CHAPTER-7

INVENTORY MANAGEMENT

This Chapter highlights the significance of inventory management in the physical distribution system and the concept of trade-off between carrying cost and stock-out costs. The chapter further throws light on the specific problems regarding inventory management in vanaspati industry. Later, the present inventory policies and inventory levels in the selected vanaspati units are discussed. Subsequently, specific recommendations are made for improving the inventory management in the vanaspati industry.

A. Inventory and Physical Distribution

Inventories of raw material and finished goods are maintained primarily with the purpose of bridging the gap between demand and supply. In a physical distribution system, inventory exists due to following reasons: -

1. Customers' demands are not uniform and completely predictable. The rate of customer order may vary from time to time because of seasonal factors and the customer's and supplier's own marketing efforts. The timing of individual order in most of the industries is quite unpredictable and there may be substantial random variation for an item from day to day or week to week.

2. There is a time lag between production and consumption. After the production, it will take time to move the item to the consumption point. There will, therefore, be adequate inventory tied-up in the physical distribution system and in process stock'.
3. To make and distribute items unit by unit is quite expensive and difficult in response to individual customer order.

Inventory levels represent a major type of physical distribution decision affecting customer's attraction and satisfaction. A very high level of inventory leads to high inventory carrying cost and substantial obsolescence, and on the other hand, a very low level of inventory results in high restocking and production cost and leads to a loss of sale and producer's goodwill. So, the control of inventory becomes extremely essential. From the customer's point of view inventory is an item and should always be readily available to meet the demand. It should never be out of stock at any time, if we want to maintain a particular level of customer service. But high level of stock leads to high inventory carrying cost, which ultimately leads to high physical distribution cost. So, there should be a balance between cost of inventory and service to the customer.

"The physical distribution system is a pipe line flow designed to carry the product to the customers in the most economical way. This flow of material/pipeline requires inventory of goods sufficient to keep the pipeline supplied and satisfies varying customer needs/demand."

Inventory consists of two major components, which are:

i) The base stock needed to fill the basic pipeline needs of distribution,

ii) The safety stock to satisfy varying customer demands.

In order to maintain an appropriate cost and service levels, the control of these two elements of inventory management becomes essential.
Further, the cost of distribution increases because of the holding of inventory. Holding costs are also referred to as, carrying cost which basically consists of the following:

i) Space rent for the storage of goods;

ii) The cost of capital tied down in the stored goods;

iii) The cost of insurance of goods against fire, theft, pilferage and taxes;

iv) Spoilage in the quality of goods in storage, breakage in handling, deterioration due to weather conditions and passage of time etc.

v) Obsolescence of goods or depreciation, especially of goods which are subject to quick changes in style.

The total of costs due to all the above mentioned components yield the true inventory carrying cost. This cost of holding inventory may go as high as 30% of the average inventory value.1

Thus, an effective inventory control system would minimise the cost due to inventory holding and the expected loss as a result of stock-out situations. Any step, taken to reduce the level of inventory, will have an immediate and significant effect on the cost of physical distribution.

B. Inventory Management Policies in Vanaspati Industry

The physical distribution of vanaspati has some special features, which make the inventory management vitally important. These are: continuous consumption largely influenced by transport bottleneck and

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1 Smykay, E.M., Bowesox; and Mossman, F.H., Physical Distribution Management, The Macmillan company New York, 1961, p.88
product deterioration due to its liquid nature, blockage of large funds on raw material due to the fact that about 75% of the selling price of vanaspati is the cost of raw-material. Inventory levels have direct and indirect impact on many aspects of vanaspati business such as; raw material procurement, cash flow planning, storage planning, transport planning, decision on when and how much rebate and discount to offer and implementation of various promotional programmes. Inventory strategy affects many other organizational functions as well.

