. The role of private sector is to supplement the efforts of the state in this activity. At the end of 31st March, 1997, there were seven public sector shipbuilding units in the country engaged in manufacturing, selling, repairing of warships, repairing of cargo ships, passenger ships, tugs, barges, trawlers, assault boats, floating docks and dredges etc. The names of the public sector shipbuilding units and their incorporation particulars are given in the following table:

A brief narration of all the public sector ship building units in India

S. No.	Name of the Shipyard	Year of establishment	Year of incorporation as public sector unit	Administrative Department	Ministry/
1.	Goa Shipyard Limited	1957	1967	Dept. of Defence Production	
2	Central Inland Water Transport Corporation Limited	1901	1967	Ministry of Surface Transport	
3	Cochin Shipyard Limited	1970	1972	Ministry of Surface Transport	
4	Garden Reach Shipbuilders and Engineers Limited	1884	1967	Dept. of Defence Production	
5	Hindustan Shipyard Limited	1941	1952	Ministry of Surface Transport	
6	Hooghly Dock and Port Engineers Limited	1901	1984	Ministry of Surface Transport	
7	Mazagaon Dock Limited		1934	Dept. of Defence Production	

Of these seven shipyards, GRSE Limited, Kolkata, MDL Mumbai, GSL, Goa are under the administrative control of department of defence production, ministry of defence. These shipyards are mainly intended to cater the requirements of the Indian navy, but a part of their capacity is also available for construction of other types of vessels. The remaining four shipyards CSL, Cochin, CIWTC Limited, Kolkata, HDPE Limited, Kolkata, HSL Visakhapatnam are under the administrative control of ministry of surface transport.

Growth of Public Sector Shipbuilding Industry

The progress of industrialization over the last four decades has been a striking feature of Indian economic development. The process of the industrialization was launched as a conscious and deliberate policy in the early 1950 and in pursuance of this policy, large investments have been made in building up of capacity in a wide spectrum of industries. A significant aspect of industrial development during this period is the predominant role assigned to the public sector in the establishment basic industries like steel, non-ferrous metals, petroleum, power, coal, fertilizer, heavy engineering and shipbuilding. The Ninth Five Year Plan has given emphasis for additional investment infrastructure sector consisting power, petroleum, coal, steel and shipbuilding with a view, especially, to overcome a wide gap between the demand and supply position of the looking to dominant role of the

industry in the Indian economy, the purpose of study becomes justified.

Among the components of working capital, inventory occupies the key position. Inventories constitute a major portion of current assets and account for a significant proportion of the total assets of most of the manufacturing organizations.

Among the number of managerial problems one of the most important problems bothering the executives is the problem of inventory management. In a developing economy like ours, capital resources are limited. Hence with the limited capital resources, every company has to increase their production. In this effective inventory management assumes great importance. Reckless management of inventory has wrecked many otherwise prosperous units in any economy. The problem to be investigated in this study comprises grave consequences such as colossal waste of inventory, erosion of profitability and liquidity, decreasing production, problems in the storage, identification and distribution uncertainty about the time when materials are needed and quantity required, problems in converting requirement estimates into provisioning quantities, problem in procurement, inferior quality of materials etc.

Objectives of the Study

The objectives of the study are:

1. to find reasons for low capacity utilization and to give practical solutions to overcome this problem.

2. to suggest ways and means to increase the return on investment.
3. to suggest certain techniques to increase the overall efficiency.
4. to suggest scientific inventory management tools and techniques to overcome the present problems in inventory management.
5. to suggest certain techniques to reduce material cost and cost of production.

Scope

The study has covered the major units like Goa Shipyard Limited, Central Inland Water Transport Corporation, Cochin Shipyard Limited, Garden Reach Shipbuilders and Engineers Ltd., Hindustan Shipyard Ltd. and Mazgaon Dock Limited.

A comparative study of the above units has been made to suggest corrective measures.

The study has been mainly concentrated on inventory management. The functioning of stores and purchase departments has also been covered by this study. Wherever necessary, the information has been obtained by other functional heads like factory accountant, planning engineer, production manager etc. The study will also have focused on production and finance department at appropriate places.

Hypothesis

Mismanagement of inventories and the irregular supply of the critical parts when they are needed is being mainly responsible for the unsmooth and irregular production by the various shipyard companies in India. Therefore, proper and efficient management of inventories is of utmost importance. Unfortunately, there are several weaknesses in the existing practices of inventory management which until recently had been left entirely unbridled. The rationale for norms and the need to link inventory management requirements is, thus, clear. Eventually, the entire system of material planning is to be dovetailed, to create better management of inventories.

Research Design and Methodology

Methodology includes use of statistical techniques, inventory control techniques included various analysis.

Tools to be Used in the Collection Data

Primary Data - A questionnaire to be issued to the units covered to elicit relevant data from personal interviewing of executives, Planning commission and other concerning government officers of the related departments, academicians and financial analysis in real life setting.

Secondary Data - Annual reports and financial statements of the selected companies, inventory and financial statistics from various journals, periodicals, newspapers and reports, Economic

Survey, Journal of Accounting and Finance, margin, productivity, the Material Management journals. *The Economic Times* and *Financial Express* etc., books and various publications of financial institutions and Reserve Bank of India, published and unpublished works of research scholars and available studies.

The problem of inventory management in every company has not so far been subjected to objective and scientific research consequent upon vast changes and new developments in the inventory control techniques witnessed after inventory policy parameters laid down by the Government of India and the set-up of canalizing agencies. The policies and the policy instruments formulated by the government have far-reaching impact on the economic activity. In our developing economy, government undertakes multifarious functions which impinge upon industrial activity and are of relevance to inventory management. Through this searching analysis I hope to come up with a whole gamut of insights not hitherto highlighted until now. The study being the first of its kind assumes paramount significance in the existing economic environment where, we have sufficient human and natural resources but our capital resources are extremely limited. In this situation, every company must follow effective and proper inventory management.

Its likely Contribution to the Knowledge

The present study is expected to reveal the latest facts regarding the inventory management practices prevailing in units

under the study. To high light the malpractices which are responsible for the mismanagement of inventories and spare units. To expose the problems confronted in the context of prevent inflation shortage of funds and credit squeeze policies of Reserve Bank of India. To develop feasible solutions to alleviate genuine difficulties experienced by the Inventory Managers in all the plants in the management of inventories, such as uncertainty about the time when spare-parts are needed and quantity required, problem converting requirement estimates into provisioning quantities, problem in procurement, storage identification and distribution. The study aims to find out the solutions of the basic problems arising in the management of inventories. For example, what should be the level of inventory for a particular item that a unit should carry or how much should one procure in a lot. Replacement time is not constant but fluctuates, resulting in stock-out situation. Every company/plant must minimize such a situation. If the spare parts and other items of inventory are to be purchased, when to order and how much to order. Finally, the study aims to develop some new models of inventory management and to try to improve the existing practices in the management of inventories.

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Chapter-II

Review of Literature

Inventory, in most of the industries, accounts for the largest proportion of gross working capital. A number of studies, therefore, have been conducted to find the determinants of investment in inventories. The following discussion provides a brief review of studies, dealing with factors influencing investments in inventory in India.

Economic studies to analyze the factors that influence inventory accumulation in India, are based on time series and pooling of cross section of time series data pertaining to manufacturers' inventories. Krishnamurty's study (1964) was aggregative and dealt with inventories in the private sector of the Indian economy as a whole for the period 1948-61. This study used sales to represent demand for the product and suggest the importance of accelerator. Short-term rate of interest had also been found to be significant.

Sastry's study (1996) was a cross-section analysis of total inventories of companies across several heterogenous industries for the period 1955-60 using balance sheet data of public limited companies in the private sector. The study brought out the importance of accelerator represented by change in sales. It also showed negative influence of fixed investment on inventory investment.

Krishnamurty and Sastry's study in 1970 was perhaps the most comprehensive study on manufacturers' inventories. They used CMI data and the consolidated balance sheet data of public limited companies published by RBI, to analyze each of the major

components *i.e.* raw material, goods-in-process and finished goods for 21 industries over the period 1946-62. It was a time series study but some inter-industry cross section analysis had also been done. Accelerator represented by change in sales, bank finance and short-term interest rate were found to be important determinants. Utilization of productive capacity and price anticipations had been found to be of some relevance. Another study conducted by them in 1975 analyzed inventory investment in the context of flexible accelerator with financial variables. Both RBI and Stock Exchange Official Directory, Mumbai data for seven important industries had been taken for the period of 1956-69. Their study of pooled cross section was in current prices whereas time series analysis based on RBI data was a constant price. OLS results showed the important influence of accelerator, internal and external funds flow and fixed investment on inventory investment.

Materials management has been considered as a separate field of management discipline only in the recent past and is accorded the status of a separate functional area. While the concept got wide popularity and recognition in all the advanced countries. In India, it is yet at an infant stage. On account of its latest origin, unfortunately research in the area of materials management both at the micro and macro levels was conspicuously absent. There does not exist adequate indigenous literature on this subject. However, in recent years on account of the growing importance of material management, few research studies were conducted at various universities in our country

which highlighted some of the problems faced by selected central and state public sector undertakings in the country. Apart from the above research work, a few studies were conducted at Administrative Staff College of India, Hyderabad and some studies were conducted by individual authors which focused to some extent on the existing policies, procedures and problems of industrial organizations in the field of materials management. Besides the above studies, there are a number of reports submitted by governmental committees from time to time. In addition to this, some studies were conducted on Inventory Management in India.

Bansal G.D., in his study on Material Management, A Case Study of Bharat Heavy Electrical Limited, Bhopal unit, (BHEL)', has evaluated the existing systems of inventory management. He emphasized the need for automatic replenishment system in the undertaking. He also studied the application of ABC analysis and EOQ technique of inventory control. He also pointed out the accumulation of surplus stores and non-moving items in the organization. He recommended that the surplus and obsolete stores, which are no longer required, should be disposed off as early as possible at the best available price. Further, he has suggested the preparation of monthly classwise statements on inventories for effective control over them. And he suggested the introduction of reconciliation of stores' ledgers with account ledgers to avoid misappropriation of stores. The study also revealed that raw material, components and stores, and spares for production and operation are above their actual consumption

level. The inventories in general are found to be above their routine requirements. The holdings of stores and spares generally are of the order of two to three years' requirements and these are considered as excess.

Rama Krishna Rao B., in his thesis 'Materials Management in Heavy Engineering Industry' a case study of Bharat Heavy Plate & Vessels Limited (BHPV), Visakhapatnam in 1979, he has evaluated the performance of materials management in BHPV and identified some problems pertaining to materials management in BHPV in particular and heavy engineering industry in general. The method of investigation involves documentary evidence and survey of expert opinion. He has evaluated the existing purchase systems and lead-time involved in procurement of materials and suggested that the long lead-time should be reduced. His study pinpointed the excess inventory in terms of number of months cost of production in all the engineering units. He also highlighted some of the problems in the area of materials management such as delay on the part of customers in supplying their own materials, existence and disposal of surplus and non-moving items, excessive lead time and excessive dependence on imports. He also found that the administrative and procurement lead times of the company are on the higher side due to the peculiar nature of the industry. He suggested the liberalized purchase procedures, increasing financial powers to the personnel, opening up of liaison offices in various countries to reduce the lead-time. In comparison with the BPE norms, the inventory levels of various stores items in

BHPV and the overall inventory accumulation in Heavy Engineering Group was relatively higher and he suggested for drastic reduction in the inventory levels.

Phaniswara Raju B produced a research work entitled 'Materials Management in Andhra Pradesh State Road Transport Corporation (APSRTC) in the year 1986. In his study, he examined the materials management practices and purchasing systems in APSRTC on the basis of various parameters like material consumption per vehicle, material consumption per kilometer, inventory per vehicle, inventory in terms of number of month's consumption etc. He highlighted some major problems in the procurement of materials. The study was primarily based on secondary data collected from published annual reports of APSRTC, the records of MIS, the reports on performance of Nationalized Road Transport Undertaking of CIRT, Pune etc., coupled with personal interview with various officials of the corporation. The study revealed the increasing levels of materials consumption in APSRTC as compared to other undertakings. He observed the absence of the use of important analytical techniques like value analysis and network techniques in the purchasing system of APSRTC.

The inventory control system in APSRTC was critically examined in respect of stock out pattern, reordering and review policies, lead time patterns, stock out levels etc. He mainly suggested the reclassification of stores items based on the

criticality, the re-fixation of reorder level and reorder quantities. The study also showed the wastage caused by maintenance of unnecessary stock records relating to items, which were no longer used.

Hari R. Swami in his research work "Materials Management in Public Undertakings" has evaluated the performance of materials management in the central public undertakings in Rajasthan such as, Instrumentation Limited, Kota unit; HMT, Ajmer unit; Hindustan Zink Limited, Debari unit; Hindustan Copper Limited, Khetri unit and Sambhar Salts Limited. The study covered various aspects of materials management in these enterprises from 1977-78 to 1981-82. The methods of investigation include questionnaire interview, on the spot study and deskwork techniques etc. It has been observed that the cost of materials accounts for more than 50 per cent of the total cost of production in the selected units of the study. Unfortunately, the importance of proper materials management was not fully realized by public undertakings in Rajasthan and very little attention has been paid so far, to the task of controlling investment in inventories through the application of various scientific techniques of materials management. The research opined that, materials management should not cover the inspection function, as it requires an autonomous and independent status in the organization. The study revealed that the lead-time in the selected public enterprises was considerably long and suggested to reduce administrative lead-time by expediting purchase files. The study also revealed

that the inventory of selected public enterprises had been accumulated due to the following reasons; faulty purchases, heavy rejections, high lead time, uncongenial organization, lack of scientific and modern techniques of materials management, defective inventory control and inflationary tendencies in the economy. He suggested that the inventory holdings could be reduced by adopting integrated system of materials management, appointing qualified and trained inventory managers, reducing lead time, setting and regulating consumption and stocking norms of raw materials and other goods, applying modern techniques of materials management and identifying slow and non-moving items. The study tested fully its hypothesis "the public enterprises had suffered losses or earned low level of profits relates to the inefficient management of materials. If the public enterprises followed standard techniques of materials management, they would not only generate resources for their own expansion but would also have contributed towards economic growth." The very important reason for public enterprises having suffered losses or earned low level of profits relates to the inefficient management of materials. Had public undertaking in Rajasthan managed materials in an efficient and effective manner, they would not only have generated resources for their own expansion but would also have contributed towards economic growth.

In the year 1980, K. Sambasiva Rao conducted a research study entitled "Materials Management in Public Sector Shipbuilding Industry." He made a review of studies conducted

earlier on materials management in the Indian industries and he threw light on planning and budgeting of materials management in Hindustan Shipyard Limited. He did an in-depth study in the areas of procurement of materials, codification and standardization, vendor analysis, and inventory control in the light of inventory norms fixed by the Bureau of Public Enterprises of the company under study. He conducted the study under certain limitations like absence of proper records, confidential nature of the information, un-disclosure of certain information, reluctance of officials in providing the necessary data pertaining to inventory control.

In his study, he highlighted the problems faced by the Indian shipbuilding industry in general and specific problems of Hindustan Shipyard Limited. The problems include international parity price on the involvement of the directorate of shipping in fixing the price of the ships constructed. Inadequate use of installed capacity, paucity of funds, paucity of orders, paucity of trained manpower, high cost of material inputs, delays in procurement of material and equipment, due to the undevelopment and underdevelopment of ancillary units, the shipbuilding industry is facing severe hardships in obtaining the necessary inputs by paying scarce foreign exchange reserves. Even if at all there are some indigenous ancillary industries to shipbuilding industry, the prices of the products of ancillaries tend to be high because of the incidence of duties, taxes and high overhead schedules are postponed after receipt of major material

and components due to lack of coordination among the various departments by drawing offices, production planning and control department, purchase department, stores organization and production department.

Finally, his study highlighted the significance of materials management function in shipbuilding industry and suggested that the procurement policies, procedures and systems need to be improved to achieve higher operational efficiency in this critical area.

In the year 1996, (Ms) Prameela Devi did a research work entitled “Materials Management in Public Sector Heavy Engineering Industry. A Case Study of Bharat Heavy Plates and Vessels Limited, Vishakapatnam.” She laid emphasis on the problems faced by materials management department in BHPV Limited. She did a comparative study of inventory management practices of BHPV with the public sector heavy engineering units. She found some weaknesses in the materials management function of BHPV and suggested some measures to turn up the materials management function and for the overall performance of BHPV Limited. She highlighted the difficulties of materials management in jobbing industry like BHPV with that of the industrial units, which are of continuous process industry. The researcher observed that frequent changes taking place in materials management adversely affects the smooth functioning of materials management.

She also observed that the number of items in the inventory is on the increase and she suggested that enforcing strict control on the delegation of powers should curb it. For determination of the appropriate quantity to be procured and minimum capital without any delay in the production is of importance, in satisfying the conflicting interests. For it, she gave some solutions like SIM (selective inventory management) which consists of Pareto analysis (ABC analysis), criticality analysis (VED analysis), movement analysis (FSN analysis) and availability analysis (SED, GOLF, SOS etc.).

She further highlighted the deficiencies of the management and they are as follows. Adoption of inventory control methods like classification, codification, and standardization, variety reduction, value analysis, ABC analysis is not systematically implemented. Economic order quantity was not adopted. Vendor rating techniques and value analysis were not followed. Materials management manuals were not even prepared in BHPV. Buying cost or inventory carrying cost of materials was not worked out systematically. Computerization was not extensively done.

So far, a good number of research studies were conducted by different researchers in different institutions in universities and they tried to cover all the aspects of materials management in both public sector and private sector industrial units located throughout the country. But there was not even a single work done in the area of materials management in shipbuilding units managed by defence production department. As such, researcher

found this gap and took up the study of “Materials Management in Indian Shipyards: A Case Study of Goa shipyard Limited.”

Apart from the above research studies, as a result of growing awareness of the subject, some studies were conducted in the area of materials and inventory management which focuses attention on the existing policies, procedures and problems. Some of them are: “Rationalizing Materials Management,” (Datta A.K., 1990), “Essentials of Materials Management,” (Gokarn P.R., 1986), “Inventory Management, Text and Cases,” (Gopalakrishnan P. and Sandilya M.S., 1978), “Spare Parts Management, Text and Cases,” (Gopalakrishnan P. and Sundaresan M., 1977), “Materials Management, Procedures Text and Cases,” (Datta A.K., 1984), “Management of Materials,” (Chowdary B.K. Roy, 1979), “Materials Management,” (Sharma P.C.,1986), “Integrated Materials Management,” (Patel, Chuna Walla and Patel, 1984), “Integrated Management: Concepts and Cases,” (Verma M.M., 1984), These books are textual in nature, which explain mainly the functions, procedures and problems in the area of materials management, which mainly intended to cater the needs of students, researchers and professionals dealing with the subject. However, in some textbooks, some typical and useful case studies were discussed at length for the benefit of the readers.

In addition to the above mentioned text books, which deal with all the aspects of materials management, there are some other text books exclusively on inventory management such as *Inventory Management in India* (Chandda R.S., 1984), *Inventories in Indian*

Manufacturing (Krishna Murthy K. and Sastry D.U., 1970), *Inventory Management* (Institute for Financial Management and Research, 1980), *Purchasing and Inventory Control* (Menon K.s. 1985), *Inventory Holding by Manufacturers in India and United States* (Mazumdar H.K., and Soloman M.J. 1960), *Inventory Holdings by Manufacturers in India and United States* (Rajeshwar Rao K. 1985), *Working Capital Planning and Control in Public Enterprises in India, Problems of Working Capital* (Mishra R.K., 1975), *Management of Working Capital* (Agarwal N.K., 1983).

In all these books, an attempt had been made by the respective authors to explain the concepts, importance, tools and techniques and problems of inventory management with some case studies. For instance, Krishna Murthy and Sastry have studied inventory behaviour of 21 industries comprising 91 per cent of output and 96 per cent of inventories of the group of the industries covered by the census of manufacturers. The study deals only with inventory holdings of the manufacturers and the analysis is mainly in terms of the prices prevailed during the study period.

Similarly, the IFMR's survey "Inventory Management" summarizes briefly the findings of four important surveys, it conducted in the area of inventory management practices in Indian industry. A study on control practices in Indian industry conducted by the faculty members of the Jannalal Bajaj Institute of Management Studies, University of Bombay concluded that most of the companies were still guided by rules of thumb and

intuition in deciding on how much capital to invest in inventory. Out of the 224 companies approached, 36 responded and among them only 13 reported using inventory control techniques. Only six out of the 13 companies took into account inventory costs in controlling inventories.

The faculty members of the Administrative Staff College of India made a survey on spare parts management practices in India in 1977. 200 organizations were covered under this study. The survey findings indicate that a major bottleneck is the painful slow process of import substitution. This is mainly because inability of ancillaries to provide quality goods, scarcity of certain raw materials etc.

The faculty members of the Administrative Staff College of India made another study on inventory management practices with a focus on the Tandon Committee recommendations concerning inventory norms. The study indicated that industries were found to carry by an large more stocks of raw materials including spare parts and imported items than the suggested norms by Tandon Committee. It also revealed that industries except in engineering and textile sectors were managing the work-in-progress inventory within the specified norms.

To highlight the range of problems affecting inventory management and to get an appreciation of the techniques and practices adopted in the Indian context and to tackle these problems, the IFMR has conducted an empirical study on inventory management practices in public sector undertakings

and public limited companies in the private sector in 1979. While it was intended to cover 200 organizations, response was actually received from 48 organizations only. The study revealed that a majority of the respondents gave high priority in inventory management, to the financial objectives of maximizing the return on the investment. It also revealed that there is considerable scope for reducing the spares inventory in the engineering and process industries. There is a general lack of appreciation of the benefits of, and the need for integrated materials management. Most of the respondents viewed that materials management functions as a service centre, and a few conferred on it the status of a profit centre. In most instances, there is a very strong case for the materials management function to be elevated to a much higher status with close and continuing association with top management.

In addition to this, there are a number of reports submitted to the government from time to time. For instance, the committee on public undertakings in its 40th report on "Materials Management," Parliamentary Committee on Public Sector Undertakings, pointed out source of the deficiencies in the realm of materials management of the public sector undertakings in India. The BPE 'Guidelines for Materials Management in Public Sector Enterprise', Bureau of Public Enterprises, Ministry of Finance, Government of India, New Delhi, 1979 has issued guidelines on material management to the public sector

undertakings to introduce modern methods and for improving their materials management function.

The administrative reforms commission, Report on Public Sector Undertakings, New Delhi, 1967 made some recommendations for reducing inventory levels. The RBI Study Group, on the follow-up of Bank credit, Bombay, 1975 was appointed to frame guidelines and to lay down norms for bank credit to be made applicable to all classes of industrial borrowers (popularly known as Tandon Committee report). It classified inventories and prescribed inventory norms for 15 industries. The Fifth report of the Committee on Inventory control, Bureau of public enterprises (BPE), Ministry of Finance, Government of India, New Delhi, 1972 appointed by BPE in 1972 examined inventories of the following three public sector undertakings - *viz.*, Hindustan Shipyard Limited, Hindustan Cables Limited, and National Mineral Development Corporation Limited. The committee fixed inventory levels for HSL and made some concrete recommendations to reduce inventory levels in all the three undertakings.

Apart from the research studies conducted at various universities and institutions and textbooks published on the subject, there are a few famous journals on materials management published in India. Though the journals, experts, professional and practitioners in the field of materials management have shared their thoughts in the form of writings. Hereunder, an attempt has

been made to review some of the important articles published in various journals in India.

