CHAPTER - I

INTRODUCTION

1.1 General Background of the Study

Inventory plays vital role on success of an organization. Inventory is a store of goods and stocks. Modern concept of inventory management can be traced to 1915-1922 AD which developed an economic lot size equation that minimize sum of holding cost and carrying costs where the demand was known and constant.

"Inventories form a link between production and sale of a product. The inventory exists in manufacturing and non-manufacturing organization. In manufacturing organization there are four types of inventories. First is raw material, to purchased and stored for future production. Second work-in-progress refers semi-manufactured products. They represent products that need more work before they become finished products for sale. Third finished goods inventories completely manufactured products which are ready for sale and the fourth is office and plant cleaning materials [Soap, brooms etc.], oil, fuel bulbs and the like these materials don't directly enter production" *(Pandey, 1994:755).*

In case of trading concern, inventory would comprise only finished goods and stock in trade owned by if for sale to customers in the normal cause of business; *(Jain and Narang, 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 dimension 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 the inventory management to reduce the cost of production (manufacturing) Sales (non-manufacturing) and working capital requirements. Inventory should be maintained in appropriate quantity so as to avoid both under stock and over stock situation. For this purpose, inventory

management is necessary it is because the aim of inventory maintains optimum level of inventory for the smooth production and sales operation. Therefore inventory cost of maintain desired level of inventory and minimizing total cost of inventory investment for the plants and policies that will lead to optimal inventory investment for attainment of desired objective.

"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).*

The area of inventory management covers the following individual phases: determining the size of inventory (table carried establishing time schedules). Procedure and a lot of sizes for new order, determining minimum safety stock levels and co-ordination of sale production and inventory policies for providing proper storage, facilities, arranging the receipt, disbursement and procurement of materials, developing the forms of recording these transaction, assigning responsibilities for carrying out the inventory control function and providing the reports necessary for supervising these overall activities.

1.1.1 Introduction 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. It is also expected to be financially sound and contribute surplus to the national treasury. The demand of milk and milk product is gradually increasing. So, it was found necessary to improve Dairy Development Center. As a result Dairy Development Commission was converted into Dairy Development Board in 2019 B.S. DDC established on 1st Shrawan 2026 as manufacturing enterprise under the Corporation Act 2021 B.S. Public enterprise in Nepal constitutes a vital instrument for the social economic development of our country. It enjoys a strategic and crucial position in our mixed economy.

The Main objective of the 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. Due to public enterprises, its main object is fulfilling the social benefits rather than earning profit.

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 form the milk producer 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.

1.1.2 A Brief Introduction of Sitaram Gokul Milk Private Limited

Sitaram Gokul Milk Private Ltd. was established on July 18, 1996. It is the private limited company and promoted by Kedia organization. The enterprise does not have any collaboration. The paid of capital of the company is NRs. 61.25 Million. The main products of this enterprise are pasteurized milk, cream butter, ghee and yoghurt. The company perceived as the pioneer in the modern dairy industry from the private sector.

Sitaram Gokul Milk Private Ltd. has been collecting buffalo milk and cow milk with the farmers by cooperative centers with the farmers at the price fixed by the enterprise, and then brought to chilling centers. The company has 13 chilling centers around Butwal area (about 259 km distance from the Kathmandu) in Rupandehi District in Western Development Region of the country.

To provide packaged drinking milk conforming to relevant specification, Incorporating Hazard Analysis and Critical Control Points (HACCP) requirements at to provide at competitive price to meet or exceeds requirements and satisfaction of valued customers, which should be achieved through continues improvements in quality of work, enhancing employee participation at all levels and by using best available resources. The Nepal Bureau of Standards and Metrology (NBSM) have fixed the quantity of milk e.g. fat, S.M.F. Contents. The enterprise follows the quality standards set by Nepal Bureau of Standards and Metrology. The enterprise is in the process of acquiring ISO-9000.

The sale of packaged drinking milk confirming to relevant specification, following HAACP requirements to some extent to provide at competitive price to meet or exceed requirements and satisfaction of valued customers is done through 620 dealers and 1,143 sub-dealers in Kathmandu Valley. The enterprise sells the pasteurized milk in half-liter plastic pouch through dealers and sub dealers.

1.2 Statement of the Problem

Nepal is rich in natural resource but the people of the Nepal are still poor. In Nepal the public enterprises are accepted to build the infrastructure to produce and supply important consumer goods in complement 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. The Dairy Development Corporation is one of the public enterprises and Sitaram Gokul Milk Private Ltd. is private company. Both are established in Nepal to fulfill the need of people by supplying quality milk at reasonable price. It is also expected to be financially sound and contribute surplus to the National treasury. As one of the manufacturing, it is required to contribute a return of at least ten percent on its' capital employed.

Many enterprises could not achieve their pre-established objectives and goals, due to the lack of an authority and communication of objectives and goal from top to lower level management moreover them. They are not maintaining responsibilities and co-ordination between various developments and responsibility centre. Beside them integration of different activities and motivated to employees are more challenging problems behind the every management. There are other various problems, such as political interference, bureaucratic tendency, poor profitability, exposure to public enterprises, lack of continuity, stability lack of enough investment, negligence of management, 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 study of inventory management huge amount of money to blocked on the inventory. How much money should the firm invested in the inventory, how much inventory to be stocked, How can we minimize the ordering and carrying cost, what is to be EOQ, how many times we order that minimize the carrying costs are the same questions that evoke management always.

Present study is about a comparative analysis of inventory management of DDC and Sitaram Gokul Milk Private Ltd. So many short coming can be seen in the inventory system of both firms. For example, the Economic Order Quantity and actual order quantity of the projects are not equal. They are not maintaining the desirable safety stock which the production department has been facing many interruption in the production process. Maintain inventory quality. Company doesn't know when should be order and how the carrying and ordering cost will be minimized.

On the basis of the above mentioned issues, the following questions were put forward during the research period:

- What are the major problems in the existing inventory management and control system?
- What is the impact of inventory over the company's profit?
- How the firms are utilizing their inventory resources?
- What should be the optimal level to reduce the inventory cost?
- What steps should be taken to improve the existing problem of inventory management?

