CHAPTER-I

INTRODUCTION

1.1 Background of the Study

Inventory refers to stock of goods. Inventories form a link between production and sale of products. The inventory exists in manufacturing and non-manufacturing organization. "In manufacturing organization there are four types of inventories. First raw materials, those input components that have been purchased and stored for future production. Second work-in-progress refers to semi-manufactured products. They represent products that need more work before they become finished products for sale. Third finished goods inventories which are completely manufactured products which are ready for sale and the fourth is about supplies which includes office and plant cleaning materials [Soap, brooms etc.] oil, fuel bulbs and the like, these materials don't directly enter production," (Pandey, 2000:455).

"In case of trading concern inventory will comprise of only finished goods and stock in trade owned by if for sale to customers in the normal cause of business," (Jain, 1993:68)."Inventory management involves planning of the optimal level of inventory and control of inventory cost supported by an appropriate organization structure, which is staffed by trained person and directed by top management. It involves both financial dimensions as well as physical dimension and these dimensions are interrelated and can't be looked in isolation," (Agrawal, 2000:238).

Thus management should pay adequate attention to Inventory management to reduce the cost of production and working capital requirements. Inventory should be maintained in appropriate quantity so as to avoid both under stock and over stock situations. For this purpose, inventory management is necessary because the aim of inventory is to maintain optimum level of inventory for the smooth production and sales operations.

"The growing number of corporations in Nepal is facing problem of inventory management. Due to lack of proper inventory policies, there are many corporations where large amount of

capital has been blocked up and very little measures have been taken to manage the inventory decisions. Models and techniques that have so far developed," (Shrestha, 2065:142).

1.1.1 Profile of Dairy Development Corporation

Dairy Development Corporation was established to fulfill the need of people by supplying quality milk and milk product at reasonable price. The demand of milk and milk product is gradually increasing. So, it was felt necessary to form Dairy Development Center. As a result Dairy Development Commission was converted into Dairy Development Board in 2019 B.S. DDC was established on 1st Shrawan 2026 B.S. as manufacturing enterprise under the Corporation Act 2021 B.S.

Public enterprises in Nepal constitute a vital instrument for the social economic development of our country. It enjoys a strategic and crucial position in our mixed economy. Public enterprises are operating in many sectors for over all economic development of the country with different goal and objectives. The main objective of DDC is to provide guaranteed market and fair price to the rural milk producers and supply hygienic pasteurized milk and other dairy product to the urban consumers. Due to public enterprise, its main object is fulfilling the social benefits rather than earning profit.

The Main objective of DDC is to provide a guaranteed market for milk to the rural farmers with fair price and to supply pasteurized milk and milk products to urban consumers. Develop organized milk collection system to meet increasing demand for pasteurized milk and milk products. Develop an organized marketing system for milk and milk products in urban areas.
The Board of Directors formed by Nepal Government governs the corporation. Board of Directors comprising of Chairman, two members from Agriculture & Co-operative Ministry, one from Finance Ministry & GM of DDC as a member secretary. World Food Programme (WFP) has supported DDC for about a decade in the early years. The New Zealand and Danish Government had contributed towards the establishment and rehabilitation of milk processing plants. USAID and Danish Government have been the major donors.

DDC produce milk and milk related products. Its main products are Dairy Ghee/Yak Ghee, Yoghurt, Cheese, Ice-cream, Paneer, Skimmed Milk Powder, Raswari (Sweets) in Can,

Lalmohan (Sweets) in Can. Dairy Development Corporation has been collecting buffalo milk, cow milk, and chauri milk from the milk producer from around the country. DDC has been playing a vital role to uplift the economic status of rural farmers. So it has been recognized as an effective tool of poverty elimination and economic development of rural farmers. DDC could not buy all milk offered by the farmers especially during the flush season. As consequences it had to impose milk holiday on certain days during the period. On the other hand during the lean season DDC has been importing slimmed milk powder to meet consumers demand. So DDC is playing an important role to improve the economic condition of milk producers and rural community.

1.2 Statement of the Problem

In Nepal the public enterprises are expected to build the infrastructure to produce and supply important consumer goods and supplement to the private sector and to operate as a model for efficiency. They are also expected to generate revenue and contribution to the national treasury in order to carry out these exceptions successfully. Public enterprises must be efficient in utilization of their resource.

Dairy Development Corporation is one of the public enterprises established in Nepal to fulfill the need of people by supplying quality milk at reasonable price. It also expected to be financially sound and contribute surplus to the National treasury. As one of the manufacturing corporation, it is required to contribute a return at least ten percent on its' capital employed. Many enterprises could not achieve their pre-established objectives and goals, due to lack of an authority and communication of objectives and goal from top to lower level management. Beside it integration of different activities and motivating employees are more challenging problems for the every management. There are other various problems, such as political interference, bureaucratic tendency, lack of continuity, stability lack of enough investment, lack of effective managerial skill etc. The vital reason is lack of study on effective and efficient inventory management tools and techniques for controlling inventory. Due to lack of effective inventory management, huge amount of money is blocked on the inventory. How much money should the firm invest in the inventory, how much inventory to be stocked, how ordering and carrying cost can be minimized, What is to be EOQ, how many times order would minimize the carrying costs are the few questions that evoke management always.

Present study is about inventory management of DDC. So many short coming can be seen in the inventory system of DDC. For example, the Economic Order Quantity and actual order quantity of the products are not equal. They are not maintaining the desirable safety stock because of which the production department has been facing many interruption in the production process. The corporation has no record of when should be ordered and how the carrying and ordering cost can be minimized. The following questions are designed for this study to explore difficulties connected with inventory management.

- What are the major problems in Inventory management and control system of DDC?
- What is the impact of inventory on the corporation's profit?
- What should be the optimal level of inventory to reduce inventory cost?
- What steps should be taken to improve the existing problem of inventory management of DDC?

1.3 Objective of the Study

The objectives of the study to assess the inventory management of DDC are follows:

- To analyze the present inventory management position of DDC.
- To identify and analyze the problems faced by the DDC in inventory management and control system.
- To identify the optimum level of inventory to reduce inventory cost.
- To assess the status of the corporation towards utilizing inventory resources.
- To suggest and recommend to the stakeholders on the basis of major findings.

1.4 Significance of the Study

Inventory management is one of the important subject in every manufacturing company. Without effective and efficient inventory management system no manufacturing company can achieve the goal. Proper inventory management helps to maximize the profitability and reasonable investment in the inventories by avoiding capital block. A company should maintain adequate stock of raw materials/ finished goods. A slightly increase in cost of materials will effect profitability. So the company should keep adequate stock of inventory. Adequate inventory will make able the company to meet customers demand. Many companies

in Nepal, is still using traditional technique in purchasing of inventory. Every company should apply modern tools and techniques in running business profitability.

This study is focused on effective inventory management in DDC and to explore optimal investment in inventory and improve inventory management system.

1.5 Limitations of the Study

This study is not free from the following limitations.

- The study was based on secondary data.
- This study was made on inventory management hence did not cover other management activities of the company.
- The study is covered only five fiscal years from 2064/065 to 2068/069.

1.6 Organization of the Study

The whole study was organized into five different chapters.

Chapter I: Introduction

This chapter concentrated on introduction, statement of the problem, objective of the study, significant of study and limitation of the study.

Chapter II: Review of Literature

This chapter dealt with review of various Journals, books, published or unpublished reports, articles and previous thesis.

Chapter III: Research Methodology

This chapter dealt with various descriptions of tools and techniques for data collection, presentation and analysis.

Chapter IV: Data Presentation and Analysis

In this chapter, the collected data were tabulated and analyzed by the use of various statistical tools, graphs and figure and major findings.

Chapter V: Summary, Conclusion and Recommendation

This chapter dealt with summary, conclusion and recommendation.

A bibliography and appendix have also been included in the last part of the study.

CHAPTER - II

REVIEW OF LITREATURE

2.1 Inventory Management

Inventories are current assets needed to facilitate smooth and uninterrupted production and sales. Inventories are a part of the current assets of a business since they are intended to be sold or used within one year, in the normal course of business operation. Inventories constitute an important item in the total mix of resources to be presented in the balance sheet of merchandise as well as manufacturing companies. "A merchandise company generally buys and sells the goods and will have a single form of inventory of unsold goods and will be reported as merchandise inventory. A manufacturing organization's inventory constitutes the stock of raw material, work in progress, finished goods, part supplies etc. which from a link between purchase-production and sales", (Singh, Ojha & Acharya, 2004:3.28).

"Inventory management involves planning of optimal level of material and cost control of material cost supported by an appropriate organization structure, which is staffed by trained person and directed by the top level management. It involves both financial dimensions as well as physical dimension and these dimensions are interrelated and can't be looked in isolation. Inventory in the form of raw materials, work-in-progress and semi-finished goods are of great significance for the success of an enterprise. These can directly affect the efficiency of the system. It is observed that irrespective of the size of an enterprise," (*Agrawal, 2000:238*).

The expenditure of materials is a major item of every manufacturing firm. In many cases, materials consumption varies from 25% to 75% of sales turnover. The expenditures made on materials include money invested in inventories, transportation cost, cost of storage, wastage, insurance etc. Because of the magnitude of expenditures, efforts are required in controlling inventory and their impact on profit. "A great deal of attention is required towards the management of operation associated with materials. Materials Management is one of the aspects of production management. Production management is developed and handled by production engineer. Therefore later inventory management becomes a separated and

significant management for the development of industries. The inventory management is assumed to maintain an adequate supply of correct materials at the lowest totals cost. The responsibility of determining the material requirement implied by the marketing forecast and liaising with the purchasing department for their acquisition, receiving and storing the material safety and in good condition for its subsequent issue and identifying surplus stock and taking action to reduce it. Under the inventory management there is not only essential production approach but also need marketing management but actually inventory management is purely subject of production management", (*Chary, 1994: 387*).

Inventory is working capital and therefore the control of inventories is an important aspect of operation management. The basic questions in the management of inventory are:

a) How much inventory to keep?
b) When the optimum EOQ level?

Before getting to a mathematical treatment of the above questions, first understanding of the function of inventory management is required.

a) There are inventories for normal consumption requirement rates and average lead times for procurement/manufacture of the materials, inventories is kept at the appropriate time.
b) A production process however continuous it may be is bound to have some interruptions. It may also have imbalance in the consumption and production rates of the materials at different stage at the production process this interruptions and imbalance make it necessary to kept stocks of inventories between the different stages of the operation.

Every Enterprise needs inventory for smooth running of its activities. There is a time lag between the reorganization of a need and its fulfillment. The greater the times lag the higher requirement for inventory. The unforeseen fluctuation in demand and supply of goods also necessitate the need for inventory. It also provides a cushion for future price fluctuations. About 90% part of working capital is invested in inventories, it is necessary for every management to give proper attention to inventory management. A proper planning of purchasing, storing, handling, and accounting should form a part of inventory management.

An efficient system of inventory management will determine

- What to purchase?
- How much to purchase?
- From where to purchase?

(Source: Sharma & Gupta, 1998:22-23).

"Inventory management is one of the aspects of production management. Production management is developed and handled by production engineer procurement is handling by its specialist. Therefore later inventory management becomes a separate and significant management for the development of industries. Under the inventory management there is not only essential production approach but also need marketing management but actually inventory management is purely subject of production management," (*Johnson, 1982:126*).

"Executive in production, purchasing and marketing departments, take decisions relating to inventories primary. Usually raw materials policies are shaped by purchasing and production executive. Work-in-progress inventory is influenced by the decision of production executives and finished goods inventory policy is evolved by production and marketing executive. Yet as inventory management has an important financial implication it has the responsible to ensure that inventories are properly monitored and controlled. It has to emphasis the financial point of view and initiate programmed with the participating and involvement of other for effective management of inventory," (*Chandra ,1998:328*).

Thus, Inventory management means not only branch of production management, it is an integrated view of management “Companies devoted a great deal of attention to the efficiency of their materials and inventory management operation. A brief look at the historical evolution of material faction will give us a fuller appreciation of the current situation. Up until the time F.W. Taylor, the production foreman was focal intents and purposes in complete control of the production activity. He hired, fired and promoted, he purchased the necessary raw materials scheduled production and handled individuals almost all of the other aspects of production.” Every business operation however big or small has to maintain some inventory; inventories serve us cushions to observe the stock of errors in demand forecast and provides more efficient use of the resources. Inventory for any organization is necessary and required careful planning and formulation of policies keeping in view the best interest of the organization. Depending upon the nature of the industry and firm, inventories may be durable and non durable. The various forms of inventory occur in manufacturing enterprises are as below:

a) Raw Material

These are goods that have not yet committed to the production in the manufacturing firm. “Raw materials are those basic inputs which are converted into finished products through the manufacturing process raw material inventories are those units, which have been purchased and stored for future production", (*Pandey, 1999: 755*). It consists of item that firm purchase for use in its production process it may consists of basic materials and or manufactured good maintaining adequate raw materials inventories provides a firm with advantage in both purchasing and production.

Materials used in factory are traditionally classified as direct materials and indirect materials. Direct materials are generally defined to include all materials and parts that are integral part of the finished product and their contribution can be directly identified. Indirect materials are generally defined as material used in manufacturing process as supporting materials. The following types of raw materials are held by dairy corporation.

- Auxiliary Materials,
- General Material,
- Lubricant Materials,
- Milk Materials, and
- Mechanical Materials

b) Work-in-Process

Work-in-process inventories are semi-manufactured products which need more work before they are converted as finished product for sale.”Sometimes it becomes very difficult to determine which materials is work-in-process and which are not because the same material in one industries and the same material may be a raw material may be a work-in-process as well as finished goods in other industry, it depends upon the nature of production. For milk industry milk is the final product. But a sweet industry uses this milk as raw material", (*Johnson, 1997:590*).

c) Finished Product

These inventories are those completely manufacturing product which are ready for sale. Stocks of raw materials and work-in-progress facilitate production while stock of finished goods is

required for smooth marketing operations. Therefore finished goods are completed goods awaiting sale. In a manufacturing concern they are the final output of production process. Firms carry finished goods to ensure that order can be filled when they are received. If a firm don't have finished goods inventory it would have to wait for the completion of the production process before inventory could be sold thus demand could not be satisfied when it arrive. When demand arrives and there is no inventory to satisfy that demand a stock out situation exists. In such situation, the firms will be in danger position of losing the customers to competitors permanently. DDC produces the following types of products:

- Butter
- Ghee
- Milk Power
- Skimmed Buttermilk
- Yoghurt
- Cheese
- Ice cream.
- Vanilla products
- Lassie
- Other Dairy products

2.4 Cost Associated with Inventory

The goal of inventory management is to provide inventories for sustaining operation at the lowest possible cost. The first step in inventory management is to identify all the costs involved in purchasing and maintaining inventories. The typical costs associated with the inventories are describes below:

i) Carrying/Holding Costs

The cost that is incurred after the acquisition of inventory is carrying cost. The cost associated with having inventories, which includes storage cost, insurance cost, depreciation cost and so on. Total carrying cost generally increases in direct proportion to the average amount of inventory carried. Inventory carried in turn depended upon the frequency with which orders are placed. To illustrate, if a firm sales S unit per year and if it places equal order N times per

year then Q = S/N unit will be purchased with each order. If the inventory is used evenly over the year and if no safety stock is carried then the average inventory will be:

$$\text{Average Inventory} = \frac{\text{Quantities per order}}{2}$$

Defining the annual percentage carrying cost as C, annual total carrying cost as (TCC), as the percentage carrying costs C times, price per unit PP times the average inventory in units.

Total Carrying Costs (TCC) $= CCP \times Q/2$

The inventory carrying costs are further explained as:

a) Capital Opportunity Cost: This consists of expenses of raising funds (interest on capital) to finance the acquisition of inventory, if funds were not locked up in inventory. They would have earned a return. This is opportunity cost of the funds or financial cost of components of the cost. Therefore, an opportunity cost determined by alternative use to which could be put. For example, for the alternative uses if firm can earn 10% then the capital cost of inventory is 10%.

b) Handling Cost: The size of consignments and the material handling facilities in the store determines these costs. Up to a certain level of inventory size per unit handling cost decreases but after that level, per unit handling costs starts increasing.

c) Storage Cost: The cost associated with maintenance of inventory is storage cost. These includes expenditure made on inventory staff, expenditure to provide various facilities like heating, floor space, shelves, lighting, and racks, bins and containers, materials handling equipments and other provision for safe and proper storage of items. These costs generally depend upon the volume to value ratio of an item.

d) Spoilage and Shortage Cost: Many products deteriorate over time in storage. The precise nature deteriorates various from product to product but whatever the causes, it represents reduction in the company's assets. This is term as a spoilage cost sometimes because of shrinkage and pilferage of inventory.

e) Depreciation Cost: In every organization, the value of the capital investment decrease with time. Thus, there is tendency among organization to reduce its capital investment on machines and other equipments. The depreciation costs are thus reduced. Naturally the desired amount of production with running the machines in stock period thus increasing the size of inventory.

f) Insurance and Taxes: Many of the goods in inventory require insurance and it should be included in inventory holding cost. The inventory a firm has on hand those make higher their tax bill. Where such taxes are in effect prudent, inventory management may dictate periodic reduction in inventory to coincide with the data on which the assessments are made.

ii) Ordering Cost

The ordering cost which is also 'set up cost' consists of the cost incurred from the initiation of purchasing procedures to the receipt of the ordered inventory. Purchase department remuneration, transportation expenses, postage and telegram, receipt and inspection ordering cost are some common examples of ordering cost. Ordering cost will have a proportionate relationship with the number of orders i.e. as the number of orders increases, the ordering cost also increases and as the number of orders decreases, the ordering cost also decreases.

In practices the cost per order generally contains both fixed and variable components, since the portion of cost such as that of receiving and inspecting the order normally varies with the quantity order. Ordering cost may differ in the sense of inventories nature. In case of raw materials ordering cost involves the clerical cost in placing an order as well as certain cost of receiving and checking the goods once they arrive for finished goods, ordering cost involves scheduling a production run and for work in progress ordering costs likely to involves nothing more than record keeping furthermore, ordering costs are the cost involved in placing and receiving an order or purchased items. The expenses involved in this cost are:

- Cost of placing an order,
- Requisition cost,
- Transportation/ Shipping cost,
- Receiving, inspecting and storing cost,
- Cost incurred when raw materials in transit,
- Insurance of raw materials,
- Telephone/Fax/Postage/Expenses,
- Sales tax, customs,
- Clearing and forwarding cost,
- Bank commission/ LC chargers,

- Stationary cost etc;

(Source: *Van Horne, 1985:416-419*).

Ordering cost increases with the number of order, thus more frequency in inventory acquired, higher the firm ordering cost. On the other hands if the firm maintains large inventories level there will be few orders placed and ordering cost will be relatively small. Thus, ordering costs decrease with the increasing size of inventory.

The fixed costs associated with ordering inventories as O for N order per year, the total ordering cost is given as:

Total Ordering Cost (TOC) = O N = O(S/Q)

Where, TOC = Total Ordering Cost

O= Fixed cost per order

N = No of order placed per year

Q = Inventory Quantity for each order (*Van Horne, 1988:417-430*).

iii) Stock-out Costs

Stock out cost is associated with demand. The depletion in stock results in loss in sales or back order costs. When the sales are lost due to stock out, the firm losses both the profit margin on unmade sales and the firm's goodwill. If the customer uses another business elsewhere, future profit margin may also be lost and back order cost in needed to convince customers to use again after inventories have been replenished. Back order cost includes, loss of goodwill money paid to re-order goods and notification to customers when goods arrived.

Stock out cost computed from following formula:

Stock out Cost = Inventory cycle per year × Stock output units × Probability of possible stock out unit × stock out cost.

$$\text{Inventory Cycle per Year} = \frac{\text{Annual uses}}{\text{Quantity order size}}$$

(Source: *Van Horne, 1988:428-445*).

2.5 Inventory Control

As the inventory of every organization requires a large portion of its investment; it requires an adequate practical form of control. The inventory control is a system which ensures the provision of required quantity of the inventory of the required quality at the required time with the minimum capital. The commonly used system or techniques for a proper control of inventory are perpetual inventory system, two bins system, ABC analysis and just-in-time inventory system. The function of inventory control is to obtain the maximum inventory turnover with sufficient stock to meet all requirements. There are basically two approaches to inventory control:

a) Unit control and

b) Value control.