Pren. Vrat's, 'Materials Productivity in Indian Industries,' published in *Indian Management*, All Indian Management Association, new Delhi, December, 1978, highlighted the importance of increasing materials productivity in Indian industries. Ravindra Kumar described materials management as a truly creative, productive and profit centre. Renuka Raja Gopalan's, 'Increased Productivity' published in the *Materials Manager*, Indian Institute of Materials Management (IIMM), stressed the importance of productivity through efficient materials management in manufacturing enterprises. Suresh Krishna's 'Role of Materials Management Professionals in Industrial Growth,' stressed the need for professionalism in materials management to achieve the organizational goals. Krishna Swamy S's 'Trust - The Key to Better Materials Management' published in *The Materials Manager*, Indian Institute of Materials Management (IIMM), emphasized the need for maintaining good vendor relations. Somayajulu S.V.R. highlighted an integrated view of the role of materials management in improving the profitability of the undertakings. Al Prased R's 'Increased Productivity through Better Materials Management' published in *The Materials Manager*, Indian Institute of Materials Management (IIMM), emphasized the need for proper planning and good inventory management systems in achieving organizational goals. Parsed Mukherjee S.K.'s 'Materials Management in Food Corporation of Indian (FCI)

published in *Lok Udyog*, New Delhi, felt that the key result areas in material function have a direct and important bearing on productivity or purchasing, transportation, materials handling and realizations from disposal of obsolete surplus and waste products in Food Corporation of India (FCI)'. He also felt that the materials management is a profit center of great importance in industries where 50 to 60 per cent of the cost of production is on materials and where the entire working capital is in the form of inventory. According to Mahadevan, 1982, materials management is vital to corporate management and goals and no wonder it constitutes one of the 5 M's of the corporate; Marketing Management by sales, Man Management - by personnel, Money management by Finance, Machine Management by workers' factory, Materials management - by Materials. Gurani V.G. emphasized the need for cost reduction and cost savings in the area of materials management by a combined approach and teamwork of all persons in the organization. Mahalanobis P.C's, 'A New Look at Materials Management,' published in *The Materials Manager*, Indian Institute of Materials Management (IIMM), stressed the need for materials management in improving productivity. He stressed the need for total materials control to achieve better results. Sreenath H.R.'s, 'Materials Management in a Steel Plant', viewed the importance of the role of materials management in the productivity of steel plants. He suggested regular interaction between materials management groups, centralized procurements, extensive use of computerization etc., to

improve the productivity of steel plants. Sari, A.R. (1977) in his article 'Materials Management in the Industrial Economy', published in *The Indian Buyer* highlights the importance of modern materials management in the present competitive market. The author has discussed in details the silent points to curb and control excess inventory. He also stressed on the purchasing function at large. 'Materials Management in Process Industries', an article published in *The Materials Manager* by Chandramouli. K. published by Indian Institute of Materials Management (IIMM), in 1983, differentiated the materials management function between engineering and processing industries. He highlighted the problems of materials management in the process industry. Ramaswamy S., in his article 'Effective Materials Management-key to Productivity', in *The Materials Manager*, published by Indian Institute of Materials Management (IIMM), 1983, highlighted the importance of materials management function to contribute effectively to the productivity of the organization. Hans Busch F. viewed materials management as a total concept involving organizational structure unifying a single responsibility, the systematic flow and control of materials. He stressed the need for implementing modern concepts in materials management. Madho Narain stressed the need to develop professional personality and other managerial virtues for the people working in the materials management area in his article 'Material manager in the managerial hierarchy of the Indian industry'. Kapok M.L.'s article, 'Productivity in Materials Management', in *The Materials Manager*

journal published by Indian Institute of Materials Management in 1988, felt that materials management can contribute to the growth and profitability of an organization to achieve better productivity in materials management. He suggested to maintain good relationship with the suppliers and to remove the fear complex of stock outs.

Rama Krishna Rao B., in his article 'Some Problems of Materials Management', reviewed the inventory position in central public sector heavy engineering units and highlighted the problems faced by engineering units in particular and all central public sector undertakings in general. Roy Chowdhury Bipul K.'s 'Materials Management Availability Research' article outlined some of the salient points necessary for the development and disposal of availability research in the area of materials management. Some methods are also discussed and these can be used for setting certain types of research work. Rao and Rama Rao, in their article 'Information and Material Management,' published by *the Economic Times* in 1977, have emphasized the need for constructive information system to the materials management sphere to achieve good results.

Adisesh Iyer, discussed the methods of valuing inventories in his article 'Inventory Control', published by *The Chartered Accountant* journal. He is of the opinion that the work-in-progress inventories have to be valued as per the cost account ledgers instead of attempting physical valuation. Kulkarni, P.V., (1977) discussed ABC analysis techniques at a length in his article 'ABC

analysis: A Technique of Inventory Management'. Pillai and Ashok Agarwal discussed the inventory management in Indian Air Transport Industry and found its weaknesses and suggested remedial measures for efficient inventory management. Rao K.V's, article 'Techniques of Inventory Management' in *The Economic Times* considered four costs viz., replenishment cost, inventory carrying cost, under-stocking cost and overstocking cost in developing an inventory system. Gopalkrishnan P., in his article published in *The Hindu* entitled 'Importance of Inventory control', stressed the need for inventory control in view of the Tandon Committee norms and suggested some methods to control inventories. Gangahara Rao M. and Rama Kishan Rao B. analyzed the trends in inventory levels besides bringing into focus the causes for inventory accumulation in all central public sector undertakings during the period from 1970-71 to 1978-79. Ganesh Kulkarni highlighted the problems of valuation of work-in-progress in the context of identification of materials and valuation in his article (1983) 'Work-in-progress'. Ramakishna Rao B. in his thesis 'Inventory control in public sector units' highlighted the problems of inventory control in public sector units and he classified the costs for inventory accumulation as internal and external. According to him, unrealistic government policies with regard to import licences and erratic delivery schedules and long lead times are responsible for inventory accumulation in public sector units. Rao and Gupta viewed that the effective management

of inventory reduces the cost of production and consequently increases the profitability of the enterprises.

All the above research studies conducted at various universities in India and other published research studies and surveys in this area and text books brought out and research papers published in journals, newspapers etc., revealed that the various facets of materials management have not been fully developed and are not satisfactory. There is no common opinion on what functions have to be covered under the preview of materials management. Even the method, techniques, procedures and systems suggested by various authors to control the inventories varied widely. However, the materials management has been identified as the most potential area of prime importance to increase the productivity and efficiency of an organization. Even then, serious attempts of research have not been made in this area. The present study has been to some extent able to highlight the importance of the materials management as one of the important functional areas in an industry like shipbuilding.

Chapter-III

Stores Organization and Quality Control

- Stores Organization
- Procedures Followed in Respect of Materials
- Quality Control

In this chapter, the researcher tries to explain and analyse the importance of stores location, organizational structure, procedures followed in respect of receipt of materials and quality control.

Actual procurement, storage and preservation activities form the last link in the material management process. Quality Control of raw materials, storage of materials, parts and supplies are an integral part of the process by which the supply department maintains a non-stop flow of the items maintained from the points of supply from outside the organization to their points of usage in the organization.

The stores management plays a crucial role in smooth running of an organization. The purpose of the stores is to provide uninterrupted material flow to the work-sights of the various departments in the organization. By this, one can understand that the stores is not just a dumping yard but an important element of the economy of the business organization.

Reorganising the significance of stores in majority of industrial firms in the United States of America, receiving and stores departments are attached either to the purchase department or lumped it along with procurement and other related activities in the materials management department.

In the history, we come across names like 'Kothari', 'Bhandari' which were derived from the nature of work such families have been dealing with, like stocking and controlling goods and material (Gopala Krishnan. P, and Shandilya. M.S.,

1980) Store keeping involves the receipt, storing and issue of materials, concerned with the physical handling and well being of stocks (Anantha Krishna V, 1972). Storage means holding in custody of all kinds of stores and materials including spare parts, components, semi-processed and finished products. This was put forth by Institute of Costs and Works Accountants of India.

Stores management assumes greater importance in the Indian context because of the stiff supply positions of materials. It is a known fact that majority of the industrial undertakings in India are maintaining four to six months' inventories. For certain imported items, it is as high as 24 months. Thus, the stores department is responsible for the receipt, identification, and general inspection, keeping an eye on the levels of the stock for the replenishment purpose and of all the incoming materials. Besides these responsibilities, the stores department is also responsible for safe storage of all work-in-progress, production materials, maintenance material and other repair items. In some organizations, the store is responsible for the finished goods storage also. But, however, in ship building industry, after the delivery of store items to the user departments and making an entry to this effect in Electronic Data Processing (EDP) and ledger, the stores department's responsibility automatically ceases. The stores department must protect the materials in its custody against pilferage, unwanted drawings, unauthorized drawings, damage and deterioration.

For easy identification, the stores personnel need to classify the items into various categories and attach the materials with some codes *i.e.* codification and assign some marks to all the materials in a manner which facilitates ready accessibility. Last but not the least, the stores must control the issuance of the material in a way that provides effective services for the production operations. The responsibilities of the stores are :

- (a) The receipt of equipment, raw material, tools, spare parts, components, greases, and other items and verify them against the purchase order placed with the supplier by the organization and account for the said items.
- (b) Arrange the received items at appropriate places, proper storage and preservation of the items in accordance with their nature, usage, value and importance.
- (c) To meet the needs of the consuming department, by proper issuing procedures and account for the consumption.
- (d) To help in verification and provide supporting data for effective purchase action.
- (e) To make higher ups aware of discrepancies, if any, like abnormal consumption and accumulation of stock.
- (f) To help in minimizing surpluses, obsolescence and scrap through appropriate codification, preservation and handling.

- (g) To maintain clean and tidy store place, so that the material receipts, preservation, stocking and issue can be done easily without any difficulty.

The stores location and layout have a bearing on the organizational effectiveness. The general practice is that the stores should be located in the proximity of the user departments so as to minimize transportation and other handling expenditure and to ensure timely supply of the necessary material to the consuming departments/work places. In fixing the location of the stores, its size and design etc., various determinants should be taken care of by the industrial organizations. The determinants include nature of industry, size and volume of transactions, type and value of stocks, volume of stock to be held, handling, re-handling and transport costs, security, safety requirements, statutory obligations etc.

While planning the layout of the stores, the government criteria would be free flow of materials, optimum utilization of storage space sufficient space for material, men and handling equipment and proper usage of equipment in stores such as racks, pallets, shelves and preservation against light, rain and temperature. Besides these factors, some other factors like number of users and their location, the variety and volume of goods to be handled, the distance from the central receiving station and the accessibility of transportation are to be taken into account. The stores block must have adequate light, ventilation, air circulation facility, air conditioning, heating equipment, if necessary, which

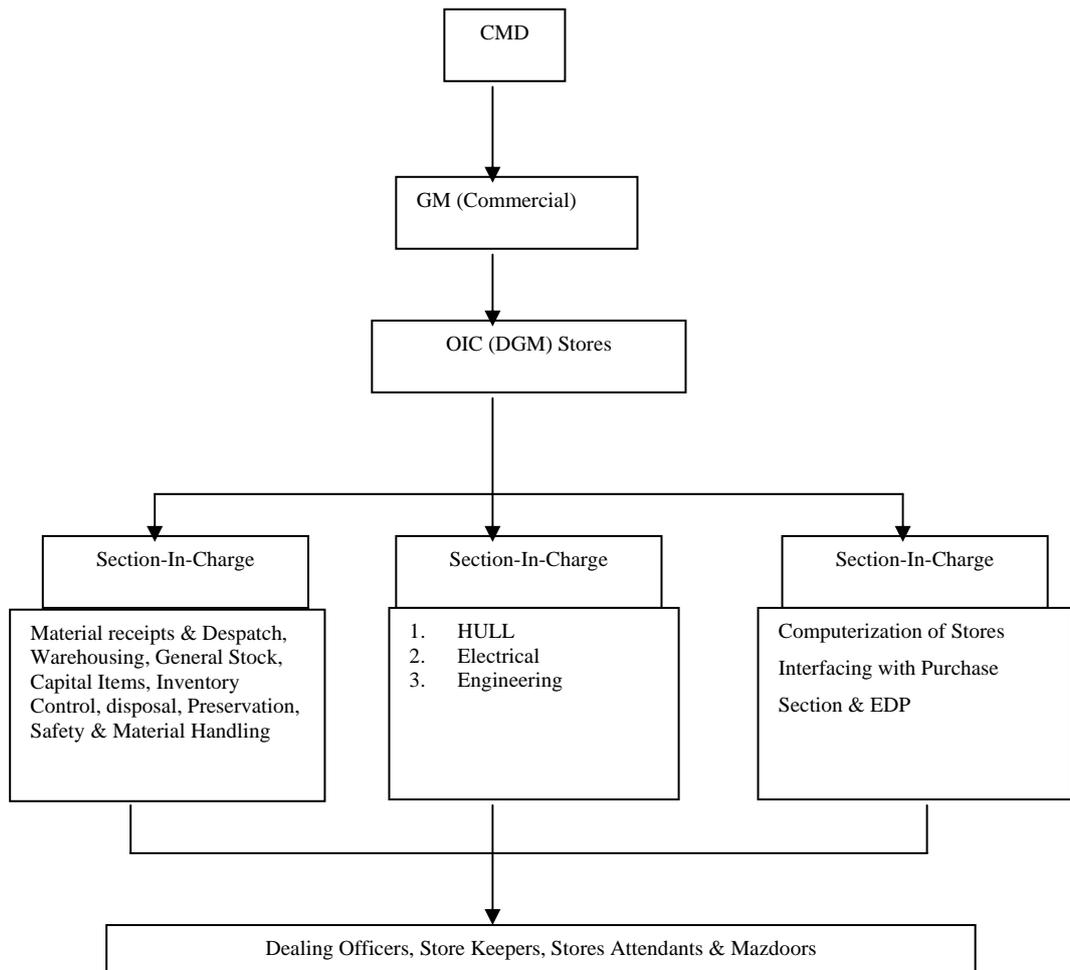
should be planned well in advance before construction of the stores. Besides these, in order to get the maximum work from stores personnel, it is necessary to create well working conditions.

Besides size, organization needs to consider its activity, size of stock items, volume of transactions, kind of stock, the minimum and maximum size of stock of each item to be held at any point of time, of warehousing (carrying cost), transport, handling costs and re-handling costs, statutory obligations like cold storage and controlled temperate zones, insulated storage and finally, safety and security requirements. In stores layout, space for material, men, material handling equipment and appropriate allocation of storage space for furniture such as shelves, racks and pallets is required. It is the responsibility of the management to adopt scientific measures for proper preservation of the material against light, rain, fire and other such elements. In addition to the above mentioned factors, the number of users and their location, the variety and volume of items to be used and handled, the location of the initial receiving and accessibility to the modes of transportation are of great importance in drawing the layout of the stores organization. As the stores and sub-stores have to be built nearer to the user departments, larger organizations usually have so many sub-stores attached to each consuming department. Whereas, receiving of materials is done at the central receiving stores. The stores block must have necessary and adequate facilities such as heating equipment, cold storage, and other facilities, which should be planned well in advance while

constructing the storage building. To get optimum efficiency from the stores personnel, proper facilities within the stores and necessary working conditions must be provided while planning the stores layout. The shipbuilding industry is basically an assembling industry, which procures some thousands of various items and equipment. These items and equipment must be stored and maintained by the stores until the materials of different kinds with different sizes and designs are issued to the various departments. Adequate attention is to be paid for stores items and equipment procured from aboard for easy identification and for easy location. Certain items do not contribute directly to the construction of ship. But these items have a bearing on the smooth functioning of the industrial organization. These general items include vegetables, edible oil, soaps, linen, electrical bulbs and fittings, medicines, first aid peripherals, clothing, shoes, safety kits, fire extinguishers etc. Certain other items go directly into the construction of the ship. They include steel bars, steel sheets, brass, copper and all items of wood, interior decoration items, engine items, hull items, deck items. D.G. Set items etc. Preservation of these items and their delivery at an appropriate time as demanded by the user department is of utmost significance. The timely delivery of items from stores to the user department is possible only when the stores layout is well-planned and enables the stores organization for the quick delivery of the materials to the end user departments. The stores organization of shipyard companies limited is given in chart 3.1.

Chart-3.1

Stores Organisation of Selected Shipyard Companies



Stores Organization

The stores organization in all the shipyard companies is headed by an officer-in-charge (stores) and he is responsible directly to General Manager (Commercial). The General Manager,

(Commercial department), in turn, is responsible for Chairman-cum-Managing Director and at the apex level there is a team of Board of Directors. Under officer-in-charge (stores), there are three different sections. Each one is responsible to discharge certain responsibilities pertaining to stores organization. Section-in-charge (I) is responsible for material receipts, preservation, warehousing, distribution, inventory control, disposal of general stock and capital items. Section-in-charge (II) is responsible for interfacing with purchase section and planning department and Electronic Data Processing section and this section-in-charge is also responsible for computerization of stores. Section-in-charge (III) is responsible for the project items which includes hull, electrical and engineering items. Totally, there are five officers in the stores organization including the officer-in-charge, three dealing officers who are also the section-in-charges of the stores and one liaison officer and are assisted by 58 storekeepers and equal number of stores attendants. About 85 mazdoors are engaged in the stores organization to provide continuous and uninterrupted flow of supply of materials to various user departments. It is the responsibility of the stores section for proper receipts, storage, handling, issue of materials and accepting of in-coming and outgoing materials and arrangement of materials for inspection and quality control. The stores section also provides necessary information to General Manager (Commercial) on matters like inventory levels, control and requirements. In all the selected shipyard companies, the disposal of ferrous and non-ferrous,

wood and steel, and other project items and the capital budget items are now supervised by the stores section. The stores section, through one section-in-charge is looking after computerization of stores and Electronic Data Processing. The stores section in all the selected shipyard companies is expected to despatch the material as and when the user departments want them.

In reality, it was observed that whenever the stores section received any material requisition notes, it will take four to five hours to locate the items demanded by the user departments in its material requisition notes. Only in the recent past, with computerization of the stores, it is possible to know whether the item is there or not. Earlier, it would have been highly difficult without computerization to draw the material by the user departments. This kind of situation can be managed very well with codification and standardisation. In all the selected shipyard companies, the stores section has been adopting the scientific codification and standardization systems. It reduces this long time of identification and thereby, the availability of the material to all the concerned user departments is instant without any delay.

Procedures Followed in Respect of Materials

Basing on the orders received from the customers, the corporate planning department suggests the commercial department to initiate steps to procure the necessary material and equipment required by the ship, which is going to be constructed

by the company. Here starts the combined work of the commercial department, purchase section and stores organization. Any organization, which purchases materials, find it impracticable and undesirable to bin or rack the goods as soon as they are received. It is desirable to allot a specific space at the stores where materials are received and inspected for quality and quantity *viz-à-viz* purchase orders placed to ensure that they are suited to the requirements and that they fulfil the terms and conditions of the order. Material purchased, as per the unique specification, invariably have many features that are subjected to inspection. The sizeable number of items purchased by industrial firm does require technical inspection. This should be done on a regular basis for two compelling reasons. Firstly, it provides the qualitative measurement of supplier's quality performance, which among other uses is essential to the development of an effective supplier evaluation programme. Secondly, this kind of checks helps to have a sound business practice. Efficient receipt of material procedure reduces the lead-time and helps in effective inventory control. To have a close watch of the incoming material as far as possible, the receipt section and inspection department should be located closely to the entry point. This avoids unauthorized entry of persons deep into the stores. Also, there will be no mix up of incoming and outgoing consignments. The size and type of stores organization that is needed for receipt and inspection depend on the quantum of the stores items and other stores activities. A big undertaking requires several officers at

different levels and supporting clerical staff in abundant and whereas a relatively small unit requires only one or two people to discharge the duties of receiving the material and inspection. Basically there are two types of organizations for receipt and inspection, they are centralized and decentralized. In centralized receipt of inspection organization, all material is routed through a central receipt and inspection department located in the main stores. Instead of locating individual reception department in each plant and stores, a central reception section must work in the main stores organization for an effective reception of the incoming materials. As against the centralized reception section, some organizations establish independent reception section in each of their stores located in each plant, work place and even if the plants are located at the same premises. Then reception work is to be carried out at each point, which ultimately necessitates to have more number of people to carry out the job of receiving the materials. This, in turn, increases the salary budget of the organizations and, finally, it results in poor earnings.

The incoming material supplied by suppliers is verified with the help of purchase order. The materials will be sent to the concerned stores department soon after the verification is completed. If there is any discrepancy between the terms specified in purchase order and the incoming materials as to quality and quantity, the materials will be kept in abeyance till the supplier rectifies the discrepancy. Before delivering the material to the concerned stores, the items are recorded in the stores ledger.

Simultaneously, data relating to the incoming materials are fed to the computer. The concerned stores department after receiving the material will prepare goods receipt notes (GRN), the proforma of which is presented in Appendix-I. The stores personnel issues the materials to the concerned shop floor departments on receipt of material requisition note (MRN), a proforma of which is presented in Appendix-II. Materials requisitioned are entered into the ledger and posted in the terminals of electronic data processing (EDP) for cross verification. In order to identify stock levels (minimum, maximum, and reorder levels), the materials in the selected shipyard companies are broadly classified into:

1. Project items
2. Capital Budget items
3. General items.

Project items consist of machinery used for fitting to the ship. Capital Budget items include the machinery used by the shipyard. General items comprise all other materials such as nuts, bolts, clothing, electrical items, plumbing items, pipes, colours, etc.

Quality assurance department verifies the quality of project items. Capital Budget items are verified by the commercial department as well as quality control department. The concerned customer will verify all other general items. Sometimes, the buyer of the ship entrusts the task of the Quality control societies. The task of quality control in case of naval vessels rests with Directorate of Quality Assurance (WP).

All the receipts of the materials are subject to the quality check either by the stores organization or quality Assurance department of all the selected shipyard companies and or by the representatives of the buyers of the ships *viz.*, Quality control societies. If any deviation was observed by all the selected shipyard companies against the agreed terms and conditions of supply, the materials will be rejected scrupulously. The deviations might be time, price, quality, quantity and transit charges etc., Non-compliance over terms will automatically gives a right to the management to reject the whole consignment or part thereof. In this case, all the selected shipyard companies having a practice of informing the rejection of the consignment to the supplier within 15 days from the date of the receipt of the materials. The materials so rejected on various grounds are listed by the concerned officer with the help of his subordinates who are in-charge of receiving the incoming materials. They prepare a note on the materials with the quality and quantity and present the same note to the General Manager (Commercial) within three days from the date of the receipt of the materials.

Then, the General Manager (Commercial) authorizes to pass on message to the concerned parties and requesting them to fulfil the deviations found for the supplies they made. Due to decentralization the stores in the premises of all the shipyard companies, they found it difficult to receive the materials at various stores located at different places which are away from two to five kms from the selected shipyard companies. Eventually,

location of stores at different places give rise to certain problems like transportation, poor delivery to work spots, communication problems from the main stores and other stores located outside the premises of selected shipyard companies.

In order to avoid the incurrence of transportation cost of the materials, which is now being received from a distant stores of stock yards, need to be established within the selected shipyard companies' premises. This helps the management of all the selected shipyard companies to centralize the receipt and distribution of materials from one place thereby, it may exercise proper control over the movement of valuable scarce materials and goods.

Quality Control

It is pertinent to have a look at the innumerable items like materials, equipment, machinery, and fittings that take part in shipbuilding. These items are supposed to be highly qualitative because, marine equipment is expected to work in a different climate on the seas and need to withstand the sea weather conditions. Whereas, the similar items used in other industries differ in their quality because, their usage is on surface. Marine equipment differs from the equipment used in other industries for established reasons. Firstly, the climatic and weather background in which the former have to operate namely, the salt-laden water and atmosphere, widely variant climates and the floating foundation causes severe limitations on the design of the equipment. Secondly, the ship form imposes restrictions in respect

of the weight and space available for machinery and equipment and their disposition. Thirdly, there are greater risks involved to life and property that is inherent in sea transportation. Quality control societies and various governments laid down certain rules and regulations governing the design, quality, construction and operation of the equipment. Under these limitations, the principal design criteria for all-marine machinery and equipment would be reliability, compatibility with the sea environment, simplicity and ruggedness, operational costs and weight. Standards of reliability are much more stringent with marine equipment than with the corresponding land based equipment. Since, failure at sea can risk the vessel as well as the valuable lives of the crew. All components directly exposed to sea water have either to be protected from corrosion through such means like painting and cathode protection or should be made with non-corrosive materials. Materials used in shipbuilding are grouped into nine categories. They are as follows:

- (i) Steel plates and sections
- (ii) Steel and non-ferrous pipes
- (iii) Timber scantlings and laminates
- (iv) Plastic items
- (v) Insulation materials
- (vi) Electric control panels, cables, switches, switchboards, fuses etc.,
- (vii) Welding materials.

- (viii) Gases like oxygen (industrial grade), acetylene, argon and Co₂ etc.,
- (ix) Marine products.

Except the categories iii (viii) and (ix), the remaining other materials are required well in advance before use. These items need to be identified and approved by the classification society entrusted with the classification of the ship. In respect of steel plates and sections, they are individually stamped by the classification society prior to their despatch from the integrated steel mills. Such stamping itself is a certificate of having witnessed the prescribed material tests and having satisfied itself through inspection and evaluation that the material is in conformity with the laid down specifications.

In all the remaining cases, certificates from manufacturers have to be obtained for submission to the surveyor of the classification society before their use. As far as timber is concerned, certain purposes like non-combustible and heat resistant bulkheads, special timber compositions are prescribed requiring necessary approval from statutory agencies entrusted with implementation of safety regulations. In the case of paints, the ship buyer's approval is required and this is usually given only if the paints have an international reputation and is manufactured by internationally recognized manufacturers.

The ship fittings comprise of material hatch, cargo hatch and compartment access covers that are required to close the manhole

and drain plugs. Steel doors, ladders, platforms, ducting, fair leads, railings, exhaust pipes, cowls, pipe fittings, equipment and machinery seating, walls, windows, sanitary fittings, side lights, galley fittings, thermal insulation, accommodation equipment, clips, distribution boats, cathode protection, switch boards, indicating panels, electrical cable work accessories, heavy electrical castings, rudder posts, anchors, lamp and light fittings, navigational and signal lights, heavy steel chain cables, wireless sets etc. All these items require the approval of the owner's inspection and in some cases like electrical components, valves and fittings, heavy castings, chain cables, the approval of the classification society or the statutory authorities is also required. Ship Board equipment may be grouped as follows.

- (i) Kitchen equipment, cooking ranges, steam cookers, mixing machines, refrigerators deep fryers, water coolers, boiling pans etc.
- (ii) Laundry equipment, hydro extractors, washing machines, plot work irons, drying chambers, drying tumblers etc.
- (iii) Life saving equipment and other accessories related with them like jackets, life boats, distress signal equipment etc.,
- (iv) Navigation equipment and other related instruments like Eco sounder, direction finder, gyro compass, auto plot telescopes, fog horns, binoculars, lunar equipment etc.