1.3 Objective of the Study

The basic objectives of these studies are:

- To carry out a comparative analysis of the present inventory management position of DDC and Sitaram Gokul Milk Priavte Ltd.
- To identify and analyze the problems faced by the companies in inventory management and control system.
- To examine the inventory management practice and to analyze its impact on profitability of the sampled two companies.
- To assess the status of companies towards utilizing inventory resources.
- To identify the optimum level of inventory to reduce inventory cost.
- To recommend some suggestions based on major findings and conclusion.

1.4 Significance of the Study

Inventory management is one of the important in any manufacturing companies with our effective and efficient inventory management system no one manufacturing company can achieve the goal. Proper inventory management helps to maximize the profitability and do not block the inventories. A company should maintain adequate stock of raw materials/finished goods. If slightly changes in the cost of materials it will effect in the profitability. So the company should keep adequate sock of inventory by keeping adequate inventory the company able to supply whatever the demand. Nepal, an under industrialized country is still using traditional technique in purchasing of inventory. To have a sound achievement the company should apply modern tools and techniques.

This study is needed for effective inventory management in DDC and Sitaram Gokul Milk Private Ltd. and to see the impact in profitability and find out how much money should be invested in inventory. How can we improve the inventory management system? What is the present situation of inventory management and soon. I hope it will move beneficial to both companies and general public.

1.5 Limitations of the Study

The study was based basically on the past data. This study is more specific in inventory management but not on other functional management activities of the company.

1.6 Organization of the Study

The whole study was organized in to five different chapters are as follows:

Chapter I: Introduction

This chapter concentrated on introduction, statement of the problem, objective of the study, significance of the 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, collected data were tabulated and analyzed by the use of various statistical tools, graphs and diagram and major findings.

Chapter V: Summary, Conclusion and Recommendation

This chapter dealt with summary, conclusion and recommendation of the study.

CHAPTER - II

REVIEW OF LITERATURE

2.1 Meaning of Inventory Management

"Inventory management involves planning of optimal level of the material and 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, irrespective of the size of an enterprise" *(Agrawal, 2000:238).*

The expenditure on materials is a major item of budget. In many cases materials consumption varies from 25% to 75% of sales turnover. The expenditure made on materials is money invested in inventories, transportation cost, cost of storage, wastage, insurance etc. Because of the magnitude of expenditures required on acquiring and 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.

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).*

Investment in 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 and how long to keep?

Before getting to a mathematical solution of the above questions, let us understand the function of inventory management.

- 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.
- 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. It serves as a link between production and distribution process. There is a time lag between the reorganization of a need and it's 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 from a part of inventories management.

An efficient system of inventory management will determine

- What to purchase?

- How much to purchase?
- From where to purchase?
- Where to purchase? *(Sharma and 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 and Kaplan, 1987:126).*

"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:

(i) Raw Material

These are input components waiting for production in a 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, 1995: 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. There are following types of raw materials held by these two dairies:

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

(ii) Work-in-Process

"Work-in-process inventories are semi-manufactured products and they represent that need more work before they are converted as finished product for sale" *(Joseph and Koeinigsberg, 1970:583).* 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.

(iii) 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 a waiting sale. In a manufacturing concern they are the finals 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 danger position of losing the customers to competitors permanently these two dairy has produced these types of products:

• Butter • Ghee • Milk Power • Skimmed Buttermilk	• Yoghurt • Cheese • Ice cream. • Other Dairy products

2.2 Objectives of Inventory Management

Inventory is the most important to all manufacturing organization in today's industrial world. So, it is necessary to manage it properly because both situation of inventories i.e. either excessive or in adequate are not desirable to the industry. The excessive

level of inventors consumes funds of the firm, which cannot be used for another purpose and thus it involves an opportunity cost. The carrying cost such as the cost of storage, insurance, handling, recording and inspection also increase in proportion of volume of inventory. These costs will impair the firm's profitability further.

On the other hand maintaining an inadequate level of inventory is also dangerous. Inadequate level of inventory means under investment of industry inadequate raw materials and work-in process inventories will result in frequent production interruption. Similarly, if finished goods inventories are not sufficient to meet the demand of consumer regularly consumers may shift to competitors, which will amount to permanent loss to the firm.

Therefore, proper inventory or optimal level of inventory in industry is quite significant. But, it is difficult task for the management, because the optimal level of inventory always lies between two dangerous points of excessive and inadequate inventories.

An inventory management should be:

- Ensure a continuous supply of raw material to facilitate uninterrupted production.
- Maintain sufficient stocks of raw materials in period of short supply and anticipated price changes,
- Maintain sufficient finished goods inventory for smooth sales operation and efficient customer service,
- Minimize the carrying cost and time, and
- Control investment in inventories and keep in at optimum level *(Pandey, 1999:887).*

The objective of inventory management should be to determine and maintain optimal level of inventory. The optimum level of inventory will lie between two points of excessive and inadequate inventories. Firm should always avoid over investment or under investment in the inventories. Due to over investment, unnecessary tie-up the

amount that we can't invest in other propose excessive carrying costs risk of liquidity. Excessive carrying costs will impair the firm's profitability further. Due to over inventories, it may not be possible to sell them in time and at full value. Similarity, work-in-progress is far more difficult to sell. In the same way, finished goods inventory should sell at low prices due to fall in the prices in market and the seasonal factors. So, more investment in inventories is harmful to producer/company. It should be cut down.

Under investment in inventories also not good for company. It carries some problems such as production hold-ups, frequent production and interruptions. If finished goods are not sufficient, we don't meet the customers demand and our goodwill also lost. Thus the objective of inventory management should be neither excessive not in adequate level of inventories but maintaining sufficient inventories level for the smooth production and sales operations. An optimum level of inventory should be determined on the basis of the tradeoff between costs and benefits.