If values control is imposed there is always a risk of running short of materials. Thus, an optimum control is achieved when the required materials can be obtained at a minimum cost through proper planning, formulation of policies and procedure in order to maintain the inventory to keep is decided after taking into consideration the availability of finance. The quantity discount allowed the cost of storage and storage accommodation, order placing and receiving costs risk of loss due to falling prices, deterioration, evaporation, obsolescence theft etc, economic orders, quantity and time in obtaining delivery. Thus, in the words of John L. Burbidge, "Inventory control is, then, concerned with the control of the quantities and loss monetary values of these items at predetermined level of within safe limits." Thus, the inventory control management includes the following aspects; (*Varma and Agarwal, 1998:225*).

- Providing proper storage facilities arranging the receipts disbursement and procurement of materials, developing the forms of recording these transactions.
- Assigning responsibilities for carrying out inventory control functions.
- Providing for the reports necessary for supervising the overall activity.
- Size of inventory determining maximum and minimum levels establishing time schedules, procedures and lot of size for new orders, ascertaining minimum safety levels coordinating sales, production and inventory policies.

It is, therefore, necessary that process co-ordination must be there in the activities and policies of purchase, production and sales department to affect the better inventory control.

2.6 Techniques of Inventory Control

According to Alton N. Smith "Inventory is (money) on which a company pays interest rather than collect interest. It is money always in danger of deviation. Non controlled inventory is an industrial danger." Adequate inventories facilitate smooth production activities and help to provide off shelf delivery to customers. On the other hand excessive inventory is idle resource of the firm and can prove costly because it tries up working capital unnecessarily which could have been better used had it been utilized for some other purpose. The major problems of inventory management therefore should be, to arrive at an optimum balance between too much inventory and too little inventory. So that there may be no stock out problem and cost of inventory should be minimum. Following are the inventory control techniques:

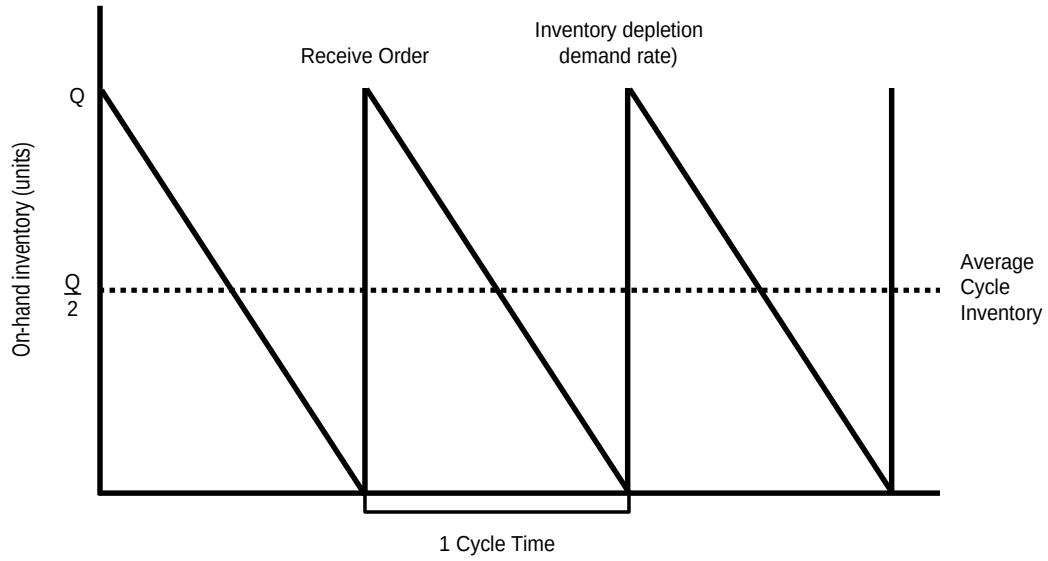
I. Economic Order Quantity (EOQ)

The purchasing officer of an organization should determine the appropriate quantity to be ordered. The economic order quantity refers to the quantity of material/items in a single purchase order that gives the maximum economy. The economic order quantity, which is also known as an optimum order quantity or an economic lot size is that quantity where the total cost of an inventory is the minimum. In other words, this techniques attempts to establish the more economic balance between the acquisition cost and carrying cost by determining quantities to be ordered. In 1915, F.W. Harris developed the famous economic order quantity (EOQ) formula. Later, through the consultant named Wilson, this formula gained wide use in industrial area. Later on this formula was developed by Harris. The EOQ is still widely used in inventory for independent demand. The EOQ model is an inventory management technique used to find the optimal order includes order quantity that minimizes the total cost which includes ordered and carrying cost.

John J. Hampton defined economic order quantity as “The order size that will result in the lowest total of order and carrying costs for an item of inventory. Furthermore, he states the importance of economic order quantity as if a firm places unnecessary orders it will incur unneeded order costs if it places to few orders, it must maintain large stock of goods and will have excessive carrying costs by calculating an economic order quantity, the firm identifies the number of units to order that results in the lowest total of these costs.” (*Hampton, 1996:.233*)

Figure .2.1

Economic Order Quantity



It refers to the order size that will results in the lowest total cost (Total Ordering Cost + Total Carrying Cost) for an item of inventory. If a firm places many orders it will insure unneeded ordering costs. If it places too few orders, it will have excessive carrying cost. By EOQ model, we can identify the number of units to order that results in the lowest total costs. EOQ seeks that how much units of inventory should purchase at an order, which minimizes the total cost. When we are going to calculate EOQ one thing should keep in mind. To calculate the cost involve in the carrying and ordering. A fairly large error, say 21% in determining the carrying and ordering costs will introduce a much smaller error (10%) in the determination of EOQ.

In calculating EOQ don't include fixed costs and must use marginal cost only.

$$EOQ = EOQ \quad = \sqrt{\frac{2AO}{C}}$$

Where, A = Annual Demand

O = Ordering Cost per Order

C = Carrying Cost per Unit

Assumption of Economic Order Quantity

The concept of EOQ is the based on following assumption:

- The same fixed quantity is ordered at each re-ordering point.
- Time lag in the placement of an order and its delivery, annual demand, carrying cost and ordering cost are certain.

- Purchase price of an item is unaffected by the quantity ordered.
- The demand rate is constant recurring and known for example, demand (or usage) is 100 units a day with no random variation and demand is assume to continue into the indefinite future.
- The lead time is constants and knows. The lead time for order placement to order delivery is therefore always a fixed number of days, No stock outs are allowed. Since demand and lead time are constant one can determine exactly when to order material to avoid stock out.
- A specific cost structure is used as follows the unit cost is constant and no discounts are given for large purchase. The carrying costs depend linearly on the average inventory level there is a fixed ordering or set up costs of each lot which is independent of the number of items in the lot; (*Martin; 1996:60-65*).

The item is a single product there is no interaction with other products.

Approaches to Set EOQ

The EOQ model can be illustrate by:

- Mathematical (short-cut) formula method
- The long analytical approach or tabulation method or trial and error approach, and
- Graphical approach, which are explained below:

Mathematical (Short-Cut)/Formula Method

Mathematical models are also available to calculate economic order quantity. There are numerous models exist, as the field of inventory management and can be studies in college programs such as operation research and production management. Even many mathematical model exists the main objective of these model is to reduce minimizes the inventory cost/total costs.

Without getting into highly refined decision models we can illustrate the concepts of EOQ with a basis mathematical model.

We can calculate EOQ by using the following formula

$$EOQ = \sqrt{\frac{2AO}{C}}$$

Where, A= Annual requirement

O = ordering cost per order

C= Carrying cost or inventory holding cost.

I = carrying cost if it is given as % of inventory value.

The Long Analytical Approach or Trial and Error Approach

This approach is also called a tabular or analytical approach where the total cost (i.e. ordering cost and carrying cost) for each order size is calculated. A firm has different alternative purchase policy of its inventory. It can purchases its entire requirement own one single lot. Alternatively, the firm can purchase its inventory is small lots periodically say weekly, monthly, bio-monthly, six monthly and so as its means more than one time the firm can place an order to purchases inventory. The smaller the lot sizes the lower average inventory and vice-versa. Low inventory holding are associated with high ordering cost and low carrying cost. This approach for the determination of EOQ uses different permutations and combination of total costs inventory purchase so as to find out the total cost.

In the other words, according to this approach the carrying cost and ordering cost for a different size of order to purchases inventories computed and the order size with the lowest total cost/ordering plus carrying of inventory is the economic order quantity.

The Graphic Approach

The Economic order quantity can also be found graphically. The following figure illustrates the EOQ functions:

Figure 2.2

Economic Order Quantity

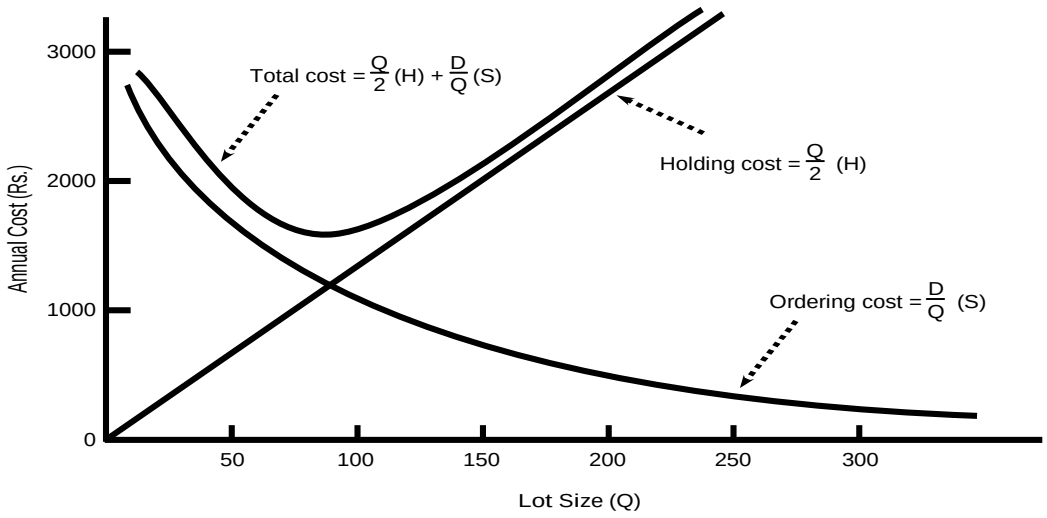


Figure 2.2 depicts the carrying; ordering and total costs are plotted on vertical axis, horizontal axis used to represent the order sizes. Total carrying cost increases as the order size increase. Because on an average a large inventory level will be maintained and ordering cost decline with increase in order size. The behavior of total cost line is noticeable since it is a sum of two types of costs that behave differently with order size. The total cost decline in the first stage but they start rising when the decrease in average ordering cost is more than offset by the increase in carrying cost. The economic order quantity occurs at the point Q where the total cost is minimum if the order size increase carrying cost exceeds ordering cost that are saved. Thus, the firm operation profit is maximized at Q; (*Gupta & Agrawal, 1993: 156:157*).

Quantity Discount

Quantity discount helps the firm will to increase its order size more than the EOQ level. It will reduce number of orders and increase the average inventory holding. When we accepts quantity discount the firm will save on ordering costs, but will incur additional carrying costs. The net return is the differences between the resultant saving and additional carrying costs. If the net return is positive, the firm's order size should equal the quantity necessary to avail the discount if negative order size should equal EOQ level.

II. ABC Analysis

The ABC analysis is proportional value analysis, which is also called a selective control or the always best control, is a simple technique that is used to analyze and control the stock, by considering it as being in one of the three groups. An analysis of the materials costs will show that a smaller percentage of items of materials in the store may contribute to a large percentage of the value of consumption and on the other hand a large percentage of items may represent a smaller percentage of the value of items consumed between these two extremes will fall those items the percentage number of which is more of less equal to their value of consumption item falling in the first category are treated as 'A' items of the second category as 'B' items and items of the third category are taken as 'C' items such as, analysis of material is known as ABC analysis. This technique of stock control is also known as stock control according to the value method or always better control method or proportional parts value analysis method. Thus, under this technique of material controls, materials are listed in 'A', 'B' and 'C' categories in descending order based on money value of consumption. ABC analysis measures the cost significant of each item of material. It concentrates on important items, so it also known as "Control by importance and exception; (*Richmond, Herbert, 1999:79-85*).

Classifying inventory according to some measure of importance and allocating control efforts accordingly.

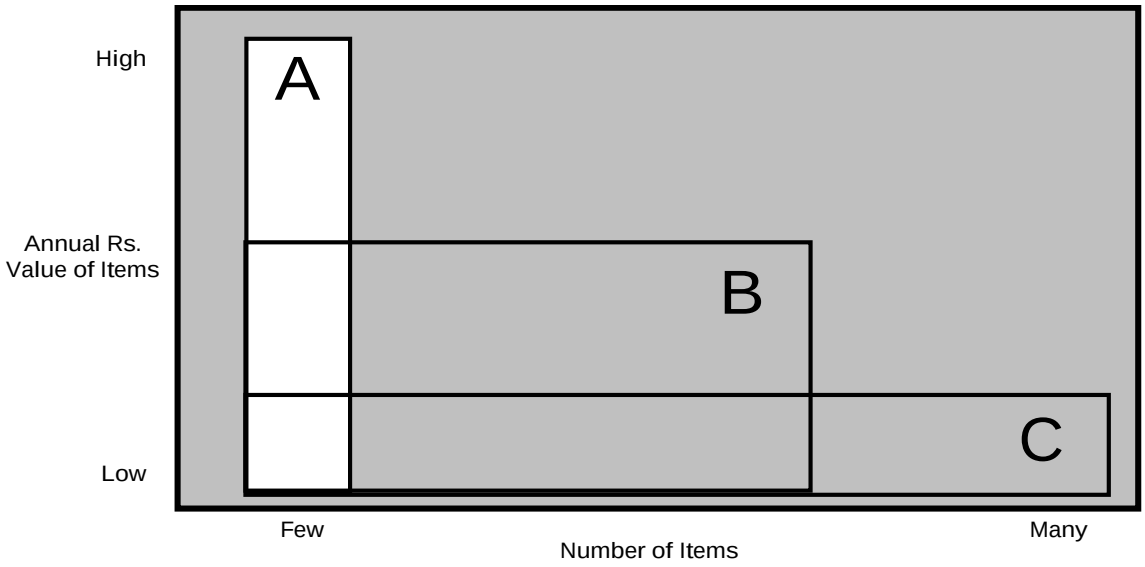
A - Very important

B - Mod. Important

C - Least important

Figure 2.3

ABC Classification System



The report of Indian productivity term on report of “Stores and Inventory Control in U.S.A, Japan and West Germany” gives the following examples of ABC analysis.

Table 2.1

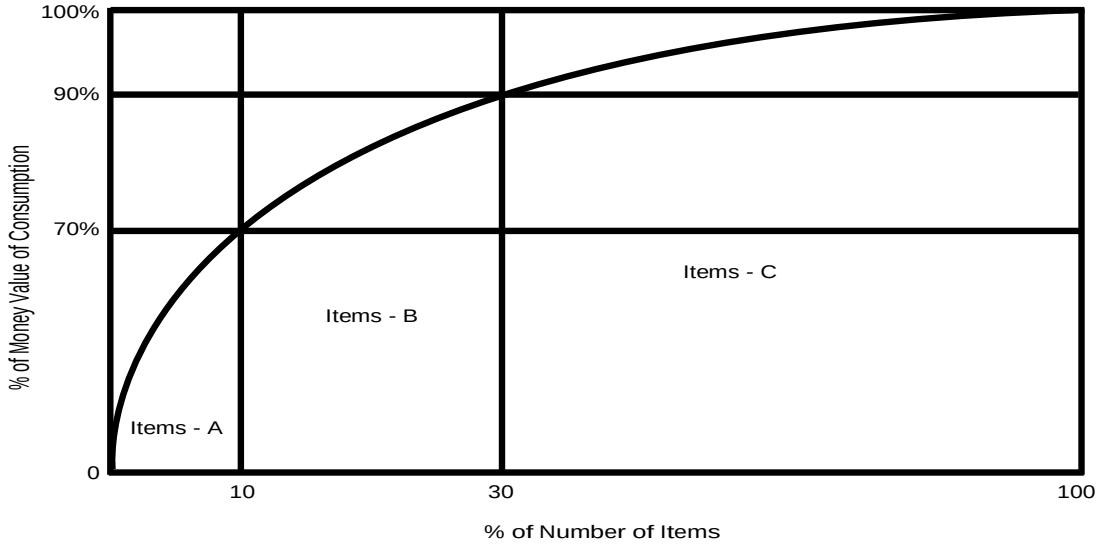
ABC Classification System

Group	Percentage of Items	Percentage of Costs
A	8%	75%
B	25%	20%
C	67%	5%

The significance of this analysis is that a very close control is exercised over the items of 'A' group which account for a high percentage of costs while less stringent control is adequate for categories 'B' and very little control would sufficient for category 'C' item. The graphical representation of ABC analysis may be as given below.

Figure: 2.4.

Graphical presentation of ABC Analysis



Procedure

The Steps Computing ABC analysis is:

- First calculate annual usage, multiplying the quantity (number of the units) of the item consume in one year by it's unit price.
- Arrange all inventory items, first - items will show maximum annual usage in rupees, the second item the second maximum. The third items the third maximum and so on. After having done this, total of annual usage in rupees is put at the bottom of the last.
- Inventory items are categorized on the basis of annual usage and its price, which item has more annual usage and higher it's price these item is categorized as 'A' item, which contribute lesser than categories. This should be kept in categories 'B' and the rest contribution of the total percentage of annual usage is called 'C' categories.
- Placing of the orders on the basis the classified.(Solomon, Ezra:1978:419)

III. System of Ordering: When to Order?

The problem how much to be ordered is solved by determining the economic order quantity (EOQ). The second problem is when to be order. This question is when to be ordered. This question is related to determine the reorder point. It is also known as order point or optimal re-order point or recording level of ordering level. It is the point which if stock of material falls down then the store keeper initiates the purchase requisition up to time the fresh supply of the

materials. This level is fixed somewhere between the maximum & minimum level in such a way that the difference recording level and maximum will sufficient to meet the requirement of production of to time the fresh supply of the material received. The re-order point is the level of inventory at which the firm places an order in the amount of the economic order quantity. If the firm places the order when the inventory reaches the re-order point, the new goods will arise before the firm runs out of goods to sell. As long as delivery is not instantaneous an order must be placed so that inventory is not depleted till new shipment arrives. This required inventory level is termed 'transit stock' and represents the amount of inventory that would be used (or sold) between the times of an order is placed and time delivered. Transit stock is determined by using the following formula:

Transit Stock = Stock used per time period x transit time

To confirm the validity of this formula, the following example has been quoted.

Major motors used 800 tires per day (based on 250 working days, in a year 200,000/250) and that five days are required for delivery of new orders. The order points reached when inventory is reduced to the transit stock level of 4000 tires.

Transit Stock = 800 × 5 days = 4000 tires

Uncertainly in demand can be accommodated by adding safety stock for the transit stock level. Safety stock refers to extra inventory held as a hedge or protection against the possibility of a stock-out. Safety stock reduces or eliminates the costs incurred by a stock-out, but it adds to carrying costs.

The reorder point then is determined by adding transit stock to the safety stock level that the company determines to be cost effective.

Optimal Reorder Point = Transit Stock + Safety Stock

If major motors decide that safety stock of 800 tires is optimal, it will place a new order for the EOQ of 6000 tires when inventory falls to 4800 units.

Optimal Reorder Point = 4000 + 800 = 4800 units.

Thus, basically these items of information are needed as inputs to design the reorder point.

