# Study And Analysis Of Finished Good Inventory & Logistic Management

**Ashutosh Kumar, Dr. Nagendra Sohani**

**Abstract**: Inventory management is a difficult problem area in supply chain management. Companies need to have inventories in warehouses in order to satisfy customer's demand. These inventories have holding costs and frozen fund that can be lost. Therefore, the task of inventory management is to find the quantities of inventories that will satisfy customer demand and help in avoiding overstocks. This paper presents a study and analysis for the steel bar manufacturing industry (Small Scale Industry) on finished good inventory and logistics management. The research found that company Y had a few inventory problems such as unorganized finish good inventory arrangement, high vehicle in-vehicle out time and no provision for safety stock. The study also proved that how we can reduce the finished good inventory level and reduce the vehicle in- vehicle out time along with the introduction of safety stock. This paper also provides a recommendation to the company and for further research.

**Index Terms**: Demand forecasting methods, Inventory management, Safety stock, Queue length.

## 1. INTRODUCTION

Inventory can be termed as stock on hand at a given point of time which may be held for the purpose of later use or sale. It has an economic value and it includes raw material, work in process inventory, semi-finished goods, and finished goods. Industries in which products are less customized tend to operate primarily according to a Make-To-Stock (MTS) policy. In Make-TO Stock (MTS) policy, companies made their product in advance before the order placed because of least customization of product and known product market. Demand in iron and steel industries are highly fluctuating and not easier to foresee future demand. Inventory management is a systematic approach to obtaining, storing, profiting from non-capital assets like raw material and finished good. The right stock, at the right level, in the right place and at the right time and at the right cost defines another meaning of inventory management. Safety stock is defined as the constant inventory kept throughout a year to compensate for the demand fluctuations. Safety stock help in reducing the potential profit loss due to the shortage of inventory at the time of demand. In the iron and steel industry basically steel bar industries, demand fluctuations are seasonal.

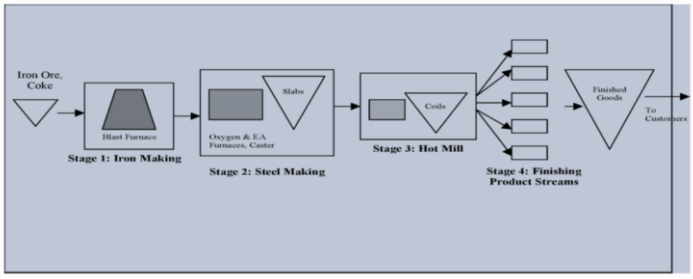


**Figure 1:** Manufacturing process of the steel bar.


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Forecasting technique helps to understand the seasonal variation in demand and to predict future demand. Forecasting technique is also fruitful in maintaining low inventory level. Logistics management in steel bar industries can be defined as the management of the vehicle, loading of finished good as well as timely delivery of the product to the customer destination according to customer demand.

## 2. LITERATURE REVIEW

The Council of Supply Chain Management Professionals (CSCMP) defines Inventory Management is the part of Supply chain management that helps in planning, implementing and controlling the efficient, effective, forward, and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to fulfil the customer's requirements.

In 1993 Evers, P.T. and Beier, F.J. Proposed the portfolio effect literature that contains a method of reduction in aggregate safety stock that can be achieved through centralization of stocking locations. Through this concept, we can reduce the cost of transportation and the cost of holding. [8]

In 1993 Evers and Waller et al. Examined the issues such as transshipment and cross-docking in order to focus on the integration of warehousing and inventory control. [9]

In 2004, DENTON, B. and GUPTA, D. Proposed the paper on Strategic inventory deployment in the steel industry. In this paper, he explained the technique about the position of inventory to meet customer levels while minimizing inventory and storage levels. [15]

In 2002, Kim et al. Proposed a nonlinear programming model to configure a supply network that consists of one manufacturer and multiple suppliers with uncertain demand. An iterative algorithm is developed to solve the problem with the assumption of normal demand distribution. [2]