The various objectives of inventory management can be summarized up as follows *(Goyal, 2005:69).*

- Availability of all items of inventory.
- No excessive investment in inventory.
- Reasonable Price: when we purchase the raw materials, there should be strict on the pricing the raw materials. It should be reasonably low price. But we don't ignore the quantity by keeping lower prices materials. Firm should be adjusted between price of raw material and its quantity.
- Minimum Wastage: There should be minimum wastage of material while storing in the go downs by the workers. Wastage should be allowed up to a certain level known as normal level of wastage and if should not exceed that level. Storekeeper and workers should be trained to handle the material in a scientific way to avoid wastage.
- Risks of spoilage and obsolescence of inventory must be avoided for this purpose, a maximum quantity of each item of inventory is determined and proper

method of issue the inventory is followed LIFO and FIFO method is used to issue the inventory.

- Information about availability of stock should be made continuously available to the management. So the planning of production may be done.

The storekeeper can supply this information because he keeps and up-to-date record of every item of stocks under a proper system of inventory control.

2.3 Need and Importance of Inventory Management

Inventories in any organizations are of pivotal role. If the organization is not paying attention to inventory management, it will affect the efficiency and profitability of the organizations. Buffa observes a "Inventories serve the vital function of developing the various operation in sequence beginning with raw materials extending through all the manufacturing operations and into finished goods storage and continuing to warehouse and retail stores" *(Buffa, 1998:474).*

Importance of inventory management can be written as follows:

- Inventory helps in smooth and efficient running of business.
- Inventory provide service to the customers immediately or at a short notice.
- Due to absence of stock, the company may have to pay high prices because of piece-wise purchasing maintaining of inventory may earn price discount because of bulk purchasing.
- Inventory also acts as buffer stock when raw materials are received late and so many sales-orders are likely to be rejected.
- It reduces product cost because there is an additional advantage of batching and long smooth running production runs.
- Inventory helps in maintaining the economy by absorbing some of the fluctuations when the demand for an item fluctuates or is seasonal.

2.4 Cost Associated with Inventory

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

(I) Carrying/Holding Costs

Total carrying generally increases in direct production to the average amount of inventory carried. Inventory carried in turn depended upon the frequency with which orders are placed. The cost associated with having inventories, which includes storage cost, insurance cost, depreciation cost and so on. These costs generally increase in production to the average amount of inventory held. To illustrate, if a firm sales S unit per years 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 A will be:

$$\text{Average Inventory (A)} = \frac{\text{Unit per order}}{2}$$

$$\frac{\frac{S}{N}}{2} = \frac{Q}{2}$$

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

$$\text{Total Carrying Costs } (TCC) = CPP \times A$$

$$= \frac{CCP \times Q}{2}$$

The inventory carrying costs are further explained as:

(a) Capital Opportunity Cost

This consists of expenses of rising funds (interest on capital) to finance the acquisition of the 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.

Funds associated with inventory are not available for other uses. 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 the 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 decrease with that level per unit handling costs start increasing.

(c) Storage Cost

The cost associated with maintenance of inventory is storage cost. These include 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 and such in a cost of holding inventories. 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

among 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 and it should be included in inventory holding cost, whether the year. The inventory a firm has on hand those data's the higher their tax bill will be. 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.

One final type of inventory holding cost remains to be discussed those associated with the administration of the inventory system in use such as information gathering costs, supervision costs, physical stock checking costs and record keeping equipment cost: It is difficult to determine whether these expenses will be high or low expect by making a comparison among actual inventory system *(Hadley and Whitin, 1999:17).*

(II) Ordering Cost

It is assumed that carrying costs are entirely variable and increase in direct proportion to the average size of inventory, ordering cost usually are fixed regard less of average size of inventory for example the cost of placing and increasing in an order generally inter office memos, using fax transmission or long distance telephone calls and taking delivery-essentially are fixed regardless of average size of an inventory.

In practices the cost per order generally contains both fixed and variable components, since zero 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 *(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 0 and we placed 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

(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.

$$\text{Inventory Cycle per Year} = \frac{\text{Annual uses}}{\text{Quantity Order Size}}$$

2.5 Technical Formulation

2.5.1 Inventory Control

Inventory control is a system, which ensures the provision of the required quantity of inventories at the required time with the minimum amount of capital investment. 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.

Unit control involves the control over inventories in terms of units while value control entails the control over inventories in terms of value. These two approaches seem to be conflicting in it control of inventories ensures stocks for continuity of operations and sales and obviously the greatest insurance against running out of any item at crucial moments is maintaining huge supplies of everything stored in the plant. It will

increase the cost of handling the inventory and investment. 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, 199:225).*

- 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.
- 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.

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

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. 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." 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)

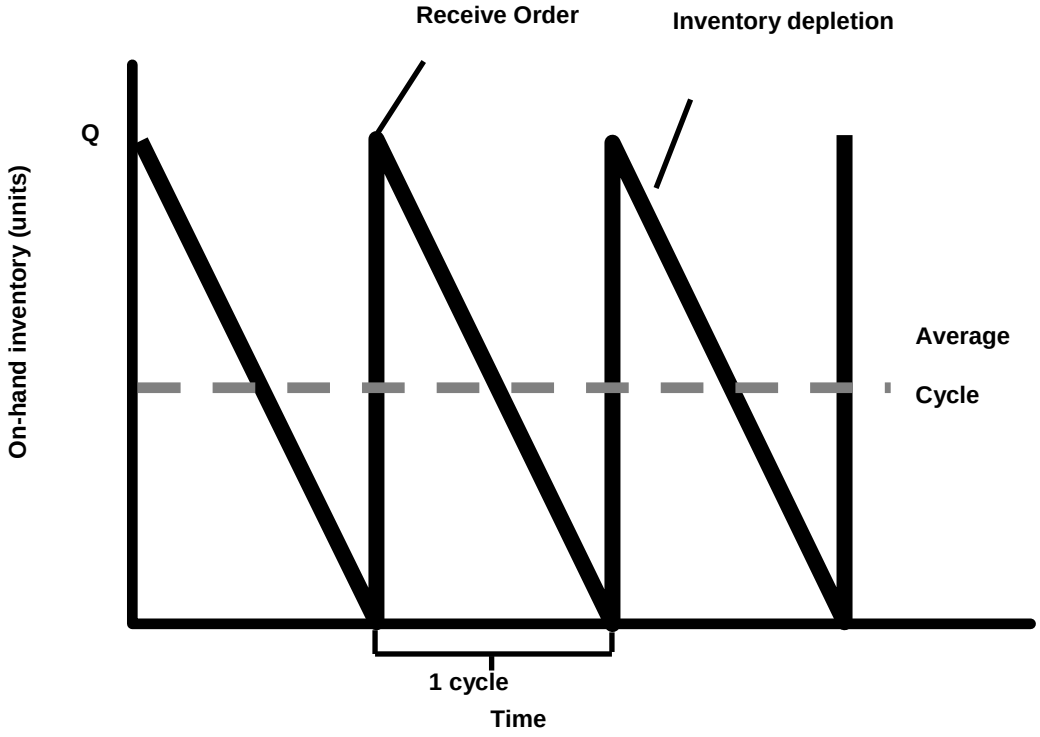
This techniques attempts to establish the more economic balance between the acquisition cost and carrying cost by determining quantities to be ordered. The most economic quantity is ascertained at this point.