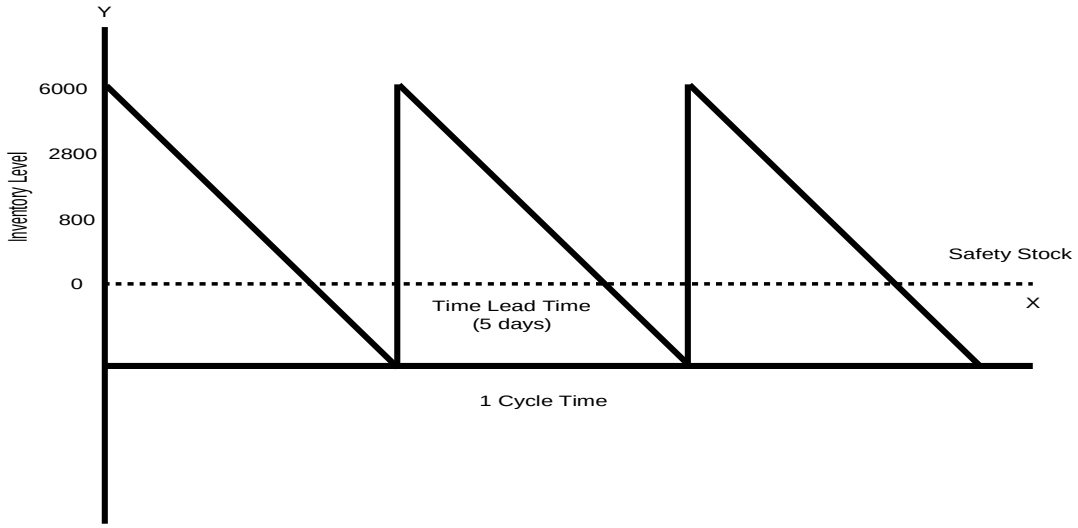
The safety stock involves two types of cost (i) stock out cost and (ii) carrying cost. Safety stock in necessary under the condition of uncertainty in such situation the demand and supply of goods may fluctuate day by day. If the actual usage or sales increases and delivery from the

supplies are delayed the firm would face a stock-out problem. The firm would therefore be advised to keep a sufficient safety margin by having additional inventory to guard against stock out situation. Such stocks are called safety stock.

Following figure depends the inventory levels overtime when transit and safety stock are taken into account; (Solomon and Pringle, 1978:218-221).

Figure: 2.5

Inventory Level with Transit Stock and Safety Stock



IV. Stock Level Subsystem

Carrying of too much and too little of inventories is detrimental to the firms. If the inventory is too little, the firm will face frequent stock - outs involving high re-ordering cost and if the inventory level is to high, it will be unnecessary ties of capital. Therefore, an efficient inventory management requires that a firm should maintain the optimum level of inventory where inventory the optimum level of inventory where inventory costs are the minimum and at the same time there is no stock out which may result in loss of sale or stoppage of production. Various stock levels are; (*Nair , Banerjee and Agrawal,1998: 220*).

A. Minimum Level

It represents the minimum quantity of inventory, which must be maintained in hand at any time. This quantity is fixed so that production as sales may not be held up due to shortage of inventory in this level. The following factors are taken in to consideration:

- Lead-time i.e. time lag between in denting and receiving of the inventory.
- Rate of consumption of the inventory during the lead time.
- Nature of inventory, minimum level is not requires in case of special inventory, which is required against customer specific orders.

Formula for the calculation of:

Minimum Level = Re-ordering Level - (Normal Consumption x Normal Re-order Period).

B. Maximum Level

Maximum level represents the maximum quantity of an item of inventory that can be hold in stock at any time that stock should not exceed this quantity. The quantity is fixed so that their may be no over stocking. The maximum stock level is fixed by taking into account the following factors:

- Amount of capital available for maintaining stores.
- Go down space available
- Maximum requirement of the stores for production purpose at any point of time.
- Rate of consumption of the material during the lead time.
- The time lag between indenting and receiving of the inventory.
- Possibility of loss in stores by deteriorations, evaporation etc.
- Fluctuation in price
- The seasonal nature of supply of inventory some items of inventory goods are available only during specific periods of the year, so these have to be stocked heavily during these periods.
- Restriction imposed by Government of local authority in required to material in which there are inherent risks, e.g. fire and explosion.
- Possibility of change in fashion and habit, which will necessitate change in requirements of materials.

Formula of maximum stock level = Re-order level + Reordering quantity - (minimum consumption x minimum re-ordering period)

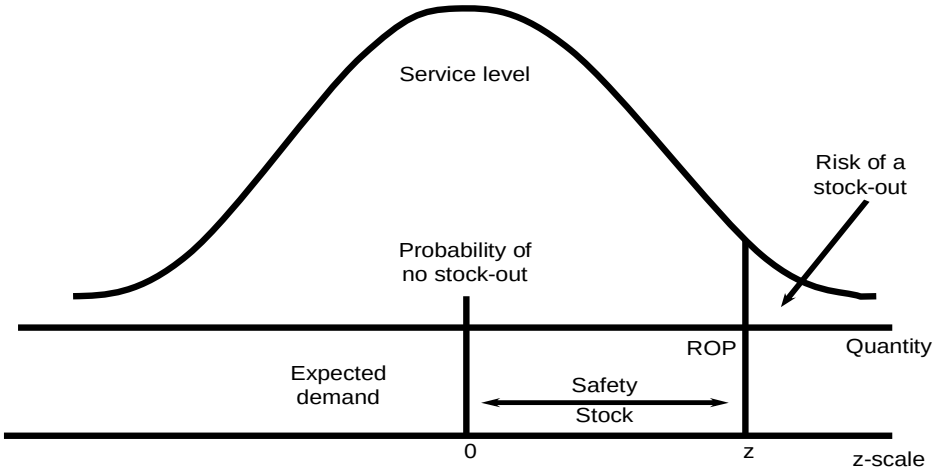
C. Re-ordering Level

An important question in any inventory management system is "when an order for the purchase of an item should be placed, so that the concern does not run out of goods." The re-order level provides the answer to this question.

“It is the point at which if stock to material in store approaches the stock-keeper should initiate the purchases requisition for fresh supplier of material. This level is fixed some where between the maximum and minimum level in such a way that the different of quantity of the materials between the re-ordering level and the maximum level will be sufficient to meet the requirement of production up to the time the fresh supply to the material received. "Re order point sub system answers the important question in any organization's inventory management. The question is "when an order should be placed so that the firm does not run out of stock; (*Van Horne, 1985:426*)

Figure 2.6

Re-order Point



"The re-order point is the level of inventory at which the firm places an order in the amount of the economic order quantity. If the firm places the order when the inventory reaches the re-order point, the new goods will arrive before the firm runs out of goods to sell." So determine the re-order point under certainty. There are three information/assumptions are needed.

i) **Usage Role:** This is the rate per day at which the item is consumed in production. It is expressed in units.

ii) **Lead Time:** It refers the time normally between placing an order and receiving the delivery of inventory. Lead time covers the time span from the point when a decision to places an order for the procurement of inventory is made to the actual receipt of the inventory by the firm. It is also called procurement time of inventory. It is expressed in days, weeks, and months.

iii) **Safety Stock Level:** The minimum level of inventory may be expressed in days this level can be computed by multiplying the usage rate times and the number of days that the firms want to hold as a protection against shortage.

Reorder Level = Maximum Consumption Maximum Re-order point.

iv) **Average stock level:** Average stock is calculated as:

Average Stock Level = Minimum stock level + 1/2 of re-order quantity.

v) **Danger Level:** This is a level of which normal issue of the material are stopped and issued are made only made specific instructions. The firms will make special arrangement to get the materially, which reach at their danger levels so that the production may not stop due to shortage of materials.

Danger level = Average Consumption x Maximum Reorder Period

V. Just in Time System (JIT)

The just- in-time inventory is a recently developed management philosophy which assumes the purchase of raw materials and component parts arrive just in time for use in manufacturing process-often within a few hours of the time they are scheduled for use and sales. The primary focus of the just in time system is to reduce order costs and the purchase price of the goods purchased. The Japanese have carried the just in time system to great lengths, and U.S. companies are increasingly adopting this system in their manufacturing plants. To some extents the just in time system reduces the need for the purchaser to carry inventories by passing the problem back to its suppliers. However with a coordinated production schedule, the supplier may also benefit (a) by being able to schedule production runs better and (b) by having to carry lower finished goods inventory safety stock. In any event, coordination between suppliers and users lessens total inventory requirements and also reduces total production costs.

The JIT system was developed by Toyota in the 1950s to 1960s and was adopted by other Japanese companies in 1970s. US companies started adopting it during the 1980s since when it was also been adopted by UK companies (Singh, Ojha & Acharya; 2004:3.26). Toyota provides a good example of the Just in time system. Eight of Toyota's ten factories, along with most of Toyota's suppliers do the countryside around Toyota city. Delivery of the components is tied to the speed of the assembly line and parts are generally delivered no more than a few hours before they are used. Similarly, Ford has been restructuring its production system with a goal of increasing its inventory turnover from 20 times a year to 30 or 40 times.

VI. Out-Sourcing

It is the practice of purchasing components rather than making them in house. Thus, if General Motors arranges to buy radiators, axels, and other parts from suppliers rather than making them itself, it has increased its use of outsourcing. Outsourcing if often combined with Just in time systems to reduce inventory levels. However one important reason for outsourcing has nothing to do with inventory policy because of wage rate differentials, a heavily unionized company like GM can often buy parts from a nonunion zed supplier at a lower cost than it could make them. (*Solomon & Pringle, 1988:242*).

2.7 Inventory System

We can now proceed to analyze the system that management use to control inventories. Basically there are just two types of inventory systems, although both have humorous variation. One is termed the "Fixed order size system", a fixed quantity of goods is order whenever inventory deeps below to predetermined level. The time between orders varies with the demand rates, but the size of the order remains constant. In practice, fixed order size system are generally called perpetual inventory system, are since up to date records of the of inventory's status. These posting operations may be done manually an inventory record card or as increasingly the case, through remote input terminals to a computer file. In general only class A and B inventory are maintained in this fashion.

The "two bin-system" an application of the fixed-order size approach is one of the oldest inventory system in use for illustration let us imagine that all material or given type is placed in two large bins. When the first empty, the second is put into use and a replacement order for

a fixed amount is disnatured immediately when the new materials arrives, it is placed in the empty bin and the process continues.

In the second basic type the fixed order interval system, periodic review of inventories are made, at which time they are restored to some predetermined optimum level, no running records of daily inventory activities are kept. The status of inventory is known only at the time of the review, which may take place weekly, monthly, quarterly or yearly. Because of this, inventory system of this type is commonly called "Periodic inventory system". Such systems are generally used for class B or C inventories or in instances where the large number of items precludes the updating of each inventory transaction.

1. **Periodic System**

   Physical count of items made at periodic intervals

2. **Perpetual Inventory System**

   System that keeps track of removals from inventory continuously, thus monitoring current levels of each item.

3. **Two-Bin System**

   Two containers of inventory; reorder when the first is empty.

4. **Universal Bar Code**

   Bar code printed on a label that has information about the item to which it is attached.

2.8 Comparison of the Periodic and Perpetual Inventory System

The fixed order-size system is well suited for managing inventories of low value items, since it permits loser control. Items of this sort are usually bought in large quantities relative to their use and can be readily obtained from the supplier at any time. A simple to bin process without a large investment in record keeping can control them. Perpetual inventories also lend themselves to the stocking of high-cost items that can be purchased at anytime. Continuous positing to inventory records controls these items. In this way the status of the high cost items can closely watched. This is costly; however for inventories with a large number of items, since the critical cost is high yet, with the use of computer, such cost can be reduced. The broader application of perpetual inventory records made feasible by computer will in turn result involves control of inventories.

The fixed order interval system lends itself to Inventories that consist of large number of products because the clerical cost of periodic evaluation is substantially below that required for perpetual recording. This system is also well suited for items whose availability may be limited because of the suppliers demand for period order so that they can plan their production runs economically. In order to use, the Fixed-order-interval system, however, higher safety stock must be maintained.

2.9 Review of the Previous Thesis

An attempt is made to review the related studies conducted by different agencies, expert, scholars related with inventory management of manufacturing enterprises in Nepal. Some studies were made in the subject of inventory management but few studies were reviewed in this chapter.

Dhakal, Amit (2008), has conducted a thesis on *Inventory Management*: *A case study of Nepal Food Corporation* an unpublished Master level thesis submitted to Shanker Dev Campus, Faculty of Management, T.U. He had made following objectives and major findings.

Objectives:

- To highlight the policies related variables like purchase, sales, sales food quota of NFC.
- To determine optimal inventory level of major raw materials.

Major Finding:

- The relationship between edible cereal production and requirement is negative.
- The total food grains quota is fluctuated in year after year because of production fluctuation in Nepalese food cooperation.
- Food grains purchasing the domestic purchase are more in fluctuated and greater than import.

Gaire, Mahesh (2009) has conducted a thesis on *Inventory Management of Bottlers Nepal limited* an unpublished Master level thesis submitted to Shanker Dev Campus, Faculty of Management, T.U. He had made following objectives and major findings.

Objectives:

- To study the practice of inventory management in bottlers Nepal Ltd. (acquisition of raw materials, storing of goods and issuing of goods)
- To analyze the position of inventory level and its trend in different periods of operation.
- To evaluate the relationship between the factors like net profit, sales, purchase etc.

Major findings:

- The inventories maintained are of different types and there is a huge fluctuation of inventories from period to period, in some fiscal year the firm has not maintained some inventories.
- Raw material occupies the largest portion of the inventories for each inventories type where finished goods occupy the least portion on total. In inventories to total assets ratio, the ratio are not consistent, though there is not a huge fluctuation. The inventories to total urgent assets ratio is negative due to negative current assets.

Kshetri, Sabina (2010) conducted a thesis on *Inventory Management of Dairy Development Corporation (DDC) Ltd and Sitaram Gokul Milk Pvt Ltd (SGML)* an unpublished Master level thesis submitted to Nepal Commerce Campus, Faculty of Management, T.U. She had made following objectives and major findings.

Objectives:

- To examine the inventory management practice and to analyze its impact in profitability.
- To assess the study of company towards utilizing inventory resources.
- To identify the optimum level of inventory to reduce inventory cost.
- To recommend some suggestion based on major findings and conclusion.

Major findings:

- The company have not categorized its inventory for the purpose of control and paid equal attention for all the inventories held in the time store.
- There is not proper and timely improvement in inventory management DDC have lack of

study on effective and efficient inventory management system due to this; huge money is blocked in inventory.

- The EOQ model is not followed in the purchasing decision by the Company. Cost related with ordering and holding inventory are not recorded separately in DDC, but recorded as whole.
- The inventory turnover ratio of the company was not satisfactory. There is no significant relationship between inventory and profit of the company.
- The DDC efficiency in inventory is poor. The company has not changed their inventory in to receivable\cash through sales.

Gautam, Ramesh (2012) has conducted on *Inventory management of Dairy development Corporation and Sitaram Gokul Milk Private Ltd* an unpublished Master level thesis submitted to Shanker Dev Campus, Faculty of Management, T.U. He had made following objectives and major findings.

Objectives:

- To carry out a comparative analysis of the present inventory management position of DDC and Sitaram Gokul Milk Private Ltd.
- To identify and analyze the problems faced by the companies at the time of inventory management and control system.
- To examine the inventory management practice and to analyze its impact in profit of the two sampled companies.
- To assess the status of the companies towards utilizing inventory resources.
- To identify the optimum level of inventory to reduce inventory cost.

Major Findings:

- Both companies have not categorized its inventory for the purpose of control and paid equal attention on all the inventories.
- The economic order quantity model is not followed in purchasing by both of the companies.

- Cost related with ordering and holding inventory are not recorded separately in Dairy Development Corporation and Sitaram Gokul Milk Private Ltd., but recorded as a whole.
- Dairy Development Corporation and Sitaram Gokul Milk Private Ltd used Re-order after stock is finished.
- There is no significant relationship between Inventory and profit of both companies.

The main objective of this study is to examine the "cost-volume profit analysis effectiveness of Nepal Food Corporation and Wai-Wai Noodles". To identify this, the following objectives have been carried out:

- To find the desired profit with specified sales volume of NFC and Wai- Wai Noodles.
- To analyze and evaluate the profitability and financial performance of Nepal Food Corporation and Wai-Wai Noodles.
- To examine the profit or loss at specified level of sales of NFC and Wai- Wai Noodles.
- To study and compare sales volume regarding break-even point of manufacturing company.

Dhakal, Prabin (2013) has conducted on the topic of Cost-Volume-Profit analysis as a Tool to Measure the Effectiveness of Profit Planning and Control: A Case Study of Gorkhkali Rubber Industry Ltd. an unpublished Master level thesis submitted to Shanker Dev Campus, Faculty of Management, T.U. He had focused his study to examine CVP as a tool to measure the effectiveness of profit planning and control by using both primary and secondary data. Dhakal had point out some following remarkable objectives and findings of research:

Objectives:

- To measure the effectiveness of profit planning and control of Gorkhali Rubber Industry Ltd (GIRL).
- To explore the whether the product of Gorkhali Rubber Industry are high quality and exportable or not.

Major findings:

- Sales plan are not properly maintained by GRIL.
- Appropriated cost classification technique is not practices in GRIL.
- There is very low contribution margin of GIRL.

- GIRL is in very high interest bracket.
- GIRL does not have a detailed and systematic practice of planning.
- Goals and objectives are not communicated to the lower level of management.
- GRIL produces very high quality and exportable product but the production cost is high.
- The profitability of the industry is very poor and suffering a high degree of losses.

2.10 Research Gap

The review of the relevant thesis has contributed to enhance the fundamental understanding and knowledge and ideas required to make inventory management of Dairy Development Cooperation (DDC). Similarly, reviewing various books, thesis and other independent studies by different authors related to the topic, it could be concluded that all those works performed are related to the study of inventory management. EOQ, Re-Order Level, Ratio Analysis, Turnover Ratio, Re-order point, Inventory to Total Assets Ratio, Inventory to Sales Ratio, Inventory to Current Assets Ratio, Inventory to Profit Ratio, Inventory Turnover Ratio, Inventory Holding Days (DIH) Regression Analysis on Inventory and Sales, Sales and Sales Expenses, Closing Inventory and Net Profit of primary and secondary data of the DDC were presented and analyzed. Likewise, secondary data were analyzed by using average mean, percentage, simple and multiple regression analysis whereas primary data are analyzed by using percentage and pie chart with 30 sample size /respondents. Similarly, this study is based on five fiscal years data from 2064/065 to 2068/069 of the DDC.

CHAPTER -III

RESEARCH METHODOLOGY

3.1 Research Design

The study has used secondary data. Analytical as well as descriptive research design was adopted to clarify the situation through the presentation and analysis of various data. An explanatory research design was used to show the relationship between the variables.

3.2 ABC Analysis

ABC Analysis is a widely used Inventory classification technique to identify various items of Inventory for the purpose of inventory control. This analysis is important since a firm should not exercise the same degree of control on all types of inventory. Raw materials are essential to classify on the basis of investment in inventory. In this analysis inventories are formed into three categories A, B and C are formed. Generally Group A inventory involves the largest investment therefore most rigorous and sophisticated inventory are needed to be applied. The Group C inventory involves relatively small investment although the items of this inventory may large. So less is given attention to control such inventory. The Group B inventory stands midway. It deserves less attention than A but more than C.

In ABC Analysis firstly, all the inventories are classified into three categories.
In the context of DDC three groups of raw materials are classified as follows:
Group A - Milk - 75 % of Total value
Group B - Additive (Chemical) - 15 % of Total Value
Group C - Packing Materials - 10 % of the Total Value

The group A inventory is most important in terms of investment, which bears 75 % of total value. But the group C inventory holds more quantity but lower value inventory. The items of B groups inventory hold moderate investment and quantity also lies in moderate.

3.3 Population and Sample

Number of Dairy corporations operating in Nepal is the population size.

1. Dairy Development Corporation (DDC)
2. Sitaram Gokul Milk Pvt. Ltd
3. Today Milk
4. Anmol Dairy
5. Goodmorning Dairy
6. Every Day Milk
7. Kalika Dairy
8. Saiju Dairy
9. Rasdhani Dairy Corporation
10. Kantipur Dairy Milk

In this study only the government owed DDC was taken as a sample among all the Dairy Industries of Nepal.

3.4 Sources of Data

Information is the lifeblood of any research; together the information data collection is a major task. Secondary data were used to achieve the objectives of this study. Information collected through personal observations and interviews and officials were taken as primary data. The secondary data were collected from the following sources.