- (v) Domestic refrigeration systems
- (vi) Entertainment equipments
- (vii) Fire fighting equipments, fire-extinguishing system, breathing operators, fire alarm system, portable extinguishers etc.
- (viii) Main and emergency electrical switch boards
- (ix) Internal communication systems.
- (x) Engine room workshop, machine tools, cranes, welding and cutting equipment.
- (xi) Incinerator.
- (xii) Ship wireless equipment including telephones, walky-talkies, VHF-radio etc.
- (xiii) Transformers, batteries, UPS systems with battery charging outfit.

At this juncture, it is worth-noting that the quality of the ship entirely depends on the material inputs used in the construction of the ship. We can expect better quality vessel with the higher quality of material used.

As per the World Development Report published by United Nations Development Programme, India is considered as the tenth industrial power in the world. But it is lagging behind in the development of ancillary industries to meet Indian Shipbuilding needs. Even today, the Indian shipbuilding Industry is depending on foreign supplies for basic and other associated material and equipment required by it. As long as this dependence continues, there will be a long lead-time involved in procuring the material.

At the same time, it is very difficult for the Indian shipbuilders to go and check the material manufactured by the foreign manufacturers. Further, the indigenous material, equipment, tools, spares etc. are also subjected to inferior quality because of the short sightedness of the manufacturers. Many a time, it was found that the quality of the supplied items could not match with the quality of the sample forwarded earlier to the shipyards for quality check and for price negotiations. The managements of the shipyards must try to check the quality of each and every item received by them to ensure the quality of the inputs and thereby, the quality of the ship constructed.

All the public sector shipyards in the country are having their own quality check methods either by quality control department or by the quality control section created for the purpose. The prime aim of establishing the quality control department or quality control section is to examine the quality of the products they received and to ensure the fitness of the quality to put it in use in the production of a ship. In case of non-compliance, as regards to the quality, the same is expected to report to the production, planning and purchase departments within the shortest possible time. So that the rejected items are placed separately to avoid the use of such materials, equipments, spares and other miscellaneous items which are used in shipbuilding. As known, ships need to sail on the deep seas for a number of days. Compromising in the quality of the material leads to break down of the ship in mid of the seas and bringing it to

normalcy warrants to invest lot of money, efforts and time. As such, no ship owner prefers, irrespective of the types of ship (cargo, passenger, liner, oil carrier, anchor, survey vessel, trawler and Ballard), to take the risks of breakdown as it requires a lot of patience to attend the repair works on board in the seas. At the same time, the customers who booked their cargo and material at different sea ports in the world look for the delivery of their materials at the earliest, which creates more pressure on the ship owner.

All the selected shipyard companies have their own quality assurance section under the direct control of Director (operations). There are two Additional General Managers in the quality assurance section to look after the functions of their section. Under them, there are two chief managers to assist the Additional General Manager. Under the two chief managers, some supporting staff is also working in the section to examine the quality of the materials they received.

Table 3.1 indicates the performance of quality assurance section of selected shipyard companies during 1998-99 to 2008-09. In the year 1998-99, the number of consignments received by the quality assurance section were 1,326, out of which the consignments examined during the same period were 1,271. Forty eight consignments were rejected due to the inferior quality of the products that they received. In the year 2008-09, the number of consignments received by the section were 1,684 and the number

of consignments examined in the same year were 1,563 out of which 38 were rejected.

Table 3.1
Performance of Quality Assurance Section
in Selected Shipyard Companies during 1998-99 to 2008-09

Year	No. of Consignments Received	No. of consignments inspected	No. of Rejections	Percentage of Rejections in Total No. of Consignments received
1998-99	1326	1271	48	3.6
1999-00	1239	1202	44	3.5
2000-01	1124	1008	19	1.7
2001-02	1248	1110	62	4.9
2002-03	1276	1128	41	3.2
2003-04	1396	1227	31	2.2
2004-05	1438	1294	37	2.5
2005-06	1472	1306	51	3.4
2006-07	1526	1387	47	3.0
2007-08	1638	1505	48	2.9
2008-09	1684	1563	38	2.2

Source: Compiled from the records of the selected shipyard companies and on the basis of information collected through face-to-face interaction with the officials of Quality Assurance Section.

The highest number of consignments rejected were found in the year 2001-02 with 69 rejections. The immediate previous year *i.e.* 2000-01, the rejections were 19 out of 1,008 consignments examined and 1,124 consignments received. The difference

between the consignments received and consignments examined was due to the role of quality assurance societies like LRS, IRS, DQA (WP) and DQA (N) in quality assurance for the material on behalf of the customers. In view of the growing availability of varied quality material in the market, the shipyard needs to have its own check for the material once certified by quality assurance societies. In other words, all the consignments comprising of equipment, materials and items are to be examined in the light of the availability of the fake certificates attached to the materials received by the shipyard. In such case, the shipyard needs to employ additional machinery, men and instruments to check the quality of the material.

The stores management assumes greater importance in the Indian context because of the stiff supply positions of various scarce materials. The blocking up of investments in huge amounts in inventories in the Indian industry attracted the Government of India and appointed Tandon Committee to recommend steps to reduce inventories in Indian industries.

The stores organization is responsible for receipt, standardization, identification, general inspection, and levels of stock of the incoming materials. Besides these responsibilities, preservation, storage, distribution and disposal of various materials are also held by it. The stores location and layout have a bearing on the organizational effectiveness. Locating the stores, proximity to user departments is a general practice to minimize

transportation and other handling expenditure and to ensure timely supply of the necessary material.

The ship building industry is basically an assembling industry and which requires over 20,000 items to put in the construction of the ship. These items need to be procured, stored and maintained by the stores until the materials are issued to the various user departments at various time periods.

The stores organization of the selected shipyard companies along with the roles and positions is given in the chart 3.1 which tells about various sections and the roles of these sections along with the number of officers and assistants.

The stores organization in the selected shipyard companies is headed by officer-in-charge (stores) who is responsible directly to the General Manager (commercial). In turn, the General Manager (commercial) is responsible to Chairman-cum-Managing Director. Under officer-in-charge (stores), there are three different section-in-charges and are responsible for various functions of stores organization. The officer-in-charge (stores) is in the cadre of Deputy General Manager and the section-in-charges are in the cadre of Senior Manager. Under these three section in-charges, there are five dealing officers, 58 storekeepers and equal number of stores attendants and mazdoors.

The procedures followed in respect of receipt of materials involves the physical inspection of the material received and to examine the quality and quantity against the specifications made in the purchase order and this is to ensure the suitability of the

material for the requirements of the companies and to know whether the supplier fulfilled the terms and conditions laid down or not.

The stores section after careful inspection of the materials received, needs to make arrangements for the quality control check which is going to be done by quality assurance section of the selected shipyard companies. The selected shipyard companies have decentralized material receipt centres because it has four to five store yards located at a distance of two to five kilometers from the shipyard premises. These decentralized receiving centres ultimately necessitated to have more number of people to carry out the job of receiving materials.

If any deviation in the quality and quantity of the material ordered and received is found, it will be kept in abeyance till the supplier rectifies the discrepancy. In case of other materials, which satisfies the stores receipt centre, the items received are recorded in the ledger and the incoming material particulars are fed to the computers simultaneously. Afterwards, the receiving officer prepares a goods receipt note. In case of rejections, if any, the shipyard companies have a practice of informing it to the supplier within 15 days from the date of receipt of it by the selected shipyard companies.

Due to decentralization of all the stores in the premises of the selected shipyard companies, they are forced to receive the materials at stores located at different places which are away from two to five kilometers. Eventually, the location of stores at

different places gives rise to certain problems like higher transportation costs, poor delivery of materials, communication problems and other associated problems. To exercise control over the materials, it is necessary to locate all the stores at one place, as such, it is suggested that the selected shipyard companies should take necessary steps to locate all the stores in the premises of shipyard companies under review itself.

The materials used in ship construction are expected to work in a different climate on the seas and they need to withstand for the sea weather conditions. Marine equipment is different from the equipment used in other industries as their usage is on surface.

Chapter-IV

Storage, Distribution and Disposal Management

- Storage
- Distribution
- Disposal
- Government Policy for the Disposal of Imported Surplus

Storage

Stores management plays a significant role in the operation of any business. Stores management is nothing but receiving, storing and issuing of materials, on which the efficiency of the manufacturing operations depend. Receiving and storage are service functions and involve a lot of paper work. The benefits of an efficient receiving and storing are bound to determine the cost of administering them. Receiving and storing are the key actions considered in the materials management because of the following reasons:

- (i) The quality of the end products largely depends on the quality of materials received.
- (ii) The smooth and uninterrupted production flow is dependent on the efficient stores function.
- (iii) The stores organization acts as a custodian of the items received by the business organization.
- (iv) Above all, these functions directly or indirectly affect the production costs (Patel and Chunawalla, 1986).

Since material stored is equivalent to cash and form a major part of the total product cost, it is essential that material should be properly accounted for and safe-guarded in an efficiently organized stores section or stores department. With a judicious

and proper control in the management of stores, one can minimize the losses of obsolescence, pilferage, excess storing etc.

A proper scientific method of store keeping will help in bringing down the acquisition and retention cost of inventory and thereby reduces the material cost and its overheads. In India, on account of several constraints, 4 to 6 months' inventories are common and for certain items it will be in between 20 to 30 months' stock (Anantha Krishnan, 1976). It is in this context that the stores management assumes great importance. As on now, certain big, industrial organizations in India like Maruthi Udyog Limited, brought down the inventory levels to a low of 10 to 15 days of consumption with the adoption of techniques like Just-in-Time. This just-in-time technique enables the suppliers and vendors to supply the materials needed by the company within hours after receiving the purchase order from the user company and by using the facilities like land and buildings extended by the user companies. This just-in-time technique enables the user companies to minimize ordering costs, carrying costs, warehousing costs, insurance costs etc. It is appropriate in the light of the above facts that there is an urgent need to all the manufacturing industrial units to go for just-in-time technique.

Preservation of items in the space provided in the stores is of great importance because floor space accommodation is a costly affair. The high cost of space is due to the price of the land, the cost of construction of the building and the facilities provided for it. So, the space provided needs judicious use of it. Keeping items

in stores, particularly the slow-moving and non-moving spare parts, is an important job and often this was given least importance in Indian industry. To have an effective storage programme, factors such as nature of the item, condition of part, the expected idleness, item economic value aspect and the need for protective for certain items should be taken care of. In some cases, the additives to preserve the item intact exceed the cost of the item itself. That's why, this kind of articles are to be placed at a separate location within the stores. It is desirable to have a separate portion of the stores, ear-marked with specific dimension, controlled entry and controlled conditions of weather to protect from dust, sun-rays and extreme temperature. The preservatives applied for some parts include bearings, delicate instruments, rubber articles, valves, electricals, grinding wheels, batteries, steel wire rows, lead, copper, silver parts, acids, cylinders holding different gases, wood, glass sheets etc. While preserving some of the items certain measures are to be taken by the stores personnel to protect the items from moisture, water, rats, white ants, sunrays, humidity, dust and dirt etc.

To identify the item in shelves or racks of the stores requires good lighting in the stores building, otherwise darkness resist the personnel working in stores to work effectively and efficiently. Lighting also enhances good working conditions for the employees in the stores, who work day-in and day-out in operations like receiving, inspecting, staging, handling and distribution of goods in a pleasant environment and it goes in a

long way in reducing monotony and in ensuring optimum service to the organization.

Safety is another important factor to be considered in stores location and layout. Since the stores handle a good number of goods of high value everyday in large volume, it needs proper safety measures. The following are some of the measures expected to be adopted by the managements to reduce accident and pilferage in the stores.

- (a) By arranging some training programmes, providing literature on the materials and displaying the visual aids, the managements should instill a kind of safety consciousness amongst the personnel working in stores section.
- (b) Safety kits like shoes, gloves, helmets, minor's lamps must be provided to the workmen and all other concerned personnel in the stores organization to keep away from the accidents. Wearing safety kits must be encouraged.
- (c) In order to minimize the handling expenses, stocking must be at an appropriate place as decided earlier for different items.
- (d) The operators of the material handling equipment must be trained well in handling various kinds of stores and items and the materials handling equipment must be kept in good working condition so that the materials

demanded by the user department reach the work spot within minutes of their order to the stores section.

Necessary fire fighting equipment must be provided at various points where inflammable materials are stored and at different incoming and outgoing doors. Fire extinguishers, fire escape alarms and sprinklers of water and foam and stand buckets must be made available to all the personnel working in the stores section and familiarize them in handling the above said fire fighting equipment. Finally, in order to extract more work from the personnel of stores organization, certain facilities are to be provided by the management near the stores. They include drinking water, toilets, enough number of windows to have good ventilation, air sucking pumps etc.

Shipbuilding is an assembling industry, which procures thousands of assembles and equipment. They must be stored in the stores until they are issued to the production departments. To extract all the associated benefits of an ideal stores organization, the selected shipyard companies established their stores nearer to the production departments with all the necessary facilities except few stores, which are located at distant places and away from the shipyard of about five kilometers, three kilometers, two kilometer and one kilometers. Getting material from distant stores is a difficult task and also involves higher handling cost. This can be attributed for a simple reason, that is, non-availability of space within the shipyard.

The stores function is a crucial function of all the industrial undertakings irrespective of type of management whether in public or private sector. This is known for its pivotal corner of activities of materials in motion. The operational conditions of the stores in different organizations differ in a wide manner. Therefore, the systems followed also vary from organization to organization. An efficient stores system must aim at good procedures, efficient organization, smooth and speedy receipts and issues (Shah N.M., 1978). A designed stores system ensures timely information for decision making particularly, because this is the starting point of all other activities in the organization for control. It is in this context that the systems and procedures have to be looked into.

There are mainly two stores systems for physical control of stores material:

- (1) Closed stores system
- (2) Open stores system

A firm often employs the two systems basing upon the scale of operations and the ability of the organization.

In a closed stores system, the items are physically stored in a closed and controlled area. The general practice is to maintain physical control by locking the storage area so that no one can enter the stores other than the authorized stores personnel. Materials incoming and outgoing will take place only when it is accompanied by an authorized paper signed by the concerned authority.

In an open stores system, there is a great advantage for mass production type of operations, which requires continuous supply of the same materials. Under this system, each material is stored close to the point of its usage. Materials are stored in bins, shelves, racks, pallets, rotary boxes etc. Storage facilities are completely open and any worker has access to any storage facility. After the materials are received, stores personnel are usually responsible for the delivery to the production departments. This system is designed to expedite production activities in the organization. Under this method, little emphasis is laid on physical safety of the materials. An assembling industry like shipbuilding exhibits the cleanest example of an open stores system. Generally speaking, an open system is more likely to function successfully, if it is not applied to a large number of items. Firms apply such a system to several hundred items typically experience bitter results.

The stores section, which is a part of the commercial department in all the selected shipyard companies, maintains certain relationship with different branches of its own and other departments in the organization. The stores section has to deal with planning, production, quality control and commercial departments of the selected shipyard companies. The stores section and purchase sections and their functions are more or less complimentary. Close co-operation between these two sections will result in better standardization, coding of stores items, value analysis, variety reduction, inventory control, salvage, disposal of obsolete material, scrap, etc.

Even in the absence of an integrated materials management department in selected shipyard companies the stores section and purchase section have close co-operation and co-ordination. These sections are under the direct control of General Manager (Commercial Department). Presently, the stores sections are headed by an officer-in-charge in the cadre of Deputy General Manager. Similarly, a deputy general manager also heads the purchase department. These two sections are working under the overall control of General Manger (Commercial Department).

To co-ordinate the activities of the two important organs (stores section and purchase section) of the selected shipyard companies, the stores section inspects some items of the stores independently and internally by itself. For some other items, the stores sections take the help of quality assurance department to conduct test of quality. The stores section usually gathers the samples from the received items. This quality assurance department works with close cooperation with the stores section. The stores organization maintains close contacts with the production departments. It is the responsibility of the production department to fix production schedules and communicate the same to the stores organization. The stores section has to arrange for the supply of raw materials, tools and consumables in the required quantities and at the required time without sacrificing the policies of the stores section.

Distribution

Next to storage, the stores section's responsibility is to issue the material to the consuming departments as well as to outside ancillary units for further processing. Depending upon the production programme, the bill of materials and the necessary work orders are issued. Similarly, the quantity to be issued against each component requiring material is also specified by the competent authority. This automatically controls the consumption of materials. Besides regular consumption requirements, sometimes the user departments made material requisitions on *ad hoc* basis and against this *ad hoc* material requisition notes, issue will be made available by the stores section to cater the temporary needs such as tools, kits, samples, issue on returnable basis. Separate methods are to be followed for these issues and this should be made by authorized persons and accounted in a proper way. It is necessary to have a valid authorization in the form of a material requisition voucher note. It is against this, the stores people after collecting the materials requisition voucher form, the user department will issue the quantities of materials mentioned in the voucher by making an entry in the books of stores section and also an entry has to be made in Electronic Data Processing (EDP).

Before issuing the material, the store keeper will have to check the availability of the materials, quantity required, work places and centres, material code, budgeted quantity, verification of signature of the authroised persons was signed on the MRN/MRV, authenticity of indenture, conformity with the

control limits and then issues the material. This is the procedure laid down by the General Manager (Commercial Department) to issue the materials from stores section. In the selected shipyard companies, the stores documentation is maintained in a proper and pucca manner. Receipts and issue are the two basic documents on which the entire material management operates. As on now, there is no such separate materials management department in the selected shipyard companies,. The functions of materials management department are now carried out by commercial department, purchase department, import section and stores section. The stores department in selected shipyard companies is maintaining a separate and detailed register for one time issues like air conditioners, water coolers and such other items. For the issues to the sub-contractors will be authorized by the sub- contracting section and gate passes to be provided by the same section and on providing the necessary gate pass only, the stores section issues the material to the subcontractors. While issuing the materials, the stores personnel must be very cautious in counting the units and measuring the quantity to be issued. In order to minimize the discrepancies and for better reconciliations of physical stock with book balance, necessary precaution must be taken up by comparing the figures of the items with that of the opening stock, plus receipts during the month, minus issues made to the various departments during the month, considering the rejections and similar other unaccepted consignments. However, it is noticed that there are a number of discrepancies in the stores

section. This must be avoided by taking some measures of tallying the material regularly and periodically from time to time. One such measure seems to fit to control discrepancies by posting issues, receipts and returns. Another measure is that the stores section needs to debit the materials issued to the user departments. The personnel working in the stores need to indicate a lower balance in the stock of each item after the issue is made. This will help of the replenishment of stores by receipts with equal quantity of the issued materials to maintain a minimum level, which helps the production department to run uninterruptedly. Apart from these measures, the stores is expected to maintain documents like bin card, kardex, list of slow-moving, non-moving, fast-moving, obsolete items, scrap, disposal, rejected note, accepted note, delivery, supplier invoices, indents, bills of materials, copy of purchase orders, codification files, documents pertaining to bin number for the item and copy of purchase order along with purchase order number and copies of material requirement for planning.

In the selected shipyard companies, even after computerization of stores section, because of the poor reliance and poor experience of the people working in Electronic Data Processing, it still maintains manual documents of the above said. Again certain discrepancies were observed while reconciliation of figures and facts of the stores items which were fed into the computers and manual documents they maintained. This should be curtailed soon after the people working in EDP and stores

section gains experience and expertise in using computers and computer data on material information system. Maintaining both manual and computer documents is a high expensive exercise and this will be ruled out within a short period.

Disposal

Recently regarding SOS (Surplus, obsolete and scrap) items, management has assumed tremendous importance in materials activity, in view of the financial stringency. Those materials, which are in excess of concern's operational requirements forms surplus and this surplus originates basically from three sources namely scrap, obsolete materials and damaged equipment. The problem of identification and disposal of obsolete surplus goods is acute in many developing economies, because of the fear that the same item may not be available, if needed again in the same organization. Holding obsolete and surplus stocks is costly. The costs include: inventory carrying charges which is currently estimated at about 30 per cent cost of periodic stock-taking, cost of maintaining the records, cost of security, cost of preservation, loss of use of capital tied up in inventories, cost of additional staff for stores work, cost of storage space, cost of lower morale due to seeing the same non-moving item every day etc. In view of the cost impact of the redundant and obsolete stocks, special efforts must be made to avoid keeping them.

Surplus from production process is inevitable. All the materials are not used completely or wholly in manufacturing process. It is not possible to eliminate this type of surplus. At the

most, what the managements can do is to minimize the surplus by proper planning. Surplus sometimes results in ineffective use of machinery, equipment and tools. Further it arises due to ineffective or poor purchasing process adopted by the management. Through appropriate steps in procurement process, this can be reduced significantly. Proper identification and recovery of surplus, scrap from valuable materials, precious metals, tools, machinery, instruments and other materials such as wood, iron, brass, copper etc. is a growing source of revenue. These items are very important in the present day because of their growing rate of demand and usage by other industrial units.

The items, which are not damaged, not used, and have some economic value and use but not by the concern's operations are called obsolete items. These items include spare parts of machines which are phased out assemblies related to modified equipment for which there is no further need by the user, items like food and drugs whose effectiveness have lapsed with the passage of time. Changes in product design, technological innovation, rationalization, cannibalization, inaccurate forecasts, faulty purchase practices, improper store keeping, wrong codification, poor maintenance and mistakes in several departments like planning, purchasing, transportation, design, stores handling, etc., are some reasons for obsolete items. All tools and equipments at some point in their life become surplus due to wearing out or due to technological obsolescence. In the present day rapid advancing

technological, world majority machine tools seldom wear out as they are replaced very frequently.

Various estimates of money locked up in the obsolete items are available in Indian Scenario. The then finance minister Mr. C. Subramaniam provided the first estimate. He mentioned on December 10, 1974 that the amount of money blocked in obsolete and surplus material is estimated around Rs. 2,500 crore in India. Presently with further industrialization the figure today is expected to be over Rs.50,000 crore. Strategies for identification, minimization and disposal of obsolete items need a good computerized information system for generating periodic reports for action.

Scrap is another classification, which is usually tagged on to obsolete and surplus materials. Scrap can be defined as a process of identifying waste such as turnings, borings, flashes etc. In other words, it can be defined as a residue from within the organization. The amount of scrap as a percentage of total production is certainly a measure of the working efficiency of the personnel connected with the production. Scrap also arises due to a number of reasons like breakage, distortion, in the form of condemnation of the machinery, turnings, borings, screws, flashes, spoilage, empties, broken tools etc. Waste steel, irreparable materials are usually catagorised as scrap. Thus, scrap refers to unusable material, whose value is only in terms of its material content. Only 80 per cent of material that gets into the plant will come out as

finished product and the remaining 20 per cent is normally converted into process scrap.

Scrap is usually collected, properly segregated, and categorized into (i) ferrous scrap, (ii) metal scrap, and (iii) waste. Non-returnable containers, packing cases, pallets, gas cylinders, drums, tins, containers are also treated as scrap for the purpose of disposal.

Since the purchase department is well versed with the quality, price, availability and non-availability, lead time etc, in majority of the companies, the responsibility of disposing the scrap, surplus and obsolete materials has been assigned to the purchase department.

The other departments and sections are not expected to know everything about all the materials required by the company. The familiarity with all the methods of obtaining the material by purchase department made it competent to handle the crucial responsibility of disposal of the disposable materials.

Basically, there are three methods of disposal and these include (a) annual contract. (b) Inviting offers from time to time, and (c) public auctions. It is necessary to ensure that the items which are to be listed as identified items for disposal are not needed in any department, division, section of the company. Similarly, it is essential to look for the highest possible realized value from the disposable items. For it, it needs to consider the minimum valuation of the item that should be done in terms of the depreciated use, or its scrap value. The advantages of transferring

the item to other departments should be thoroughly examined. Dangerous chemicals must be dumped in the deep seas or buried in the ground. Before disposal, it is essential that scrap is segregated according to metal, shape, size, etc. When the scrap is mixed, the return is even lower than the lowest element in the mixture. The costly surplus or scrap such as copper, aluminum, tungsten involved is inevitable that they are segregated as returns are huge and price levels are different. The buying parties are required to deposit the earnest money. Many a time, the selling company insists on the basic price calculated in close co-ordination to the finance department. Sometimes the selling agency (generally purchase department) has to deal with hard bargainers, who form into cartels and at the same time it should be able to answer the queries raised by audit department as regards to the realization value of the scrap.

Government Policy for the Disposal of Imported Surplus

Sale of any imported materials or item have to be put to the notice of chief controller of imports and exports (CCI and E) for obtaining a prior approval before the sale is made. For the disposal of surplus and scrap material, the government departments and the government undertakings make use of the services of the above canalization agencies. The canalization agencies include State Trading Corporation of India, Metals and Minerals Trading Corporation of India, SAIL International, Director General Supplies and Disposal and Metal Scrap Trading

Corporation of India. If the company intends to sell any scrap, it has to be informed at least to any one of the canalisation agencies.

Table 4.1 shows the pattern of steel scrap in the selected shipyard companies during the years 1998-99 to 2008-09. In the year 1998-99, the consumption of steel was Rs. 85.32 lakh and having steel scrap of Rs. 11.16 lakh and amounts to 13 per cent of the consumption. Whereas, in the year 1999-2000, the scrap value of steel amounts to Rs. 12.83 lakh against consumption value of steel of Rs. 91.65 lakh with a 14 per cent scrap. Similarly, in the year 2000-01, the consumption of steel was Rs.113.99 lakh with a scrap of Rs. 13.45 lakh and amounts to 11.8 per cent of the consumption. Rs.251.98 lakh worth of steel was consumed in the year 2001-02 and recorded a scrap of Rs. 31.25 lakh which contributed 12.4 per cent.