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” (Hamptin, 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.

We can compute EOQ with the help of forecasting usage; ordering and carrying costs, in EOQ calculating we must use marginal cost only, don't include fixed costs.

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

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 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.
- Material is orders or produced in a lot or batch and lot is placed into inventory all at one time.
- 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 (Van Horne, 2003:377).

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 trail 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

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

The Long Analytical Approach or Trial and Error Approach

This is another to calculate economic order quantity. 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.

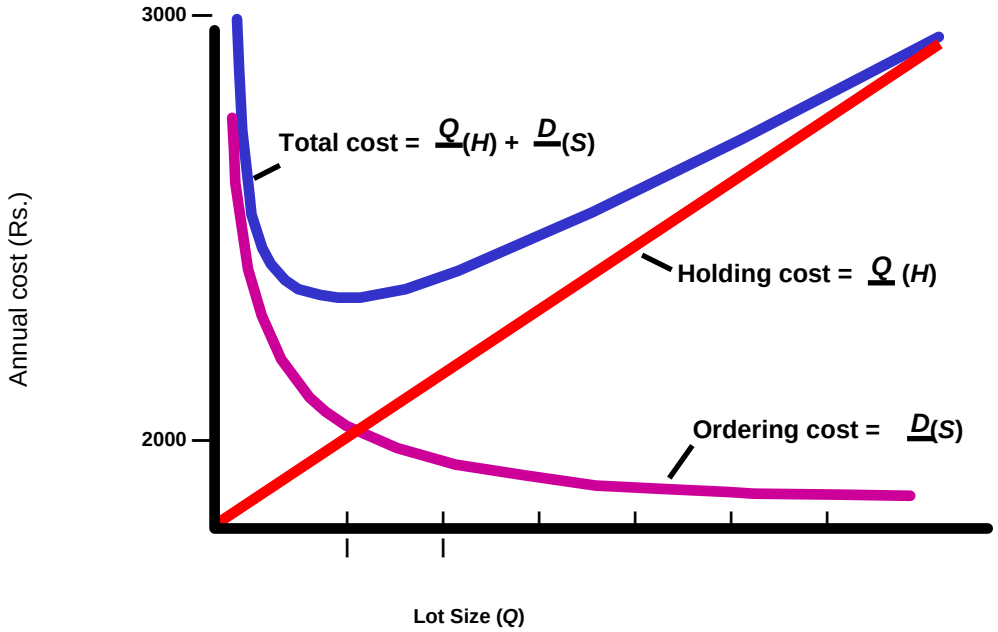
In the other words, according to this approach the carrying cost and ordering cost for a different size of order to purchases inventories computed and the order size with the lowest total cost/ordering plus carrying of inventory is the economic order quantity.

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



In figure 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 (Pandey, 1999:888).

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

Manufacturing organization finds it useful to divided material into three categories for the purpose of exercising selective control on materials. 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 (Dobler, D.W., Lamar Lee, T.R., & Burt, D.N. 1992).