1 Reports and financial statements of the DDC factories provided by the officials.

2 Both published and unpublished documents related to Dairy Development Corporation Limited.

3 Books, magazines & previous dissertation of Dairy Development Corporation Limited.

3.5 Data Collection Method

All the gathered data were used according to need and requirement of this study. Secondary data were directly obtained from various sources mentioned above specially, to obtain the data from official records, the researcher has to visit the company frequently and get it from the records.

3.6 Tools Used for Analysis

Data collected from various sources are managed, analyzed and present in proper table and formats. Interpretations and explanations are made where necessary. To analyze the collected data, financial and statistical tools are used to analyze the effectiveness of inventory management wherever necessary for this.

3.6.1 Financial Tools

I. Selective Inventory Control- ABC Analysis

Firm have to use several types of inventories those who have highest value the firm should pay attention. The firm should, therefore, classify inventories to identify which item should receive the most effort in controlling. This analytical approach is called the ABC analysis and tends to measure the significance of each item of inventories in terms of its value. The high value items are classified in "A times" and would be used the highest control. "C items" fall in between these two categories and require reasonable attention of management.

II. EOQ

Economic order quantity technique is the most important of inventory control. It attempts to establish the most economic balance between the carrying costs and ordering costs determining the quantities to be ordered.

The EOQ is that inventory level, which minimizes the total of ordering and carrying, costs. The relationship between the Ordering costs and Carrying costs is called cost factor. EOQ is calculated from the following mathematical formula: $$EOQ = \sqrt{\frac{2AO}{C}}$$

Where,

A = Annual usage in units

O = Ordering cost

C = Carrying cost per unit.

Graphic and analytical (or trial and error method) approaches are also used in calculation of EOQ. Complexities can be introduced by introducing the concept of constant cost and quantity discounts. The basic objectives of these techniques; however is to determine the optimal size of order to be placed on the basis of usage, Ordering costs & Carrying costs.

III. Re-Order Level

This refers to the level at which new orders are placed to replenish low stocks. New supplies will be received before the stock reaches the minimum level.

It is on the basis of, Rate of consumption, Minimum level, Delivery time, & Stock out cost.

Formula

Ordering Level = Minimum Level + Consumption during the time required to get the Fresh Delivery (i.e. Daily Requirement × Time Required for Fresh Delivery)

Another formula given by Weldon in his book 'Cost Accounting Methods' is as follows:

Re-order Level = Maximum Consumption × Maximum Delivery Time.

IV. Safety Stock

Safety stock is a buffer to meet some unanticipated increase in usage. Therefore, in order to guard against the stock-out, the firm may maintain a safety stock, or how much safety stock should be maintained. It depends upon that company's policy. The size of safety stock determined on predictable lead-time and demand variation by using following methods:

1 **On Situation When Demand Rate Varies**

Safety Stock = Lead-Time (Maximum Demand Rate - Average Demand Rate)

1 **On the Situation Lead-Time Varies Demand Uniform**

Safety Stock = (Maximum Lead Time - Average Lead-Time × Demand Rate)

1 **On the situation When Both Demand Rate And Lead Time Fluctuate**

Safety Stock = (Maximum Lead Time x Maximum Demand Rate) - (Average Lead Time x Average Demand Rate)

V. Ratio Analysis

Financial analysis is an evaluation of both firm's post financial performance and its prospects for the future. Financial statement analysis involves the calculation of various ratios. In mathematics ratio is the relationship between two quantitative figures.

The ratio analysis is the financial tool by which the financial strength and weakness are measured by relating two accounting data following ratio will be used to analysis data,

$$\text{Inventory to Total Assets Ratio} = \frac{\text{Inventory}}{\text{Total fixed assets}}$$

$$\text{Inventory to Sales Ratio} = \frac{\text{Inventory}}{\text{Net sales}}$$

$$\text{Inventory to Current Assets Ratio} = \frac{\text{Inventory}}{\text{current assets}}$$

$$\text{Inventory to Profit Ratio} = \frac{\text{Inventory}}{\text{Net Profit}}$$

VI. Turnover Ratio

It measures the efficiency on Inventory management and how quick inventory is sold. It indicates the relationship between the cost of goods sold and the inventory level. In general, high turn over ratio is better than low ratio. High turnover ratio indicates good inventory management; finished goods are quickly selling over a period of time and farmable to earn profit by it.

$$\text{Inventory Turnover Ratio } X\frac{\text{Cost of goods sould}}{\text{Average Inventory}} \quad \text{or} \quad \frac{sales}{Closing\ Inventory}$$

3.6.2 Statistical Tools

I. Simple Regression Analysis

Regression analysis in general sense means the estimation or prediction of the unknown value of one variable from the known value of the other variable. It is specially used in business and economics to study the relationship between two or more variables that are related causally. Regression analysis is a mathematical measure of the average relationship between two or more variables in terms of original units of the data.

In this analysis, regression equation y and x is used. The equation of regression line, where the independent variable x determines the dependent variable y is:

$y = a + bx$

$a = y$ - intercept.

Where,

b = slope of regression line (i.e. it measure the change in y percent change in x) or the regression of y on x, which is denoted by byx.

According to the principle of least square, two normal equations for estimating two numerical a and b are given by.

$y = na + bx$

$$xy = ax + bx^2$$

Where, n is the number of pair observation

This Topic is related with the Analysis of the Relationship between

1. Inventory purchase and sales, where sale is the dependent variables y and inventory purchase is the independent variable x.
2. Sales expenses and sales, where sale is the dependent variables y and sales expenses is the independent variable x.
3. Closing stock and sales, where sales are the dependent variables y and closing stock is the independent variable x.
4. Closing stock and net profit, where net profit is the depended variable y and closing stock is independent variable x.
5. Raw materials and its purchase expenses, where purchase expenses are the dependent variable y and raw materials purchase is the independent variable x.

II. Multiple Regression Analysis

Multiple regressions is defined as the statistical device which is used to estimate the value of one dependent variable when the values of two independent variables are known or given. In multiple regression analysis two or more independent variables are used to predict the value of a dependent variable. It is a statistical technique for investigating the relationship between one dependent variable and a set or two or more independent variables. Following are the main objectives of the multiple regression analysis:

1. To describe the multiple regression equation which provides estimate of the dependent variables from the values or two or more independent variables?
2. To examine the measure of error (i.e. the multiple standard error of estimate.)
3. To use multiple correlation analysis to determine how well the regression equation describes the observed data (i.e. computing the coefficient of multiple determination.)

Multiple regression equation describes the average relationship between one dependent variable and two or more independent variables and this relationship is used to predict (or control) dependent variable. Thus multiple regression equation is equation for estimating a

dependent variable (say X_1) from independent variable (sayX_2 and X_3) and is called a regression equation of X_1 on X_2 and X_3.

The multiple regression equation of dependent variable X_1 on two independent variables on X_2 and X_3 is given by,

$$X_1 = a + b_1. X_2 + b_2. X_3 \quad \ldots (1)$$

Where,

a = value of X_1 when X_2 =0 and X_3 =0

b_1 = Partial regression coefficient of X_1 on X_2 when X_3 constant(i.e. amount of change in X_1 per unit change in X_2 holding X_3 constant)

b_2 = Partial regression coefficient of X_1 on X_3 when X_2 constant (i.e. amount of change in X_1 per unit change in X_3 holding X_2 constant)

The multiple regression equation of dependent variables Y on "n" independent variables X_1, X_2, X_3,… X_n can generally be expressed as:

$Y = a + b_1.X_1 + b_2.X_2 + b_3.X_3 \ldots + b_n.X_n$

This Topic is related with the Analysis of the Relationship between

Net Profit, Net Sales and closing stock, where Net profit is dependent variable denoted by X_1, sales and closing stock are two independent variables denoted by X_2 and X_3 respectively.

CHAPTER -IV

DATA PRESENTATION AND ANALYSIS

4.1 Item wise Production and Quantity sold of Milk of DDC

The item wise production and quantity sold of milk of DDC was described as following.

Table 4.1

Item wise Production and Quantity Sold of Milk of DDC

(In Metric ton)

S. N.	Particular	FY 2064/065		FY 2065/066		FY 2066/067		FY 2067/068		FY 2068/069	
		Production	Qty. Sold	Production	Qty. Sold	Production	Qty.Sold	Production	Qty.Sold	Production	Qty. Sold
1	Milk collection	50,641	-	54,059	-	56,418	-	58,475	-	60,241	-
2	Purified Milk	63,536	52,094	66,700	55,315	71,647	57,876	75,437	59,365	83,726	63,547
3	Ghee	617	628	477	459	513	502	589	552	605	599
4	Makhan	894	165	782	137	762	123	798	113	803	110
5	Dahi	2030	2009	2312	2299	2522	2517	2723	2697	2912	2901
6	Cheej	174	164	206	187	215	187	225	197	259	117
7	Panir	99	96	126	123	127	127	137	131	147	140
8	Ice cream	55.5	53	63	65	79	80	89	91	102	100

9	Skim Milk Powder	426	-	343	-	506	-	703	-	913	-
10	Raswari batta (in 000)	81	74	76	73	91	88	107	103	123	118
11	Lalmohan batta (in 000)	81	73	87	87	96	96	107	105	117	116
12	DDC fresh botal (in 000)	95	94	490	564	626	622	686	682	752	750
13	Peda batta (in 000)	30	29	37	37	37	36	45	44	51	50

(Source: DDC's Annual reports)

The table 4.1 depicts the item wise product of DDC. According to this, DDC collection the milk as production. The production of DDC was increasing trend i.e. 50,641, 54,059, 56,418, 58,475 and 60,241 metric tons from the five fiscal year 2064/065 to 2068/069 respectively. DDC purified the milk of the collection milk. The purified milk production and quantity sold tends to be increasing or positive direction in each fiscal year. The purified production was 63,536, 66,700, 71,647, 75,437 and 83,726 metric tons respectively from fiscal year 2064/065 to 2068/069. Likewise, sales of purified milk were 52,094, 55315, 57,876, 59,365, 63,547 metric ton respectively from the fiscal year 2064/065 to 2068/069. The production of ghee items was fluctuating and some stock occurred which indicates that there was lack of good market research and inventory management. Makhan item of product is highly fluctuating and decreasing upto first three fiscal years and then slightly increasing trend but suffered from the larger stock which may occurred loss. Dahi was the best item of dairy milk product which was sold in huge quantity. The production and sales of Dahi were 2030, 2009, 2312, 2299, 2522, 2517, 2723, 2697 and 2912, 2901 metric ton respectively from fiscal year 2064/065 to 2068/069. Similarly, Cheej was also major products of the milk items. The production and quantity sold of DDC milk was increasing trend for the five fiscal years. Panir and ice- cream were also major items of DDC milk but little quantity because these were the seasonal

products. Similarly, milk's item products were made in also bottle pack. Among them, DDC fresh botal was the major production and quantity sold of milk item on the basis of production and quantity sold in recent fiscal years. The production and quantity sold of DDC fresh botal (in 000) were 95, 94, 490, 564, 626, 622, 686, 684, 752 and 750 respectively from the fiscal year 2064/065 to 2068/069. The quantity demanded of DDC fresh botal was increasing in the recent fiscal year. Likewise, Raswari batta, Peda batta, Lalmohan batta, were also increasing trend. From this, product wise, milk product, DDC more focused to manage the production and quantity sold of DDC fresh milk botal, purified milk, dahi and other seasonal products as stated in table 4.1. to reduce the wastage of product and generate profit, DDC was properly should focus the inventory management as matching the production and quantity sold.

4.1 EOQ of DDC for the five fiscal years from 2064/065 to 2068/069

DDC used milk additive and packing material. Calculation of EOQ of additive is difficult, because it, this material is collected through annual tender method. So, calculations of ordering and carrying cost are difficult. Calculation of EOQ of packing material is also difficult. Packing material includes many types of material which is expressed in different units such as pieces, big, liters, cup, kg., packing jar, tin etc. So, converting them into equal parameter is not possible.

4.1.1 EOQ Determination of milk of DDC for the Fiscal year 2064/065

The following data were obtained from the records of DDC.

a) Mathematical Formula Method

Annual Requirement (A) = 11,41,77,000 liters

Ordering Cost per Order (O) = Rs.31,048

Carrying Cost per Liter (C) = Rs.1.12

No. of orders = 362 times

Applying formula,

$$EOQ = \sqrt{\frac{2AO}{C}}$$

$$= \sqrt{\frac{2 \mid 11{,}41{,}77{,}000 liters \mid Rs.31{,}048}{Rs.1.12}}$$

= 25, 16,008.56 liters.

Where,

Ordering cost per order (O) = purchase department's remuneration+ transportation cost including transit insurance + inspection cost = Rs14,000 + Rs13,500+ Rs 3,548 = Rs 31,048

Carrying cost per liter (c) = brokerage charge + opportunity cost = Re 1+ Re 0.12(i.e. 12%) =Rs1.12

Trial and Error Method/Tabulation Method

$$\text{No. of Order Size} = \frac{\text{Annual Demand}}{\text{EOQ}}$$

$$= \frac{11{,}41{,}77{,}000 liters}{25{,}16{,}008 liters}$$

= 45.38 times

= 45 times

Table 4.1

EOQ of DDC

No. of Order	Order Size (liters)	Average Inventory (liters)	Ordering Cost (Rs)	Carrying Cost (Rs)	Total Cost (Rs)
5	2,28,35,400	1,14,17,700	1,55,240	1,27,87,824	1,29,43,064
15	76,11,800	38,05,900	4,65,720	42,62,608	47,28,328
25	45,67,080	22,83,540	7,76,200	25,57,564	33,33,764
35	32,62,200	16,31,100	10,86,680	18,26,832	29,13,512
45	25,16,008	12,58,004	13,97,160	14,08,964	28,06,124
362	20,75,945	10,37,972	1,12,39,376	11,62,528	1,24,01,905

Source: DDC's Annual reports

The table 4.1 depicts the size of orders and times of orders required so that the total cost can be minimized. DDC's EOQ is 25, 16,008 liters which is the optimum quantity for economic benefit. It is clear that the lowest inventory cost of DDC is Rs 28,06,124 under trial and error approach which includes total ordering cost of Rs. 13,97,160 and total carrying cost of Rs 14,08,964 and it takes 45 times of order placement in a year. In other words, when DDC makes order 45 times in the fiscal year there will be total cost minimization.

4.1.2 for Fiscal Year 2065/066

The following data were obtained from the records of DDC.

a) Mathematical Formula Method

Annual Requirement (A) = 12, 08, 00,000 liters

Ordering Cost per Order (O) = Rs.32,348

Carrying Cost per Liter (C) = Rs.1.1424

No. Of Orders = 362 Times

Applying formulas,

$$EOQ = \sqrt{\frac{2AO}{C}}$$

$$= \sqrt{\frac{2 \mid 120800000 liters \mid Rs32348}{Rs1.1424}}$$

= 26, 15,550.35 liters.

= 26, 15,550 liters.

Where,

Ordering cost per order (O) = purchase department's remuneration+ transportation cost including transit insurance + inspection cost =Rs 13,000+Rs15,000 +Rs 4,348 = Rs 32,348

Carrying cost per liters (c) = brokerage charge + opportunity cost =Re 1+ Re 0.1424(i.e 14.24%) =Rs1.1424

b) Trial and Error Method/Tabulation Method

To calculate EOQ by Trial and Error Method, we have developed following formula:

$$\text{No. Of order size} = \frac{\text{Annual Deman}}{EOQ}$$

$$= \frac{12,08,00,000 liters}{26,15,550 liters}$$

= 46.19 times

= 46 times

Table 4.2

EOQ of DDC

No. of Order	Order Size (liters)	Average Inventory (liters)	Ordering Cost (Rs)	Carrying Cost (Rs)	Total Cost (Rs)
5	2,41,60,000	1,20,80,000	1,61,740	1,38,00,192	1,39,61,932
15	80,53,333	40,26,666	4,85,220	46,00,063	50,85,283
25	48,32,000	24,16,000	8,08,700	27,60,038	35,68,738
35	34,51,428	17,25,714	11,32,180	19,71,455	31,03,635
46	26,15,550	13,07,775	14,88,008	14,94,002	29,82,010
362	3,33,702	1,66,851	1,17,09,976	1,90,610	1,19,00,586

Source: DDC's Annual reports

The table 4.3 shows the lowest inventory cost of DDC is Rs 29, 82,010 which includes total ordering cost of Rs. 14, 88,008 and total carrying cost of Rs. 14, 94,002 and it takes 46 times in the fiscal year. In other words when DDC places 46 times order in the fiscal year there will be total cost minimization.

4.1.3 for Fiscal Year 2066/067

The following data were obtained from the records of DDC.

a) Mathematical Formula Method

Annual Requirement (A) = 12, 80, 65,000 liters

Ordering Cost per Order (O) = Rs. 33,742

Carrying Cost per Liter (C) = Rs. 1.16

No. of Orders = 362 Times

Applying formulas,

$$EOQ = \sqrt{\frac{2AO}{C}}$$

$$= \sqrt{\frac{2 \mid 128065000 liters \mid Rs33742}{Rs1.16}}$$

= 27, 29,522.26 liters.

= 27, 29,522 liters.

Where,

Ordering cost per order (O) = purchase department's remuneration+ transportation cost including transit insurance + inspection cost = Rs13,000+Rs 15,000+ Rs5742 =Rs 33,742

Carrying cost per liters (c) = brokerage charge + opportunity cost = Re1 +Re 0.16(i.e.16%) =Rs1.60

b) Trial and Error Method/Tabulation Method

We have been used formula to determine the no. of order size. And that order size where total inventory cost will be minimize, will be the economic order quantity in Trial and Error method.

$$\text{No. Of Order Size} = \frac{\text{Annual Demand}}{\text{EOQ}}$$

$$= \frac{12{,}80{,}65{,}000 liters}{27{,}29{,}522 liters}$$

$$= 46.92 \text{ times}$$

$$= 47 \text{ times}$$

Table 4.3

EOQ of DDC

No. of Order	Order size (liters)	Average Inventory (liters)	Ordering Cost (Rs)	Carrying Cost (Rs)	Total Cost (Rs)
5	2,56,13,000	1,28,06,500	1,68,710	1,48,55,540	1,50,24,250
15	85,37,666	42,68,833	5,06,130	49,51,846	54,57,976
25	51,22,600	25,61,300	8,43,550	29,71,108	38,14,658
37	34,61,122	17,30,561	12,48,454	20,07,451	32,55,905
47	27,29,522	13,64,761	15,85,874	15,83,123	31,68,997
362	3,52,796	1,76,398	1,22,14,604	2,04,622	1,24,19,226

Source: DDC's Annual reports

The table 4.3 shows the lowest total inventory cost of DDC Rs 31,68,997 which includes total ordering cost of Rs. 15,85,874 and total carrying cost of Rs. 15,83,123 and it takes 47 times in the fiscal year, there will be total cost minimizes. DDC should order 47 times in the fiscal year. But the firm has placed an order with 362 times, which involves total inventory cost of Rs. 1, 24, 19 226. This amount is very high as compared with EOQ cost.

4.1.4 for Fiscal Year 2067/068

The following data were obtained from the records of DDC.

a) Mathematical Formula Method

Annual Requirement (A) = 13, 57, 48,000 Liters

Ordering Cost per Order (O) = Rs. 34,173

Carrying Cost per Liter (C) = Rs. 1.18

No. Of Orders = 362 Times

Applying formula,

$$EOQ = \sqrt{\frac{2AO}{C}}$$

$$= \sqrt{\frac{2 \mid 135748000 \mid 34173}{1.18}}$$

= 28, 04,027.49 liters.

= 28, 04,027 liters.