Table 4.1

Percentage of Steel Scrap Identified in Relation to Value of Steel Consumption in the Selected Shipyard Companies during 1998-99 to 2008-09

Year	Iron & Steel Consumption (Rs.in Lakh)	Scrap of Iron & Steel (Rs. In Lakh)	Percentage of Scrap in Consumption
1998-99	85.82	11.16	13
1999-00	91.65	12.83	14
2000-01	113.99	13.45	11.8
2001-02	251.98	31.25	12.4
2002-03	275.36	44.6	16
2003-04	138.1	19.33	14
2004-05	229.18	28.42	12.4
2005-06	619.53	81.78	13.2
2006-07	208.76	25.3	12.1

2007-08	113.49	15.89	14
2008-09	NA	NA	NA

NA : Not Available

Source: Compiled through the interview with stores personnels.

In the year 2002-03, Rs. 44.06 lakh worth of steel became scrap with an annual consumption of Rs. 275.36 lakh. This pushed the percentage of scrap to 16 per cent. In the year 2003-04, steel scrap was generated to the tune of Rs. 19.33 lakh and contributed 14 per cent of Rs. 138.1 lakh of consumption. During the year 2004-05, the percentage of scrap amounted to 12.4 per cent with a scrap of Rs. 28.42 lakh and with a consumption of Rs. 229.18 lakh. There was a meager percentage of hike in scrap with a value of Rs. 81.78 lakh and for consumption of Rs. 619.53 lakh. There was no drastic change in the percentage of scrap in the year 2006-07 with a scrap value of Rs. 25.30 lakh against the consumption of Rs. 208.76 lakh. During the year 2007-08, the consumption was recorded at Rs. 113.49 lakh with a scrap value of Rs. 15.89 lakh and contributed a percentage of 14.0. It has been observed from the table 4.1 that the percentage ranged between 11.8 and 16. This is much higher than the scrap percentage of European ship building units whose scrap ranges between 9 to 10 per cent.

It is generally accepted that no one is capable of utilizing cent per cent material in the production process. If we carefully observe the trends in the percentage of scrap, it is alarmingly high which speaks of the ineffective use of raw materials *i.e.* steel. This phenomenon suggests that there is a considerable amount of scope

for the selected shipyard companies to control the generators of steel scrap.

Table 4.2
Percentage of Disposable Surplus and Scrap
to the Income Generated From the Sale of Stores and Scrap in the Selected
Shipyard Companies

Year	Disposable Surplus Identified (Rs.in Lakh)	Income Generated by Sale of Stores and Scrap (Rs. in Lakh)	Percentage of (3) in (2)
1998-99	563.6	25.02	4.4
1999-00	147.41	18.53	12.6
2000-01	-118.36	19.46	N.A.
2001-02	186.04	20.91	11.2
2002-03	542.48	23.9	4.4
2003-04	757.6	31.26	4.1
2004-05	1156.89	42.79	37
2005-06	1279.8	22.39	1.7
2006-07	1826.44	23.23	1.3
2007-08	2460.69	14.39	0.6
2008-09	NA	NA	NA

NA : Not Available

Source: Compiled from annual Reports of Selected Shipyard Companies

The table 4.2 reveals that the disposable surplus and scrap of all the materials including stores, scrap, ferrous, non-ferrous, wood, machinery, equipment, fittings, components, alloys and spares amounted to huge blocking of scarce financial resources. Whereas, the income generated by the sale of surplus, obsolete, scrap and disposable revenues are coming down gradually year

by year. This reduction in income generated by the sale of scrap and surplus automatically increased the accumulation of disposable surplus and scrap items. In the year 1998-99, the disposable value of the items stood Rs. 563.31 lakh and in the year 2007-08, it was about Rs. 2060.69 lakh. The income generated by the sale of surplus and scrap in the year 1998-99 was Rs. 25.03 lakh and it was only Rs. 14.39 lakh in the year 2007-08. This is only a fraction less than 1 per cent of the accumulated disposable surplus and scrap. From this, it can be attributable that the management of the selected shipyard companies is not effective enough in managing the scrap and surplus.

Presently, the chairman-cum-managing directors of the selected shipyard companies periodically appoint a committee with the heads of departments of various departments as its members to identify and value the surplus and the scrap carried unnecessarily by the company. There was no separate department or section to identify, value and dispose off the surplus, scrap and non-moving equipment and materials.

The committee appointed by CMD is required to submit a detailed report of the identified surplus and scrap items to him within the time prescribed. Due to their pre-occupations, the functional heads and members of the committee responsible for identifying excess and unwanted items of different kinds might not be in a position to present the information relating to the items. It has been observed that about Rs. 25 crore worth of disposable surplus and scrap items lay useless in all the stores

owned by the selected shipyard companies. Safeguarding and preserving from pilferage, weather, sun and heat is again a problem for the management of the selected shipyard companies. Hence, there is a need to establish a separate section under the overall control of General Manager (commercial) to identify, locate, value and initiate steps to dispose off the unwanted scrap at an early date so that the realization value may be put for some other productive purpose.

Certain items ensure the quality with the mark on them by the classification society prior to their despatch from their manufacturer. For certain other items, the surveyor of the classification society visits the work places of the suppliers and examines the quality and finally issues a certificate to the manufacturer. The shipyard obtains these certificates with the material. Again, when certain items are required, approval of the owner's inspection on the quality it is necessary. It is worth noting that the quality of the ship entirely depends on the material inputs used in the construction of the ship.

The classification societies include Lloyds Register of Ships, Indian Register of Ships and DQA of the Department of Defence, Government of India.

Since material stored is equivalent to cash and forms a major part of the total product cost, it is essential that the material should be properly accounted for and safe guarded in an efficiently and organized stores. With a judicious and proper control of

management of stores, one can minimize the losses due to the obsolescence, pilferage, excess storing, etc.

Preservation of items in the space provided in the stores is of great importance because floor space accommodation is a costly affair. Keeping of items at various places in stores, particularly the slow moving and non-moving items is an important job. But often this is given least importance in Indian industry.

To have an effective storage programme, factors such as nature of the item, codification of the item, the expected idleness, economic value of the item and the need for protection should be taken care of. To identify the item in an easy way on the shelves and racks, it is necessary to have good lighting.

The stores section which is a part of commercial department in the selected shipyard companies has to maintain good relationship with branches of its own other departments in the organization. The stores and purchase sections' functions are complimentary and close cooperation between these two sections will result in better standardization, codification, value analysis, variety reduction, inventory control, salvage, disposal of obsolete and scrap. Even in the absence of integrated materials management in the selected shipyard companies, the stores and purchase sections have close cooperation and co-ordination.

The stores section is responsible for the issue of materials to various departments and sections in the selected shipyard companies. Basing on the bill of materials, work order, material requisition notes, the stores personnel need to issue the material as

prescribed in the authorized documents as mentioned above. While delivering the quantities of material, the personnel in stores section, enter an entry in the books of stores and also an entry has to be made in EDP.

The two basic documents, which are supposed to be maintained by the stores section, are receipts and issues. They are being maintained in proper and pucca manner. However, it is noticed that there is a good number of discrepancies in stores section and this can be avoided by taking certain measures like tallying the material regularly and periodically from time to time. The store is expected to maintain documents like bincard, kordex, obsolete items, rejected items, suppliers index, indents and bills of materials.

Even after the computerization of the stores section, the selected shipyard companies are depending mostly on manual documents because of the poor reliance and inexperienced people working in the EDP section. For this, the selected shipyard companies should arrange for training in the area of material information system of EDP people and thereby minimize the expenses of maintaining both.

Surplus obsolete and scrap items management assumed tremendous importance in the materials management activities. Surplus originates from three sources namely scrap, obsolete materials and damaged equipment. Holding these items is costly to the organization. These costs include carrying charges, cost of maintaining the records, loss of the use of capital held up in

inventories. In view of this, special efforts need to be made to avoid keeping them.

In Indian scenario, the first estimate was provided by the then Finance Minister, Mr. C. Subramaniam, who mentioned on December 10th, 1974 that the amount of money blocked in obsolete and surplus material was about Rs. 2,500 crore in India and it is expected to be Rs. 50,000 crore.

There are three methods of disposal of surplus, obsolete and scrap items. They are (a) annual rate contract, (b) inviting offers from time to time, and (c) public auctions.

Table 4.2 presents the percentage of disposal surplus and scrap of all items to the income generated by the sale of such items during 1998-99 to 2008-09. After observing the percentage of disposed surplus against the identified disposable surplus, it is suggested that the selected shipyard companies should establish a separate section under the overall control of General Manager (Commercial) to identify, locate, value, and initiate steps to dispose off the unwanted material and scrap at an early date so that the realization value may be put for some other productive purpose.

Chapter-V

Critical Evaluation of Inventory Practices

This chapter deals with inventory management practices in selected shipyard companies in India. It also seeks to examine the issues concerned with accumulation of inventory.

Inventory management is an integral part of materials management and plays a significant role in the smooth and economic running of the industry. The speedy industrialization in India brought enormous problems of management. Inventory management is also one such problem. Having had abundant natural resources and human resources, India is not in a position to exploit the same because, the required capital resources are extremely limited. That is why, steps should be taken to increase the productivity with the available limited capital. It is in this context, effective and efficient inventory management assumes greater importance.

To have higher operational efficiency and profitability of an organization, reduction of capital locked up in inventories is very

essential. This helps in getting higher return on investment and also to minimize working capital and at the same time, it helps in improving the liquidity position of the enterprise (Swami R. Hari, 1987). As inventories involve locking up of capital, proper care must be given in dealing with the problem of inventory management.

The sum of the value of raw materials, fuels, lubricants, consumables, spare parts, processing material and finished goods is called as inventory. A practical definition from the materials management perspective, would be “item of stores and materials kept in stock to meet future demands of production, repairs and maintenance etc.” Inventory management may be defined as “A branch of business management concerned with the development of policies to which the firm’s inventory is meant to conform” (John P., Magee and David M. 1991). There always exists some time lag between the procurement of the materials and their consumption in the production process in an organization. Hence, inventory for materials is needed in almost all the manufacturing organizations. This acts as a cushion in an organization and protects the manufacturing process against the imbalances of required materials.

The objectives of inventory management would be (a) to keep down capital investment at a minimum level in inventories, (b) to minimize the idle time of man, machinery, and capital caused by shortage of various kinds of materials, store items and spare parts, (c) to reduce the costs in maintaining the inventory,

and (d) to minimize the losses of obsolescence. Inventories account for a major portion of working capital of an industrial unit. Because of this, predominant position in total working capital obviously warrants for the maximum efficiency in their management. Though it is essential to have some inventories, excessive inventory is an idle resource of the concern. Thus, inventory management should aim at balancing between too much inventory and too little inventory. A firm cannot afford either excessive or shortage of inventory. To achieve higher degree of operational results, it is inevitable to maintain effective control and management of inventories.

Inventories can be classified basing on the usage in the point of entry into operations, production inventories: These are raw materials, components and parts, which enter into the production process to get a product. Again these production inventories are of three types. They are special items, standard industrial items and non-standard items and MRO item, MRO stands for Maintenance, Repairs and Operating supplies, which are consumed in the production process and do not become a part of the product (fuels, lubricants, tools, industrial firebricks etc.). Process inventories: some semi-finished products are available at various stages in production process. Finished goods inventories: The completed items, which are ready for delivery, dispatch and shipment.

Inventory requires some capital outlay to invest, which is a liquid asset like money. If money is deposited in a bank, it will earn some interest on it. But if we invest in inventories, it costs to

maintain. Further, it is difficult to realize the money by the sale of inventories. The following costs are incurred in maintaining the inventories, which have a definite influence on the profitability of the organization :

- Procurement of ordering costs.
- Understocking or stock out costs,
- Inventory carrying costs
- Over stock in costs.

The former two costs are viewed as supply side costs and help to determine the quantity to be ordered for replenishment. The latter two costs are viewed as demand side costs and help in the determination of the amount of variations in demand and the delay in supplies, which the inventory should withstand. The exact percentages differ from organization to organization and even from year to year within the same organization.

The ABC analysis is a systematic approach, which determines the degree of control that should be exercised on each item of the inventory. 'A' class items should be subjected to strict management control under either continuous review or periodic review with short review cycles. 'C' category items require little attention and can be delegated down the line for periodic review. Control over 'B' class items should be somewhere in between.

Besides this ABC analysis, there are certain other measures of inventory control and they include FSN, VED, XYZ, HML, SDE, GOLF analysis, and SOS classification. In FSN analysis, the consumption pattern and movements of materials are to be taken

into account. The stock items are classified as fast-moving, slow-moving and non-moving items. In VED analysis, the stock items are classified in accordance with their importance like vitality, essentiality, and desirability of items. This analysis is used mainly for classifying the maintenance items. In XYZ analysis, the items are arranged in descending order for the value of the inventory holdings. 'X' items are high value items, 'Z' items are low value items and 'Y' items are somewhere in between. HML analysis is based on the price paid per item whether high, medium or low. This analysis is extremely helpful to the manager or officers of the purchase department as it enables them to control purchases effectively. Basing on the availability of materials, they are classified as scarce, difficult and easy items. For determining lead-time analysis, HML analysis is of great help. In GOLF analysis, the items are classified basing on the source of supply like 'G' government supplies, 'O' open items that are valuable in the open market, 'L' local items purchased for cash and 'F' items for foreign items.

Basing on the nature of the inventories carried by an organization, a suitable method of classification may be chosen. For better results it is useful to combine two or three methods.

No effort has been made to make use of these inventory control techniques by the management of the selected shipyard companies. The inventory accumulation has its adverse effects on the profitability of an organization. In India, inventory management is a product of industrialization and have had

relatively too short period of experience in industrialization. Due to improper inventory management practices and lack of conceptual understanding about the concepts of materials management, many other public sector undertakings maintained excess stocks over the years. Inventory accumulation has been a perennial problem for many of the industrial undertakings. Whatever the type of the management of the organization may be, inventory accumulation blocks up the capital, which can be otherwise profitably utilized for the organizational growth and development. The inventories not only tie up with the scarce capital but also cost high to carry them, in the form of carrying costs, capital cost, cost of storage, cost of handling and cost of deterioration and obsolescence. Incidentally, the higher the accumulation of inventories, the greater the risk of wastage will be.

Inventory accumulation over and above the requirement obstructs an organisation's growth by locking up the capital in the form of inventories. As a result of this, the working capital requirements are growing up irrespective of the norms prescribed for it. As a consequence of this phenomena, a good number of organizations are experiencing acute shortage of working capital and thereby facing the threat of survival. Inventories are considered as 'grave yard' of organizations and uncontrolled inventories are treated as 'industrial cancer' unless and otherwise they are effectively managed. They may prove to be fatal for the very survival of the organizations.

Inventory accumulation has been on the higher side in both the public and private sector organizations and it is more in ship building industry, which can be viewed from the data, provided in this study. All the public sector ship building units have been maintaining excessive inventories of all kinds when compared to the norms prescribed for them. This might be because of long construction cycle of vessels, huge working capital, keeping up of huge amounts of raw materials, stores and spares in Indian ship building industry.

Non-availability of majority of items that are required in the construction process, in India, necessitated the Indian ship-builders to import 65 per cent of the required materials from abroad. This involves long administrative, procurement and inspection lead-time in the procurement of foreign material and equipment. Under these circumstances, the Indian shipyard have been forced to maintain huge inventories. The delays in production schedules for reasons beyond explanation and faulty material requirement planning practices adopted might have contributed to the excessive inventories. Besides these problems, the Indian shipyards adopted traditional inventory control techniques only and completely ignored the modern and scientific inventory control techniques. It is not an exaggeration to say that the economies derived from the American economy had a reduction of around 30 per cent cost of production in their manufacturing organizations just by the adoption of economic ordering quantity, an inventory control technique. Similarly, in

Japan, with the adoption of Just-in-Time (JIT) inventory control technique, they were able to manage their organizations with the least and at times with 0 (zero) inventory of the required material. This automatically reduces the investments in inventories and thereby reduces the total working capital required of their units. We too can expect the same kind of benefits experience hitherto by the USA and Japan with the adoption of modern and scientific inventory control techniques in our industries.

The structure of inventory of the public sector undertakings can be studied by classifying their total inventory into five broad categories: Raw materials, goods-in-process, finished goods, stores and spares and miscellaneous items. Further, the structure of inventory can be analyzed in two ways. First, the share of each component of inventory may be related to aggregate inventory. Secondly, appropriate indicators about the adequacy or inadequacy of each type of inventory may be developed and applied to the actual positions obtained in the public sector enterprises.

The director of commercial audit classified the total inventory of the public enterprises into the following two classes: (a) Raw materials stores and spares, loose tools and fixtures, (b) finished and semi-finished goods. The inventories relating to the public enterprises consists of (1) raw materials, components, tools, stores and spares (2) work-in-progress, (3) finished goods, and (4) other miscellaneous goods (Rajan N. 1969).

The structure of inventory of the ship building industry in the public sector can be studied by classifying their total inventory into three categories namely (a) raw materials, stores and spares inventory, (b) work-in-progress inventory, (c) finished goods inventory. Shipbuilding is a job-oriented industry, ships are constructed against the specific orders from the buyers. As and when the vessel got ready, it will be delivered immediately. Hence, the finished goods inventory does not arise in ship building units. However, an insignificant amount of finished goods inventory has been observed during the period under study in some ship building units.

The structure of inventory in Goa Shipyard Limited and other public sector ship-building units is explained in two ways. (1) The share of each component of inventory to the total inventory, (2) the level of each inventory component in terms of

- Number of months consumption
- Number of months, cost of production, and
- Number of months' sales.

The former reflects the point where the inventory is concentrated more, while the later will direct as to when and where the over stocking was made in these units.

The dictionary meaning of the term 'practice' is 'to form habitually.' Inventory management practices refers to those practices practised by the organizations in relation to the inventory management. Whatever the policies and procedures

followed by an industrial organization are, they reflect finally on the results they obtained. That's why, the numerical figures pertaining to the inventory like - the total inventory, inventory excluding work-in-progress, raw materials, stores and spares inventory were considered as key elements to reflect the practices of the shipyards.

In the present chapter, efforts have been made to examine the above said indicators of efficiency of the inventory management in the selected shipyard companies. The practices of other public sector ship building units have also been examined and finally a comparative study has been made with other shipyards.

Inventory Control Techniques

Materials management covers various activities including purchasing, receiving, codification, inventory control, storage, distribution, handling and disposal of materials. Of which, inventory control is one of the most important activities carried out by the materials management of the organizations. The term inventory control has been defined by American Production and Inventory Control Society as "the technique of maintaining the stock keeping items at desired level whether they are raw materials or work-in-progress or finished goods." (APICS, 1966).

Effective inventory management requires an understanding and the knowledge of the nature of the inventories. The determination of desired inventory levels and maintaining them at

those levels is the core of inventory control problem. From the inventory management's point of view, all items used in an organization may be divided into two groups *viz.*, repetitive items and non-repetitive items. The repetitive items cover raw materials stores, consumables, minor capital items, which have to be stored and replenished regularly. In the other category, would fall all other non-stock items.

The purchase and inventory control policies for both items will obviously differ because of their usage in production process. An effective inventory control system ensures the following; but before going for it let us know the different kinds of inventory systems. P and Q systems are there and are prevalent world over. In P system inventory procurement is based on the price of the materials. Whereas, Q system takes into consideration, the quantity required by the organization. The effective use of any of these two systems ensures the following benefits to the organization.

- Ensures an adequate supply of materials, stores, spares etc. and minimizes stock-outs and shortages and helps in smooth flow of production operations.
- It keeps down all costs relating to inventory *i.e.* procurement, carrying and obsolescence costs.
- It helps in procuring and purchasing economies through measurements on the basis of recorded experiences.

- It helps to completely eliminate duplicating in ordering and replenishing stocks.
- It helps in better utilization of the material stocks by facilitating intra- and inter-departmental transfers within the same company.
- It checks the losses like pilferage and undue drawings from the stores.
- With the help of it, management can allocate material costs to products and to various departments.
- It enables the management to prepare financial statements basing on perpetual inventory values.

The significance of inventory control was recognized much earlier in the advanced countries and this is laudable. In India, it is yet to get momentum. The problem in our country is more serious than that of any other industrially advanced country and at the earliest possible, we should made regular and systematic attempts to control inventories. Scientific inventory management is essential in India for the following reasons :

- (i) To conserve scarce foreign exchange.
- (ii) To release tied-up capital that is scarce in our country.
- (iii) To reduce costs associated with both shortage and possession of surplus inventories and, thus, increase the competitiveness in the international markets.

Control of material and inventory control are considered as one and the same and sometimes used as synonyms, but they

differ from each other. "Inventory control is management process and whereas material control is the operation process." Material control comes into the picture only when the inventory control ends in an organization. Material control involves the operational aspects of material receipts, store keeping, distribution and associated activities. But inventory control fixes the area in which the material control operates.

Proper inventory control solves the critical problem of liquidity of the firm and at the same time, helps to increase the profit of the company. Exercising control over inventories can be possible only by adoption of available inventory control techniques. The available techniques are ABC, VED, FSN and SDE analysis etc., and by determining Economic Order Quantity for each and every item needed by the company; fixing of reorder, minimum and maximum levels of each item, replenishment timings etc. It can be possible with the properly laid down inventory policies, fixation of inventory norms and close supervision on the movements of material.

The pre-requisite for effective inventory control is to adopt some selective control techniques. Petro or ABC analysis is one such analysis for the management.

In ABC analysis, the total items are classified according to their annual usage into three categories *i.e.* A, B and C categories. The universal experience is that very few items whose annual

consumption value is very high contributes significantly to the total inventory holdings of the company. Contrary to this, a large number of items whose annual consumption is small have very meagre and insignificant contribution to the total inventory holdings.

The problem is to segregate items which are most important 'A', less important 'B' and least important 'C' and to devise the type of controls which are adequate for the three groups of items in the selection, purchase and procurement. The three classifications used in ABC analysis are given hereunder. High value items constitute 5 to 10 per cent of the number of items. They account for approximately 70 per cent of the usage value. Medium value items constitute 15 to 20 per cent of the number of items that account for approximately 20 per cent of the number of items that account for only about 10 per cent of the usage value (Dobler, 1995).

(A) Practices relating to Goa Shipyard Limited

Table 5.1(a) depicts size of total inventory in Goa Shipyard Limited during 1998-99 to 2008-09. In the year 1998-99, the amount of total inventory was of the tune of Rs. 4,425 lakh and it suddenly fell down to Rs. 2,090 lakh in the year 1999-2000. It then gradually increased and in the year 2000-01, it registered Rs. 3,800 lakh. In the year 2001-02, it witnessed around 60 per cent hike on the previous year's figure and stood at Rs. 6,366 lakh. In the following year *i.e.* 2003-04, it figured Rs. 19,783 lakh and registered a rise of

around 25 per cent. In the year 2004-05, there was about 15 per cent rise and stood at Rs.22,738 lakh. On this, the following year registered a 30 per cent rise and had Rs. 28,310 lakh. In the remaining three years of study, *i.e.* 2006-07, 2007-08 and 2008-09, the Goa Shipyard Limited maintained a total inventory of Rs. 29,500 lakh approximately in each year.

Table 5.1 (A)
Size of Total Inventory in Goa Shipyard Limited
during 1998-99 to 2008-09

(Rs.in lakh)

Year	Inventory
1998-99	4425
1999-00	2090
2000-01	3800
2001-02	6366
2002-03	14253
2003-04	19733
2004-05	22738
2005-06	28310
2006-07	29457
2007-08	29644
2008-09	29644

Source: *Public Enterprises Survey Reports*, Bureau of Public Enterprises,
 Ministry of Industry, Government of India, New Delhi

Table 5.2 (a) shows the size of inventory excluding work-in-progress and finished goods in Goa Shipyard Limited during 1998-99 to 2008-09 the Goa Shipyard Limited maintained Rs. 475 lakh worth of this category of inventory in the year 1998-99 and an insignificant hike was registered in the immediate next year i.e., 1999-2000 with Rs. 498 lakh inventory. There was about 45 per cent hike in this category of inventory in 2000-01 and stood at Rs. 818 lakh. A 110 per cent rise was experienced by Goa Shipyard Limited in the year 2001-02 and recorded a worth of Rs. 1,752 lakh. About 300 per cent hike was observed in the year 2002-03 with Rs. 5,572 lakh of this category of inventory. In the following year, it stood at Rs.9,783 lakh and it comes around 45 per cent hike than the previous year's figure.

Table 5.2(A)

Size of inventory excluding Work-in-Progress and Finished Goods in Goa Shipyard Limited during 1998-99 to 2008-09

(Rs.in lakh)

Year	Inventory Excluding Work-in-Progress
1998-99	495
1999-00	498
2000-01	818
2001-02	1752
2002-03	5572
2003-04	9783
2004-05	10011
2005-06	8468
2006-07	11135

2007-08	8933
2008-09	6028

Source: *Public Enterprises Survey Reports*, Bureau of Public Enterprises, Ministry of Industry, Government of India, New Delhi

The year 2004-05 has no remarkable change in the quantum of inventory of this kind and registered a worth of Rs. 10,011 lakh. From that year onwards, it can be observed that there was some decrease in the inventory carried by Goa Shipyard Limited and figured at Rs. 8,468 lakh in the year 2005-06. Again it increased to Rs.11,135 lakh during the year 2006-07. It then declined to Rs. 8,933 lakh in the year 2007-08 and further decline was witnessed by Goa Shipyard Limited in the year 2008-09 and had Rs. 6,026 lakh. This reduction reflects the efficiency of commercial department and purchase department of Goa Shipyard Limited.