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

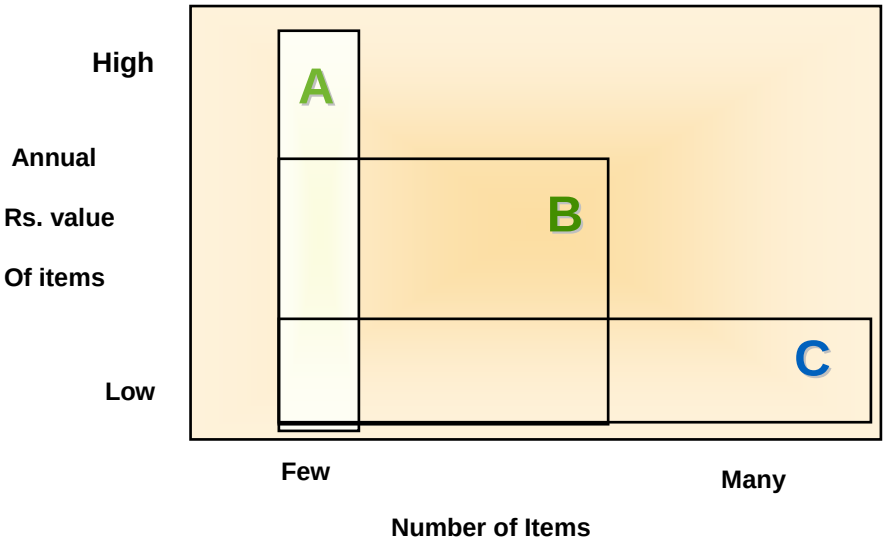
A - Very important

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

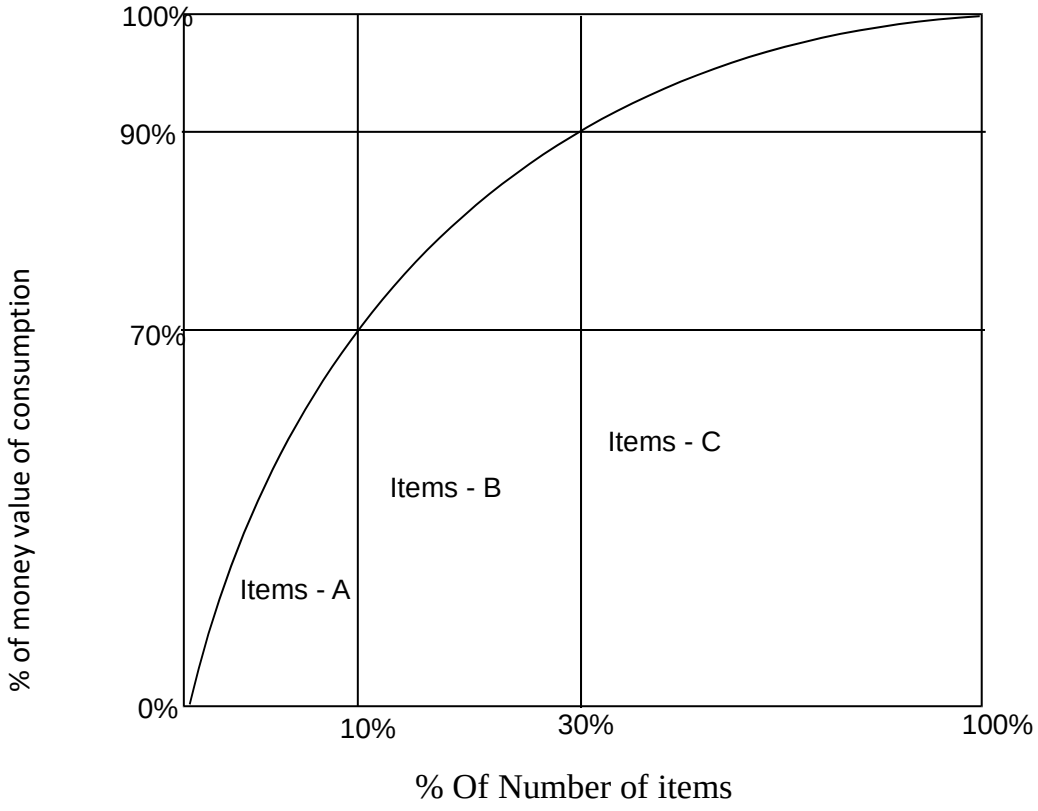
ABC Classification System

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:

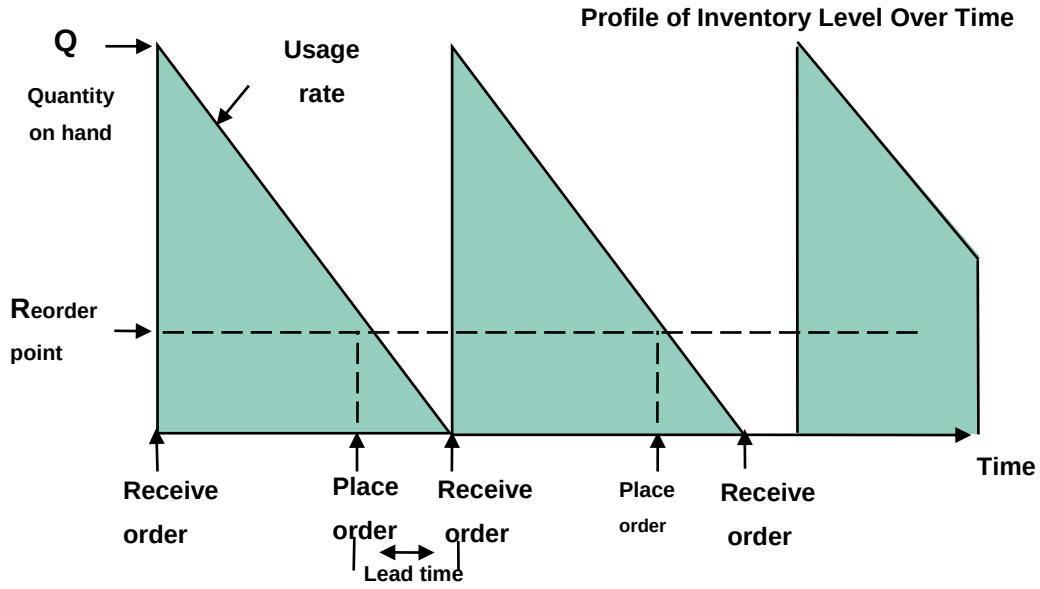
- First we calculate annual usage, multiplying the quantity (number of the units) of the item consume in one year by its unit price.
- Arrange all inventory items, first - items will show maximum annual usage in rupees, the second item the second maximum. The third items the third maximum and so on. 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 its 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 (Magee, J.F. 1956).

(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.

Figure 2.5

Inventory Cycle



"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 400 tires per day (based on 250 working days, in a year 100,000/250) 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 2000 tires.

Transit Stock = 400 times per day x 5 days
= 2000 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 2800 units.

Optimal Reorder Point = 2000 + 800 = 2800 units.