Where,

Ordering cost per order (O) = purchase department's remuneration+ transportation cost including transit insurance + inspection cost = Rs13,000 + Rs 17,000+ Rs4,173 = Rs 34,173

Carrying cost per liter (c) = brokerage charge + opportunity cost = Re1.01 +Re 0.17(i.e.17%) = Rs1.18

b) Trial and Error Method/Tabulation Method

$$\text{No. Of Order Size} = \frac{\text{Annual Demand}}{EOQ}$$

$$= \frac{13,57,48,000 liters}{28,04,027 liters}$$

= 48.41 times

= 48 times

Table 4.4

EOQ of DDC

No. of Order	Order size (liters)	Average Inventory (liters)	Ordering Cost (Rs)	Carrying Cost (Rs)	Total Cost (Rs)
5	2,71,49,600	1,35,74,800	1,70,865	1,60,18,264	1,61,89,129
15	90,49,866	45,24,933	5,12,595	53,39,420	58,52,015
25	54,29,920	27,14,960	8,54,325	32,03,652	40,57,977
37	36,68,865	18,34,432	12,64,401	21,64,630	34,29,031
48	28,04,027	14,02,013	16,40,304	16,54,375	32,94,679
362	3,73,961	1,86,980	1,23,70,626	2,20,636	1,25,91,262

Source: DDC's Annual reports

The table 4.4 shows the lowest inventory cost of DDC is Rs 32, 94, 679 which includes total ordering cost of Rs. 16, 40,304 and total carrying cost of Rs 16, 54,375 and it takes 48 times in the fiscal year. In other words, when DDC places 48 times order in the fiscal year there will be total cost minimization. But the firm has placed an order with 362 times, which involves total inventory cost Rs. 1, 25, 91,226. This amount is very high as compared with EOQ cost.

4.1.5 for Fiscal Year 2068/069

The following data were obtained from the records of DDC.

a) Mathematical/Formula Method

Annual Requirement (A) = 13, 87, 04,000 Liters

Ordering Cost per Order (O) = Rs 35,640

Carrying Cost per Liter (C) = Rs. 1.25

No. of Orders = 362 times

Applying formulas,

$$EOQ = \sqrt{\frac{2AO}{C}}$$

$$= \sqrt{\frac{2 \mid 138704000 liters \mid Rs35640}{Rs1.25}}$$

= 28, 12,375.66 liters.

= 28, 12,376 liters.

Where,

Ordering cost per order (O) = purchase department's remuneration+ transportation cost including transit insurance + inspection cost = Rs13,000 + Rs 18,000+ Rs 4,640 = Rs 35,640

Carrying cost per liter (c) = brokerage charge + opportunity cost = Re1.05 +Re 0.20(i.e.20% = Rs 1.25

b) Trial and Error Model/Tabulation Method

$$\text{No. of Order Size} = \frac{\text{Demand Annual}}{\text{EOQ}}$$

$$= \frac{13{,}87{,}04{,}000 liters}{28{,}12{,}376 liters}$$

$$= 49.32 \text{ times}$$

$$= 49 \text{ times}$$

Total Carrying Cost = Average inventory × carrying cost per unit

Total ordering cost = No. of order × ordering cost per order

Total cost = Total Carrying Cost + Total ordering cost

$$\text{Order Size} = \frac{\text{Annual Demand}}{\text{No. of Order}}$$

$$\text{Average Inventory} = \frac{\text{Order size}}{2}$$

Table 4.5

EOQ of DDC

No. of Order	Order size (liters)	Average Inventory (liters)	Ordering Cost (Rs)	Carrying Cost (Rs)	Total Cost (Rs)
5	2,77,40,800	1,38,70,400	1,78,200	1,73,38,000	1,75,16,200
15	92,46,933	46,23,466	5,34,600	57,79,333	63,13,933
28	49,53,714	24,76,857	9,97,920	30,96,071	40,93,991
39	35,56,513	17,78,256	13,89,960	22,22,820	36,12,780
49	28,12,376	14,06,188	17,46,360	17,57,735	35,04,095
362	3,83,160	1,91,580	1,29,01,680	2,39,475	1,31,41,155

Source: DDC's Annual reports

The tables 4.5 shows the lowest total inventory cost of DDC is Rs.35,04,095 which include total ordering cost of Rs. 17,46,360 and total carrying cost Rs.17,57,735 and it takes 49 times in the fiscal year, there will be total cost minimization. DDC should order 49 times in the fiscal year but the firm has placed an order with 362 times, which involve total inventory cost Rs. 1, 31, 41,115. This amount is very high as compared with Rs. 35, 04,095. According to this both firm had placed an order in every day because they need daily fresh material (milk) to provide consumer good fresh product. If DDC order more than 49 times in the fiscal year, that results carrying cost decreased and ordering cost increased. When the carrying and ordering costs are likely same or equal to it at that point the total inventory costs will be minimized. In inventory management two costs i.e. carrying cost and ordering costs play an important role. These costs more opposite direction i.e. when carrying cost decrease, the ordering cost will rise and vice versa.

Table 4.6

EOQ of DDC based on formula and Purchase made by DDC (in Liters)

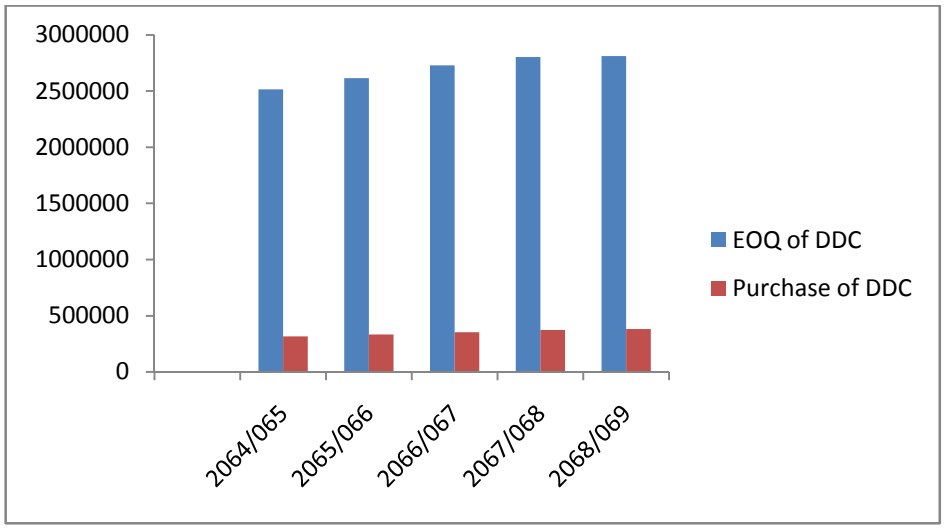
Fiscal Year	EOQ of DDC based on the formula	Purchase of DDC
2064/065	25,16,008	3,15,406
2065/066	26,15,550	3,33,702
2066/067	27,29,522	3,52,796
2067/068	28,04,027	3,73,961
2068/069	28,12,376	3,83,160

Source: DDC's Annual reports

The EOQ obtained by using EOQ formula differed with the existing purchase of DDC. DDC needs to determine EOQ and apply the optimal order quantity which reduces cost of inventory. The table 4.6 shows the EOQ quantity of DDC. Hence, purchases of milk made by DDC were not based on EOQ purchase. The EOQ of DDC and its purchases are shown in the following.

Figure 4.1

Graphical Presentation of EOQ of DDC



4.2 Re-Order Point of Milk in DDC

Re-order point is that point of inventory at which the firm places fresh order. Re-order point of milk is calculated on the basis of lead time and safety stock maintained by the firm as well as daily usage of the five fiscal years covering 2064/065 to 2068/069.

The formula for calculation of Re-order point without safety stock:

$$\text{Usages Rate} = \frac{\text{Annual Consumption}}{\text{No. of Days in a year}}$$

(Assume) No. of days in years = 365

Re-order Point (ROP) = Usage Rate × lead time

Or,

The formula for calculation of Re-order point with safety stock:

Re-order Point ROD) = safety stock + Usage Rate × lead time

Table 4.7

Re-order Point of DDC

Fiscal years	Usage rate per day In Ltr.	Lead time in days	Re-order Point Ltr. (without safety stock)	Safety stock in days	Safety stock in Ltr.	Re-order Point Ltr. (with safety stock))
2064/065	3,12,813	1	3,12,813	2	6,25,626	9,38,439
2065/066	3,30,959	1	3,30,959	2	6,61,918	9,92,877
2066/067	3,50,863	1	3,50,863	2	7,01,726	10,52,589
2067/068	3,71,912	1	3,71,912	2	7,43,824	11,15,736
2068/069	3,80,011	1	3,80,011	2	7,60,022	11,40,033

Source: DDC's field survey 2013

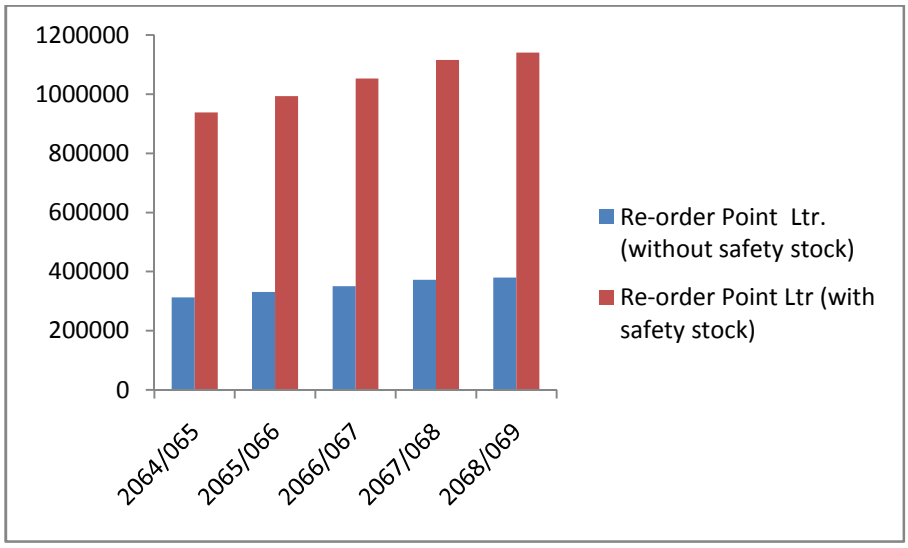
DDC needs fresh milk. It maintains safety stock for 2 days from the view point of strike. The table 4.7 depicts the calculation of ROP including and excluding safety stock. The highest re-order point without safety stock and with safety stock were 3, 80,011 liters and 11,40,033 liters in fiscal year 2068/069. And the lowest re-order point without safety stock and with safety stock were 3,12,813 liters and 9,38,439 liters respectively in fiscal year 2064/065.

The ROP of the fiscal year 2068/069 shows that when the balance of milk remains for 1 day's consumption of 3, 80,011 liters another order for 11, 40,033 liters should be placed if DDC maintains 2 days safety stock level. If we consider this safety stock, the order should be place by keeping 3 days consumption (i.e. 3x 3,80,011 liters = 11,40,033 liters). It means, when the inventory falls to 11,40,033 liters that another order for 28,12,376 liters (EOQ) has to be placed. In other words, next order should be placed in the difference of 7 days, i.e. the practices used by the firm for the safety stock is equal to 2 days consumption. If we consider this safety stock, the order should be placed by keeping 3 days consumption i.e. (4 (3+1) × 380,011 = 15,20,044 liters). It means when the inventory falls to 15,20,044 liters that another order has to be placed. In this way, we can compute ROP for next remaining days.

Figure: 4.2

Graphical Presentation of Re-order Point

(Without and with Safety Stock)



4.3. Inventory to Total Assets Ratio

Here, inventory means closing inventories of raw materials, finished goods, other stock and spare parts including constructing material also.

$$\text{Inventory to Total Assets Ratio} = \frac{\text{Inventory}}{\text{Total Fixed Assets}}$$

Table 4.8

Inventory to Total Fixed Assets Ratio of DDC

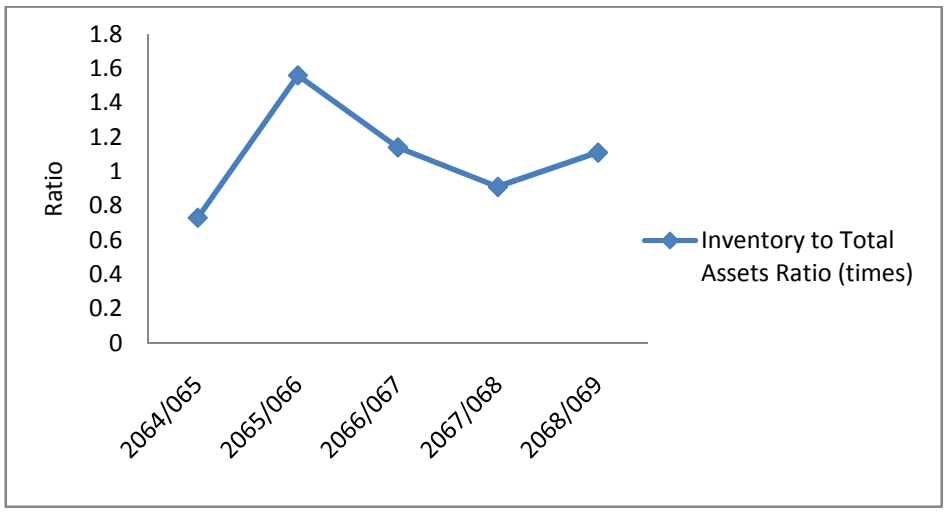
Fiscal Year	Inventory (Rs)	Total Fixed Assets (Rs)	Inventory to Total Assets Ratio (times)
2064/065	12,31,90,816	16,65,40,388	0.73
2065/066	27,32,09,494	17,48,67,408	1.56
2066/067	28,09,03,177	24,66,55,983	1.14
2067/068	25,31,35,468	27,93,62,953	0.91
2068/069	35,25,17,619	31,87,82,224	1.11

Source: DDC's Annual reports

The inventory to total fixed assets ratio of DDC was 0.73 times in the fiscal year 2064/065 and maximum inventory to fixed ratio was 1.56 times in the fiscal year 2065/066. In the fiscal year 2064/065, the inventory to total fixed assets ratio is reasonable. The standard inventory to total fixed ratio of DDC is 0.80:1 but it depends upon the nature of the firm. However, Low inventory to total fixed assets ratio is preferred for efficient in inventory management. It indicates low level of closing inventory in relation to sales. From this analysis, this ratio is good in fiscal years 2064/065 and 2067/068. In other fiscal years this ratio is higher than the standard and hence weak in inventory to total fixed assets management. Low inventory to total fixed ratio indicates that firm not being hold high amount of money in the field of inventory i.e. good trade cycle of inventory to total fixed assets. The inventory to total fixed assets ratio of DDC are shown in the following.

Figure 4.3

Graphical Presentation of inventory to total fixed assets ratio of DDC



4.4 Percentage of Inventory to Sales Ratio

Table 4.9

Inventory to Sales Ratio of DDC

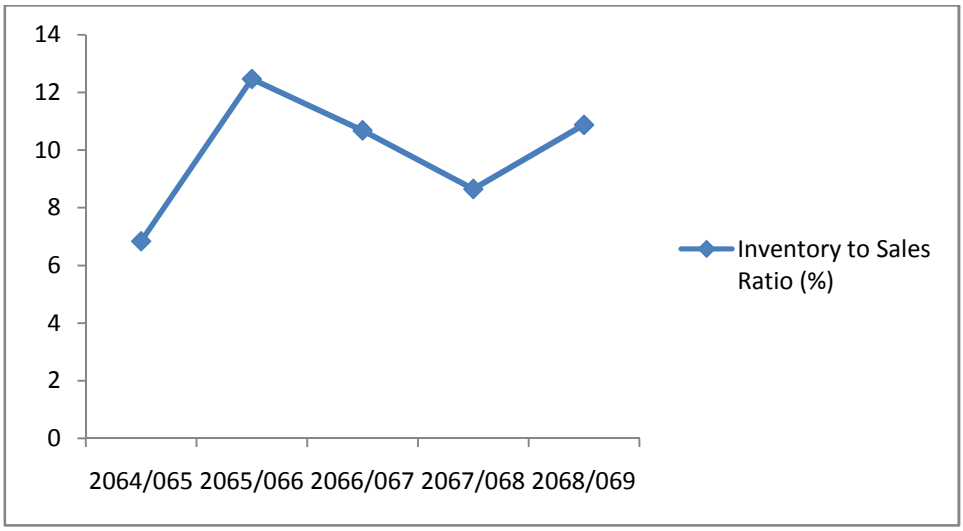
Fiscal Year	Inventory (Rs)	Net Sales (Rs)	Percentage of inventory to Sales (%)
2064/065	1,2,31,90,816	1,80,06,73,560	6.84
2065/066	27,32,09,494	2,19,33,09,447	12.46
2066/067	28,09,03,177	2,62,83,50,971	10.68
2067/068	25,31,35,468	2,92,68,88,212	8.65
2068/069	35,25,17,619	3,24,29,39,440	10.87
Average	25,65,91,314	2,55,84,32,326	9.9

Source: DDC's Annual reports

The table 4.9 depicts the percentage of inventory to sales. The percentage of inventory to sales of DDC was 12.46% in the fiscal year 2065/066 & lowest of 6.84% in the fiscal year 2064/065. The average inventory and net sale are Rs 25,65,91,314 and Rs 2,55,84,32,326 respectively. As compare to annual inventory and sales with an average the amount of both are more volatile in the fiscal years. Likewise, the percentages of inventory to net sales are slightly nearer with an average in last three fiscal years. The percentage of inventory to net sales is shown in the following.

Figure: 4.4

Graphical Presentation of Inventory to Sales Ratio of DDC



4.5 Inventory to Current Assets Ratio

Inventory to current assets ratio is about 45 to 50% in manufacturing enterprises in Nepal.

$$\text{Inventory to Current Assets Ratio} = \frac{\text{Inventories}}{\text{Current Assets}}$$

Here, inventories include closing stock of raw materials, finished goods, other stocks and stores and spares parts. Current assets includes debtors, inventories, prepaid expenses, advance, deposits, staff loan and advance, different revenue expenses, cash in hand and cash at bank.

Table 4.10

Inventory to Current Assets Ratio of DDC

Fiscal Year	Inventory (Rs)	Current assets (Rs)	Inventory to current assets ratio (%)
2064/065	12,31,90,816	9,20,25,580	133.86
2065/066	27,32,09,494	58,37,82,890	46.79
2066/067	28,09,03,177	68,09,90,300	41.25
2067/068	25,31,35,468	74,44,32,574	34.00
2068/069	35,25,17,619	77,48,43,059	45.49
Average	25,65,91,314	57,52,14,880	60.27

Source: DDC's Annual reports

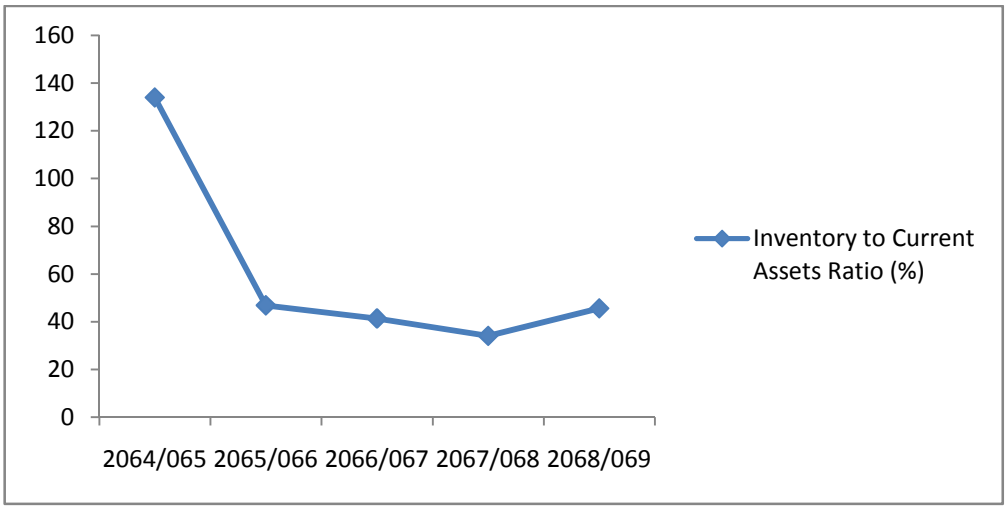
The table 4.10 depicts the inventory to current assets ratio of DDC from fiscal year 2063/064 to 2068/069. The standard inventories to current Assets ratio should about 45 to 50%. But this ratio is vary & more fluctuating and not have such ratio. As that situation we can conclude the companies hold more inventory as current assets whenever more inventories kept by the firm. They can't mobilize the amount, which have blocked in inventory and they can't see it immediately. So it direct affects the profitability of the firm. Blocked amount in inventory, both companies can't reinvest in other areas. So they lose the return of that blocked amount inventory. The average inventory and current assets are Rs 25,65,91,314 and Rs 57,52,14,880 respectively. Likewise, inventory to current assets ratio is 60.27%.