It is generally observed that the total inventory of vanaspati is continuously falling at a rate greater than its consumption. This leads to a lower customer service and also a high per unit inventory carrying costs as the warehouse space and administration remains the same. Various factors are responsible for this; e.g. the pattern of transportation followed by the manufacturers attitude towards distribution channels, polices on the terms of delivery of the material; Public distribution system (PDS), policies of the government; oil pricing policies of the government and sale tax exemptions to new units etc. As a cumulative consequence of all these factors, total inventory in the vanaspati industry comes down steeply, which results in an increase in per unit inventory carrying cost. Therefore inventory management becomes substantially essential.

In the Indian vanaspati business, inventory carrying cost constitute the third largest clement of marketing cost. It is next to the transportation and warehousing cost. The increased rent rates of godowns and high interest rates of godowns and high interest

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3 As result of decrease in inventory level, per unit inventory carrying cost increases because, administration, space occupied, cleaning expenses etc. are not affected by the decrease in inventory level.
rates in the country are the main reasons for this high level of inventory carrying cost.

It is clear from the above analysis that, there is a need for greater vigil and planning on the inventory front.

There are three basic steps in inventory management in any business. These are:

i) Identification of functions which are actually performed by the inventories.

ii) Establishing the right relationship between the inventory functions and inventory level; and

iii) Developing appropriate strategies for optimizing the inventory levels.

This approach to inventory management holds good in case of vanaspati also. The first step is relatively easy. The most important function performed by the inventories is bridging the gap between production and consumption. Establishing the right relationship between the inventory functions and inventory levels and optimization of inventory level are somewhat difficult. The nation cannot afford to take the inventory decision for a commodity like vanaspati purely on consideration of cost, because it is a necessity of every household and should be available at every home for the preparation of food.

At unit level, it is not difficult to determine the optimum stock level in a given depot with reasonable degree of accuracy if the demand in that depot could be worked out accurately. It requires an accurate demand forecasting of a product. Demand forecasting at micro level is a key to an effective
inventory management. Micro level demand projections would greatly assist in the maintenance of inventory of appropriate product at the depot. For demand forecasting, it would be necessary to consider in detail the local factors influencing the demand. Based upon these factors, a realistic sales plan can be developed. The sales plan should provide product-wise, location-wise and month-wise detail of the demand of a product. Past consumption trend-data, intensity of competition and other such factors relevant to vanaspati consumption should also be considered at the time of developing a sales plan. In fact, sales plan serves as a basis for inventory management.

The important decisions in vanaspati inventory management are:

- When to ship
- How much to ship
- To whom to ship

These decisions will depend upon the location of consumption point, mode of transport used, transit lead time, and order booked by a particular depot holder and stock available at the depot at the time of receipt of an order. To study the off-take pattern of different types of vanaspati at various consuming points, it is necessary to obtain depot-wise, month-wise and product-wise data. This month wise off-take pattern over previous years would help to establish a time series analysis and will help to make the projections for each month.

C. Inventory Management in Selected Companies

So far as inventory polices of the selected companies (ABC, MARKFED & HVOC) are concerned, there is hardly any difference. These
companies prepare their sales plan in the beginning of every month. Usually, these plans are prepared on the basis of past data years-wise/month-wise sales data of a particular area and is also based upon the demand estimated by their Area Officers/Development Officers or District Managers etc. The sales targets for their distribution channels are usually fixed by the management of every company from time to time. At the end of a predetermined period, the achievement vis-a-vis target statement is prepared; analysed, and reviewed by the management. The statement showing state-wise, depot-wise and month wise receipt of material in depot and sales affected from these depots are also being prepared by these companies. Thus, it is evident that vanaspati companies are having the data required for exercising an effective inventory control. However, the management of these companies have not bothered to institute any effective inventory control mechanism for the reason which are never specified and are known only to them. To what extent the above mentioned data helps them, as control mechanism is anybody's guess. In the absence of an effective inventory control technique, the available data maintained by these companies are not helping in controlling the ever-increasing inventory carrying costs of these companies. All this results in large inventory carrying cost, which ultimately leads to increase in physical distribution cost. An analysis of sale, stock and turnover ratios of vanaspati on the selected companies has been attempted in the following pages to highlight the problems of inventory management in these companies.