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

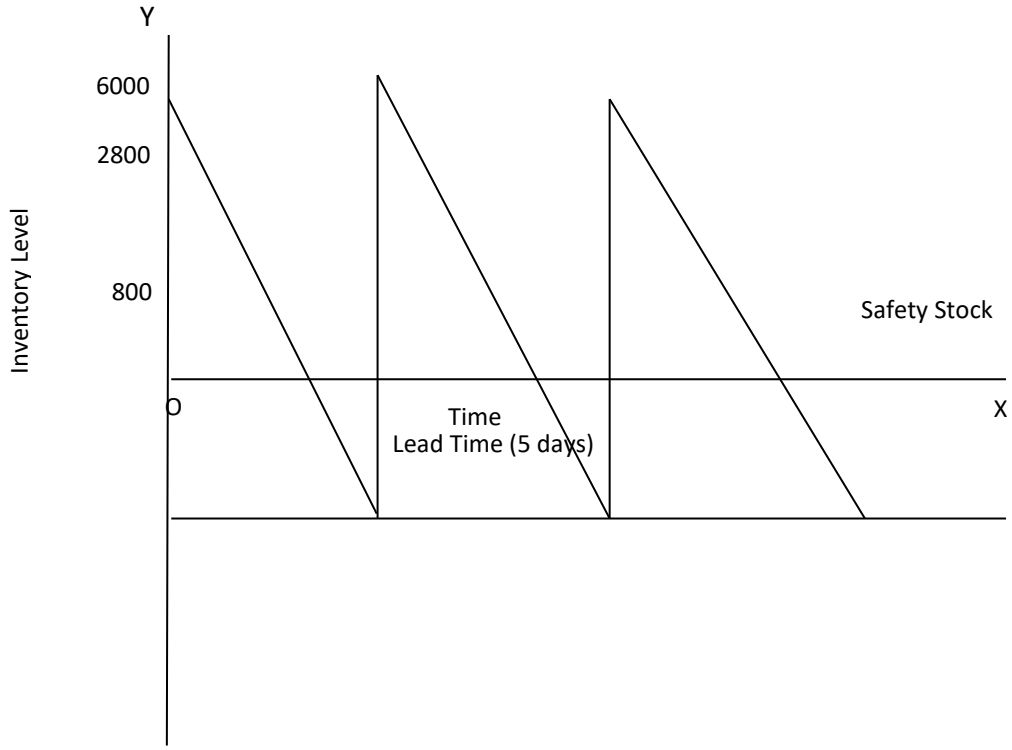
The safety stock involves two types of cost (i) stock out cost and (ii) carrying cost. Safety stock in necessary under the condition of uncertainty in such situation the demand and supply of goods may fluctuate day by day. If the actual usage or sales

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 (Hampton, 1993:245).

Figure 2.6

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 (Munankarmi, 2003: 13-02).

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

Maxi mum 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 there 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.

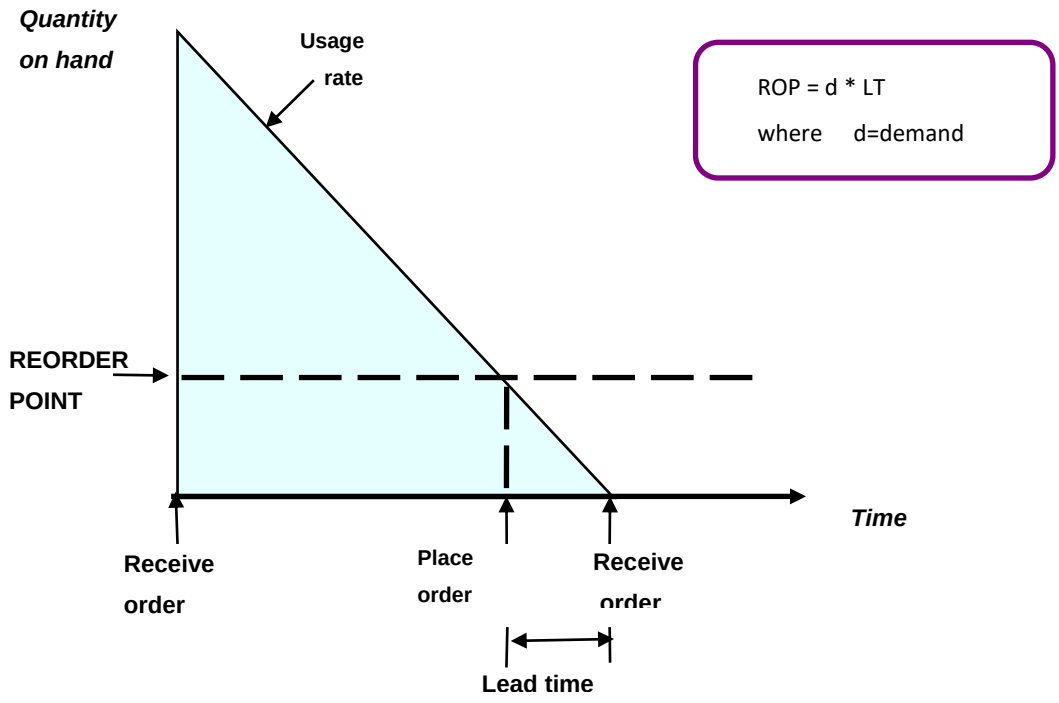
- Restriction imposed by Government of local authority in required to material in which there are inherent risks, e.g. fire and explosion.
- Possibility of change in fashion and habit, which will necessitate change in requirements of materials.

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.