Table 5.3(a) throws light on the quantum of raw material, stores and spares inventory in the term of number of days consumption. In the early part of the period under study, Goa Shipyard Limited witnessed below 500 number of days consumption of this category of inventory. It started with 142.6 days in the year 1998-99 and it was 116.9 days in 1999-2000. It rose to four-fold during the year 2000-01 and it stood at 482.34 days. In the subsequent year, Goa Shipyard Limited witnessed a decline in it and had 405.79 days. In the middle period of the period under study *i.e.*, 2002-03, 2003-04 and 2004-05, it oscillated between 1,200 and 800 days. From there onwards, a significant reduction has

been observed with 558 days in the year 2005-06, 566 days in the year 2006-07, 406 days in the year 2007-08 and in the last year of the study, it stood at 299.44 days. This declining phenomena is welcoming feature and it speaks of the efficiency of the management of Goa Shipyard Limited in general and commercial and purchase departments in particular. But the officials were not in a position to tell why it had higher number of days during 2002-03 and 2004-05.

Table 5.3 (A)

**Raw Materials, Stores and Spares Inventory
in No. of Days Consumption in Goa Shipyard Limited
during 1998-99 to 2008-09**

(In no. of days)

Year	Raw Materials Stores and Spares
1998-99	145.6
1999-00	116.9
2000-01	482.3
2001-02	405.8
2002-03	1200.3
2003-04	930.1
2004-05	699.4
2005-06	557.2
2006-07	566.5
2007-08	406.2
2008-09	299.4

Source: *Public Enterprises Survey Reports*, Bureau of Public Enterprises, Ministry of Industry, Government of India, New Delhi

Table 5.4(A) is meant to know the size of work-in-progress inventory in Goa Shipyard Limited. The Goa Shipyard Limited

registered Rs.3,950 lakh in the year 1998-99 and it fell down to about 60 per cent and stood at Rs. 1,644 lakh in the year 1999-2000. It almost doubled and stood at Rs.2,986 lakh in the year 2000-01. In the year 2001-02, it registered a figure of Rs. 4,614 lakh and it doubled in the subsequent year with Rs.8,681 lakh. In the year 2002-03, it witnessed Rs.10,000 lakh plus mark and the remaining years in the period under study has a continuous increase till 2005-06. The figures in lakh of rupees are 10,900 in the year 2003-04, 19,017 in the year 2004-05, 19,842 in the year 2005-06. It then decreased to Rs.18,322 lakh in the year 2006-07 and it has gone up to Rs.20,712 lakh in the year 2007-08 and in the last year of study, it registered Rs.23,435 lakh.

Table 5.4 (A)

**Size of Work-in-Progress Inventory in Goa Shipyard Limited
During 1998-99 to 2008-09**

(Rs.in lakh)

Year	Work-in-Progress Inventory
1998-99	3850
1999-00	1644
2000-01	2986
2001-02	4814
2002-03	8681
2003-04	10900
2004-05	19719
2005-06	19842
2006-07	18322
2007-08	20712
2008-09	23435

Source: *Public Enterprises Survey Reports*, Bureau of Public Enterprises, Ministry of Industry, Government of India, New Delhi

The phenomenal increase of this category of inventory speaks that huge amounts are tied up in work-in-progress inventory. Therefore, the management should take stringent measures to reduce this inventory by expediting to the jobs assigned to it by the customers and deliver the finished ship at an early date which automatically increases the efficiency, helps to increase the profitability as well as minimize the total inventory held by it.

Table 5.5 (a) reflects the work-in-progress of number of months cost of production. This index of performance oscillated between 6.5 months and 22.7 months in Goa Shipyard Limited during 1998-99 to 2008-09. The figures pertaining to the year 1998-99 are not available. In the year 1999-2000, it had 6.5 months and this was the only year with the minimum of it. In all other years, this index went about 15 months. In the year 2000-01, it recorded a figure of 17.7 months. In the year 2001-02, it was 14.8 months and it stood at 22 months in 2002-03. There was sharp fall by 0.4 months and stood at 21.6 months in the year 2003-04. Still a sharp reduction of 1.8 months consumption was observed in the year 2004-05 and stood at 20.2 months. In the year 2005-06, it stood at 22.7 months. A decline was observed by 3.5 months in the year 2006-07 and registered at 19.2 months. A 0.2 months increase was observed in the year 2007-08 over the previous year's index. In the year 2008-09, it had 20.3 months cost of production.

Upto the year 2001-02, Goa Shipyard Limited witnessed less than 15 months of work-in-progress of number of months cost of

production. From 2002-03 onwards, it had more or less 20 months cost of production. It carried the inventory in the form of work-in-progress. The higher the number of months cost of production, the lower will be the efficiency of materials management in particular and the overall management in general. Therefore, necessary steps should be initiated to reduce this index as much as possible to make the organization further viable for the cause of the development of the country in various spheres.

Table 5.5 (A)

Work-in-Progress of Number of Months Cost of Production in Goa Shipyard Limited during 1998-99 to 2008-09

Year	Work-in-Progress
1998-99	N.A.
1999-00	6.5
2000-01	17.7
2001-02	14.8
2002-03	22.0
2003-04	21.6
2004-05	20.2
2005-06	22.7
2006-07	19.2
2007-08	19.4
2008-09	20.3

N.A. : Not available

Source: *Public Enterprises Survey Reports*, Bureau of Public Enterprises, Ministry of Industry, Government of India, New Delhi.

Table 5.6(a) shows the size of inventory in total current assets in percentage in Goa Shipyard Limited during 1998-99 to 2008-09. It reflects that there was a significant percentage of

inventories in the current assets of Goa Shipyard Limited. The inventories recorded 72.29 per cent of the total current assets in the year 1998-99. In the year 1999-2000, the percentage fell down to 45.82 per cent. From the year 2000-01 onwards, it has gone up to 70 per cent mark with 62.85 per cent in the year 2000-01 and 66.5 per cent in the year 2001-02. From 2003-04 onwards, it gradually fell down to 47.34 per cent in the year 2005-06. In the year 2003-04, it was recorded 63.3 per cent and in the year 2004-05, it further decreased to 51.75 per cent. In the year 2006-07, it increased again and stood at 50.04 per cent and in the later years, gradual decrease was seen and it was recorded 42.09 per cent in the year 2008-09 as against 45.26 in the previous year 2007-08.

Table 5.6 (A)

Size of Inventory in Total Current Assets in Goa Shipyard Limited during 1998-99 to 2008-09

Year	Inventories	Total Current Assets	Percentage of Inventories in Total Current Assets
1998-99	4425	6121	72.29
1999-00	2090	4561	45.82
2000-01	3800	6048	62.85
2001-02	6366	9572	68.51
2002-03	14253	20468	69.63
2003-04	19783	31251	63.61
2004-05	22738	43931	61.75
2005-06	28310	59789	47.34
2006-07	29457	58855	50.04
2007-08	29644	65436	45.26
2008-09	29461	69982	42.09

Source: Annual Reports of Goa Shipyard Limited

This shows that the abilities of the management worked out and reflected in the reduction of the percentage of total inventories in total current assets in the year 2008-09, when it recorded only 42.09 per cent. This is considered as ever least percentage of inventories in total current assets in Goa Shipyard Limited. This is a noteworthy feature and appreciable effort of the management of Goa Shipyard Limited in reducing the inventory component in the current assets even without a separate materials management department. This low percentage naturally helps to have a fairly good turnover ratio, *citris paribas*. The decrease in the inventory growth rates has a positive influence on the operational performance of the undertaking. The decline might be due to the strict adherence to inventory norms prescribed by Bureau of Public Enterprises.

Table 5.7 (A)

**The Position in Inventory Turnover in Goa Shipyard Limited
during 1998-99 to 2008-09**

Year	Inventory Turnover
1998-99	0.5
1999-00	2.58
2000-01	0.12
2001-02	0.36
2002-03	0.08
2003-04	0.24
2004-05	0.29
2005-06	0.12
2006-07	0.49
2007-08	0.44

2008-09	0.45
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Compiled From Public Enterprises Survey Reports

Table 5.7(a) gives the position of inventory turnover ratio in Goa Shipyard Limited during 1998-99 to 2008-09. Goa Shipyard Limited has 0.5 inventory turnover in the year 1998-99 and there was a drastic increase in it and witnessed a turnover of 2.58. It never touched an inventory turnover of one during the remaining period of study. In the year 2000-01, it was 0.12 and 0.3 in the year 2001-02. In the year 2002-03, it witnessed an ever-lowest figure of 0.08 and in the subsequent year, it was 0.24. In the immediate next year, it was 0.29 and it fell down to 0.12 in the year 2005-06. In the year 2006-07, it again witnessed a sharp rise in the turnover ratio with 0.49. The year followed by it experienced turnover ratio of 0.44 and in the last year of study *i.e.* 2008-09, it stood at 0.45.

The higher the turnover ratio, the higher will be the efficiency indicating the effectiveness of techniques used for inventory control. A low turnover in an organization results in over investment in inventories. Therefore, necessary measures are to be taken up by the management of Goa Shipyard Limited to improve the inventory turnover ratio and can expect a good efficiency in the overall management of scarce resources of capital which will be used for other purposes.

Table 5.8 (A)

Progressive Base Year Percentage Growth of Total Inventory,
Total Output and Total Net Sales in GSL
During 1998-99 to 2008-09

Year	Growth Rate of Inventory		Growth Rate of Output		Growth Rate of Net Sale	
	Total Inventory (Rs.in lakh)	Growth Rate in percentage	Output (Rs. in lakh)	Growth Rate in percentage	Net Sales (Rs. in lakh)	Growth Rate in percentage
1998-99	4425		3437		2227	
1999-00	2090	-47.23	3206	-93.27	5513	247.55
2000-01	3800	-85.87	1786	-51.96	444	-19.93
2001-02	6366	143.86	3931	114.3	2303	103.4
2002-03	14253	322.1	5343	155.45	1276	-57.29
2003-04	19783	4470	6883	200.76	4765	213.96
2004-05	22738	513.85	8589	249.89	6698	300.76
2005-06	28310	639.77	10638	309.51	3516	157.88
2006-07	29457	665.69	13038	379.34	14557	653.65
2007-08	29644	669.91	15695	456.64	13304	597.39
2008-09	29461	665.78	16238	472.44	13515	595.37

Source: Compiled from *Annual Reports of GSL*

The table 5.8(a) showed that the progressive percentage growth rate output and net sales in Goa Shipyard Limited during 1998-99 to 2008-09 was lower where compared with the progressive percentage growth rate of inventories. The progressive base year percentage of growth rate of inventories crossed 600 per cent for consecutively four years *i.e.* from 2005-06 to 2008-09. Whereas, the progressive base year percentage of growth rate of output never touched 500 per cent. It was less than

450 per cent except in the years 2007-08 and 2008-09. In these two years, the percentage growth rate was 456.64 and 472.44 respectively. When it comes to progressive base year percentage, growth rate of net sales, it was about 600 per cent in three consecutive years *i.e.* 2006-07, 2007-08 and 2008-09. It crossed once the 600 per cent in the year 2006-07. But in all the remaining years, it varied between minus growth rate of 19.93 to 300.76 per cent.

Thus, it clearly indicates the progressively increasing inventory accumulation in absolute terms and in growth percentage from base year. This rate is higher than the percentage growth rate of output and net sales. This is deplorable indication that the management of Goa Shipyard Limited is not very serious about the higher inventory levels. Hence, inventory accumulation should be dealt with utmost care.

It is worth mentioning about the steps taken by BPE from time to time. "The committee on public sector undertakings has prescribed an ideal norm of six months cost of production" (A N Banerjee, 1967), Chairman, High Power Committee on Inventories in shipbuilding units and public undertakings). Taking this yardstick, an attempt has been made to assess the value of excess inventories in Goa Shipyard Limited.

Table 5.9(a) reveals the excess value of inventory held by Goa Shipyard Limited from 1998-99 to 2008-09. This excess has been identified by taking into consideration the norm of six

months of cost of production laid down by BPE. In the year 1998-99, the excess value of inventory was of the tune of Rs. 3,106 lakh. There was a drastic reduction in the year 1999-2000 and stood at Rs. 559 lakh and from there onwards, it increased gradually year by year and by the end of March, 2007, this figure reached to its peak of Rs. 23,645 lakh. In the remaining years of study, there was a slight reduction in the value of excess inventory, which is almost insignificant. Understandably, this is the case of the extreme deviation of the management from the norms prescribed for it. Necessary remedial measures should be initiated to keep the excess value of the inventory in tune with the norms. As it has been already noticed, lot of scarce financial resources were held up unwantedly, otherwise the same could be put for certain other investment avenues available to the Goa Shipyard Limited.

Table 5.9(A)

Excess Inventory Identified against the BPE Norms in Goa Shipyard Limited during 1998-99 to 2008-09

Year	Inventory (Rs. In lakh)	Cost of Production (Rs. In lakh)	NORM*	Value of Excess (Rs. in Lakh)
1998-99	4425	2638	1319	3106
1999-00	2090	3062	1531	559
2000-01	3800	2054	1027	2733
2001-02	6366	3787	1894	4472
2002-03	14253	4812	2406	11847
2003-04	19783	6070	3035	16748
2004-05	22738	7645	3823	18915
2005-06	28310	10636	5318	22992
2006-07	29457	11624	5812	23645
2007-08	29644	12957	6479	23165
2008-09	29461	13967	6984	22477

*Refers to 180 days inventory of No. of months cost of production.

Source: Compiled from *Annual Reports of GSL*

(B) Practices in Other Shipyards

Table 5.1(b) reveals the total inventory in other public sector ship building units during 1998-99 to 2008-09 in terms of lakh of rupees, which are nothing but the outcomes of the policies and procedures laid down and practised by different managements of the ship building units.

In case of Central Inland Water Transport Corporation (CIWTC), the total inventory started with Rs. 796 lakh in the year 1998-99 and ended with Rs. 405 lakh in the year 2008-09. This being the lowest, Rs. 1,274 lakh was the maximum total inventory, which was recorded in the year 2003-04.

Table 5.1(B)

Size of Total Inventory in Other Public Sector Shipbuilding Units during 1998-99 to 2008-09

(Rs. in lakh)

Years	CIWTC	CSL	GRSE	HSL	HDPE	MDL
1998-99	796	6037	10601	9782	1523	42504
1999-00	667	7744	13694	4356	1811	67777
2000-01	546	5771	13409	4044	1461	63757
2001-02	888	3401	22076	4355	1911	75004
2002-03	1050	5528	30587	4176	2222	78498
2003-04	1274	3898	31397	4079	2767	65623
2004-05	1039	5472	32804	4948	3354	57401
2005-06	1068	1684	44299	5354	3660	78814
2006-07	1068	1591	59924	5245	3534	102806
2007-08	419	2299	73607	5238	3806	81172
2008-09	405	3415	98750	7431	3761	111098

Source: *Public Enterprises Survey Reports*, Bureau of Public Enterprises, Ministry of Industry, Government of India, New Delhi

The same table reflects an inventory of Rs. 6,037 lakh pertaining to Cochin Shipyard Limited (CSL) in the year 1998-99 and ended with Rs. 3,415 lakh in the year 2008-09. It ranged between Rs. 1,591 lakh and Rs. 7,744 lakh. In Garden Reach Shipbuilders and Engineers Limited (GRSE) in the year 1998-99, there was a total inventory of Rs. 10,601 lakh and ended with Rs. 98,750 lakh in the year 2008-09.

The Hindustan shipyard Limited (HSL) registered Rs. 9,782 lakh of worth of total inventory in 1998-99. It ended with Rs. 7,431 lakh in the year 2008-09. The total inventory ranged between Rs. 4,044 lakh and Rs. 9,782 lakh. It was Rs. 1,523 lakh in Hooghly Deck and Port Engineers (HDPE) in the year 1998-99 and ended with Rs. 3,761 lakh in the year 2008-09. The total inventory varied in between Rs. 1,461 lakh and Rs.3,806 lakh.

The Mazagon Dock Limited (MDL), the lowest total inventory appeared in the year 1998-99 with Rs. 42,504 lakh and ended with Rs. 1,11,098 lakh in the year 2008-09. On the whole, the inventory in all public sector ship building units led between Rs. 405 lakh and Rs. 1,11,098 lakh.

Table 5.2(b) reflects the size of inventory excluding work- in-progress and finished goods in other public sector ship building units during 1998-99 to 2008-09 in lakh of rupees. This table reveals that in HSL, inventory of this kind had Rs. 5,628 lakh in 1998-99 and ended with Rs. 7,200 lakh in the year 2008-09. The

range of variation was in between Rs. 2,993 lakh and Rs. 7,200 lakh.

In GRSE, the lowest inventory of this category was recorded with Rs. 1,780 lakh in the year 1998-99 and ended with Rs.17,441 lakh in 2008-09. It varied in between these two figures. The same table reveals that, in MDL there was Rs.8,844 lakh in the year 1998-99 and ended with Rs.22,376 lakh in the year 2008-09. The range was in between the above said two figures.

Table 5.2(B)

**Size of Inventory excluding Work-in-Progress and Finished Goods in Other
Public Sector Ship Building Units
during 1998-99 to 2008-09**

(Rs.in lakhs)

Year	HSL	GRSE	MDL	CSL	CIWTC	HDPE
1998-99	5628	1780	8344	827	245	371
1999-00	2993	2821	14304	1023	263	173
2000-01	3418	2982	19274	2606	206	156
2001-02	2999	7159	16817	1178	220	448
2002-03	3740	9938	13999	1228	254	300
2003-04	3639	8464	10515	944	726	422
2004-05	4013	13067	16460	1063	370	422
2005-06	4891	15999	15368	1585	312	598
2006-07	5183	14955	14709	1430	312	541
2007-08	3971	16770	1997	1514	344	572
2008-09	7200	17441	22376	1430	255	402

Source: *Public Enterprises Survey Reports*, Bureau of Public Enterprises, Ministry of Industry, Government of India, New Delhi

In case of CSL, the lowest of Rs.827 lakh worth of inventory in this category was recorded in the year 1998-99 and ended with Rs.1,430 lakh in 2008-09. Further, it had Rs. 2,606 lakh worth of

inventory during the year 2000-01. The CIWTC started and ended with around Rs.250 lakh worth of inventory and it reached a peak of Rs.726 lakh in the year 2003-04. The HDPE maintained in between its 156 lakh and Rs. 572 lakh of inventory during the period 1998-99 to 2008-09.

Table 5.3 (b) depicts the figures of raw materials, stores and spares inventory of other public sector shipyards in terms of number of days consumption during 1998-99 to 2008-09. HSL carried inventory of this category in the range of 116.16 and 1257.7 days consumption. Whereas, GRSE had a minimum of 179.2 and maximum of 1386.6 days consumption of this category of inventory during 1998-99 to 2008-09.

Table 5.3 (B)

Raw Materials, Stores and Spares Inventory in Terms of No. of Days Consumption in Other Public Sector Ship Building Units during 1998-99 to 2008-09

Year	HSL	GRSE	MDL	CSL	CIWTC	HDPE
1998-99	298.6	179.2	196	270.2	266.4	58.6
1999-00	209.4	220	590.1	474.5	237.6	63.3
2000-01	312.6	240.1	740.9	975.6	247.3	156.9
2001-02	255.8	683.4	338.9	717.6	267.7	259.8
2002-03	252.2	471.8	312.6	248.3	237.7	133.8
2003-04	425.1	389.9	348.5	169.9	325.6	278.5
2004-05	797.5	543.9	508.4	157	443.6	278.5
2005-06	1257.5	478.9	367.2	176.1	450.1	371.5
2006-07	368.7	429.5	254.9	484.7	450.1	336.9
2007-08	116.1	651.5	353.9	468.4	724.9	1111.6
2008-09	416.5	1386	665.9	468.3	447.5	4940

Source: *Public Enterprises Survey Reports*, Bureau of Public Enterprises, Ministry of Industry, Government of India, New Delhi

The MDL's inventory during the same period varied in between 195.9 days and 740.92 days. On the other hand, the CSL had the lowest of 157 days and a maximum of 975.58 days.

The CIWTC carried this category of inventory to the minimum extent of 237.6 days consumption and maintained a high of 450.12 days of consumption during 1998-99 to 2008-09. The HDPE had its credit at the lowest figure of 58.6 days consumption of this category of inventory and reached a peak of 111.59 days consumption.

Table 5.4 (B)

**Size of Work-in-Progress Inventory in Other Public Sector
Ship Building Units during 1998-99 to 2008-09**

(Rs. in lakh)

Years	HSL	GRSE	MDL	CSL	CIWTC	HDPE
1998-99	4156	8666	51394	5210	551	1143
1999-00	1551	11126	53963	6848	404	1620
2000-01	0	10556	44923	4661	339	1280
2001-02	1436	14917	58187	2231	668	1472
2002-03	428	20649	64499	4300	796	1782
2003-04	440	22933	54908	2854	548	0
2004-05	935	19737	40941	4409	661	2799
2005-06	463	28300	63446	97	756	3062
2006-07	142	44969	88907	165	286	2993
2007-08	1259	52483	61575	785	175	3234
2008-09	231	66326	88722	1983	150	3349

Source: *Public Enterprises Survey Reports*, Bureau of Public Enterprises, Ministry of Industry, Government of India, New Delhi

Table 5.4(b) gives a view of the size of the work-in-progress inventory in other public sector ship building units during 1998-99 to 2008-09 in lakh of rupees. HSL carried a minimum of Rs. 142 lakh of work-in-progress and a maximum of Rs.4,156 lakh. During the period under study, the work-in-progress inventory varied between this minimum and maximum. The GRSE's work-in-progress inventory during the same period ranged between Rs.8,666 lakh and Rs.66,325 lakh.

The MDL at its credit, registered the highest work-in-progress inventory in all the years from 1998-99 to 2008-09 over the other shipyards' work-in-progress inventory and ranged between Rs.40,941 lakh and Rs.88,722 lakh, whereas, CSL lied in between Rs.99 lakh and Rs.6,848 lakh during the same period as far as work-in-progress inventory is concerned.

Table 5.5 (B)

Work-in-Progress of Number of Months Cost of Production in other Public Sector Ship Building Units during 1998-99 to 2008-09

Year	CIWTC	CSL	GRSE	HSL	HDPE	MDL
1998-99	N.A	N.A	N.A	N.A	N.A	N.A
1999-00	2	20.5	13.13	1.6	9.3	21.3
2000-01	1.6	9.9	15.4	0	14.6	19.3
2001-02	3	3.9	15.6	1.2	12.5	17.6
2002-03	2.8	4.6	15.1	0.3	10.4	19.9
2003-04	1.6	3.7	16	0.3	0	21.7
2004-05	1.9	4.8	11.8	0.6	0	16
2005-06	2	0.1	15.2	0.3	15.9	14.3
2006-07	2	0.2	24.9	0.1	14.9	19.4
2007-08	0.4	1	32.6	0.4	19.5	13.5

2008-09	0.3	1.9	43.9	0.1	18.2	27.6
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N.A.: Not available

Source: *Public Enterprises Survey Reports*, Bureau of Public Enterprises, Ministry of Industry, Government of India, New Delhi

In CIWTC, the minimum was Rs 150 lakh and the maximum was Rs.796 lakh during 1998-99 to 2008-09. The work-in-progress inventory of various years oscillated in between. While in HDPE, the minimum was zero in the year 2003-04 and the maximum was Rs.3,349 lakh and the work-in-progress inventory in each of the years varied in between.

Table 5.5(b) reflects the work-in-progress of number of months cost of production of the other public sector units during 1998-99 to 2008-09. The CIWTC carried the work-in-progress inventory equal to 0.3 months cost of production in the year 2008-09 and it carried this category of inventory of a maximum of three months cost of production for about two years in between the period under study. In the remaining years, this category of inventory lied between 0.3 months to 3 months cost of production.

The CSL maintained a minimum of 0.1 month cost of production during 2005-06 and a maximum of 20.5 months in the year 1999-2000. This index ranged in between in all the remaining years. GRSE with its 49.3 months of cost of production stood first in carrying this category of inventory during the entire period under study. It has a maximum of 11.8 months cost of production in 2004-05.

HSL with zero minimum in the year 2000-01 had a maximum of 1.6 months cost of production in the year 1999-2000 and it never touched to one month in the remaining years under

study. In HDPE, significantly, there appeared zero minimum in two consecutive years *i.e.*, 2003-04 and 2004-05 and experienced a maximum of 19.5 months cost of production. This index lied in between the above said two figures during the period under study. MDL had work-in-progress of number of months of cost of production of 13.5 months minimum in the year 2007-08 and in the following year, this was doubled and for all the years, it was about 15 and around 20 months.