The sales, stock and inventory turnover ratios of vanaspati for the selected companies during the years from 1989-90 to 1994-95. The table 7.1
(Appendix -I) shows that there is a significant decrease in the sale of HVOC vanaspati on all India basis. Sale of HVOC is decreasing with a galloping rate from 1989-90 to 1994-95. In 1994-95 sale of HVOC decreased to 8996 MTs. from 51839 MTs. in 1989-90. But it is also obvious that stocks are not decreasing in the same ratio. The closing stock of HVOC has decreased to 2061 MT. in 1991-92 from 3969 MTs. in 1989-90 and again to only 1286 MT. in 1994-95. The inventory turnover ratio has come down to 8.8 in 1994-95 from 15.88 in 1989-90. The sales of MARKFED and ABC have also decreased regularly from 1989-90 to 1994-95 except in 1992-93. Table 7.1 (Appendix - I) shows that there is a considerable increase in the stocks of Markfed and ABC. The inventory turnover ratio in the case of Markfed has come down to 11.6 in 1994-95 from 25.2 in 1989-90. Hence, there is a continuous fall in the inventory turnover ratio of MARKFED. The stocks of ABC vanaspati have increased considerably on all India bases during the period of 5 years from 1989-90 to 1994-95. But, inventory turnover ratio in case of ABC vanaspati is still high as compared with HVOC and MARKFED. Table 7.1 (Appendix-I) shows a considerable decrease in inventory turn over ratio. The inventory turn over ratio of ABC has come down to 26.07 in 1993-94 from 33.9 in 1989-90. This shows that the stocks of ABC vanaspati as compared to its sales in the respective years are more on all India basis. But, in comparison, the stock of HVOC and MARKFED are proportionately higher as compared to their sales in the respective years.
D. Inventory Levels of Selected Companies in Punjab and Haryana

(a) HVOC: In the state of Punjab, the inventory levels of HVOC are relatively high as compared to Markfed and ABC as shown by Table 7.2 (Appendix -I) which results in lower inventory turnover ratio. Table 7.2 (Appendix-I) also shows that inventory turnover ratio of HVOC vanaspati is continuously falling which indicate that inventory of HVOC vanaspati is quite high as compared to its sales in Punjab. The inventory turn over ratio of HVOC in Punjab in 1989-90 was 14.4. The sale of HVOC vanaspati in Punjab in 1993-94 has come down to one third where as decrease in stock is comparatively low.

(b) MARKFED: Table 7.3 (Appendix-I) shows the sales and stocks of MARKFED vanaspati in Punjab and Haryana. Table 7.3 (Appendix-I) shows that inventory turnover ratio of both Punjab and Haryana is falling. In 1992-93, the inventory turnover ratio of Punjab was 23.2, which came down to only 8.7 in 1994-95. It is due to a considerable fall in sale from 15600 in 1992-93 to only 7896 in 1994-95. Similarly, table 7.3 (Appendix-I) shows a spectacular fall in the inventory turnover ratio in Haryana. It is due to a fall in the sale and rise in inventory level. Table 7.3 (Appendix-I) shows that sale of Markfed vanaspati has come down to 1214 MTs. in 1994-95 from 2400 MTs. in 1992-93 where as there is a very nominal fall in the stock i.e. from 92 MTs. in 1992-93 to 89 MTs. in 1994-95. It leads to a considerable fall in the inventory turnover ratio.

The inventory turnover ratios of ABC are relatively higher as compared to HVOC and MARKFED in Punjab and Haryana.
(e) **ABC :-** Table 7.4 (Appendix-I) shows that inventory turnover ratio of ABC vanaspati in Punjab is continuously falling from 1991 to 1994. In 1991 the inventory turnover ratio was 41.8 which came down to 23.2 in 1994. The main cause of this fall was, a significant fall in the sales (i.e. from 20770 MTs. in 1989 to 14867 MTs. in 1994) and relatively lesser fall in stocks.