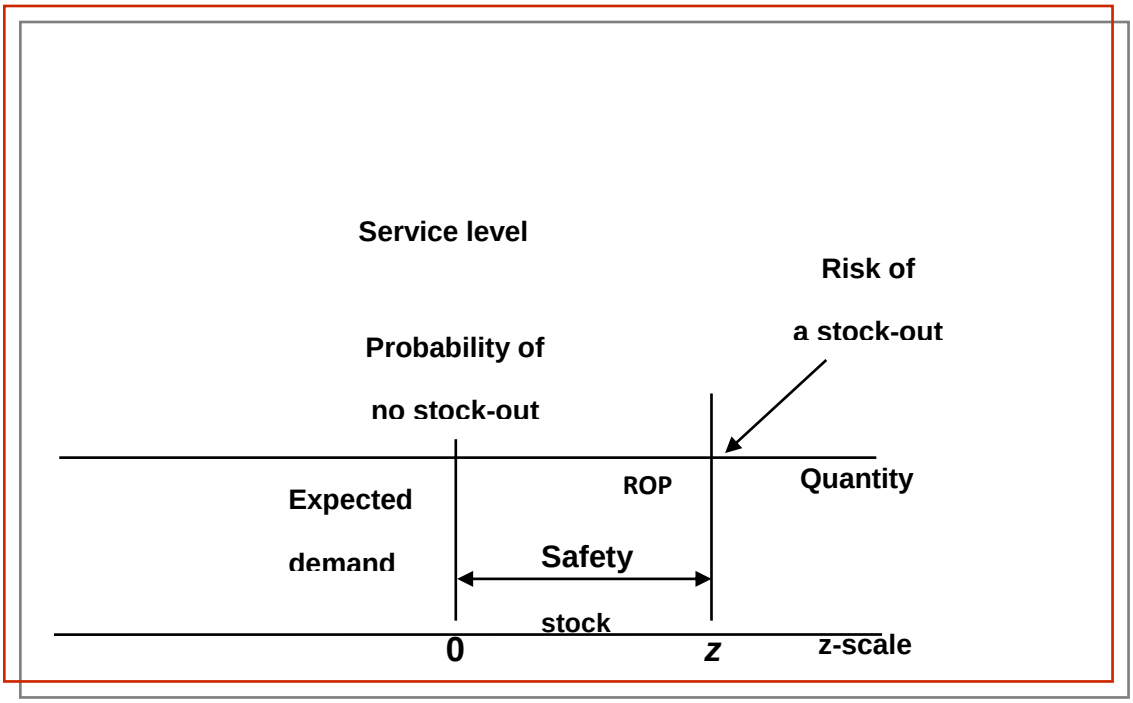
Figure 2.7
When to Order for EOQ Models



"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 somewhere 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 2.8
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 (*Martin and Miller, 1956:103-116).*

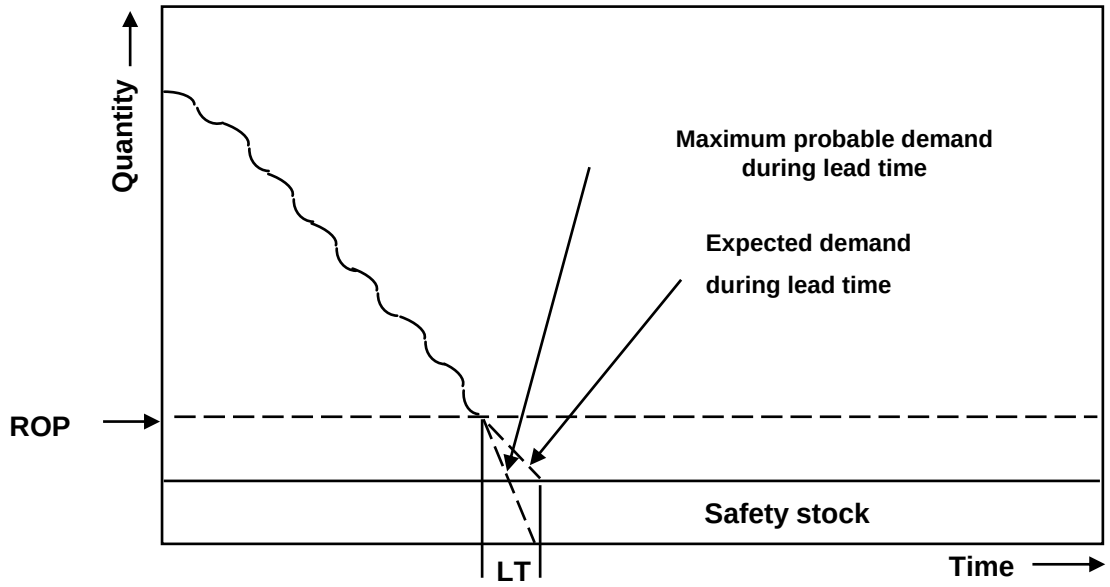
(iii) Safety Stock Level

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.

Figure 2.9

Safety Stock



(iv)Average Stock Level

Average stock is calculated as:

Average Stock Level = Minimum stock level + $\frac{1}{2}$ 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)

In this system a manufacturer coordinates production with suppliers so that raw materials or components arrive from suppliers just as they are needed in the production process. 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 (1) by being able to schedule production runs better and (2) 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.

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 is 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 (Khan & Jain, 2003:20-3).

2.7 Inventory System

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.

- **Periodic System**

Physical count of items made at periodic intervals

- **Perpetual Inventory System**

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

- **Two-Bin System**

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

- **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 system are both designed to control Inventories in the face uncertainty, whether one of the other is employed in a particular instance depend upon the nature of the items stocked, the type of controls needed the nature of the sources of supply.

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 Articles

Inventory management is wide subject but no one-pay attention in the subject. Many modern techniques to control inventory management have been developed; still many problem/difficulties have faced by many manufacturing company. In Nepal there are many public enterprises facing with inventory problem. Few analysis has been made but only the aspect of financial performance. A few researchers made the research in inventory management of manufacturing company.

From the various studies of thesis, dissertations business reports and other sources, it is found that no public enterprises are apply modern methods or techniques to manage as per the requirement. So far the related studies, some studies made on inventory management are considered relevant, which are shown below according to their major findings.

Puskar Bajracharya has conducted his "Study on management problem in public sector manufacture enterprises in Nepal. One of the important finding was the inventory. There management suffer from lack of planning high carrying cost, poor recording and stores management and virtual absences of controlling system" *(Bajracharya, 1983:222).*

Inventory management is to discover and maintain the optimal level of inventory investment and minimizing the cost of inventory. So, physical and financial dimension of inventory should be effectively managed. If the top management can not be managed efficiently, these will be an adverse effect upon profits which is main goal for maximizing the profit of a modern company.

Raw and N.V.S. Jagmohan Roa also observed that for the efficient management of inventory, there are the needs of tackling the human element the third world country

like Nepal. They have suggestion to orienting the attitude of the staffs towards material cost because lack of knowledge and carelessness, which were the responsible of this management of inventory.

A study relating to Nepal Transport Corporation concerning with various aspects has been made by CEDA. One of the major findings was that through inventory management of this factory is rather simple but due to management of stocking of spare parts it hampered the smooth operation of the enterprises.

Another significant study relating to agriculture tools factory has been conducted by CEDA was that the ratio of inventory to sales gives more restorative picture as the sales could not go with inventory or vice versa.