According to table 4.10 of inventory to current assets it is clear that the highest ratio of DDC is 133.86% in fiscal year 2064/065 & lowest is 34.00% in fiscal year 2067/068. In other fiscal

year DDC have satisfactory level in fiscal year 2065/66 and 2068/069. It is also presented in following figure.

Figure: 4.5

Graphical Presentation of Inventory to Current Assets Ratio of DDC



4.6 Inventory to Profit Ratio

This ratio tells how much inventory is needed to create a good profit. Here, inventories includes total amount of main materials consumed DDC. According to both companies main material is milk. We need total amount of milk except collection cost profit includes total amount of profit/loss, which earn by companies in five fiscal years respectively. The formula to calculated inventory to profit ratio is as follows:

$$\text{Inventory to Profit Ratio} = \frac{Inventory}{Netprofit}$$

Table 4.11

Inventory to Net Profit Ratio of DDC

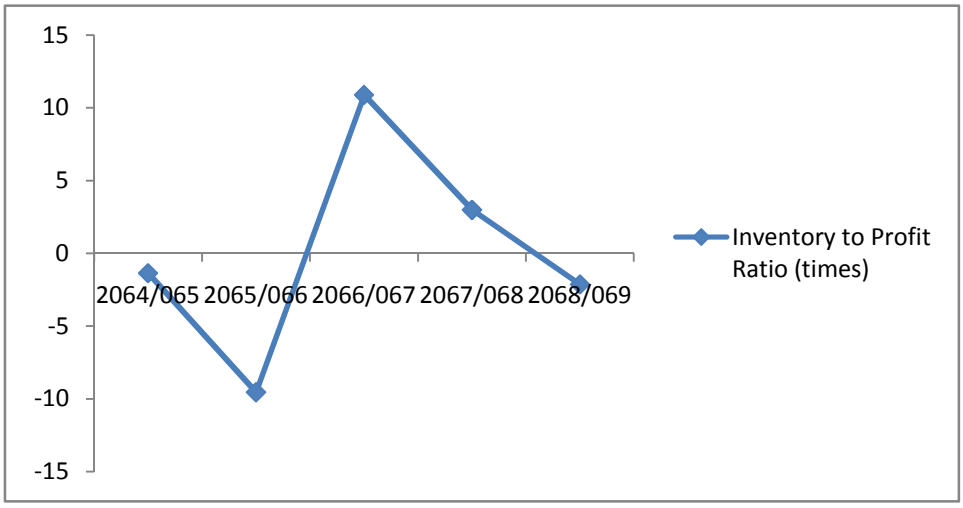
Fiscal Year	Inventory (Rs)	Net Profit (Rs)	Inventory to Profit Ratio (times)
2064/065	12,31,90,816	(8,97,90,181)	-1.37 (negative)
2065/066	27,32,09,494	(86,09,484)	-9.55 (negative)
2066/067	28,09,03,177	2,58,10,924	10.88 (positive)
2067/068	25,31,35,468	8,49,21,969	2.98 (positive)
2068/069	35,25,17,619	(16,49,32,764)	-2.14 (negative)
Average	25,65,91,314	(3,05,19,907)	0.124

Source: DDC's Annual reports

The table 4.11 shows the inventory to profit ratio of DDC from fiscal years 2064/065 to 2068/069. This ratio of DDC was positive in only in two fiscal years i.e. 2066/067 and 2067/068 the ratios was positive i.e. 10.88 times and 2.98 times and other subsequent fiscal years net profit is negative. It means companies didn't generate the profit except two fiscal years. The average inventory and net profit were Rs 25,65,91,314 and (3,05,19,907) respectively whereas their average ratio was 0.124 times. DDC is suffering from loss year by year. It indicates that DDC suffer bad condition year. It is also presented in following figure.

Figure: 4.6

Graphical Presentation of Inventory to Net Profit Ratio of DDC



4.7 Inventory Turnover Ratio

It measures the efficiency on inventory management and how quickly inventory is sold. It indicates the relationship between the cost of goods sold and the inventory level. In general, high turnover ratio is better than low ratio. High turnover ratio indicates good inventory management; finished goods are quickly selling over a period of time and firm able to earn profit by it.

Inventory turnover ratio can be calculated by dividing cost of goods sold by the average inventory.

$$\text{Inventory Turnover Ratio} = \frac{\text{Cost of goods Sold}}{\text{Average Inventory}}$$

Another way, we can compute the inventory turnover ratio by dividing closing stock to sale.

$$\text{Inventory Turnover Ratio} = \frac{\text{Sales}}{\text{Closing Stock}}$$

In this formula sales is valued at market price and closing stock is valued at costs it is not comparable. Appropriate formula to calculated inventory turnover it described earlier.

Table 4.12

Inventory Turnover Ratio of DDC

Fiscal Year	Cost of Goods sold (Rs)	Average Inventory (Rs)	Turnover Ratio (Times)
2064/065	1,92,91,64,826	9,61,30,818	20.07
2065/066	1,91,61,07,145	19,82,00,155	9.67
2066/067	2,31,20,63,599	27,70,56,335	8.35
2067/068	2,54,46,23,530	26,70,19,322	9.53
2068/069	2,92,02,79,512	30,28,26,543	9.64
Average	2,32,44,47,722	22,82,46,635	11.45

Source: DDC's Annual reports

The table 4.12 depicts the inventory turnover ratio of DDC. A very low inventory turnover ratio is dangerous. It signifies excessive inventory or over investment in inventory, Low inventory level shows firm has more stock of finished goods for sale. Due to this, inventory involves cost in terms of interest of blocked amount, rental of warehouse, damage/deterioration and so on. A low ratio may be the result of obsolete goods, over-valuation of closing stock, reduce demand in market, more purchase of raw materials in

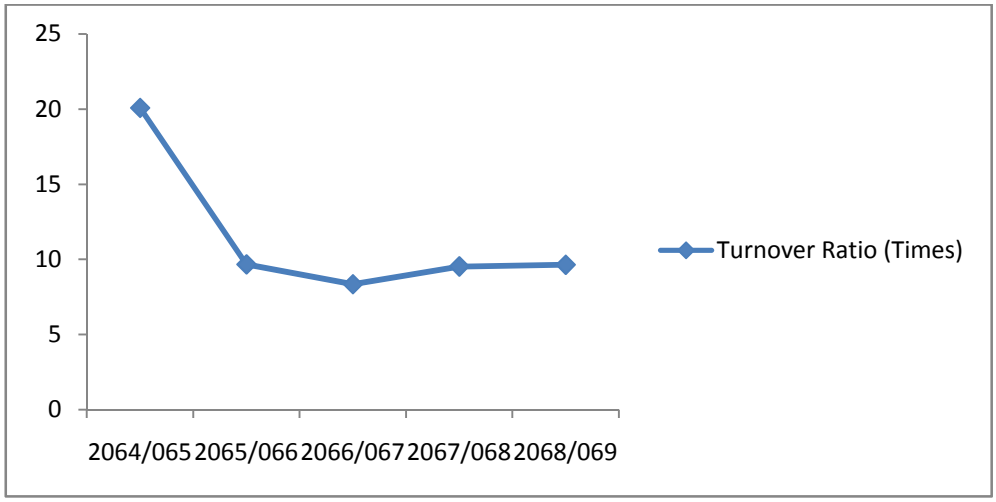
anticipation of future increase in their process and so on. Likewise, excessive inventory also increased the warehouse and storage cost and some products will be also expired. So companies have to keep optimum level of inventory. Through the study of inventory turnover ratio it helps to detect the imbalance investment in the various inventory components.

Here, cost of good sold computed adding opening stock, purchase (milk purchase, raw materials, other purchase), manufacturing expenses (processing cost, administrative cost, depreciation cost, gravity cost, deferred cost, interest cost) and deduct closing stock. Adding opening inventory and closing inventory and dividing by 2 and compute average inventory.

The table 4.12 shows the inventory turnover ratio is fluctuating every year. The average cost of goods sold and average inventory were Rs 2,32,44,47,722 and Rs 22,82,46,635. Likewise, inventory turnover ratio was 11.45 times. In year 2066/067, Turnover Ratio is low i.e.8.35 times. It means more inventories are kept in the stock, unnecessary investment tied up on it. It direct effect on the profitability of the firm from the study of five fiscal year period, the highest turnover ratio is 20.07 times in 2064/065 fiscal year. And also next remaining year inventory turnover ratio is below but little good. In totality, The Dairy Development Corporation efficiency in inventory is poor in beginning and satisfactory in recent year but not reach at optimum level. This may be due to unable to change their inventory into receivable/cash through sales. So DDC has to give more attention in inventory management. It is also presented in following figure.

Figure: 4.7

Graphical Presentation of Inventory Turnover Ratio of DDC



4.8 Inventory Holding Days (DIH)

Inventory holding days represent how many days firm holds the average inventory. The formula to calculate DIH is also follows:

$$\text{DIH} = \frac{\text{Average Inventory}}{\text{Costs of Good Sold}} \times 365$$

$$\text{DIH} = \frac{\text{Closing Stock}}{\text{Sales}} \times 365$$

Note: If cost of goods sold is not available this time we have to use second formula.

Table 4.13

Inventory Holding Days of DDC

Fiscal Year	Cost of Goods sold (Rs)	Average Inventory (Rs)	DIH
2064/065	1,92,91,64,826	9,61,30,818	18.18
2065/066	1,91,61,07,145	19,82,00,155	37.75
2066/067	2,31,20,63,599	27,70,56,335	43.73
2067/068	2,54,46,23,530	26,70,19,322	38.30
2068/069	2,92,02,79,512	30,28,26,543	37.84
Total DIH			**175.83**
Mean DIH (total/ 5)			35.16

Source: DDC's Annual reports & Appendix-I

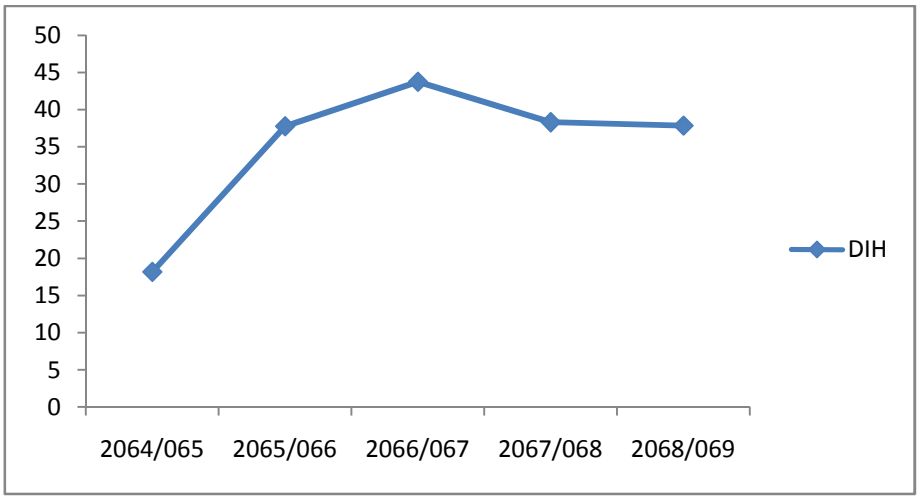
The table 4.13 depicts the Inventory holding days represented the how many days firm hold the inventory in factory or warehouse without any work year by year. Low DIH represented or indicated good inventory management; finished goods are quickly selling over a period of time and firm able to earn profit by it. In other way, high DIH represented or indicated dangerous. High inventory holding day's shows firm has more stock of finished goods for sale. Due to this inventory involves cost in terms of interest of blocked amount, rental of warehouse, damage/deterioration and so on and firm not able to earn profit by it.

From the table 4.13 inventory holding day of DDC from 2064/065 to 2068/069 fiscal year being represented the mean of inventory holding days 15.30. In other words the project holds average inventory 35.16 days in regards of mean. Except in fiscal years 2064/065 all fiscal years, DIH had crossed the mean and highest DIH in 2066/067 which is 43.73 days. From this

analysis, it is cleared that DDC is felt to manage inventory holding period and its management. It is also presented in following figure.

Figure 4.9

Graphical Presentation of inventory holding days of DDC



4.9 Regression on Inventory and Sales

Here, in the analysis of inventory and sales, the sales are the dependent variable, which is denoted by Y, and inventory purchase by DDC is the values of independent variables, which is denoted by X. The regression equation of Y on X, which is used to describe the variation in the value of Y for given change in the value of x.

Table 4.14

Regression Result of DDC

(In Rs)

Fiscal Year	Net Sales (Y)	Inventory (X)
2064/065	1,80,06,73,560	12,31,90,816
2065/066	2,19,33,09,447	27,32,09,494
2066/067	2,62,83,50,971	28,09,03,177
2067/068	2,92,68,88,212	25,31,35,468
2068/069	3,24,29,39,440	35,25,17,619

Source: DDC's Annual reports

According to this data regression of Yon X be

a = 1078.37, b= 5.77

y = 1078.37 + 5.77 X

(Source: Calculation are made in Appendix-II)

The above regression equation shows a positive relationship between closing inventory and net sales.

The stated regression equation shows a positive relationship between closing inventory and net sales of DDC. The slope coefficient of 5.77million means that the marginal propensity to earn sales revenue Re.5.77million means that if the value of inventory increase by Re one million on the average sales goes up by Rs 5.77 million. The intercept values 'a' 1078.37million of DDC means that the average expenditure on main material purchase should be 1078.37 million if net sale is zero.

4.10 Regression on cost of goods sold and Sales

On the basis of variable derived from Annex cost of goods sold is main part of expenses during the period of milk and milk product sales on sales obtained by DDC. Here, in the analysis the researcher assumed the sales is the values of the dependent variables which is denoted by Y and cost of goods sold which actually spend in area of sales of milk and milk product by DDC is the values of independent variables which is denote by X.

Table 4.15

Regression Result (DDC)

(In Rs)

Fiscal Year	**Net Sales (Y)**	**Cost of goods sold (X)**
2064/065	1,80,06,73,560	1929164826
2065/066	2,19,33,09,447	1916107145
2066/067	2,62,83,50,971	2312063599
2067/068	2,92,68,88,212	2544623530
2068/069	3,24,29,39,440	2920279512

Source: DDC's Annual reports

According to this data we calculate regression of Y on X be

a = -440.68, b = 1.29

y = -440.68+1.29X

(Source: Calculation are made in Appendix-II)

The above regression equation shows a positive relationship between sales and cost of goods sold i.e. with the increase in sales with increase in cost of goods sold/ sales expense.

In case of DDC the slope coefficient of Rs.1.29 million means that marginal propensity to earn sales revenue Rs. 1.29 million meaning that if the value of sales expenses increases by Re one million on the average sales goes up by 1.29 million. The intercept value of 'a' is -440.68 million means the average value of cost of goods sold/sales expenses would be -440.68 million if the sales were zero .i.e. would bear the suffered loss.

4.11 Regression on (closing) Inventory and Net Profit

Here, in the analysis we assume the net profit is the values of dependent variables, which is denoted by 'Y' and closing inventory, which holds the project end of the fiscal year, is the value of independent variables denoted by X. The regression equation or evaluation of Y on X, which is used to describe the variation in the value of Y for given change in the value of X.

Table 4.16

Regression Result (DDC)

(In Rs)

Fiscal Year	Net Profit (Y)	Inventory (X)
2064/065	-8,97,90,181	12,31,90,816
2065/066	-86,09,484)	27,32,09,494
2066/067	2,58,10,924	28,09,03,177
2067/068	8,49,21,969	25,31,35,468
2068/069	-16,49,32,764	35,25,17,619

Source: DDC's Annual reports

According to this data regression of Yon X be

a = 2880.89, b = -0 .139

Y = 2880.89 -0 .139 X

(Source: Calculation are made in Appendix-II)

The above regression equation shows that positive relationship between inventory and Net Profit.

The table 4.16 depicts the slope coefficient of -0.139 million means the marginal propensity to earn net profit Rs. 0.139 million meaning that if the value of closing inventory decreased by Re one million on the average, the net profit decreased by 0.139. The intercept value of 'a' 2880.89 million means that the average value of closing inventory would be 2880.89 million if net profit were zero.

4.12 Multiple Regression on Profit, Sales and Closing inventory of DDC

On the basis of variable derived from Annex the regression equation of Net Profit, Sales and closing stock.

Here in the analysis we assume that,

Profit = X_1, Dependent Variable

Sales = X_2, Independent Variable

Closing Stock = X_3, Independent Variable

Table No 4.17

Analysis of Multiple Regression result (DDC)

(In Rs)

FY	**Net Profit (X_1)**	**Net Sales (X_2)**	**Closing inventory (X_3)**
2064/065	-8,97,90,181	1,80,06,73,560	12,31,90,816
2065/066	-86,09,484)	2,19,33,09,447	27,32,09,494
2066/067	2,58,10,924	2,62,83,50,971	28,09,03,177
2067/068	8,49,21,969	2,92,68,88,212	25,31,35,468
2068/069	-16,49,32,764	3,24,29,39,440	35,25,17,619

Source: DDC's Annual reports

According to this data we calculate multiple regression of X1 on X2 and X3 be

$a = 96.31$ $b_1 = -0.084$

$b_2 = 0.345$

$X_1 = 96.31 - 0.084X_2 + 0.343X_3$

(Source: Calculation are made in Appendix-III)

The above multiple regression equation shows that there is negative and positive relationship among the net profit, sales and Closing inventory.

In case of DDC, the slope coefficient of -0.084 million and 0.0343 million means that if the value of sales is increased and if the value of closing inventory is decreased by Re one million on the average the net profit will also increased. The intercept value of 'a' 96.31 million means that the average value of sales and closing stock would be 96.31 million if net profit was zero.

4.13 Analysis of Primary Data

An empirical investigation was made conducted in order to identify inventory management problem faced by DDC. The major tool used for this purpose was an opinion survey. Sets of questionnaire were distributed to DDC staffs and some of the customer responses were also concerned. Sample size is 30 persons from the different department inclusive of procurement, production, account, finance and administration. The questionnaires and the result of respondents are presented in the following table.

4.13.1 Basic reasons for keeping inventory in the Firm

The following answers were received from the respondents in the first question, for the basic reason for keeping inventory in DDC.

Table 4.18

Basic reasons for keeping inventory in DDC

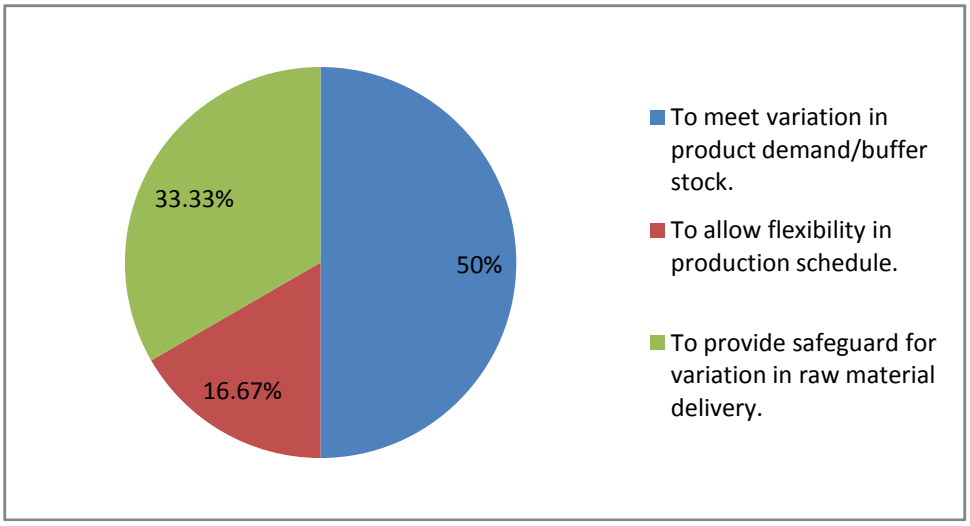
Option	No of Respondent	% of respondent
To meet variation in product demand/buffer stock.	15	50.00
To allow flexibility in production schedule.	5	16.67
To provide safeguard for variation in raw material delivery.	10	33.33
Total	30	100.00

Source: Field survey May, 2013

The respondents representing, 50% as per this survey, were of the opinion that inventory in DDC should be maintained to meet variation in product demand / better stock. Among 30 respondents, 16.67% and 33.33% respondent answered respectively flexibility in production schedule and provide safeguard for variation in raw material delivery respectively.