Table 7.4 (Appendix-I) shows that the position of ABC vanaspati in Haryana is relatively better. The inventory turnover ratio of ABC vanaspati is improving from 1991 to 1994. In 1991 inventory turnover ratio was 7.8 which has increased to 16.2 in 1994. It is due to an increase in the sale and decrease in the stock from 1991 to 1994. The lower inventory levels of ABC vanaspati can be explained on the basis of their consumer preference all over India, and in the states of Punjab and Haryana. In table 7.4 (Appendix-I), only unit level stocks have been taken due to the non-availability of inventory figures of Punjab depots over previous years. Graph 7.1, 7.2 and 7.3 (Appendix-II) also indicate that the comparative stock of HVOC and MARKFED vanaspati are proportionately higher as compared to their sales in the respective years. But the inventory level of ABC vanaspati are much lower because of high consumer preference.

Thus, from the comparative analysis of the selected companies, it is very clear that inventory control is of utmost importance in vanaspati distribution system and requires utmost attention. The development of a realistic sales plan, quick and effective communication between depot and concerned department with inventory control, periodical review of the marketing situation, would help the vanaspati producers in developing appropriate strategies for optimizing the inventory levels.
E. Elaboration of Suggested Application of Inventory Management in Vanaspati Organizations

An effective forecasting is the first step in the inventory management followed by control of inventory level. The following pages indicate how this can be achieved in the vanaspati companies.

The organizations under the present study possess the data required for sales, month-wise, depot-wise, product-wise and area/state-wise for demand forecasting. So these concerns are in a position to forecast the demand for an effective inventory management. This can be done by applying 'exponential smoothing' method of time series analysis. There are various methods available for forecasting. The best method for inventory control may be said to be that of 'time series analysis', which includes moving average, exponential smoothing, X-11, Box-Jenkins and trend projections technique. Out of these 'Exponential Smoothing' has received increasing acceptance in the recent years for the short term forecast of demand. It meets various requirements of a forecasting technique for inventory control such as:

i) It does not require maintenance of large histories of each item in the data Bank.

ii) Its computation takes the minimum possible time.

iii) It identifies seasonal variations

vi) It easily adapts to the changes in trend etc.

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A quantitative forecasting method serves to smooth out fluctuation in demand pattern. But, in 'Exponential smoothing' these smoothing characteristics are controlled by adding a factor, the smoothing constant called 'oc'. The smoothing constant 'oc' may be assigned any value between '0' and '1' but, high value such as 0.9 puts greater weight on the old average and current demand has little effect on a new average. A smaller value of 'oc' has opposite effect, and the average changes more quickly. A common value of 'oc' in inventory control is 0.95. 'Exponential smoothing' is a type of moving average representing a weighted sum of past trend in time series analysis. A forecast utilizing 'exponential smoothing' results from the following equations.

\[ F_n = \alpha . Y_{n-1} + (1-\alpha).F_{n-1} \]

where:

- \( F_n \): forecast for next period
- \( F_{n-1} \): forecast for previous period
- \( \alpha \): smoothing constant (0 ≤ \( \alpha \) ≤ 1)
- \( Y_{n-1} \): actual value for previous period.

\[ F_n = \alpha . Y_{n-1} + \alpha . (1-\alpha).Y_{n-2} +\alpha .(1-\alpha)^2.Y_{n-3} +...... \alpha .(1-\alpha)^n.Y_{n-n} \]

where:

- \( F_n \): forecast for period 'n'
- \( Y \): historical data

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\( Y_{n-n} : \text{starting forecasting} = F_0 \)

Thus, the above function is a linear combination of all past data weighed according to the smoothing constant. The smoothing constant is chosen based on the value of the best fitting of the past data. For example; for estimating off-take from a particular depot of ABC (R) unit at Lambra in Jalandhar district of Punjab, during April 1996, April 1995, April 1994 and April 1993 could be used as under:

\[ F = (0.9) \times 296 + (0.9) \times (0.1) \times 218 + (0.9) \times (0.1)^2 \times 235 \]

Where: 296, 218 and 235 are the sales from this depot in April 1995, April 1994 and April 1993 respectively, and \( \alpha = 0.9 \). Thus, from the above equation the estimate of sale in April 1996 i.e. \( F = 287 \) MTs.