In 2000, Sabri and Beamon developed an integrated multi-objective supply chain model for use in simultaneous strategic and operational supply chain planning. The model consists of a strategic-level sub-model that minimizes total cost subject to flexibility criterion and other constraints, and several operational-level sub-models. Uncertainty was considered at the operational level: determining order batch size with uncertain demand. [4]

In 2014, S.Takim developed the technique of optimization of effective inventory control and management in manufacturing industries. He proposed a heuristic approach by which we can reduce the inventory level to maximize the profit. [12]

In 2015, Seungjiae, S., Ennis, K. L., and Spurlin, W. P. proposed the effect of inventory management efficiency on the profitability of manufacturing industries. He explained that the profitability of a manufacturing industry depends upon how they managed their inventory to satisfy the demand and also explained the factors through which we can see the effect of inventory management efficiency on the contribution of industries. [10]

## 3. RESEARCH METHODOLOGY

### 3.1 Listing of required data

In this step, we need to find out the type of data required which defines our research objective. For the fulfillment of the research objective, we listed our required data as: -

- Production & Sales data for the last 3 years
- Inventory level data of the last 3 years
- Product wise production data & Sales data of past years
- The ratio of product mix which was delivered in a truck to understand product positioning.
- Process mapping of a truck in and truck out.
- Data collection of truck spending hours in a factory.

### 3.2 Data Collection

In this step, we need to collect the required data from company Y dispatch department. Then figure out the production and sales data into an Excel sheet to understand the trend of demand and inventory level.

- **Production & Sales data for the last 3 years**

| Year | Production(mT) | Sales(mT) |
|---|---|---|
| 2016 | 2,16,400 | 2,14,350 |
| 2017 | 2,38,500 | 2,36,400 |
| 2018 | 2,78,740 | 2,77,260 |

- **Inventory level data of finished good for last 3 years**

| Year | Beginning Inventory(mT) | Closing Inventory(mT) |
|---|---|---|
| 2016 | 3000 | 2050 |
| 2017 | 2050 | 2100 |
| 2018 | 2100 | 1480 |

- **Product wise production data & Sales data of past years**

**The year 2016**

| Size of TMT bar | Production (mT) | Sales(mT) |
|---|---|---|
| 8 mm | 32400 | 32152.50 |
| 10mm | 97300 | 96457.50 |
| 12mm | 43280 | 42870 |
| 16mm | 25968 | 25722 |
| 20mm | 10820 | 10717.50 |
| 25mm | 6492 | 6430.50 |

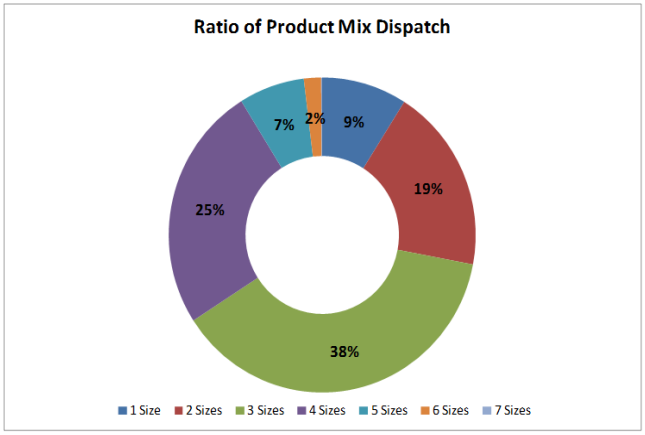
**The year 2017**

| Size of TMT bar | Production (mT) | Sales(mT) |
|---|---|---|
| 8 mm | 35775 | 35632.50 |
| 10mm | 107325 | 106897.50 |
| 12mm | 47700 | 47510 |
| 16mm | 28620 | 28506 |
| 20mm | 11925 | 11877.50 |
| 25mm | 7155 | 7126.50 |