Figure 4.10

Basic reasons for keeping inventory in DDC in pie chart



4.13.2 Types of inventory maintained in your firm

Table 4.19

Types of inventory to maintain in firm

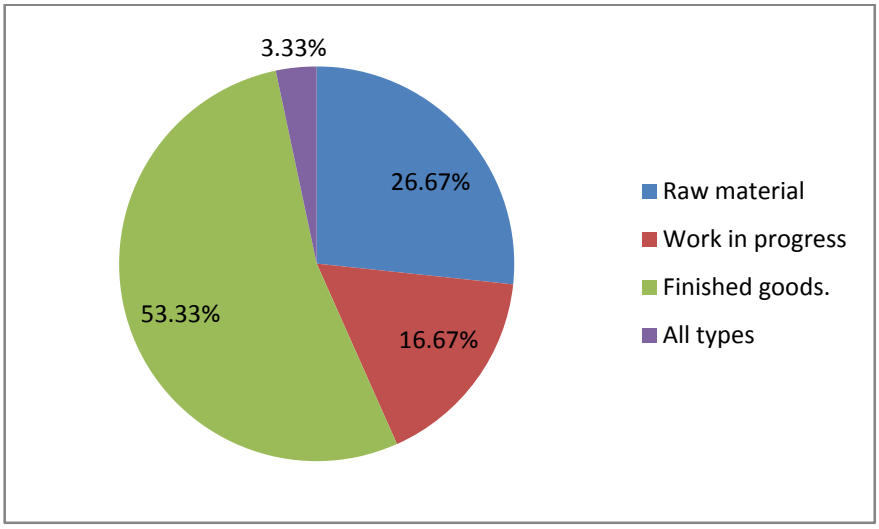
Option	No of Respondent	% of respondent
Raw material	8	26.67
Work in progress	5	16.67
Finished goods.	16	53.33
All types	1	3.33
Total	30	100.00

Source: Field survey May, 2013

From the table 4.19 Most of the respondents, 53.33% as per this survey, considered the finished goods inventory to maintain in the firm. Among the 30 respondents, 26.67% , 16.67% and 3.33% respondent the raw material, work in progress and all types of inventory. It is also presented in following figure.

Figure 4.11

Types of inventory to maintain in firm



4.13.3 Which department determines the inventory in the firm?

In the third question, which department determines the inventory in the firm, the answer of respondents is presented as follows:

Table 4.20

Department determines the inventory in the firm

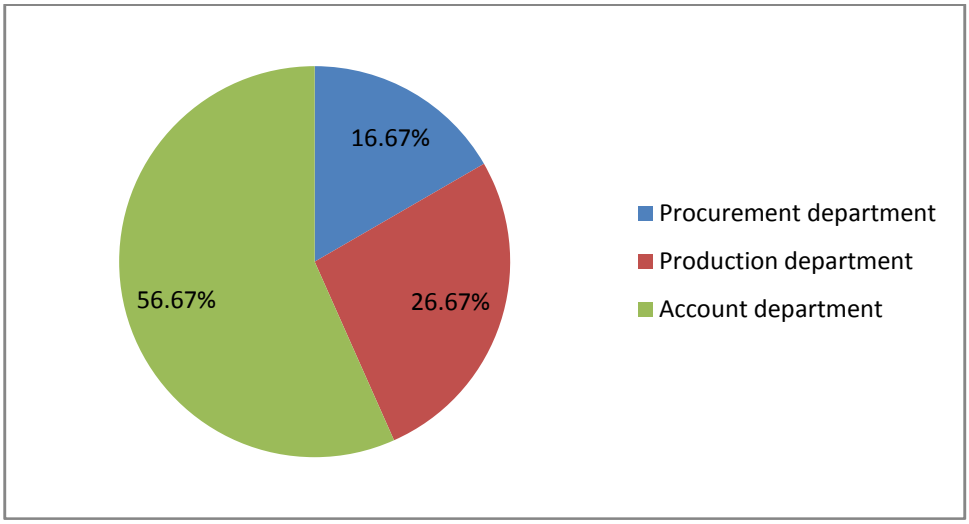
Option	No of Respondent	% of respondent
Procurement department	5	16.67
Production department	8	26.67
Account department	17	56.66
Total	30	100

Source: Field survey May, 2013

The table 4.20 depicts the department determines the inventory in the firm. Among 30 respondents, Most of them i.e. 56.67% replied that account department determine the inventory in the firm. Likewise, 16.67% and 26.67% respondents agree that procurement department and production department determine the inventory in the firm. It is also presented in the following figure.

Figure 4.12

Department determines the inventory in the firm



4.13.4 Does the firm face any problem in inventory management

In the fourth question, the respondents are asked does the firm face any problem in inventory management, the answered of respondents is as follows:

Table 4.21

Firm face any problem in inventory management

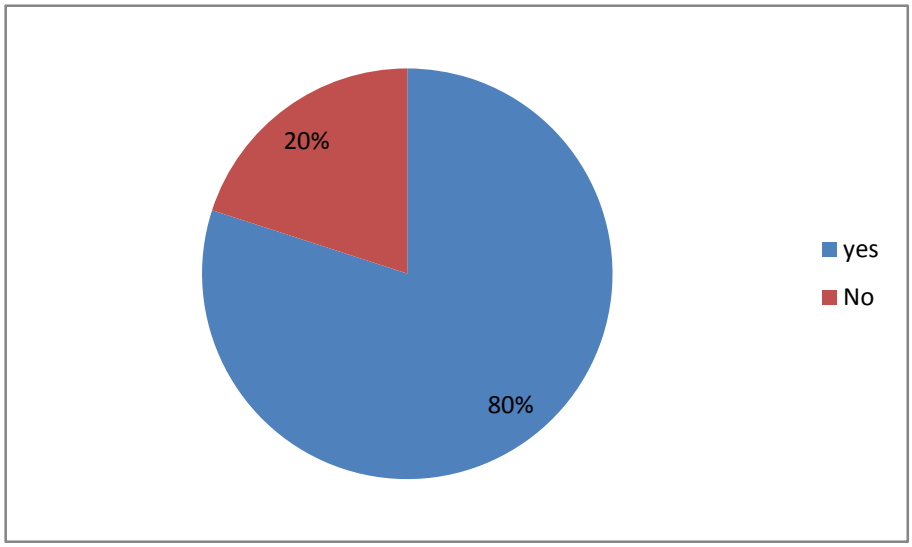
Option	No of Respondent	% of respondent
Yes	24	80
No	6	20
Total	30	100

Source: Field survey May, 2013

According to the above table 4.21, among the 30 respondents, 80% agree that the firm faced problem in inventory management. Only few i.e. 20% respondents disagree that the firm does not faced problem in inventory management. It is also shown in following figure.

Figure 4.13

Firm face any problem in inventory management



4.13.5 Types of problem faced by the firm

What types of problem is faced by the firm is asked in the fifth question. The answered of respondents can be summarized as follows.

Table 4.22

Types of problem faced by the firm

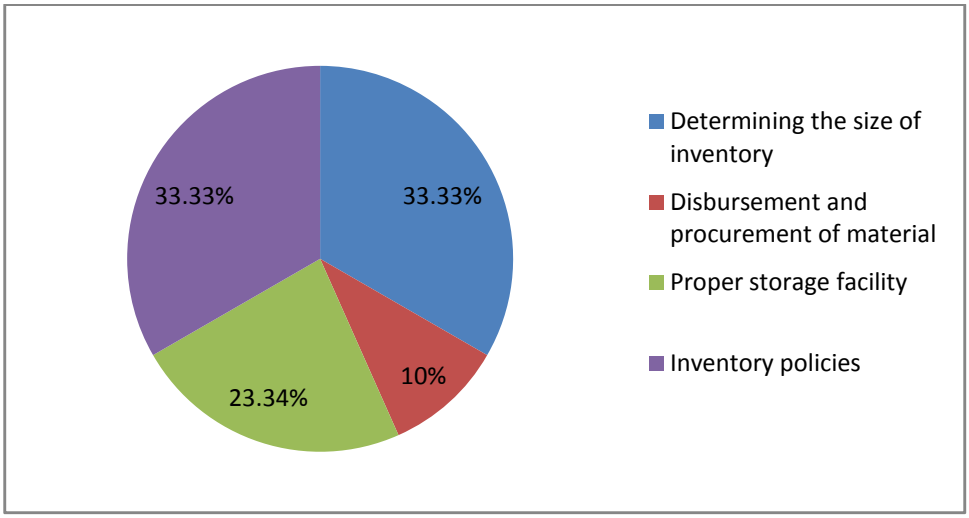
Option	No of Respondent	% of respondent
Determining the size of inventory	10	33.33
Disbursement and procurement of material	3	10.00
Proper storage facility	7	23.34
Inventory policies	10	33.33
Total	30	100.00

Source: Field survey May, 2013

Table 4.22 depicts the types of problem faced by the firm. Among the 30 respondents equal respondents i.e. 33.33% answered the determining the size of the inventory and inventory policies. Likewise, 10% and 23.34% respondents agree that disbursement and procurement of material and proper storage facilities is the problem faced by the firm respectively. It is also clear from the following figure.

Figure 4.14

Types of problem faced by the firm



4.13.6 Has the firm apply EOQ model

Has the firm apply EOQ model is asked with the respondents in the sixth question, which is answered in the following way by the respondents.

Table 4.23

Firm apply EOQ model

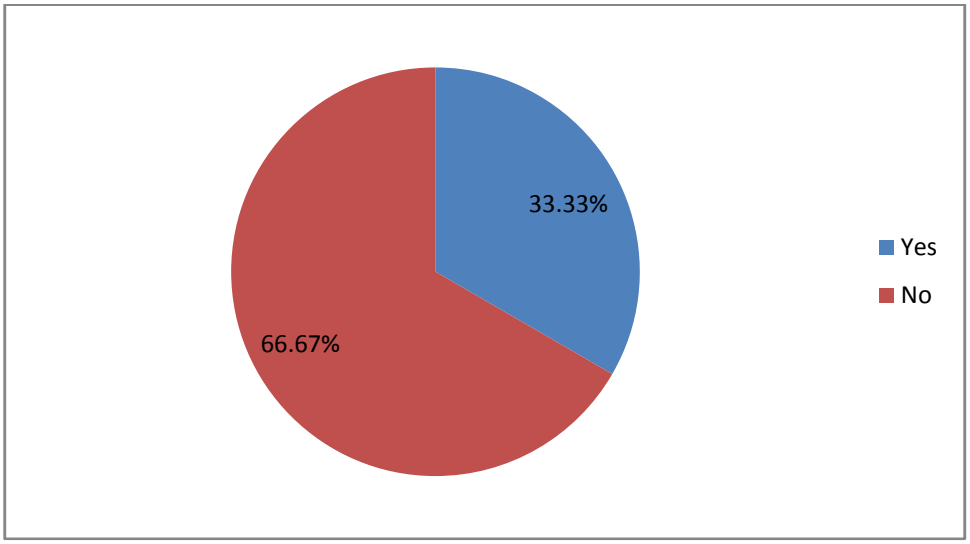
Option	No of Respondent	% of respondent
Yes	10	33.33
No	20	66.67
Total	30	100

Source: Field survey May, 2013

The table 4.23 reflects that only few i.e. 33.33% of the respondents answered that firm apply EOQ model. Most of the 66% of the respondents clearly stated that the firm does not apply the EOQ model. It clearly stated that the inventory management of the firm is poor. It is also clear from the following figure.

Figure 4.15

Firm apply EOQ model



4.13.7 Limitation of applying EOQ and ABC model

Respondents are asked about the limitation of applying EOQ and ABC model in the seventh question. They have answered it as follows:

Table 4.24

Limitation of applying EOQ and ABC model

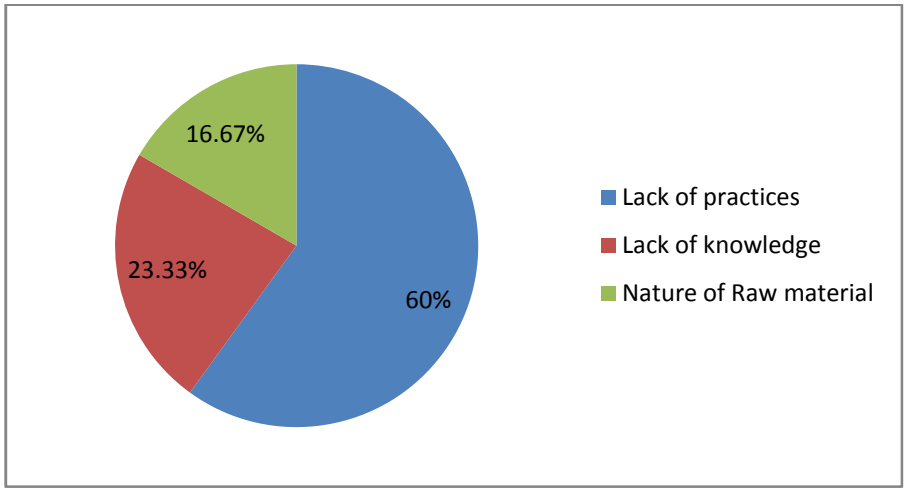
Option	No of Respondent	% of respondent
Lack of practices	18	60.00
Lack of knowledge	7	23.33
Nature of Raw material	5	16.67
Total	30	100

Source: Field survey May, 2013

Table 4.24 depicts the limitation of applying EOQ and ABC model in the firm. Among 30 respondents, most of them i.e. 60% agree that lack of practices is major limitation of applying EOQ and ABC model. Likewise, 23.33% and 16.67% of the respondents replied that the limitation of EOQ model and ABC respectively in the firm. It is also shown in following figure.

Figure 4.16

Limitation of applying EOQ and ABC model



4.13.8 Relation between cost of inventory and Profit

Respondents are asked about the relation between cost of inventory and profit in the eighth question. The answered of respondents are summarized as below.

Table No. 4.25

Relation between cost of inventory and Profit

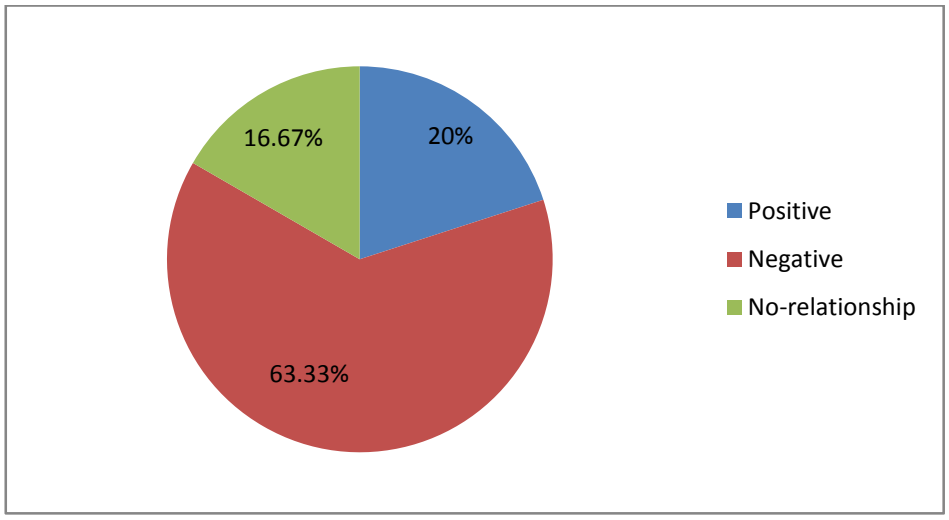
Option	No. of Respondent	% of Respondent
Positive	6	20.00
Negative	19	63.33
No-relationship	5	16.67
Total	**30**	**100**

Source: Field survey May, 2013

Table 4.25 reflects that 63.33% respondents said there is negative relationship between cost of inventory and profit. This indicates that if there is minimum inventorial cost then profit will increase and vice-versa. However, some of 20% respondents, another view that if the inventorial cost is slightly increased the producer/ firm also increase the selling price of the products in more proportion which leads to increase the net profit. But this is difficult in the competitive market. Only few 16.67% respondents that there is no relationship between cost of inventory and profit. It is also presented in following figure.

Figure 4.17

Cash Dividend by the banks



4.13.9 Firm maintain desirable Safety Stock

Respondents are asked about does the firm maintain desirable safety stock in the ninth question. The answer can be summarized as below.

Table 4.26

Firm maintain desirable Safety Stock

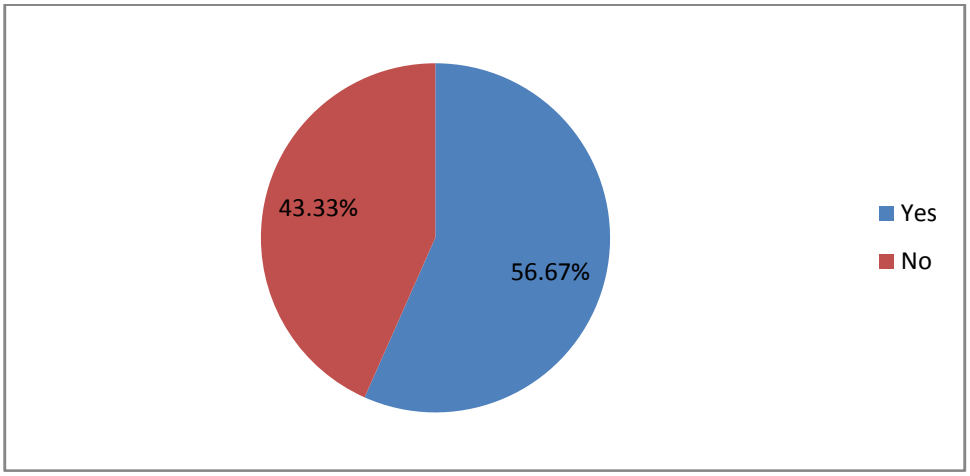
Option	No. of Respondent	% of Respondent
Yes	17	56.67
No	13	43.33
Total	**30**	**100**

Source: Field survey May, 2013

According to the table 4.26, 56.67% respondents said firm maintains desirable safety stock and 43.33% respondents depicts that firm does not maintain desirable safety stock. It is also presented in the following figure.

Figure 4.18

Firm maintain desirable Safety Stock



4.13.10 Transportation and other strike affect the inventory

The most important of inventory management is transportation and other strike affect the inventory in the tenth question. The answered of respondents are summarized as follow.

Table 4.27

Transportation and other strike affect the inventory

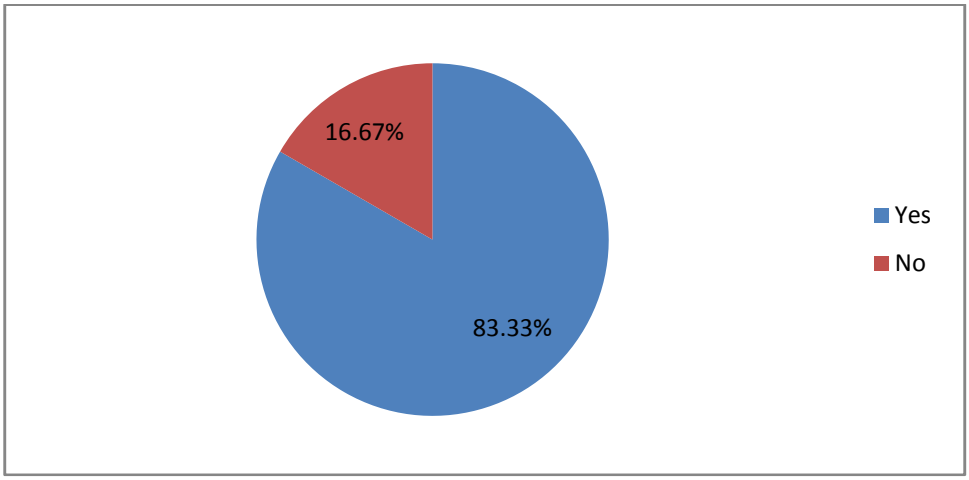
Option	No. of Respondent	% of Respondent
Yes	25	83.33
No	5	16.67
Total	**30**	**100**

Source: Field survey May, 2013

The table 4.27 presents the most important of inventory management is transportation and other strike affect the inventory which is 83.33%. Out of 30 respondents, only few respondents replied that transportation and other strike disagree in inventory management rather firm inventory policy. But in a manufacturing firm most of the important factor that affect in inventory management is transportation and strike whether firm own employee of different political union or external *Nepal banda* and other occasional strike. It is also presented in the following figure.