The actual sale during April 1996 was 301.7 MTs., which is nearer to this estimated sale of April 1996.

The units selected for the present study do not follow any scientific method to control inventory levels. Thus, it becomes necessary to evolve a system for controlling inventories efficiently. Inventory levels depend upon the service level offered. Higher the service level, greater would be the cost and will lead to higher sales. So, there must be a trade off between cost and benefits of inventory level. The cost related to a defined service level or related to variation in such level can be calculated more or less accurately but, the benefits increased by the increased service level or damages caused by a decreased service level are somewhat difficult to estimate. These effects are estimated roughly. It is of course obvious that poor service level will lead to a certain loss of sale in the short run and in the long run may result in a definite loss of market share. On the other hand, it is also obvious
that providing higher level of service is expensive and that the cost of doing so, needs to be justified by achieving improved sale and profits. It is very difficult to establish a continuous correlation between service levels and related costs.

The customer service consists of variety of elements like; order delivery cycle time, inventory reliability, delivery frequency and minimum order size, service consistency and other aspect of customer service such as order collection and transmission time, frequency of sales manager's visits to sales points and customer, meetings of management with salesmen's system of invoicing and collection, communication between customers and suppliers.

The importance of these elements of customer service would depend upon the type of the product and market situation. Some elements may be more important than others in a particular product/ market situation may and others may be more important for other market situations and vice versa. Thus, each market that the company serves will attach different importance to different service elements and therefore, it is necessary for any company to have a clearly identified policy towards customer service. Customer service is too important and too costly as well. But, for successfully developing and implementing cost effective customer service policies within the company, it is imperative that a formalized logic is adopted and closely followed.

Among all the elements of customer service, as mentioned earlier, inventory reliability is the most critical element. It has its direct and indirect impact on customers satisfaction, inventory levels and on cost. In the event
of out of stock situation of an item there may be a loss of sale and if, stock out situations are frequent this will generate dissatisfaction and loss of confidence among customers on their part in the over all reliability of the supplier. The incidence of unfilled or partly filled orders due to out of stock situation leads to substantial increase in the total delivery time. Inventory reliability can be measured in various ways. Firstly, it can be measured in terms of percentage of occasions on which an item required by the customer is available in the stock at the first pick. In other words, whether an item is immediately available for the dispatch at the moment; an order is received or not. For example, in these terms, one might have 95% or 98% inventory reliability. An other method of measuring inventory reliability, is the percentage of orders completely filled and shipped with in a certain time interval, say 24 hours or 12 hours, after the order has been received, the percentage of items per order which can be shipped within a short time interval etc. Application of these methods of measuring inventory reliability in any given situation will depend upon the availability of factors, which are most important to the customer service.

It is the general phenomena that the customer has the tendency to prefer, is the best of customer service. But, at the same time, it is very much costlier to provide all the elements of customer service at the same time. So, it becomes necessary to trade-off one or more elements against the other. Customers, normally are prepared to sacrifice one element of service level for another, which is more important. Thus, a proper trade-off between the
different combinations of all the service elements will help a company to decide about the stock levels preferred by the dealers/ customers.\textsuperscript{7}

After deciding another service level, the company can find out the total stock and safety stock needed to provide that service level by using the concept of 'Probability Theory'. In many inventory models developed for uncertain or probabilistic demand, it has been assumed that demand during lead-time follows a normal distribution trend. In case of physical distribution of vanaspati, the probability theory can also be employed to control the inventories or to find out the safety stock needed for a given service level, specifically when the basic data like inventory carrying cost, ordering cost, stock-out cost, lead time etc. needed for using any inventory control technique are not known with certainty.

With an approximation, demand follows a normal distribution trend, the calculations have been made for a depot of ABC in district Ambala, in order to illustrate the use of probability theory in controlling the inventory levels of vanaspati.\textsuperscript{8}

It would help in finding out the inventory level that must be held in a particular depot to achieve a desired service level; say 95%.