Table 5.6 (B)

The Position of Inventory Turn-Over in other Public Sector Ship Building Units during 1998-99 to 2008-09

Year	HSL	CIWTC	GRSE	CSL	HDPE	MDL
1998-99	1.14	0.29	0.72	0.5	0.92	0.53
1999-00	2.22	2.58	0.4	0.11	0.56	0.38
2000-01	1.94	2.2	0.6	0.61	0.85	0.53
2001-02	2.13	0.21	0.33	1.62	0.55	0.29
2002-03	3.1	1.47	0.36	0.51	0.49	0.43
2003-04	2.33	0.88	0.52	2	0.14	0.61
2004-05	1.65	1.3	0.69	0.89	0.37	0.76
2005-06	1.89	1.25	0.31	7.72	0.31	0.37
2006-07	3.89	1.25	0.09	4.24	0.42	0.29
2007-08	4.88	4.2	0.13	3.94	0.11	1.02
2008-09	2.42	3.13	0.08	3.28	0.11	0.08

Compiled from Public Enterprises Survey Reports

Table 5.6(b) gives the position of the inventory turnover in other public sector shipbuilding units during 1998-99 to 2008-09.

In case of HSL, the highest turnover of 4.88 is recorded in the year 2007-08 and fell down to half of it with 2.42 months in the year 1995-96. The CIWTC witnessed a turnover ratio of 4.2 in the year 2007-08 and decreased to 3.13 in the year 2008-09. Similarly, the turnover of 0.13, in the year 2007-08 was recorded with GRSE and later fell down to 0.08 in the year 2008-09. The CSL with 3.94 inventory turnover ratio in the 2007-08 declined to 3.28 in the year 2008-09. During the same period, HDPE maintained the same level of inventory turnover of 0.11 in the years 2007-08 and 2008-09. In case of MDL, in the year 2007-08, it was recorded an inventory turnover of 1.02 and it has only 0.08 in the year 2008-09.

The overall situation as far as the inventory turnover is concerned, was grim during the period under study. As such, all the units in industry should, therefore, try to achieve a higher degree of inventory turnover in order to achieve higher efficiency and thereby profits. On the other hand, to minimize operational losses incurred by the majority of the public sector shipbuilding units in the country.

The norm fixed by Bureau of Public Enterprises (BPE) for this inventory turnover is 4-6 times in the public sector shipbuilding units in a year. If we compare the actual turnover, there are 3-4 years in which very few shipyards reached the norm. In all the remaining years, the turnovers are far below the norms.

The higher the ratio, the higher will be the efficiency indicating the effectiveness of techniques used for inventory control. A slow turnover is a bane to the organization as it results

in over investments inventories. On the other hand, rapid turnover contributes to the higher capital turnover. The ratio varies from industry to industry, organization to organization, however one has to ensure that it is progressively raised. If we observe the table, the position of inventory turnover in public sector shipbuilding units has been progressively declining towards the end of the study period.

(C) Comparison of the Said Shipyard and Other Shipyards Practices

“It is necessary to find out whether the inventory holdings of industrial units had been reasonable, excessive and shortage in relation to their requirements. It is difficult to lay down a single norm to judge the adequacy of inventories. There are certain ratio tests, which provide a good understanding or insight into the extent of overstocking or understocking. The most common determinant of overstocking or understocking is the value of inventory expressed in terms of number of months cost of production and inventory turnover ratio.” (Chattopadhyaya, 1969). According to BPE, inventory in public sector enterprises should not exceed six months cost of production (BPE, 1976). According to the tariff commission, inventory in public enterprises should not exceed four to six months of production.

Table 5.1(c) disclosed the size of total inventory held by all the public sectorship building units during the period 1998-99 to 2008-09 in lakh. The total inventory of all the public sector ship

building units in the year 1998-99 was of Rs. 75,668 lakh of which GSL's share was Rs.4,425 lakh and constituted 5.85 per cent of the total inventory. The share of CIWTC is Rs.796 lakh and constituted 1.05 per cent of the total inventory of all the public sector shipbuilding units.

Table 5.1 (c)

**Size of Total Inventory in Public Sector Ship Building Units
during 1998-99 to 2008-09**

(Rs. in lakh)

Year	GSL	CIWTC	CSL	GRSE	HSL	HDPE	MDL	Total
1998-99	4425	796	6037	10601	9782	1523	42504	75668
1999-00	2090	667	7744	13694	4356	1811	67777	98139
2000-01	3800	546	5771	13409	4044	1461	63757	92788
2001-02	6366	888	3401	22076	4355	1911	75004	114001
2002-03	14253	1050	5528	30587	4176	2222	78498	136314
2003-04	19783	1274	3898	31397	4079	2767	65623	123521
2004-05	22738	1039	5472	32804	4948	3354	57401	127756
2005-06	28310	1068	1684	44299	5354	3660	78814	163189
2006-07	29457	1068	1591	59924	5245	3534	102806	203625
2007-08	29644	419	2299	73607	5238	3806	81172	196185
2008-09	29461	405	3415	98750	7431	3761	111098	254321

Source: *Public Enterprises Survey Reports*, Bureau of Public Enterprises, Ministry of Industry, Government of India, New Delhi

The CSL possessed an inventory of Rs 6037 lakh during the same period and constituted 7.98 per cent. The GRSE with Rs. 10,601 lakh worth of inventory had a share of 14 per cent in the total inventory. HSL had Rs.9,782 lakh of inventory and had a share of 12.9 per cent of the total inventory. The HDPE had

Rs.1,523 lakh of inventory and constituted 2 percent of the total inventory. While MDL occupied first place with Rs.42,504 lakh and constituted 56.17 per cent of the total inventory held by all the public sector shipbuilding units in the country during 1985-86. Thus, CIWTC carried least inventory and followed by it was HDPE and then GSL. Major stake was held by MDL with Rs.42,504 lakh.

During the year 1999-2000, the total inventory of all public sectors amounted to Rs. 98,139 lakh of which the GSL had Rs.2,090 and constituted 207 per cent. The CIWTC held inventory worth of Rs.667 lakh and constituted 0.69 percent. The CSL had a total inventory of Rs.7,744 lakh and constituted 7.89 per cent. The GRSE held worth of Rs. 13,694 lakh of inventory and had a share of 13.95 per cent. HSL carried Rs.4,356 lakh worth of inventory and had a share of 4.44 per cent. HDPE held Rs.18.11 lakh of worth of inventory and constituted a share of 1.84 per cent. The MDL again stood first with the highest inventory with Rs.67,777 lakh and had a share of 69 per cent of the total inventory.

Surprisingly, a note worthy feature has been observed from this table that the total inventory held by all the public sector shipbuilding units was reduced by about Rs. 6,000 lakh. The total inventory was of the tune of Rs.92,788 lakh of which GSL possessed Rs.3,800 lakh and had a share of 4.1 per cent. During the same year, CIWTC witnessed inventory worth of Rs.546 lakh and constituted 0.58 per cent. The CSL had Rs.5,771 lakh and constituted 6.22 per cent. The GRSE, in the same period, held

inventory worth of Rs.13,409 lakh and had a share of 14.45 per cent. The HSL carried, inventory of all categories, put together, worth of Rs.4,044 lakh and constituted 4.36 per cent of the total inventory. The HDPE in the same year, held inventory worth of Rs.1,461 lakh and constituted 1.57 per cent. Like in the earlier years, the MDL occupied first place with Rs.63,757 lakh worth inventory and had a share of 68.71 per cent.

It has been observed from the table 5.1 (C) that there was a significant rise in the total inventory held by all the public sector shipbuilding units. The total inventory worth Rs.1,14,001 lakh was held in the year 2001-02. In it, R.6,366 lakh worth inventory was held by GSL and constituted 5.58 per cent. The CIWTC had Rs.888 lakh and constituted 0.78 per cent. The CSL had Rs.3,401 lakh and had share of 2.98 per cent. While GRSE with Rs.22,076 lakh parted the cake and had a share of 19.36 per cent. HSL held Rs.4,355 lakh and had a share of 3.82 per cent. In the same year, HDPE held inventory worth of Rs.1911 lakh and had a share of 1.67 per cent, MDL as in the previous years carried Rs.75,004 lakh worth inventory and had a share of 65.78 per cent of the total inventory held by all the public sector shipbuilding units.

In the year 2002-03, the total inventory of all the public sector shipbuilding units was Rs.1,36,314 lakh of which, GSL carried Rs.14,253 lakh and constituted 10.45 per cent. CIWTC had inventory worth of Rs.1,050 lakh and constituted 0.70 per cent. The CSL had inventory worth of Rs.5,528 lakh and had a share of 4.05 per cent. The GRSE had Rs.30,587 lakh and shared 22.40 per cent.

During the same year, HSL with Rs.4176 lakh occupied a share of 3.06 per cent. HDPE in the same year had the inventory worth of Rs.2,222 lakh and had a share 1.63 per cent. MDL stood first with the highest inventory of Rs.78,498 lakh and constituted 57.58 per cent.

During the period 2003-04, there had been a reduction of 10 per cent approximately in the total inventory held by all the public sector shipbuilding units. The total inventory decreased to Rs.1,23,521 lakh from Rs.1,36,314 lakh of the previous year. There was almost an equal amount of inventory held by GSL with Rs.19,783 lakh. In CIWTC, it had Rs.1,275 lakh. CSL maintained Rs.3,798 lakh. Where as GRSE carried an inventory worth of Rs.31,397 lakh, HSL had Rs.4,079 lakh and HDPE marked Rs.2,767 lakh. In MDL there was a drastic reduction of the total inventory and recorded at Rs.65,623 lakh as against the Rs.78,498 lakh in the previous year. It was a reduction in inventory by about Rs.13,000 lakh.

In the year 2004-05, there has been a significant rise in the inventory of GSL and had Rs.22,738 lakh as against Rs.14,583 lakh recorded in the previous year. Whereas, there was about One-Fifth of reduction of inventory in CIWTC and stood at Rs.1,039 lakh. The CSL had maintained an inventory worth Rs.5,472 lakh, GRSE held almost the previous year's inventory but with an insignificant increase of Rs.1,407 lakh. In HSL, the inventory held was Rs.4,948 lakh. In HDPE, during the same year, it was Rs.3,354 lakh and in MDL, it was recorded at Rs.57,401 lakh. If we put together

inventory held by all the ship building units, it amounted to Rs.1,27,750 lakh.

In the year 2005-06 the total inventory was of Rs.1,63,189 lakh and 28,310, 1,068, 1,654, 44,299, 5,354, 3,660 and 78,814 lakh of rupees worth of inventory was maintained by GSL, CIWTC, CSL, GRSE, HSL, HDPE and MDL respectively. In the following year *i.e.* 2006-07, the inventories held were in the order of 29,457, 1,068, 1,591, 59,924, 5,245, 3,534 and 1,02,806 lakh or rupees by GSL, CIWTC, CSL, GRSE, HSL, HDPE and MDL respectively. The total inventory of all the above shipyards put together was Rs. 2,03,624 lakh.

During the year 2007-08, the total inventory held by all the public sector shipyards decreased to Rs.1,96,185 lakh in which GSL shared an amount of Rs.29,644 lakh, CIWTC parted with Rs.419 lakh, CSL had Rs. 2299 lakh, GRSE carried Rs.73,607 lakh, HSL recorded Rs.5,238 lakh, HDPE registered Rs.3,806 lakh and MDL maintained an inventory worth of Rs.81,172 lakh.

In the last year under study period *i.e.*, during 2008-09, all the public sector shipbuilding units recorded a high ever inventory worth of Rs.2,54,321 lakh of which GSL shared Rs.29,461 lakh, CIWTC carried a least inventory worth of Rs.405 lakh. MDL carried the highest inventory of Rs.1,11,098 lakh followed by GRSE with Rs.98,750 lakh. Whereas, CSL carried inventory worth of Rs.3,415 lakh and in HDPE, it was Rs.3,761 lakh. In HSL, it was witnessed a figure of Rs.7,431 lakh.

During the period under study, the total inventory held by GSL varied in between Rs. 290 lakh and Rs.29,644 lakh. In CIWTC, it varied between Rs.405 lakh and Rs. 1,274 lakh. Whereas, it varied between Rs.1,591 lakh and Rs. 7,744 lakh in CSL. The inventory ranged in GRSE between Rs. 10,601 lakh and Rs. 98,750 lakh. HSL inventory oscillated in the range of Rs. 4,044 lakh and Rs.9,782 lakh. The inventory experienced by HDPE was in between Rs. 1,461 lakh and Rs. 3,806 lakh. In MDL, the variation is between Rs.42,504 lakh and Rs. 1,11,098 lakh. The total inventory held by all the shipbuilding units in the public sector during 1998-99 to 2008-09 was in between Rs. 75,668 lakh and Rs. 2,54,321 lakh.

Table 5.2 (C)

Size of Inventory excluding Work-in-progress and Finished Goods in Public Sector Shipbuilding Units during 1998-99 to 2008-09

(Rs. in lakh)

Year	GSL	HSL	GRSE	MDL	CSL	CIWTC	HDPE	Total
1998-99	495	5628	1780	8844	827	245	371	18170
1999-00	498	2993	2821	14304	1023	263	173	22066
2000-01	818	3418	2982	19274	3606	206	156	29460
2001-02	1752	2999	7159	16817	1178	220	448	30573
2002-03	5572	3740	9938	13999	1228	254	300	35031
2003-04	9783	3639	8464	10515	944	726	422	33493
2004-05	10011	4013	13067	16460	1063	370	422	45406
2005-06	8468	4891	15999	15368	1585	312	598	47221
2006-07	11135	5183	14955	14709	1430	312	541	46565
2007-08	8933	3971	16770	19597	1514	344	572	51601
2008-09	6026	7200	17441	22376	1430	255	402	55130

Source: *Public Enterprises Survey Reports*, Bureau of Public Enterprises, Ministry of Industry, Government of India, New Delhi

The industry witnessed a phenomenal growth as far as total inventory is concerned with 336 per cent hike in the total inventory taking 1998-99 as the base year for this purpose. As against this, the GSL witnessed a 1400 per cent rise in the total inventory held by it. This indicates the poor material management practices in the said shipyard. However, the increase in the inventory might be attributable for other reasons like favourable book order position in various years, the expansion and diversification projects taken by GSL and like.

Table 5.2 (C) shows the size of raw materials, stores items and spares inventory in Goa Shipyard Limited and other public sector shipbuilding units and the industry as a whole. It can be observed from the table that the size of raw materials, stores and spare inventory in Goa Shipyard Limited has gone up from Rs. 495 lakh in 1998-99 to a maximum of Rs.11,135 lakh in the year 2006-07 and thereafter it decreased to Rs. 8,933 lakh in the year 2007-08. It can also be seen from the table that the inventories in GSL have grown gradually upto the year 2004-05 from the year 1998-99. In the year 2005-06, it was only Rs. 8,468 lakh. Thus, the size of inventory varied between Rs. 495 lakh and Rs. 11,135 lakh during the period under study. The inventory in GSL constitute 2.72 per cent of the total inventory held by all the public sector ship building units in the year 1998-99 as far as the raw materials, stores and spares are concerned. While in the year 2008-09, inventory of GSL constituted 10.93 per cent of the total inventory of all the public sector shipbuilding units in the country.

The size of raw material in Hindustan Shipyard Limited (HSL) was of the tune of Rs.5,608 lakh in the year 1998-99 and in the year 1999-2000, it was Rs.2,993 lakh. In the subsequent year, a record low of Rs.348 lakh was held up in raw material, stores and spares inventory. From the year 2001-02, it increased from Rs.2,999 lakh to Rs.5,183 lakh in the year 2006-07. There was a sudden fall in the year 2007-08 and stood at Rs.3,921 lakh. The amount invested in raw materials, stores and spares inventory in HSL varied significantly during the period under study. Finally, it stood at Rs.7,200 lakh in the year 2008-09. In the year 1998-99, the raw material, stores and spares inventory of HSL constituted 30.86 per cent of the total inventory held by all the public sector shipbuilding units. While in the year 2008-09, it was only 13.06 per cent.

In Garden Reach Shipbuilders and Engineers (GRSE), the inventory of raw materials in the year 1998-99, was of the tune of Rs.1,780 lakh and it gradually increased upto Rs.17,441 lakh in the year 2008-09. The raw material, stores and spares inventory of GRSE constituted 9.79 per cent of the total inventory held by all the public sector shipbuilding units in the year 1998-99. It increased to 31.63 per cent of the total inventory of all the public sector shipbuilding units in the year 2008-09.

The same table reveals that the inventory of raw materials was Rs.8,844 lakh in Mazagon Dock Limited (MDL) during the year 1998-99 and it rose to Rs.22,376 lakh in the year 2008-09. It has

been observed that the said inventories are by and large had the same rate of increase in all most all the years except during the years 2002-03, 2003-04 and 2004-05. MDL capacitated 48.67 per cent of the total inventory of public sector shipbuilding units in the year 1998-99 and 40.58 per cent in the year 2008-09.

In Cochin Shipyard Limited (CSL), in the year 1998-99, the inventories of raw materials stood at Rs.827 lakh and it was more than triple in the year 2000-01. From there, it decreased to Rs.944 lakh in the year 2003-04. From then, it gradually increased to Rs.1,514 lakh in the year 2007-08. In the last year of the study, it was found that the inventories held by CSL were only Rs.1,430 lakh. CSL constituted 4.55 per cent in terms of inventories in the total public sector shipbuilding units in 1998-99 and 2.59 per cent in the year 2008-09.

It can be seen from table 5.2(C) that Central Inland Water Transport Corporation had raw materials inventory of Rs.245 lakh during the year 1998-99 and it was Rs.255 lakh in the year 2008-09. There was no drastic increase or decrease of the inventory raw materials, store and spares during the period under study. CIWTC had 1.34 per cent of the total inventory in the public sector shipbuilding units in the year 1998-99 and only 0.46 per cent of the total inventory in the year 2008-09.

As per the table 5.2 (C) the raw materials, stores and spares in Hoogly Dock and Port Engineers limited (HDPE) was Rs.341 lakh in the year 1998-99 and ended with Rs.402 lakh in the year

2008-09. There was a noticeable change in the year 1999-2000 when the inventories fell down by 50 per cent and stood at Rs.173 lakh. The inventory of said kind oscillated between Rs.156 lakh and Rs.598 lakh during the period of study, HDPE constituted to 1.87 per cent of the total inventory of the public sector ship building units during 1998-99 and 0.72 per cent during 2008-09.

Table 5.3 (C)
Raw Materials, Stores and Spares Inventory in Terms of No. of Days Consumption in Public Sector Shipbuilding Units during 1998-99 to 2008-09

Year	GSL	HSL	GRSE	MDL	CSL	CIWTC	HDPE
1998-99	145.6	298.6	179.2	196	270.2	266.4	58.6
1999-00	116.9	209.4	220	590.1	474.5	237.6	63.3
2000-01	482.3	312.6	240.1	740.9	975.6	247.3	156.9
2001-02	405.8	255.8	683.4	338.9	717.6	267.7	259.8
2002-03	1200.3	252.2	471.8	312.6	248.3	237.7	133.8
2003-04	980.1	425.1	389.9	348.5	169.9	325.6	278.5
2004-05	699.4	797.5	543.9	508.4	157	443.6	278.5
2005-06	557.2	1257.5	478.9	367.2	176.1	450.1	371.5
2006-07	566.5	368.7	429.5	254.9	484.7	450.1	336.9
2007-08	406.2	116.1	651.5	353.9	468.4	724.9	1111.6
2008-09	299.4	416.5	1386	665.9	168.3	447.5	494

Source: *Public Enterprises Survey Reports*, Bureau of Public Enterprises, Ministry of Industry, Government of India, New Delhi

The table does not speak of, whether the size of this category of inventory, maintained by shipbuilding units has been excessive or not. For this, it is essential to study the raw materials, stores and

spares of these items in terms of number of days consumption. An attempt has been made in the following paragraphs to calculate and analyse this category of inventory in terms of number of days consumption in GSL and other public sector shipbuilding units.

Table 5.3 (C) reveals the raw materials, store and spares inventory in terms of number of days consumption in Goa Shipyard Limited and other public sector shipbuilding units. It can be seen from the table that the size of this category of inventory in terms of number of days consumption in Goa Shipyard Limited ranged from 142.6 days to 1200.3 days during 1998-99 to 2008-09. It was 142.6 days in the year 1998-99 and there was a slight reduction in the year 1999-2000 with 116.9 days of consumption. It was 1200.3 days in the year 2002-03 and finally stood at 299.44 days of consumption in the year 2008-09. After the analysis of various years' number of days of consumption of this category of inventory, it was found to be highly varying.

In HSL, it started with 298.6 days of consumption in the year 1998-99 and ended with 416.58 days of consumption in the year 2008-09. In between, it recorded a height of 1257.57 days of consumption in the year 2005-06 and it had a record low of 116.16 days of consumption in the year 2007-08.

It can be observed from the table that, in GRSE, this category of inventory in terms of number of days consumption was 179.2 days of consumption in the 1998-99. Gradually, it increased up to

651.49 days of consumption in the year 2007-08. Surprisingly, in the year 2008-09, it went upto 1386.06 days of consumption. There was no significant rise or fall in between 1998-99 and 2007-08.

It can be seen from the same table that, in Mazagon Dock Limited (MDL), there was 195.9 days of consumption of this category of inventory and rose to 740.92 days of consumption in the year 2000-01. Thereafter, it gradually decreased upto 2006-07 and stood at 254.81 days of consumption in the year 2006-07. In the following year, it rose to 353.81 days of consumption and ended with 665.8 days of consumption in the year 2008-09.

It has been found from the same table that, in Cochin Shipyard Limited (CSL), the days of consumption of this category of inventory was recorded at 270.2 days in the year 1998-99. It increased to 975.58 days in the year 2000-01. From there onwards, it fell down to 157 days in the year 2004-05.

It gradually increased from then to 484.69 days in the year 2006-07 and stood at 168.28 days of consumption in the year 2008-09. It can be observed that the days of consumption of this inventory ranged from 157 days to 945.58 days.

In Central Inland Water Transport Corporation (CIWTC), it started at 266.4 days in the year 1998-99 and it reached the highest peak of 724.37 days of consumption in the year 2007-08 and in between, there were some slight changes in the years under study.

Lastly, it recorded 447.48 days of consumption. An all time low was found in the year 1999-2000 with 237.6 days followed by 237.2 days in the year 2002-03.

Hoogly Dock and Port Engineers (HDPE) had the lowest number of days of consumption of this category of inventory with 58.6 days of consumption in the year 1998-99. It reached 1111.59 days in the year 2007-08 and suddenly, it fell down to 493.98 days in the subsequent year *i.e.* 2008-09. It was observed that fluctuations were very high with 58.6 and 1111.59 days. No other public sector shipbuilding unit recorded this kind of highest degree of variations in the days of consumption of raw materials, stores and spares inventory during the period under study.

The Bureau of Public Enterprises norm fixed for this category of inventory is 180 days. However, it was found from the table that there was no single unit having stick-on to the norm prescribed by BPE. Relatively, CIWTC, HDPE, CSL and MDL are maintaining inventory of this kind at a lower rate in terms of number of days consumption, but in non-conformity with the norms prescribed for it. In HSL, GRSE and GSL except in two or three years, the days of consumption of this inventory are abnormally high when compared to the remaining public sector shipbuilding units.

Work-in-progress Inventory

The size of work-in-progress inventory varies from industry to industry, organization to organization depending upon the nature of the product produced, nature of the industry and the length of the manufacturing cycle. The size of work-in-progress inventory is very high in shipbuilding units due to long manufacturing cycle. It will take two to three years to construct a vessel in Indian shipbuilding units. The required materials for constructing a ship are not available domestically. As a result of this, the Indian shipbuilders have to depend on foreign sources for procurement of the necessary materials. In turn, this will push up further the manufacturing cycle. There are situations where ship is ready for delivery at the end of the year, but for some technical reasons, it would be delivered immediately after the expiry of the accounting year and slightly thereafter. In such instances, the almost completed ship is also shown in work-in-progress until the formal delivery is made. Being the construction value of the ship is quite high, the figure viewed in isolation may be interpreted as high work-in-progress though for various justifiable reasons, this aspect cannot altogether be ignored. The size of work-in-progress inventory in GSL and other public sector ship-building units during 1998-99 to 2008-99 can be seen from the table 5.4 (C).

Table 5.4 (C)

Size of Work-in-Progress Inventory in Public Sector Shipbuilding Units during 1998-99 to 2008-09

Year	GSL	HSL	GRSE	MDL	CSL	CIWTC	HDPE	Total
1998-99	3950	4156	8666	51394	5210	551	1143	75070
1999-00	1644	1551	11126	53963	6848	404	1620	77156

2000-01	2986	0	10556	44923	4661	339	1280	64775
2001-02	4614	1436	14917	58187	2231	668	1472	83525
2002-03	8681	428	20649	64499	4300	796	1782	101135
2003-04	10900	440	22933	54908	2854	548	0	92583
2004-05	19719	935	19737	40941	4409	661	2799	128801
2005-06	19842	463	28300	63446	99	756	3062	115968
2006-07	18322	142	44969	88907	165	286	2993	155780
2007-08	20712	1259	52483	61575	785	175	3234	140223
2008-09	23435	231	66326	88722	1983	150	3349	184196

Source: *Public Enterprises Survey Reports*, Bureau of Public Enterprises, Ministry of Industry, Government of India, New Delhi

The work-in-progress inventory of GSL was of Rs. 3,950 lakh in the year 1998-99 and it increased to Rs.23,435 lakh in the year 2008-09. This was only Rs.1,644 lakh in the year 1999-2000 and thereafter, it gradually rose until 2008-09. Thus, the work-in-progress varied drastically from the lowest of Rs.1,644 lakh to the highest of Rs.23,435 lakh. There was a 14.25 fold increase in the quantum of work-in-progress in terms of lakhs of rupees under the period of study.