**The year 2018**

| Size of TMT bar | Production (mT) | Sales(mT) |
|---|---|---|
| 8 mm | 41811 | 41589 |
| 10mm | 125433 | 124767 |
| 12mm | 55748 | 41589 |
| 16mm | 33448.80 | 33271.20 |
| 20mm | 13937 | 13863 |
| 25mm | 8362.20 | 8317.80 |

- **The ratio of product mix which was delivered in a truck to understand product positioning.**




### 3.3 Data Analysis and Formulation

In this step, we will analyze the collected data to find out the following: -

- **Percentage sales contribution of different kind of steel (TMT) bars**

Percentage Sales contribution = (sales of particular bar / total sales) x 100

- **Weighted moving average method of forecasting to find out the forecasted value of sales and total inventory level**

**Method to find weight: -**

*N* = no. of Period for weighted moving average

*(a)* Find the sum of 'n' natural numbers

$$\sum_n = n(n+1) / 2$$

*(b)* Arrange them in decreasing order of weight as

$$(n/\sum n), (n-1/\sum n), (n-2/\sum n)\ldots\ldots\ldots(1/\sum n)$$

For this method, we have to take period, N=4 and then we will assign the highest weighage to the recent data and lowest weighage to the older data.

For the $4^{th}$ data, Weighage =0.4

For the $3^{rd}$ data, Weighage = 0.3

For the $2^{nd}$ data, Weighage = 0.2

For the $1^{st}$ data, Weighage = 0.1

This method gives unequal weight to each demand data in such a way that summation of all weights always equal to 1.

- **Quantity of inventory**

Total Quantity of Inventory = Forecast Quantity – Sales Quantity

- **Safety Stock**

Safety Stock = average of fluctuation in demand per month

- **Theoretical inventory level for each product**

Theoretical inventory level = total inventory × sales contribution of each product

## 4. Result and Discussion

- **Theoretical inventory level**

On the basis of data analysis and calculation, defined inventory levels of different TMT bars are

| Size of TMT bars | Theoretical Inventory(mT) |
|---|---|
| 8mm | 150 |
| 10mm | 450 |
| 12mm | 200 |
| 16mm | 120 |
| 20mm | 50 |
| 25mm | 30 |

Defined inventory level for all products is 1000 mT on the basis of demand forecasting technique. In the above table, we proposed the inventory level for different TMT bars.

- **Safety Stock**

We introduced the safety stock levels for different TMT bars in company Y to avoid stockout and potential profit loss.

| Size of TMT bars | Safety Stock(mT) |
|---|---|
| 8mm | 45 |
| 10mm | 135 |
| 12mm | 60 |
| 16mm | 36 |
| 20mm | 15 |
| 25mm | 09 |

The total quantity of safety stock is 300 mT on the basis of fluctuation in demand.

**The positioning of TMT bars in Stockyard**

On the basis of sales contributions, we introduce the position of different TMT bars in the stockyard to smooth movement vehicle during loading. After positioning of TMT bars in the stockyard, we found that vehicle waiting time during loading has been reduced by 10 min.

**Reduction in the vehicle in and vehicle out time**

The basic reason behind the higher vehicle in and vehicle out time was the improper positioning of TMT bars in stockyard and incorrect way of weighing. We introduce the automated weighing system equipped with ERP software and give the priority to loaded vehicle weight first. After doing these changes, we found that daily vehicle in and vehicle out time reduced by 20 min. hence, dispatching of numbers of loaded vehicles increases from 32 to 50 on a daily basis.

## 5. Conclusion

- This research uses demand forecasting technique to predict the future demand and to define the minimum inventory level in the system.
- In this Research, inventory level and safety stock of different TMT bars are introduced in the system based on sales contribution and average demand fluctuation.
- Proper positioning of different TMT bars in the Stockyard decreases the time of loading and traffic in the stockyard.
- After the introduction of an automated weighing system equipped with ERP software increases the daily movement of vehicles in and out of the company.

## 6. Future Work

- Detail study of all the material was not possible because of the time limit.
- The Study was confined only to the finished good inventory in the dispatch department of Steel company.
- The comparative study may new research problem for future work.

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