The month-wise sale of vanaspati from the above mentioned depot of 'ABC' at Ambala in the year 1994-95 are given in Table 7.5 (Appendix-I)

The average of these sales is arrived at 157.317 MTs therefore, the

\textsuperscript{7} Physical distribution of fertilizer, Ph.D thesis submitted to Panjab University, Chhandigrah 1990, by Indu Nahria, pp.. 265.

\textsuperscript{8} Bower son, D.J. "Logistical Mgt." Mac Milkn Publishign Co., Inc; New York, 1978, pp' 170.
Standard Deviation\(^9\) comes to 39.000 MTs. By using this standard deviation of sales i.e. 39.000 MTs., it is possible to determine the safety stock and then the total stock for a given customer service level.

For a service level of 97% the safety stock required will calculated as follow:

Safety Stock at 97% S.L.\(=\) (Number of S. D. to the right of mean) \(*\) (S.D.)

\[= 1.88 \times 39.000 = 73.32 \text{ MTs.}\]

Therefore, total stock at 97% service level will be calculated as under:

Total stock at 97% S.L.\(=\) Av. Stock + Safety Stock at 97% S.L

\[= 157.317 + 73.320 = 230.637 \text{ MTs.}\]

Thus, the total stock required by the above mentioned depot for 97% service level is 230.637 MTs. Similarly, the safety stocks and total stock can be calculated at other levels of customer service. Table. 7.6 (Appendix-I) show, the safety stocks needed for varying level of customer service.

From table 7.6 (Appendix-I), it is evident that the relationship between safety stock and service level is not linear. Large safety stocks are required for raising the service level once it passes about 97% (see graph 7.4 of Appendix-II). There fore, the company should cross the service level of 97% only in case of utmost necessity.

The actual stock of vanaspati (i.e. 230.825 MTs.) in ABC depot at Ambala in 1994-95 is much nearer to the total stock calculated (230.637 MTs.) at 97% level of customer service. It shows that at Ambala depot the company is providing 97% level of customer service. This shows that the

\(^9\) Average (X) = \(\Sigma\)
company is holding an excellent level of customer service and there is no complaint from customers and dealers. The position of others depots of ABC is also similar in the states of Punjab and Haryana. The same trend has been seen in case of Markfed. But, in the case of HVOC the situation is reverse. One comes across many stock-out situations in different depots of HVOC. In case of ABC and Markfed, companies have been operating near about 96% service levels. So, there is a slight scope for the reduction of inventory costs by reducing inventory level to a certain extent. It has been seen that there is a close relationship between inventory level and service level offered. Thus, one can conclude that a scientific approach to inventory management is lacking in all the companies and particularly in case of HVOC.

The companies selected under the present study are following nearly the similar inventory policies. All these companies do have the adequate data for possible inventory management as they develop sales plan prepare state-wise, depot-wise, product-wise and month-wise statements showing receipt of materials in depot and sales affected from these depots.

These statements are reviewed from time to time for inventory control. However, none of the company selected are using effective inventory control technique. HVOC and MARKFED have over the years increased their inventory levels and their inventory turnover ratio has come down. ABC on account of better turnover ratio shows that its inventory management is the best of all the selected companies. HVOC's inventory levels of vanaspati are considerably high in the state of Punjab in proportion to its sales position. MARKFED sales in Haryana are decreasing but stock levels are increasing which shows low inventory turn over ratio. Markfed
position is better than HVOC where as ABC's is the best of all the selected companies. The lower level of inventory of ABC is mainly due to higher consumer preferences. The over all analysis of these companies shows that there is a need for sound inventory management techniques.

This study has worked out the inventory level required for the service level of 97% of ABC depot located at Ambala. There is a need for the vanaspati industry to forecast demand accurately, establish customer service level and then calculate required level of inventory. Inventory management helps in finding out the total stock and safety stock needed once the service level is decided. Hence, the crux of this chapter is, to determine the optimum inventory level and to maintain a good balance between inventory level and customer service, the companies must start the use of scientific inventory techniques.