In HSL, the work-in-progress was of the tune of Rs.4,156 lakh and followed almost one-third of it in the year 1999-2000 and it has become a zero in the year 2000-01. In the year 2001-02, it was Rs.1,436 lakh and from there, there had been a gradual reduction in the work-in-progress and it fell down to Rs.142 lakh in the year 2006-07. It suddenly rose upto Rs.1,259 lakh in the year 2007-08. It suddenly fell down to Rs.231 lakh in the year 2008-09. The fall of work-in-progress in the year 2000-01 may be attributed mainly due to the steps taken by the management in clearing the vessels,

which were under construction. In HSL, the work-in-progress witnessed significant variations from zero to Rs.4,156 lakh. This might be because of fluctuations in productivity caused by power shortages and contributed for the huge work-in-progress in the year 2007-08 and 1998-99.

It can be observed from the table 5.4 (c) that in GRSE, the work-in-progress inventory during 1998-99 to 2008-09 in terms of lakh of rupees was in between 8,666 and 66,326. In the later part of study, *i.e.* from 2004-05 to 2008-09, there was enormous increase in work-in-progress inventory. In the former years, 1998-99 to 2004-05, it ranged between Rs. 8,666 lakh and Rs.22,933 lakh.

The same table reveals that in Mazagon Dock Limited (MDL), the work-in-progress inventory was Rs.51,394 lakh in 1998-99 and raised to Rs.88,907 lakh in 2006-07 and ended with Rs.88,722 lakh in the year 2008-09. The work-in-progress inventory of Rs. 40,941 lakh was recorded in the year 2004-05. This was said to be the record low level work-in-progress inventory in MDL.

The observation of the table reveals that Rs.5,210 lakh worth of work-in-progress inventory was tied up in Cochin Shipyard Limited in the year 1998-99. It fell down to Rs.99 lakh in the year 2005-06 and slowly it rose to Rs.1,983 lakh by the year 2008-09. The work-in-progress inventory in the former part of study period was higher, whereas the later part of the study recorded a lower work-in-progress inventory.

In CIWTC, the work-in-progress inventory was Rs.557 lakh in the year 1998-99. It fell down to Rs.150 lakh by the year 2008-09. This was the lowest ever work-in-progress inventory held by CIWTC. In the year 2002-03, it went upto Rs.796 lakh. Thus, the work-in-progress oscillated between Rs.150 lakh and Rs.796 lakh.

The observations of the table 5.4 (c) reveals that in HDPE, the work-in-progress inventory was of Rs. 1,143 lakh in the year 1998-99. It fell down to zero in the year 2003-04 and thereafter, it gradually rose from Rs. 2,799 lakh in the year 2004-05 to Rs.3,349 lakh in the year 2008-09. The variations of work-in-progress inventory of HDPE were very high and it ranged from zero to Rs.3,349 lakh. The size of work-in-in-progress inventory in the industry as a whole went up from zero to Rs.88,907 lakh during the period 1998-99 to 2008-09 *i.e.* the period under study. In HSL and HDPE, it was 0(zero) in the year 2000-01 and in the year 2003-04 respectively. The MDL was carrying the largest work-in-progress inventory held by it in terms of lakh of rupees during the said period followed by GRSE. CIWTC and HSL carried less amount of work-in-progress inventory during the same period.

Table 5.5 (C)

**Work-in-Progress of Number of Months Cost of Production in
The Public Sector Shipbuilding Units
during 1998-99 to 2008-09**

Year	GSL	CIWTC	CSL	GRSE	HSL	HDPE	MDL
1998-99	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

1999-00	6.5	2	20.5	13.13	1.6	9.3	21.3
2000-01	17.7	1.6	9.9	15.4	0	14.6	19.3
2001-02	14.8	3	3.9	15.6	1.2	12.5	17.6
2002-03	22	2.8	4.6	15.1	0.3	10.4	19.9
2003-04	21.6	1.6	3.7	16	0.3	0	21.7
2004-05	20.2	1.9	4.8	11.8	0.6	0	16
2005-06	22.7	2	0.1	15.2	0.6	15.9	14.3
2006-07	19.2	2	0.2	24.9	0.1	14.9	19.4
2007-08	19.4	0.4	1	32.6	0.4	19.5	13.5
2008-09	20.3	0.3	1.9	43.9	0.1	18.2	27.6

N.A.: Not available

Source: *Public Enterprises Survey Reports*, Bureau of Public Enterprises, Ministry of Industry, Government of India, New Delhi

Table 5.5 (C) shows work-in-progress in number of months cost of production during 1998-99 to 2008-09 of all the public sector shipbuilding units. The information pertaining to 1998-99 was not available and in 1999-2000, for GSL it was 6.5 months, 2.0 months for CIWTC, 20.5 months for CSL, 13.13 for GRSE, 1.6 months for HSL, 9.3 months for HDPE and 21.3 months for MDL. It has been observed that the work-in-progress of number of months cost of production in the year 1999-2000 varied from 2.0 months to 21.3 months.

During the year 2000-01, work-in-progress of number of months cost of production in GSL was recorded at 17.7 months, 1.6 months for CIWTC, 9.9 months for CSL, 15.4 months for GRSE, zero for HSL, 14.6 for HDPE and 19.3 months for MDL. In this respect, HSL stood at zero which is a noticeable feature where

MDL stood at 19.38 followed by GSL with 17.7 months. The lowest number of months can be seen in CIWTC with 1.6 months.

The work-in-progress of number of months cost of production in the year 2001-02 ranged between 1.2 months to 17.6 months. It was 14.8 months in GSL, it was 3 months in CIWTC, it was 3.9 months in CSL. Whereas, in GRSE it was 15.6 months, 1.2 months in HSL 12.5 months in HDPE and 17.6 months in MDL.

In the year 2002-03, the work-in-progress of number of months cost of production ranged between 0.3 months and 22 months. In this year, GSL had the highest number of months cost of production in this category of inventory. It was followed by MDL with 19.9 months. It was 15.1 months in GRSE. In the remaining shipyards, this index recorded below ten months.

In the year 2003-04, HDPE with zero index of this work-in-progress cost of production was recorded. Similarly HSL stood at a meagre index of 0.3 months. Next to HSL, came CIWTC with 1.6 months. Followed by it, CSL stood at 3.7 months, GSL stood at its highest of 21.6 months which is almost equal to previous year's index. MDL recorded 21.7 months.

Again in the year 2004-05, HDPE stood at zero index followed by HSL with 0.6 months and GSL kept it at 20.2 months. MDL stood at 16 months, CIWTC stood at third place from lower bottom of zero with 1.9 months followed by CSL with 4.8 months.

During the year 2005-06, the index ranged between 0.1 to 22.7 months and the GSL had the highest months of 22.7 and CSL had the lowest with 0.1 month. HSL followed CSL with 0.3 months. Next to it, CIWTC stood at third place with 2 months. The remaining three shipbuilding units stood equal with about 15 months.

During the period 2006-07, GRSE had the highest index with 24.9 months work-in-progress of cost of production. HSL stood at the lowest with 0.1 month. Followed by it, CSL came out with 0.2 months and next to it CIWTC with 2 months, HDPE with 14.9 months and the remaining two shipyards had 19 and odd months.

CIWTC, in the year 2007-08, recorded a minimum of 0.4 months and HSL also sailed on the same boat with 0.4 months. Followed by these two, CSL recorded one month in the same period. But surprisingly, GSL maintained almost the same as in the previous year. GRSE stood first with 32.6 months and the remaining two shipyards *i.e.* HDPE and MDL had 19.5 months and 13.5 months respectively.

The GRSE and its work-in-progress of number of months of cost of production is the highlight of all the years under study as it stood first with all time high of 43.9 months in the year 2008-09. The HSL, CSL and CIWTC witnessed a low of two months. The GSL maintained almost equal to the earlier year's months with

20.3. Followed by it, the MDL experienced 27.6 month in work-in-progress of number of months cost of production.

Except in the year 1999-2000, the GSL maintained more or less equal number of months as far as work-in-progress of number of months cost of production was concerned. Whereas, CIWTC varied in this respect from 0.3 to 3 months during the said period. The CSL witnessed a low of 0.1 and a high of 20.5 months during the period under study. GRSE maintained a low of 11.8 months and a high of 43.9 months. For some reason or other, HSL experienced zero month in the year 2000-01 and it oscillated by zero and 1.6 months. Whereas, HDPE experienced zero months twice *i.e.* in 2003-04 and 2004-05. It reached the highest of 19.5 months in the year 2007-08. Except in the year 2007-08 and 2005-06, the MDL maintained above 15 months and below 27.6 months during the period under study.

The Bureau of Public Enterprises norm fixed for this category of inventory is 180 days. However, it was found from the table that there was no single unit having stick-on to the norm prescribed by BPE. Relatively, CIWTC, HDPE, CSL and MDL are maintaining inventory of this kind at a lower rate in terms of number of days consumption, but in non-conformity with the norms prescribed for it. In HSL, GRSE and GSL except in two or three years, the days of consumption of this inventory are abnormally high when compared to the remaining public sector shipbuilding units.

Table 5.6 (C)

The Position of Inventory Turn over in Public Sector Shipbuilding Units during 1998-99 to 2008-09

Year	GSL	HSL	CIWTC	GRSE	CSL	HDPE	MDL
1998-99	0.5	1.14	0.29	0.72	0.5	0.92	0.53
1999-00	2.58	2.22	2.58	0.4	0.11	0.56	0.38
2000-01	0.12	1.94	2.2	0.6	0.61	0.85	0.53
2001-02	0.36	2.13	0.21	0.33	1.62	0.55	0.29
2002-03	0.08	3.1	1.47	0.36	0.51	0.49	0.43
2003-04	0.24	2.33	0.88	0.52	2	0.14	0.61
2004-05	0.29	1.65	1.3	0.69	0.89	0.37	0.76
2005-06	0.12	1.89	1.25	0.31	7.72	0.31	0.37
2006-07	0.49	3.89	1.25	0.09	4.24	0.42	0.29
2007-08	0.44	4.88	4.2	0.13	3.94	0.11	1.02
2008-09	0.45	2.42	3.13	0.08	3.28	0.11	0.08

Compiled from *Public Enterprises Survey Reports*

Table 5.6 (C) gives the position of the inventory turnover in all the public sector shipbuilding units during 1998-99 to 2008-09. The position of inventory turnover ratio in Goa Shipyard Limited during 1998-99 to 2008-09 has 0.5 inventory turnover in the year 1998-99 and there was a drastic increase in it and witnessed a turnover of 2.58. It never touched an inventory turnover of one during the remaining period of study. In the year 2000-01, it was 0.12 and 0.3 in the year 2001-02. In the year 2002-03, it witnessed an ever-lowest figure of 0.08 and in the subsequent year, it was 0.24. In the immediate next year, it was 0.29 and it fell down to 0.12 in the year 2005-06. In the year 2006-07, it again witnessed a sharp rise in the turnover ratio with 0.49. The year followed by it

experienced turnover ratio of 0.44 and in the last year of study *i.e.* 2008-09, it stood at 0.45.

In case of HSL, the highest turnover of 4.88 is recorded in the year 2007-08 and fell down to half of it with 2.42 months in the year 2008-09. The CIWTC witnessed a turnover ratio of 4.2 in the year 2007-08 and decreased to 3.13 in the year 2008-09. Similarly, the turnover of 0.13, in the year 2007-08, was recorded with GRSE and later fell down to 0.08 in the year 2008-09. The CSL with 3.94 inventory turnover ratio in the 2007-08 declined to 3.28 in the 2008-09. During the same period, HDPE maintained the same level of inventory turnover of 0.11 in the years 2007-08 and 2008-09. In case of MDL, in the year 2007-08, it was recorded an inventory turnover of 1.02 and it had only 0.08 in the year 2008-09.

The overall situation as far as the inventory turnover is concerned, was grim during the period under study. As such, all the units in industry should, therefore, try to achieve a higher degree of inventory turnover in order to achieve higher efficiency and thereby profits. On the other hand, minimize operational losses incurred by the majority of the public sector shipbuilding units in the country.

The norm fixed by Bureau of Public Enterprises (BPE) for this inventory turnover is 4-6 times in a year. If we compare the actual turnover ratios, there are 3-4 years in which very few

shipyards reached the norm. In all the remaining years, the turnovers are far below the norms.

The higher the ratio, the higher will be the efficiency indicating the effectiveness of techniques used for inventory control. A slow turnover is a bane to the organization as it results in over investments in inventories. On the other hand, rapid turnover contributes to the higher capital turn over. The ratio varies from industry to industry, organization to organization, however one has to ensure that it is progressively raised. If we observe the table, the position of inventory turnover in public sector shipbuilding units, it had been progressively declining towards the end of the study period.

(D) Summary

Inventory management is an integral part of materials management and it plays a significant role in the smooth and economic running of an industrial unit. The rapid industrialization in our country brought enormous problems of management. Inventory management is on such problem. India is not in a position to exploit the resources available. That is why there is a need to increase productivity with the limited resources available. It is in this context, effective and efficient inventory management assumes greater importance.

In order to achieve higher efficiency in an organization, reduction of capital locked up in inventories is very much

essential. Inventories involve locking up of capital. That is why proper care must be taken in dealing with the inventory.

Inventory includes raw materials, consumables, spare parts, processing materials, stores items, fuels and finished goods. There always exists some time lag between the procurement of materials and their consumption in the production process of an organization. Hence, inventory of materials is needed in almost all the manufacturing organization.

Inventories account for major portion of working capital of an industrial unit. Because of this, predominant position in total working capital obviously witnesses for maximum efficiency in their management. Inventories can be classified basing on the usage and point of entry into operations. They are special items, standard industrial items and maintenance and repair items.

Inventory requires some capital outlay to invest but it is difficult to realize money from the sale of inventory and not like the money deposited in a bank. The structure of the inventory of the public sector undertakings can be classified into five categories. They are raw materials, goods-in-process, finished goods, stores and spares and miscellaneous items.

The structure of inventory of the shipbuilding industry in the public sector can be studied by classifying their total inventory

into three categories namely (a) raw materials, stores and spares (b) work-in-progress inventory, and (c) finished goods inventory.

Table 5.1 (C) disclosed the total inventory held by all the public sector shipbuilding units during the period 1998-99 to 2008-09 in lakh of rupees. During the year 1998-99, the total inventory was recorded as Rs.75,668 lakh held by the entire public sector shipbuilding units. In the year 2008-09, it stood at Rs.2,54,321 lakh of which GSL shared Rs. 4,425 lakh in 1998-99 and Rs. 29,461 lakh in the year 2008-09.

Table 5.2 (C) shows the size of inventory excluding work-in-progress and finished goods in all the public sector ship- building units for the period 1998-99 to 2008-09 in lakh of rupees. This category of inventory stood at Rs.18170 lakh in the year 1998-99 and Rs. 35,130 lakh in 2008-09 of which GSL held Rs.475 lakh of this kind of inventory in the year 1998-99 and it was Rs. 6,026 lakh in the year 2008-09.

Table 5.3 (C) reflects the size of raw materials, stores and spares inventory in terms of number of days consumption in GSL and other public sector shipbuilding units. In GSL, the size of this category of inventory ranged from 142.6 days to 1,200.3 days during 1998-99 to 2008-09. The GRSE stood at the highest with 1,386.6 inventory in terms of number of days consumption.

Table 5.4 (C) highlights the size of the work-in-progress inventory in public sector shipbuilding units during 1998-99 to 2008-09 in lakh of rupees. The total inventory of this kind was

amounted to Rs.75,070 lakh in the year 1998-99 and the worth of the same inventory in the year 2008-09 was Rs. 18,4196 lakh of which GSL shared Rs. 3,950 lakh in the year 1998-99 and Rs. 3,435 lakh in the year 2008-09.

Table 5.5 (C) presents the work-in-progress inventory of number of months cost of production of all the public sector shipbuilding units during 1998-99 to 2008-09. The GSL had the lowest work-in-progress inventory of number of months cost of production in the year 1999-2000 with 6.5 months. In the year 2005-06, it reached a peak of 22.7 months. Whereas, in CIWTC, it varied between 0.3 months and 3 months. In case of CSL, it ranged between 0.11 and 20.5 months. In GRSE, it ranged between 11.8 months and 43.9 months. In HSL, the range was zero to 1.6 months. HDPE had a range between 0.02 months and 19.5 months. In MDL, it lied between 13.5 months and 27.3 months. In all the years put together, the GSL was placed in the fifth position as far as the highest work-in-progress is concerned with 22.7 months of cost of production.

Table 5.6 (C) disclosed the inventory turnover in all the public sector shipbuilding units including GSL during 1998-99 to 2008-09. In the year 1998-99, it recorded an inventory turnover of 0.5 and it increased upto 2.58 in the subsequent year and in the later part of the study period, it fell down to 0.45. This indicates the poor inventory practices, over-stocking of raw materials and other inventories in GSL. Whereas, in HSL, it registered a high inventory of 4.88 in the year 2007-08. In CIWTC, the highest record

of the turnover was 4.2 in the same year. GRSE had its credit to the lowest of the lowest turnover with 0.09 in the 2006-07. On the other hand, the CSL stood first in this respect with 7.72 inventory turnover in the year 2005-06. The remaining two shipyards, HDPE and MDL never crossed the inventory turnover of 'one' during the period under study.

The situation was very grim during the period of study and as such, there is an urgent need on the part of industry to try to achieve a higher degree of inventory turnover in order to achieve higher efficiency and to minimize operational losses.

Chapter-VI

Summary of Findings, Suggestions and Conclusion

Inventory Management

The term 'inventory' is nothing but a stock of goods that is maintained to facilitate the continuous production of goods and services. S.E. Bolten observes, "The term 'inventory' refers to the stockpile of the product a firm is offering for sale and the components that make up the products." In other words, it can be said that inventory is composed of assets that will be sold in future in the normal course of the business operations.

The assets which firms store as inventory in anticipation of need are (1) raw materials, (2) work-in-process (semi-finished goods), and (3) finished goods. The raw material inventory contains in terms that are purchased by the firms from others and are converted into finished goods through the manufacturing process. The work-in-process inventory consists of items currently being used in the production process. Finished goods represent final or completed products that are available for sale. The inventory of such goods consists of items that have been produced but are yet to be sold. To expand the definitions of inventory to fit manufacturing companies, it can be said that inventory means, "The aggregate of those items of tangible personal property which (1) are held for the ordinary course of business; (2) are in process of production for such sales; and (3) they are to be currently

consumed in the production of goods or services to be available for sale.”

Inventory is called the “Graveyard of business” because it has been a basic cause of the failure of many organizations. Inventories constitute the most significant part of current assets of a large majority of companies. Because of the large size of inventories maintained by the firms, a considerable amount of funds is required to be allowed to them. It is, therefore, absolutely imperative to manage inventories effectively and efficiently in order to avoid unnecessary investment. A firm neglecting the management of inventories will be jeopardizing its long run profitability and may fail ultimately. So, in order to manage the inventory properly, a need for inventory management arises.

Inventory management is concerned with the determination of the optimal level of investment for each component for each component of inventory and the inventory as a whole, the efficient use of the components and the operation of an effective control and review mechanism. The management of inventory requires careful planning so that both the excess and the scarcity of inventory in relation to the operational requirement of an undertaking may be avoided. Therefore, it is essential to have a sufficient level of investment in inventories.

Inventory management helps to manage stock in such a manner that there are no excessive and inadequate levels of inventories and a sufficient inventory is maintained for the smooth

production and sales operation. Thus, the objective of inventory management is to determine the optimum level of inventory.

Inventory control refers to a system, which ensures the supply of required quantity and quality of inventory at the required time and at the same time prevents unnecessary investment in inventories. According to P.K. Ghosh and G.S. Gupta, "Inventory control is concerned with the acquisition, storage, handling and use of inventories so as to ensure the availability of inventory whenever needed, providing adequate cushion for the contingencies, deriving maximum economy and minimizing wastage and losses."

Inventory control is concerned with keeping the desired inventory level and maintaining it. Its basic objective is to keep an adequate inventory level and maintaining it at the minimum inventory carrying cost. The aim of inventory management, thus, should be to avoid excessive and inadequate levels of inventories. Efforts should be made to place an order at the right time with the right source to acquire the right quantity at the right price and quality.

The norms of inventories could be set by either the top management, or by the materials department. The top management usually sets monetary limits for investment in inventories. The materials department then has to allocate this investment to the various items and ensure the smooth operations of the concern. It would be worthwhile if norms of inventories were set by the 'Management by Objectives' concept. This concept

expects the top management to set the inventory norms in consultation with the materials department.

Carrying too much or too little of the inventory is detrimental to the company. If too little inventories are maintained, the company will have to face frequent stock-outs and incur heavy ordering costs. Very large inventories subject the company to heavy inventory carrying costs in addition to unnecessary tie-up of capital. An efficient inventory management, therefore, requires the company to maintain inventories at an optimum level where inventory costs are minimum and at the same time there is no stock-out that may result in loss of sale or stoppage of production. This necessitates the determination of the minimum and the maximum level of inventories.

As we have now approached the twenty-first century, inventory management will assume increasing importance in the industrial world. To date, only the most progressive manufacturing firms realize that materials availability, engineering, purchasing, specifications and fabrication costs are all factors which ultimately contribute to total material cost. Progressive firms also realize that all factors which affect material cost should be coordinated and controlled by a system-oriented inventory management approach, if the total materials cost is to be minimized. The factors just mentioned, coupled with the fast increasing use of computer-based information systems, increasing international business activity and growing materials shortages

highlight the importance and opportunities for sophisticated management in this area.

Inventory management has a significant role in the Indian economy. In several industries more than 50 per cent of the total cost of the product or the job is generally the cost of materials alone. Unfortunately, the importance of proper materials management has not been fully realized in India and very little attention has so far been paid to the task of controlling investment in materials through the application of various scientific techniques. In contrast, advanced countries of the West and Asian countries like Japan have made gain strides in the successful use of inventory management techniques.

In view of the above reasons, it has become all the more important to study inventory management of the Shipyard Industry of India.

The shipbuilding industry in India has a chequered history throughout centuries. It declined almost to the point of extinction during foreign rule and revived after the establishment of national government in India (Sahai. IM, 1971). In India, ships building and shipping industries have had an unbroken tradition exceeding over 6,000 years dating back to Mohonjodara and Harappan period. It takes us to distant past when art of building ships had reached high degree of development, centuries before it had a beginning in other parts of the then known world. The oldest evidence is supplied by the *Rigveda* (1500 B.C.) that contains several references about the construction of ships in India in those

age-old centuries (V.C.S. Sastry, 1962). The Maurya period, which roughly coincides with the Indian campaign of Alexander the great (327 B.C.) saw considerable development in this industry. The industry was flourishing, its output and employment potential also was very high. According to Strabo (60 B.C. to 19 A.D.) for example, Alexander constructed fleet with the help of Indian artisans, from pine cedar and other trees obtained from the forest in the territory of King Poras.

There were a number of shipbuilding yards, the most important being at Hoogly, Balasur, Murgangi, Chilmiri, Jessori, and Karibari. Abul Fazal said that in the province of Sindh, the Sarkar thatta alone could provide 40,000 vessels ready for hire. Under Shivaji, the Marathas built a formidable fleets. He established shipbuilding yards first at Kolava, Suvarna Durg, and Vijaya Durg, and later at Bombay in 1735. In addition to these, there were six other managed by Parsi forms, ships built at these yards weighed from 600 tonnes to 1,300 tonnes.

Ship building in India is not a new industry but has long history. Long before the European powers came to India, Indian mariners had carried India's trade with South-east Asia and established a thriving trade partnership with east and west. The East India Company recognizing the excellence and durability off ships built in India established several shipbuilding yards in India. Between 1800 A.D. and 1840 A.D. a large number of naval crafts and merchants were built in the shipyards. However, the increase of power and entrenched authority of the British rule in India

brought about accelerated decline in Indian ship-building and shipping industry to serve the interest of their own relevant industries.

Shipbuilding is a unique industry, which is both capital and labour intensive. Huge amounts of investments are necessary to setup facilities of shipbuilding. Unlike process industries, shipbuilding involves deployment of sizeable labour force and managerial personnel. The government has invested significant amount of money in this priority sector. In the Indian shipbuilding scenario, public sector occupies a predominate role. The shipbuilding industry has been reserved for the public sector in terms of Industrial Policy Resolutions of 1948 and 1956. However, the private sector is allowed to construct “mechanized sailing vessels” up to 10,000 dwt. The role of private sector is to supplement the efforts of the state in this activity. At the end of 31st March, 1997, there were seven public sector shipbuilding units in the country engaged in manufacturing, selling, repairing of warships, repairing of cargo ships, passenger ships, tugs, barges, trawlers, assault boats, floating docks and dredges etc.

Of these seven shipyards, GRSE Limited, Kolkata, MDL Mumbai, GSL, Goa are under the administrative control of department of defence production, ministry of defence. These shipyards are mainly intended to cater the requirements of the Indian navy, but a part of their capacity is also available for construction of other types of vessels. The remaining four shipyards CSL, Cochin, CIWTC Limited, Kolkata, HDPE Limited,

Kolkata, HSL Visakhapatnam are under the administrative control of ministry of surface transport.