Figure 4.19

Transportation and other strike affect the inventory



4.14 Major Finding of the study

4.14.1 Major findings based on the secondary data

The major findings of the secondary data are as follows:

- In the fiscal year 2064/065, DDC's EOQ is 25,16,008 liters which is the optimum quantity for economic benefit. It is clear that the lowest inventory cost of DDC is Rs 28,06,124 under trial and error approach which includes total ordering cost of Rs. 13,97,160 and total carrying cost of Rs 14,08,964 and it takes 45 times of order placement in a year. In other words, when DDC makes order 45 times there will be total cost minimization in 2064/065. The lowest inventory cost of DDC is Rs 29, 82,010 which includes total ordering cost of Rs. 14, 88,008 and total carrying cost of Rs. 14, 94,002 and it takes 46 times in the fiscal year 2065/066. In other words when DDC places 46 times order in the fiscal year there will be total cost minimization in 2065/066. Likewise, the lowest total inventory cost of DDC Rs 31,68,997 which includes total ordering cost of Rs. 15,85,874 and total carrying cost of Rs. 15,83,123 and it takes 47 times in the fiscal year 2066/067, there will be total cost minimized. In fiscal year 2067/068, the lowest inventory cost of DDC is Rs 32,94,679 which includes total ordering cost of Rs. 16, 40,304 and total carrying cost of Rs 16,54,375 and it takes 48 times in the fiscal year. Similarly, the lowest total inventory cost of DDC is Rs.35,04,095 which include total ordering cost of Rs. 17,46,360 and total carrying cost Rs.17,57,735 and it takes 49 times there will be total cost minimization.

- DDC needs to calculate its EOQ cost and apply the optimal order quantity which reduces cost of inventory. Purchases of milk made by DDC were not based on EOQ purchase.
- The highest re-order point in which safety stock excluding and including is 3, 80,011 liters and 11,40,033 liters in fiscal year 2068/069. And the lowest re-order point in which safety stock excluding and including is 3,12,813 liters and 9,38,439 liters respectively in fiscal year 2064/065.
- DDC is minimum inventory to total fixed assets ratio was 0.73 times in the year 2064/065. Maximum inventory to total fixed assets was 1.56 times in year 2065/066.
- In year 2064/065 the inventory to total fixed assets ratio is good. According to this study in inventory management, low inventory to total fixed assets ratio preferred the good efficiency in inventory management. Because, if good efficiency in inventory management this could make closing inventory level being low and sales being high. At the assumption of DDC, in year 2064/065 ratio is being good and other year also ratio being little befit.
- The standard inventories to current Assets ratio should about 45 to 50%. But this ratio is vary & more fluctuating and not have such ratio. Inventory to current assets, it is clear that the highest ratio of DDC is 133.86% in fiscal year 2064/065 & lowest is 34.00% in fiscal year 2067/068. In other fiscal year DDC have satisfactory level in fiscal year 2065/66 and 2068/069.
- Inventory to net profit ratio of DDC from fiscal years 2064/065 to 2068/069. It is clear that only in two fiscal years i.e. 2066/067 and 2067/068 the ratios are positive i.e. 10.88 times and 2.98 times and other subsequent fiscal years net profit is negative. It means companies didn't generate the profit except two fiscal years. DDC is suffering from loss year by year. It indicates that DDC suffer bad condition year.
- In totality, The Dairy Development Corporation efficiency in inventory is poor in beginning and satisfactory in recent year but not reach at optimum level. This may be due to unable to change their inventory into receivable/cash through sales. So DDC has to give more attention in inventory management.
- Inventory holding day of DDC from 2064/065 to 2068/069 fiscal year being represented the mean of inventory holding days 15.30. In other words the project holds average inventory 35.16 days in regards of mean. Except in fiscal years 2064/065 all

fiscal years, DIH had crossed the mean and highest DIH in 2066/067 which is 43.73 days. From this analysis, it is cleared that DDC is felt to manage inventory holding period and its management.

4.14.2 Major finding based on the primary data

The major findings of primary survey through questionnaire from 30 sample size are as follows:

- The respondents equal to 50% as per this survey were of the opinion that in DDC should be maintained to meet variation in product demand/ suffer stock. Among 30 respondents, 16.67% and 33.33% respondent's flexibility in production schedule and provide safeguard for variation in raw material delivery respectively.
- Most of the respondents, 53.33% as per this survey, considered the finished goods inventory to maintain in the firm. Among the 30 respondents, 26.67% , 16.67% and 3.33% respondent the raw material, work in progress and all types of inventory.
- Among 30 respondents, Most of them i.e. 56.67% replied that account department determine the inventory in the firm.
- Among the 30 respondents, 80% agree that the firm faced problem in inventory management.
- Among the 30 respondents equal respondents i.e. 33.33% answered the determining the size of the inventory and inventory policies. Likewise, 10% and 23.34% respondents agree that disbursement and procurement of material and proper storage facilities is the problem faced by the firm respectively.
- Only few i.e. 33.33% of the respondents answered that firm apply EOQ model. It clearly stated that the inventory management of the firm is poor.
- Among 30 respondents, most of them i.e. 60% agree that lack of practices is major limitation of applying EOQ and ABC model. Likewise, 23.33% and 16.67% of the respondents replied that the limitation of EOQ model and ABC respectively in the firm.
- Most of the 63.33% respondents said there is negative relationship between cost of inventory and profit. This indicates that if there is minimum inventorial cost then profit will increase and vice-versa.
- 56.67% respondents said firm maintains desirable safety stock and 43.33% respondents depicts that firm does not maintain desirable safety stock.

- Most important of inventory management is transportation and other strike affect the inventory which is affected by 83.33%.

CHAPTER -V

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The agricultural sector is Nepal covering largest section of the economic activity needs diversification and commercialization to raise the economic level of Nepalese farmers. Currently this sector contributes more than 47 percent of the GDP and provides employment to more than 80 percent of the active population. In modern age, for economic development many subsections of the economy were identified in agriculture area of Nepal. For example: fishing, pastoral, bee keeping, grain production, field crops, horticulture, livestock, and forestry. One of these milk production and supply is one of the helpful businesses.

Being agricultural country, Nepal has to give importance to milk production. So that production of milk should be given more attention from the side of farmer and from the side of government. Government should encourage producing much milk. This may be a good job for jobseeker of the country and back-bone of our agricultural economy. Success of a enterprise basically depends upon the good management along with efficiently in managing the various functional aspects and modeling them to achieve the firm objectives. In other words, whatever may be the nature of business enterprises, management is basically concerned with getting the jobs done effectively and efficiently.

This study ‘inventory management of Dairy Development Cooperation’Ltd. was concerned to examine that in what extent the companies are applying inventory management and control system so as to minimize it's cost, which ultimately affect the profit. Most of the manufacturing and non-manufacturing firms invest a huge amount of capital in the form of inventories. The expenses involved for carrying on functional associated with inventory such as purchasing, handling, receiving, storage and record keeping is also large. Thus in recent years, the subject of inventory management has engaged the attention of management and extensive literature has involved which encompass statistically tools like economic order quantity for how much to purchase together with the re-order point. The basic problem of this

study is to examine the inventory management system practiced by the dairy companies. The order size, carrying cost, ordering cost, safety stock are determined unscientifically by the DDC and is not given proper attention to the lead time and all those function lead to increase the total cost of the firm.

The main objective of this study is to find out what techniques were applied by dairy companies to manage the inventory and suggestion to use the scientific techniques to help to reduce cost for this purpose, the researcher interviewed with officials and observes the inventory system personally data were collected from various sources Quantitative tools were applied in this study to analyze the collected data. The sample size of the data is 30. All the collected data and facts were analyzed on the basis of inventory management theory and with the help of ABC analysis, EOQ with re-order level, Ratio analysis and Regression analysis. To make certain type of inventory management decisions, many mathematical techniques are available for controlling the inventory but the DDC have not applied any sort of techniques available for managing inventory. In overall inventory management applied by the firm is weak in overall performance.

5.2 Conclusion

On the basis of analysis of data and information collection from DDC conclusion is drawn. To meet the consumer demand production on the efficiently and effectively, the study focused on the need for a good inventory system to maintain a suitable level of inventory and also control the cost of the Dairy Development Corporation. The values maintaining proper stock of inputs as well as discussed previously are necessary to know the answer about when and how much to buy. The models examples and formula as discussed previously are necessary for every manufacturing and nonmanufacturing enterprise to reduce unnecessary cost incurred on ordering and carrying the inventory. Transportation and other strike are directly affecting the companies' production, because both have no safety stock more than one day. By which a large number of consumer affected and firm also affect. Inventory cost decreases the profit. When inventory cost increase profit should be decrease both firm pays more money as collection cost and storage their sensitive product, which decrease the profit.

Though, these models, example and formula etc. for managing inventory are available they could not be used fully for finding out the necessary operation of the firm because of the lack of adequate data. No techniques for inventory management are possible to apply to calculate one of the major decisions when to buy because of lack of planning and unsystematic methods of recording cost. If no concrete step is taken with regards to recording and maintaining of proper data on stock out cost, carrying cost, ordering cost, price of row material etc. Separately, future researcher would not be able to predict the re-order period and how much to maintain the safety stock properly. Thus, in the real situation of the operation of the firm regarding its inventory managing system could not be found. From study and analysis of data, inventory management system is same.

5.3 Recommendations

The following suggestions are recommended for consideration on the basis of major findings.

- Dairy Development Corporation should categorize its inventory for the purpose of control and equal attention on all the inventories.
- The firm should follow scientific tools and techniques i.e. economic order quantity and economic lot size formula, which help to reduce the ordering and carrying cost of the dairy milk. The output obtained from quantitative analyzes results the lowest cost and consumer can use with low cost than firm can increase their selling.
- The easiest applicable model of ABC classification is another tool that can be applied for controlling inventory smoothly. The ABC analysis helps to know which items in inventory have higher usage value and which have not and accordingly a precise control over the items in inventory can be applied. DDC should adopt the ABC analysis.
- Closing inventory of a direct indicator of capital tie-up. If closing inventory is huge, then the more capital is used unnecessarily. There is no uniformity in the level of stock dairy development corporation ltd. Hence, proper inventory management should follow by dairy companies in an effective manner.
- The study stresses the need of a good inventory management system for better performance of DDC. If Dairy DDC initiate steps to the appropriate management of inventory, certainly firm will be able achieve their set objectives successfully.

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Appendix -I

Sales and Inventory of DDC from the fiscal year 2064/065 to 2068/069

Fiscal Year	**Inventory (Rs)**	**Net Sales (Rs)**	**Percentage of inventory on Sales (%)**
2064/065	1,2,31,90,816	1,80,06,73,560	6.84
2065/066	27,32,09,494	2,19,33,09,447	12.46
2066/067	28,09,03,177	2,62,83,50,971	10.68
2067/068	25,31,35,468	2,92,68,88,212	8.65
2068/069	35,25,17,619	3,24,29,39,440	10.87
Average	25,65,91,314	2,55,84,32,326	9.9

Calculation of average inventory of DDC from the Fiscal year 2064/065 to 2068/069

Fiscal Year	Beginning Inventory (Rs) (A)	Ending inventory (Rs) (B)	Average inventory (Rs) $(\frac{A+B}{2})$
2064/065	6,90,70,820	12,31,90,816	9,61,30,818
2065/066	12,31,90,816	27,32,09,494	19,82,00,155
2066/067	27,32,09,494	28,09,03,177	27,70,56,335
2067/068	28,09,03,177	25,31,35,468	26,70,19,322
2068/069	25,31,35,468	32,25,17,619	30,28,26,543

Appendix-II

000,000 (In NPR Rs.Million)

Fiscal Year	Net Sales (Y)	Inventory (closing) (X)	Y^2	X^2	XY
2064/065	1800	123	3240000	15129	221400
2065/066	2193	273	4809249	74529	598689
2066/067	2628	280	6906384	78400	735840
2067/068	2926	253	8561476	64009	740278
2068/069	3242	353	10510564	124609	1144426
Sum	**12789**	**1282**	**34027673**	**356676**	**3440633**

Here, n = 5,

$\phi Y = 12789, \quad \phi X = 1282$

$\phi Y^2 = 34027673 \quad \phi X^2 = 356676 \quad \phi XY = 3440633$

Let regression equation Y and X b

$Y = a + bx$ . . . (i)

Then two normal equations estimating a and b are

$\phi Y = na + b\phi X$ . . . (ii)

And,

$\phi XY = a\phi X + b\phi X^2$ . . . (iii)

Putting the above calculating value in eq. mo (ii) and (iii)

$12789 = 5a + 1282\ b$……(iv)

$3440633 = 1282\ a + 356676\ b$. . ….. (v)

Now multiplying (iv) by 1282 and (v) by 5 then solving

$16395498 = 6410a + 1643524b$

$17203165 = 6410a + 1783380b$

$-807667 = -139856b$

b= 5.77

Putting the value of b in equation No. (iv)

12789 = 5a+ 1282 ×5.77

b = 1078.37

Substituting the values of and b in eq. (i) we get y = 1078.37+ 5.77x .

Fiscal Year	Net Sales (Y)	Cost of goods sold (X)	Y^2	X^2	XY
2064/065	1800	1929	3240000	3721041	3472200
2065/066	2193	1916	4809249	3671056	4201788
2066/067	2628	2312	6906384	5345344	6075936
2067/068	2926	2545	8561476	6477025	7446670
2068/069	3242	2920	10510564	8526400	9466640
	12789	**11622**	**34027673**	**27740866**	**30663234**

Here, n = 5,

$\phi Y = 12789, \quad \phi X = 11622$

$\phi Y^2 = 34027673 \qquad \phi X^2 = 27740866 \qquad \phi XY = 30663234$

Let regression equation Y and X b

$Y = a + bx$ . . . (i)

Then two normal equations estimating a and b are

$\phi Y = na + b\phi X$ . . . (ii)

And,

$\phi XY = a\phi X + b\phi X^2$ . . . (iii)

Putting the above calculating value in eq. mo (ii) and (iii)

12789 = 5a + 11622 b……(iv)

30663234 = 11622 a + 27740866 b. . ….. (v)

Now multiplying (iv) by 11622 and (v) by 5 then solving

148633758 = 58110a + 135070884b

153316170 = 58110a + 138704330b

--4682412 =-3633446b

b= 1.29

Putting the value of b in equation No. (iv)

12789 = 5 a + 11622 ×1.29

a = -440.68

Substituting the values of and b in eq. (i) we get y = -440.68+ 1.29x .

Fiscal Year	**Net profit (Y)**	**Inventory (X)**	$\mathbf{Y^2}$	$\mathbf{X^2}$	**XY**
2064/065	-89	123	7921	15129	-10947
2065/066	-9	273	81	74529	-2457
2066/067	25	280	625	78400	7000
2067/068	85	253	7225	64009	21505
2068/069	-165	353	27225	124609	-58245
	-153	**1282**	**43077**	**356676**	**-43144**

Here, n = 5,

$\phi Y = -153, \quad \phi X = 1282$

$\phi Y^2 = 43077 \quad \phi X^2 = 356676 \quad \phi XY = -43144$

Let regression equation Y and X b

$Y = a + bx$ . . . (i)

Then two normal equations estimating a and b are

$\phi Y = na + b\phi X$ . . . (ii)

And,

$\phi XY = a\phi X + b\phi X^2$ . . . (iii)

Putting the above calculating value in eq. mo (ii) and (iii)

-153 = 5a + 1282 b……(iv)

-43144= 1282 a + 356676 b. . ….. (v)

Now multiplying (iv) by 1282 and (v) by 5 then solving

-196146 = 6410a + 1643524b

-215720 = 6410a + 1783380b

\+ – –

19574 = -139856b

b = -0.139

Putting the value of b in equation No. (iv)

12789 = 5a+ 11622 × -0.139

a = 2880.89

Substituting the values of and b in eq. (i) we get y = 2880.89-0.139x.

Appendix-III

Calculation of Multiple Regressions on Net Profit, Sales and inventory (DDC)

Amount "000,000"(NPR Million)

Fiscal Year	Net profit (X1)	Net Sales (X2)	Inventory (X3)	$X2^2$	$X3^2$	X1X2	X1X3	X2X3
2064/065	-89	1800	123	3240000	15129	-160200	-10947	221400
2065/066	-9	2193	273	4809249	74529	-19737	-2457	598689
2066/067	25	2628	280	6906384	78400	65700	7000	735840
2067/068	85	2926	253	8561476	64009	248710	21505	740278
2068/069	-165	3242	353	10510564	124609	-534930	-58245	1144426
Sum	**-153**	**12789**	**1282**	**34027673**	**356676**	**-400457**	**-43144**	**3440633**

Let,

Profit= X_1, Dependent Variable

Sales=X_2, Independent Variable

(Closing) inventory =X_3, Independent Variable

The Multiple regression equation of dependent variable X1, on two independent variables

X_2 and X_3 is given by -

$X_1 = a+b_1. X_2 + b_2. X_3$

Then a, b_1, and b_2 can be obtained by solving following three normal equations simultaneously

$\phi X_1 = n. a + b_1\phi X_2 + b_2\phi X_3$ …….(i)

$\phi X_1.X_2 = a. \phi X_2 + b1\phi X_2^2 + b_2\phi X_2.X_3$ …….. (ii)

$\phi X_1.X_3 = a. \phi X_3 + b1\phi X_2.X_3 + b_2\phi X_3^2$ ……..(iii)

Here,

n = 5,

ϕX_1 = **-153**, ϕX_2 =12789, ϕX_3 = 1282,

ϕX_2^2= **34027673**, ϕX_3^2 = **356676**, $\phi X_1.X_2$= -400457,

$\phi X_1.X_3$ = **-43144**, $\phi X_2.X_3$= **3440633**

Substituting these values in equations , we get

$-153 = 5a + 12789\, b_1 + 1282 b_2$ ……..... . (iv)

$-400457 = 12789a + 34027673\, b_1 + 3440633 b_2$ . . …….. (v)

$-43144 = 1282a + 3440633\, b_1 + 356676 b_2$ ……. . . (vi)

Now multiplying equation (iv) by 1282 and (vi) by 5 and solving we get,

$-196146 = 6410a + 16395498 b_1 + 1643524 b_2$

$-215720 = 6410a + 17203165 b_1 + 1783380 b_2$

\+ - – –

$19574 = -807667\, b_1 - 139856\, b_2$. . . . (vii)

Again multiplying equation (iv) by 12789 and (v) by 5 then solving we get,

$-1956717 = 63945a + 163558521 b_1 + 16395498 b_2$

$-2002285 = 63945a + 170138365 b_1 + 17203165\, b_2$

\+ - – –

$45568 = -6579844 b_1 - 807667\, b_2$……... . . (viii)

Also multiplying equation (vii) by 6579844 and (viii) by 807667 then solving

$1.28794E+11 = -5.31432E+12 b_1 - 9.20231E+11 b_2$

$-36803769856 = -5.31432E+12 b_1 - 6.52326E+11\, b_2$

\+ + +

$-91990096600 = -2.67905E+11 b_2$

$b_2 = 0.343$

Now, putting the value of b_2 in equation (vii) we get,

$19574 = -807667\, b_1 - 139856 \times 0.343$

or $b_1 = -0.084$

Again putting the value of b_1, and b_2 in equation (iv) we get,

$-153 = 5a + 12789 \times -0.084 + 1282 \times 0.343$

or $a = 96.31$

Substituting the values of a, b_1 and b_2 in equation (1) we get the required multiple regression line

$X = 96.31 - 0.084X2 + 0.343X3$