Among the number of managerial problems one of the most important problems bothering the executives is the problem of inventory management. In a developing economy like ours, capital resources are limited. Hence with the limited capital resources, every company has to increase their production. In this effective inventory management assumes great importance. Reckless management of inventory has wrecked many otherwise prosperous units in any economy. The problem to be investigated in this study comprises grave consequences such as colossal waste of inventory, erosion of profitability and liquidity, decreasing production, problems in the storage, identification and distribution uncertainty about the time when materials are needed and quantity required problems in converting requirement estimates into provisioning quantities, problem in procurement, inferior quality of materials etc.

Objectives of the Study

The objectives of the study are:

1. to find reasons for low capacity utilization and to give practical solutions to overcome this problem.
2. to suggest ways and means to increase the return on investment.
3. to suggest certain techniques to increase the overall efficiency.

4. to suggest scientific inventory management tools and techniques to overcome the present problems in inventory management.
5. to suggest certain techniques to reduce material cost and cost of production.

Scope

The study has been covered the major units like Goa Shipyard Limited, Central Inland Water Transport Corporation, Cochin Shipyard Limited, Garden Reach Shipbuilders and Engineers Ltd., Hindustan Shipyard Ltd. and Mazgaon Dock Limited.

A comparative study of the above units has been made to suggest corrective measures.

The study has been mainly concentrated on inventory management. The functioning of stores and purchase departments has also been covered by this study. Wherever necessary, the information was obtained by other functional heads like factory accountant, planning engineer, production manager etc. The study has also been focused on production and finance department at appropriate places.

Hypothesis

Mismanagement of inventories and the irregular supply of the critical parts when they are needed is being mainly responsible for the unsmooth and irregular production by the various

shipyard companies in India. Therefore, proper and efficient management of inventories is of utmost importance. Unfortunately, there are several weaknesses in the existing practices of inventory management which until recently had been left entirely unbridled. The rationale for norms and the need to link inventory management requirements is, thus, clear. Eventually, the entire system of material planning is to be dovetailed, to create better management of inventories.

Research Design and Methodology

Methodology includes use of statistical techniques, inventory control techniques included various analysis.

Tools to be Used in the Collection Data

Primary Data - A questionnaire to be issued to the units covered to elicit relevant data from personal interviewing of executives, Planning commission and other concerning government officers of the related departments, academicians and financial analysis in real life setting.

Secondary Data - Annual reports and financial statements of the selected companies, inventory and financial statistics from various journals, periodicals, newspapers and reports, Economic Survey, Journal of Accounting and Finance, margin, productivity, the Material Management journals. *The Economic Times* and *Financial Express* etc., books and various publications of financial

institutions and Reserve Bank of India, published and unpublished works of research scholars and available studies.

The present study is expected to reveal the latest facts regarding the inventory management practices prevailing in units under the study. To high light the malpractices which are responsible for the mismanagement of inventories and spare units. To expose the problems confronted in the context of prevent inflation shortage of funds and credit squeeze policies of Reserve Bank of India. To develop feasible solutions to alleviate genuine difficulties experienced by the Inventory Managers in all the plants in the management of inventories, such as uncertainty about the time when spare-parts are needed and quantity required, problem converting requirement estimates into provisioning quantities, problem in procurement, storage identification and distribution. The study aims to find out the solutions of the basic problems arising in the management of inventories. For example, what should be the level of inventory for a particular item that a unit should carry or how much should one procure in a lot. Replacement time is not constant but fluctuates, resulting in stock-out situation. Every company/plant must minimize such a situation. If the spare parts and other items of inventory are to be purchased, when to order and how much to order. Finally, the study aims to develop some new models of inventory management and to try to improve the existing practices in the management of inventories.

Review of Literature

The purpose of this chapter is to present a review of literature relating to inventory management. Inventory, is most of the industries, accounts for the largest proportion of growth working capital. A number of studies, therefore, have been conducted to find the determinants of investment in inventories.

A good number of studies have been carried out in this area. However, as far as the shipyards industry in India is concerned, the literature on this subject is inadequate. But in recent years the mounting accumulation of inventories in public sector and private sector made them to realize the importance of the inventory management. Very few number of researches of studies have been conducted at various institutions and in universities which projected some problems faced by the public sector units and managed by both the central and various state governments.

All the above research studies conducted at various universities in India and other published research studies and surveys in this area and text books brought out and research papers published in journals, newspapers etc., revealed that the various facets of materials management have not been fully developed and are not satisfactory. There is no common opinion on what functions have to be covered under the preview of materials management. Even the method, techniques, procedures and systems suggested by various authors to control the inventories varied widely. However, the materials management has been identified as the most potential area of prime importance

to increase the productivity and efficiency of an organization. Even then, serious attempts of research have not been made in this area. The present study has been to some extent able to highlight the importance of the materials management as one of the important functional areas in an industry like shipbuilding.

Stores Organization and Quality Control

Actual procurement, storage and preservation activities form the last link in the material management process. Quality Control of raw materials, storage of materials, parts and supplies are an integral part of the process by which the supply department maintains a non-stop flow of the items maintained from the points of supply from outside the organization to their points of usage in the organization.

The stores management plays a crucial role in smooth running of an organization. The purpose of the stores is to provide uninterrupted material flow to the work-sights of the various departments in the organization. By this, one can understand that the stores are not just a dumping yard but an important element of the economy of the business organization.

The stores management assumes greater importance in the Indian context because of the stiff supply positions of various scarce materials. The blocking up of investments in huge amounts in inventories in the Indian industry attracted the Government of India and appointed Tandon Committee to recommend steps to reduce inventories in Indian industries.

The stores organization is responsible for receipt, standardization, identification, general inspection, and levels of stock of the incoming materials. Besides these responsibilities, preservation, storage, distribution and disposal of various materials are also held by it. The stores location and layout have a bearing on the organizational effectiveness. Locating the stores, proximity to user departments is a general practice to minimize transportation and other handling expenditure and to ensure timely supply of the necessary material.

The ship building industry is basically an assembling industry and which requires over 20,000 items to put in the construction of the ship. These items need to be procured, stored and maintained by the stores until the materials are issued to the various user departments at various time periods.

The stores organization of the selected shipyard companies along with the roles and positions is given in the chart 3.1 which tells about various sections and the roles of these sections along with the number of officers and assistants.

The stores organization in the selected shipyard companies is headed by officer-in-charge (stores) who is responsible directly to the General Manager (commercial). In turn, the General Manager (commercial) is responsible to Chairman-cum-Managing Director. Under officer-in-charge (stores), there are three different section-in-charges and are responsible for various functions of stores organization. The officer-in-charge (stores) is in the cadre of Deputy General Manager and the section-in-charges are in the

cadre of Senior Manager. Under these three section in-charges, there are five dealing officers, 58 storekeepers and equal number of stores attendants and mazdoors.

The procedures followed in respect of receipt of materials involves the physical inspection of the material received and to examine the quality and quantity against the specifications made in the purchase order and this is to ensure the suitability of the material for the requirements of the companies and to know whether the supplier fulfilled the terms and conditions laid down or not.

The stores section after careful inspection of the materials received, needs to make arrangements for the quality control check which is going to be done by quality assurance section of the selected shipyard companies. The selected shipyard companies have decentralized material receipt centres because it has four to five store yards located at a distance of two to five kilometers from the shipyard premises. These decentralized receiving centres ultimately necessitated to have more number of people to carry out the job of receiving materials.

If any deviation in the quality and quantity of the material ordered and received is found, it will be kept in abeyance till the supplier rectifies the discrepancy. In case of other materials, which satisfies the stores receipt centre, the items received are recorded in the ledger and the incoming material particulars are fed to the computers simultaneously. Afterwards, the receiving officer prepares a goods receipt note. In case of rejections, if any, the

shipyard companies have a practice of informing it to the supplier within 15 days from the date of receipt of it by the selected shipyard companies.

Due to decentralization of all the stores in the premises of the selected shipyard companies, they are forced to receive the materials at stores located at different places which are away from two to five kilometers. Eventually, the location of stores at different places gives rise to certain problems like higher transportation costs, poor delivery of materials, communication problems and other associated problems. To exercise control over the materials, it is necessary to locate all the stores at one place, as such, it is suggested that the selected shipyard companies should take necessary steps to locate all the stores in the premises of shipyard companies under review itself.

The materials used in ship construction are expected to work in a different climate on the seas and they need to withstand for the sea weather conditions. Marine equipment is different from the equipment used in other industries as their usage is on surface.

Storage, Distribution and Disposal Management

Since material stored is equivalent to cash and forms a major part of the total product cost, it is essential that the material should be properly accounted for and safe guarded in an efficiently and organized stores. With a judicious and proper control of management of stores, one can minimize the losses due to the obsolescence, pilferage, excess storing, etc.

Preservation of items in the space provided in the stores is of great importance because floor space accommodation is a costly affair. Keeping of items at various places in stores, particularly the slow moving and non-moving items is an important job. But often this is given least importance in Indian industry.

To have an effective storage programme, factors such as nature of the item, codification of the item, the expected idleness, economic value of the item and the need for protection should be taken care of. To identify the item in an easy way on the shelves and racks, it is necessary to have good lighting.

The stores section which is a part of commercial department in the selected shipyard companies has to maintain good relationship with branches of its own other departments in the organization. The stores and purchase sections' functions are complimentary and close cooperation between these two sections will result in better standardization, codification, value analysis, variety reduction, inventory control, salvage, disposal of obsolete and scrap. Even in the absence of integrated materials management in the selected shipyard companies, the stores and purchase sections have close cooperation and co-ordination.

The stores section is responsible for the issue of materials to various departments and sections in the selected shipyard companies. Basing on the bill of materials, work order, material requisition notes, the stores personnel need to issue the material as prescribed in the authorized documents as mentioned above. While delivering the quantities of material, the personnel in stores

section, enter an entry in the books of stores and also an entry has to be made in EDP.

The two basic documents, which are supposed to be maintained by the stores section, are receipts and issues. They are being maintained in proper and pucca manner. However, it is noticed that there is a good number of discrepancies in stores section and this can be avoided by taking certain measures like tallying the material regularly and periodically from time to time. The store is expected to maintain documents like bincard, kordex, obsolete items, rejected items, suppliers index, indents and bills of materials.

Even after the computerization of the stores section, the selected shipyard companies are depending mostly on manual documents because of the poor reliance and inexperienced people working in the EDP section. For this, the selected shipyard companies should arrange for training in the area of material information system of EDP people and thereby minimize the expenses of maintaining both.

Surplus obsolete and scrap items management assumed tremendous importance in the materials management activities. Surplus originates from three sources namely scrap, obsolete materials and damaged equipment. Holding these items is costly to the organization. These costs include carrying charges, cost of maintaining the records, loss of the use of capital held up in inventories. In view of this, special efforts need to be made to avoid keeping them.

In Indian scenario, the first estimate was provided by the then Finance Minister, Mr. C. Subramaniam, who mentioned on December 10th, 1974 that the amount of money blocked in obsolete and surplus material was about Rs. 2,500 crore in India and it is expected to be Rs. 50,000 crore.

There are three methods of disposal of surplus, obsolete and scrap items. They are (a) annual rate contract, (b) inviting offers from time to time, and (c) public auctions.

Table 4.2 presents the percentage of disposal surplus and scrap of all items to the income generated by the sale of such items during 1998-99 to 2008-09. After observing the percentage of disposed surplus against the identified disposable surplus, it is suggested that the selected shipyard companies should establish a separate section under the overall control of General Manager (Commercial) to identify, locate, value, and initiate steps to dispose off the unwanted material and scrap at an early date so that the realization value may be put for some other productive purpose.

Critical Evaluation of Inventory Practices

Inventory management is an integral part of materials management and plays a key role in the smooth, economic and uninterrupted running of the industry. The rapid industrialization with the industrial resolution policies of Government of India brought enormous problems of management. Inventory management is one such problems. To have higher operational efficiency and profitability of an organization, reduction of the

capital locked up in inventories is very much essential. The same will help in improving the liquidity position of the enterprise. As inventories. Involve locking up of capital, proper care must be given in dealing with the problem of inventory management. The sum of the value of the raw materials, fuels and lubricants, consumable's spare parts, processing material and finished goods are called as inventory.

The basic objectives of inventory management would be to keep down capital investment at a minimum level in inventories without endangering the process of manufacturing, to minimize the idle time of men, machinery and capital caused by shortage of various kinds of materials, to reduce the costs in maintaining the inventory and to minimize the losses of obsolescence. Inventories account for a major portion of working capital of an industrial unit. The predominant position in the total working capital, obviously warrants for their maximum efficiency. Thus, inventory management should aim at balancing between too much inventory and too less inventory. A firm cannot afford either excessive or shortage of inventory. To achieve higher degree of operational results, it is inevitable to maintain effective control and management of inventories.

The structure of inventory of the public sector undertakings can be studied by classifying their total inventory into five categories: Raw materials, goods in process, finished goods, stores and spares and miscellaneous items. The structure of inventory can be analysed in two ways. First, the share of each component of

inventory is in relation to aggregate inventory. Secondly, appropriate indicators about adequacy or inadequacy of each type of inventory may be developed and applied to capital positions obtained in public sector enterprise.

The structure of inventory in Goa Shipyard Limited and other public sector ship building units is explained in two ways. (1) The share of each component of inventory to the total inventory. (2) A level of each inventory component in terms of number of month's consumption, number of months cost of production and number of months sales. The former reflects the points where the inventory is concentrated most, while the later directs as to when and where the inventories are high and low when compared to the norms fixed for them.

The size of total inventory in Goa Shipyard Limited was of the tune of Rs.4425 lakh in the year 1998-99 and suddenly fell down to Rs. 2090 lakh in the year 1999-2000. Gradually, it increased year after year up to the end of 2008-09. In the last three years, it registered a total inventory of Rs. 29500 lakh in each year. The work in progress and finished goods in Goa Shipyard Limited in the year 1998-99 was of Rs.475 lakh and it reached the maximum of Rs.11135 lakh in the year 2006-07 and declined to Rs.6026 lakh in the year 2008-09. This reduction reflects the efficiency of policies and procedures of the commercial department and the purchase section of Goa Shipyard Limited.

The quantum of raw materials stores and spares inventory in terms of number of days consumption in the early part of the

period under study, witnessed below 500 days of consumption. This indicator oscillated between 142.6 days and 1200 days. In the year 2002-03, it had 1200 days raw material in terms of number of day's consumption and gradually reduced to 299.4 days in the year 2008-09. The declining phenomenon is a welcoming feature and it speaks of the efficiency of the management of Goa Shipyard Limited. The norm fixed for this category of inventory is 180 days consumption. Still there is a scope to reduce the raw material, stores and spares inventory.

The Goa Shipyard Limited registered work-in-progress of Rs.3950 lakh in the year 1998-99 and this went up to Rs.10000 lakh in the year 2003-04 and finally it ended with Rs.23435 lakh. The phenomenal increase of this category of inventory speaks of huge amounts tied up in work-in-progress inventory. Therefore, the management should take stringent measures to reduce this inventory by expediting the jobs assigned to it by the customers and deliver the finished ship at a possible early date, which automatically increases the efficiency.

Work-in-progress of number of months cost of production was between 6.5 months and 22.7 months in Goa Shipyard Limited during 1998-99 to 2008-09. The year 1999-2000 had 6.5 months and raised to 22.7 months in the year 2005-06. It reduced to 19.2 months in the year 2006-07 and 21.2 months in the year 2007-08 and finally, it stopped at 20.3 months. The higher the number of months work-in-progress cost of production, the lower the efficiency of materials management in particular and the

overall management in general. Therefore, necessary steps should be initiated to reduce this index as far as possible to make the organization further viable for the cause of the development of the country.

The inventory turnover ratio is Goa Shipyard Limited in the year 1998-99 was 0.50 and in the immediate next year, it went up to 2.58 and it never touched an inventory turnover of 'one' during the remaining period of study. The norm fixed for it is six to eight times for this kind of industry. The higher the inventory turnover ratio, the higher will be the efficiency indicating effectiveness of techniques used for inventory control. The lower turnover in an organization results in over investment in inventories. Therefore, necessary measures are to be taken up by the management of Goa Shipyard Limited to improve the inventory turnover ratio.

The progressive growth rate of output and net sales when compared to the progressive growth rate of inventories, clearly indicates the inventory accumulation in Goa Shipyard limited. This is a deplorable state of matter and the management should respond to it properly and try to reduce the accumulation of inventories.

The excess value of inventory held by Goa Shipyard Limited is quite alarming when compared to the actual value of the inventories with that of the BPE norm of six months cost of production. The excess value of the inventory was of the tune of Rs.3916 lakh and reached a peak of Rs.23645 lakh. Understandably, this is the case for the extreme deviation of the

management from the norms prescribed for it. Necessary remedial steps should be initiated to keep down the excess value of the inventory in tune with the norms.

The practices of inventory management of other ship building units were studied in terms of inventory performances, which are the outcomes of the policies and procedures laid down and practiced by different managements of the public sector ship building units. The CIWTC carried a total inventory of Rs.796 lakh in the year 1998-99 and in the remaining years, these inventory figures fluctuated widely and varied between Rs.405 lakh and Rs.1274 lakh. In CSL, it started with Rs. 637 lakh in the year 1998-99 and reached a peak of Rs.7744 lakhs and decreased to Rs.1591 lakh during the period under study. In GRSE, the total inventory figured at Rs.10601 lakh and it gradually increased to Rs.98750 lakh by the end of 2008-09. In case of HSL, it had Rs.9782 lakh in the initial year of study and decreased to Rs.4044 lakh in the year 2000-2001 and varied among all the years. The HDPE started with Rs.1523 lakh in 1998-99 and it came down to a minimum of Rs.1461 lakhs in the year 200-01 and went up to a maximum of Rs.3806 lakhs. In all the remaining years, the total inventory of HDPE varied in between. The MDL with its lowest total inventory of Rs.42504 lakh in the year 1998-99 and recorded an enormous growth of Rs.111098 lakh in the year 2008-09. Therefore, it is understandable that the total inventory in all the ship building units varied between Rs.405 lakhs to Rs.111098 lakh during the period under study.

Size of raw materials, stores and spares inventory excluding work-in-progress and finished goods in other public sector ship building units varied between Rs.161 lakhs and Rs.31590 lakh. It is very low in CIWTC and this category of inventory ranged between Rs.184 lakh and Rs.358 lakh. The variation of this inventory is very high in GRSE and ranged between Rs.1935 lakh and Rs.31590 lakh. In CSL, it ranged between Rs.827 lakh and Rs.1585 lakhs and in HSL, the range of this category of inventory lied between Rs.2786 and Rs.7200 lakh. In HDPE, the range was in between Rs.161 lakh and Rs.1012 lakh. In MDL, it started with Rs.8844 lakh in the year 1998-99 and ended with Rs.22256 lakh in the year 2008-09.

The size of raw material, stores and spared inventory in terms of number of days consumption in other public sector ship buildings units ranged between 58.6 days to 1386.6 days. During the period under study, in very few years, the other shipyards maintained the level below the norm prescribed by BPE of this kind of inventory. The situation was very dark in light of the norm of 180 days inventory of raw material, stores and spares items in terms of number of days consumption. This has to be tackled properly to bring down the inventory to the level of norms.

The size of work-in-progress in other public sector ship building units varied between 0(zero) and Rs.88907 lakh during he period under study. HSL and HDPE maintained 0(zero) work-in-progress inventory in two different years. The work in progress inventory in GRSE and MDL is quite alarming with more than

Rs.66326 lakh and Rs.8907 lakh respectively. This might be because for certain technical reasons that the customer preferred to take delivery of the ship in the immediate next financial year to claim the depreciation on the it in the next accounting year. That is why, the figures are not realistic. Whatever may be the reason for the non-delivery of the ship, it accounts for the addition for the work-in-progress inventory.

The work-in-progress in terms of number of months cost of production in other public sector ship building units revealed that the GRSE holds the highest number of months work-in-progress with it and it ranged between 13.1 and 43.9 months. In CSL it ranged between 0.1 and 20.5 months and in HSL, the range was between 0 (zero) and 1.6 months. The MDL carried work in progress of number of months cost of production of a range of 14.3 to 27.6 months. The higher the work-in-progress of number of months cost of production, the higher will be the inventory accumulation. The industry should consider this aspect and act accordingly to minimize the work-in-progress.

The inventory turnover, is an indication of the efficiency of the inventory management. But unfortunately, the inventory turnover never exceeded 7.72 times in the industry. The prescribed norm for it is six to eight times. The material management specialists and representatives of ship building units should take up this issue for improving the inventory turnover ratio in public sector ship building units. This ratio was very poor in GRSE CSL, HDPE and MDL in all the years under the period of study. They

never touched inventory turnover of 'one' This is definitely a distressing factor noticeable with the shipyard.

The size of total inventory put together in all the public sector ship building units comes to Rs.75668 lakh in the year 1998-99 out of which GSK shared Rs. 4425 lakh inventory with 5.8 per cent of the total. In the same year, CIWTC had a minimum number of Rs.796 lakhs. MDLs inventory constituted 42504 lakh out of the total industry inventories. In the year 1999-2000, the industry's total inventory was of the tune of Rs.98139 lakh and GSL shared Rs.2090 lakh with 2.1 per cent. This percentage of GSL went up to 17.8 per cent in the year 2004-05. This gradually declined and in the year 2008-09, it shared an amount of Rs.29461 lakh from out of the Rs.254321 lakh of the industry's total inventory.

This needs to be brought down to the extent possible to improve the efficiency of Goa Shipyard Limited. Whereas, the MDL occupied a predominant place in all the years of study as far as the total inventory is concerned with more than Rs.67700 lakhs. Next to MDL, the GRSE stood second with a maximum total inventory of Rs.98750 lakh in the year 2008-09.

The size of raw materials, stores and spares inventory excluding work in progress and finished goods in the public sector shipbuilding industry was every increasing right from the beginning of the years of study to the year 2008-09. It was Rs.18051 lakh in the year 1998-99 and Goa Shipyard Limited was the third largest occupant with Rs.474 lakh out of the industry's total

inventory of this kind,. It shared 2.6 percent of the total inventory. While the industry total inventory was very increasing, the Goa Shipyard Limited share fluctuated widely from 2.1 per cent to 28.6 per cent. Percentage was increased to around three and half folds in a time span of 11 years from 1998-99 and had 8.7 per cent stake out of the total of Rs.69142 lakh in the year 2008-09. MDL and GRSE had a lion's share with Rs.22256 lakh and Rs.31590 lakh respectively in the year 2008-09.

The industry's total work in progress inventory is Rs.184196 lakh for the same period. However, in almost all the years during the period under study, the Goa Shipyard Limited occupied the same third position and it started with Rs.3950 lakh and experienced a low of Rs.1644 lakh in the immediate next year. From then onwards, is gradually increased year by year and finally it stood at Rs.23435 lakh in 2008-09. This has to be reduced to the extent possible to improve further liquidity position of the company. The CIWTC, CSL and HSL are at the lowest percentage of their contribution to the total work in progress inventory of the industry in the entire period under study.

The work-in-progress of number of months cost of production is very high in GSL, GRSE and MDL with that of the work in progress number of months cost of production of other shipyards in the industry. Though the operating results are good in all the above said three shipbuilding units, the should take steps to reduce this work in progress of number of months cost of production to six months as prescribed by BPE. In the remaining

shipyards, the work in progress is lower than the norms but still there are certain other reasons for the poor performance of the remaining shipyards owned and managed by Government of India.

The inventory turnover in all the shipyards is said to be poor as the inventory turnover is far away from the norm prescribed for it by the BPE. GAO shipyard Limited is no exception for it. The Goa Shipyard Limited, GRSE and MDL are proclaimed as the efficient shipyards in the country by paying dividends continuously. Still they are lagging behind as far as the inventory turnover ratio is concerned. This has to be improved by adopting modern and scientific techniques of inventory management. Use of computers and computer packages available in this area is of great use in improving the inventory management performance by all the shipbuilding units in the country.

The present study highlighted the importance of inventory management function in public sector shipbuilding industry. An examination of the materials management practices followed by Goa Shipyard Limited suggested that there is an urgent need to review the existing policies, procedures and systems to achieve higher operational efficiency in this pivotal area. The problems encountered by Goa Shipyard Limited in the area of materials management are quite common in almost all the public sector shipbuilding units in the country. The inventory accumulation as a whole in the industry is on the higher side. It is same in the case of Goa Shipyard Limited also. The suggestions made in the study

will hold good Shipyard industry which we are discussing about. It is hoped that the adoption of the suggestions made in this study would help in improving significantly the performance in the are of inventory management of Shipyard industry as a whole.

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Appendix

Appendix-I

Goods Receipt Note

Supplier CD	Supplier Name	GRN No.	GRN Date
PO No.	PO Date	Invoice No.	Inv. Date DC No. DC Date
Sr.Item CD No.	Item Description	UDM	Unit Qty Rate Reed Accepted
GC No.	GC Date	Excise	Taxes Freight Insurance Others Net
IR No.	IR Date	Inward No.	Inward Date Gross
Inspection Remarks		Payment Terms	
Store Keeper		Scrutiny & Verification Officer	DGM (Stores)

Appendix-II

Department	Material Requisition/Issue Note			Requisition No. Date	
Description of Vessel/Work	Ref.No.	Job. No.		Authorised _____ Name _____	
Issuer's initials	Posted by Date	Stores Reg. No. & Month		Rank _____	
Code No.	Material Description	Unit	Qty. Required	Qty. Issued	
Prepared by SH/NR		Approved by HOD(COM.)		Date of Issue	