2.10 Review of the Previous Thesis

Govinda Prashad Dhakal (2006), has conducted a research on **"A study on Inventory Management and Control of Royal Drug Ltd",** an unpublished master level thesis submitted to Shanker Dev Campus, Faculty of Management, T.U. He had used from B.S. 2057/58 to B.S. 2061/62 years.

His Main Objective:

- To find out what types of tools and techniques has been applied by the RDL to manage the inventory.
- To identify the problems which were underlying the inventory management and control system and the techniques employed by it.

His Major Findings

- The RDL had established a separate unit for management of inventory although the separate unit unable to manage the inventory.
- The economic order quantity model has not applied so that its chemical materials are overstocking day by day and its safety stock is estimated roughly.

His Major Recommendations

- The RDL was able to produce good quality medicine because of its quality control system.
- There were inadequate level of finished goods, there were no attention for packaging materials managed efficiently.
- The RDL should identify its goals and objectives clearly.
- The company should follow the quantitative models and techniques such as EOQ model and ABC analysis model so that the total cost is reduced.

Puspa Prashad Guragain (2006), has conducted a research on **"Inventory Management (A Comparative Study of DDC and SGML)",** an unpublished master level thesis submitted to Shanker Dev Campus, Faculty of Management, T.U. He had used from B.S. 2055/056 to B.S. 2060/061 years.

His Main Objectives:

- To examine present inventory management and control system of DDC and SGML and their impact towards the companies' profitability.
- To examine the inventory management system as practiced by the both companies' and to suggest some models for effectiveness of the companies'.

His Major Findings

- The DDC and SGML had ineffective and inefficient inventory management system. The huge amount of money was blocked in the inventory.
- Both the companies did not followed economic order quantity model for purchasing purpose
- Both companies has not categorized its inventory for the purpose of control and paid equal attention for all type of inventory held in the time of store. Cost associated with ordering and holding inventory was not recorded separately which were recorded in total as a whole.
- There were no consistencies using principle of inventory management in closing stock of both companies. They made re-order after stock was finished.

His Major Recommendations

- Both the company should manage effective and efficient inventory management system.
- Both the company should follow EOQ model for purchasing purpose.
- Both the company should maintain the consistencies using the principle inventory management closing store.

Surphuddin Miyan (2006), has conducted a research on "**Inventory Management: a Case Study of Gorkhapatra Corporation",** an unpublished master level thesis submitted to Shanker Dev Campus, Faculty of Management, T.U. He had used from B.S. 2056/057 to B.S. 2061/062 years.

His Main Objectives

- To collect the information underlying constraints in existing management and control system of inventory and their impact towards the corporations' profitability.
- To examined the existing inventory management system applied by corporation.
- To analyze the relationship between inventory/material cost and profit.

His Major Findings

- The tools and techniques of inventory control system are not effectively utilized
- The goals and objective are not clearly defined.
- The corporation dose not consider the proper storing system to improve the efficiency.
- The corporation does not maintain a colour machine in modern age.

His Major Recommendations

- The corporation should define its goals and objectives clearly.
- The corporation should follow all the scientific tools and techniques i.e. purchasing order, EOQ, safety stock, re-order point, ABC analysis etc.
- The company consideration for proper storing was essential to improve.

- The corporation should procure a color machine for this competitive world.

Shiva Kumar Mainali (2008), has conducted a research on **"Inventory Management and its Impact on Working Capital Management of Unilever Nepal Limited",** an unpublished master level thesis submitted to Shanker Dev Campus, Faculty of Management, T.U. He had used from B.S. 2059/060 to B.S. 2063/064 years.

His Main Objectives

- To identify the inventory management system of Unilever Nepal Ltd.
- To identify the inventory position of UNL
- To know the relationship between sales and inventories with identifying their trend.
- To assess the inventories and their consequences on profitability of UNL

His Major Findings

- To examine the inventory management system practiced by the company was unscientific.
- The carrying cost, ordering cost, order size safety stock maintained was unsatisfactory and unscientific.
- UNL did not pay much attention to the lead-time.

His Major Recommendations

- The company should use the scientific technique to manage inventory management system.
- The cost associated inventory is unscientific so it should be managed properly.
- UNL should pay attention to lead time.

Tara Nath Gaire (2009), has conducted a research on **"Inventory Management of Bottlers Nepal Limited",** an unpublished master level thesis submitted to Shanker Dev Campus, Faculty of Management, T.U. He had used from B.S. 2054/055 to B.S. 2064/065 years.

His Main Objectives

- To examine the inventory policy and inventory management by BNL.
- To assess the inventory management system of BNL is scientific or effective.

His Major Findings

- Inventory management system of BNL are neither scientific nor effective.
- The inventory purchase and sales maintain by the company are fluctuating severally

His Major Recommendations

- The company should manage inventory management system properly.
- The company should select scientific and effective tools and technique.
- The company should manage inventory under sales and purchase

Kumar Shrestha (2009), has conducted a research on "**Inventory Management and Its Effects on Cash Flow of salt Trading Corporation",** an unpublished master level thesis submitted to Shanker Dev Campus, Faculty of Management, T.U. He had used from B.S. 2054/055 to B.S. 2064/065 years.

His Main Objectives

- To analyze the condition of inventory management and its relationship with other variables like net sales, Net profit, purchase.

His Major Findings

- Corporation applied ABC and EOP technique of inventory management. However; it is applied ineffectively and unsystematically.
- The company has not adopting appropriate inventory policy.
- Liquid ratio is not satisfactory during study period.

His Major Recommendations

- To avoid excess inventory on inventory the co-operation and co- ordination among purchase, store, marketing and sales department.
- The company should manage the inventory according to the sales.
- The company should apply scientific and effective management system.

Dillp Kumar Yadav (2010), has conducted a research on **"Inventory Management of National Biscuits and Confectionary Limited NEBICO",** an unpublished master level thesis submitted to Shanker Dev Campus, Faculty of Management, T.U. He had used from B.S. 2060/061 to B.S. 2064/065 years.

His Main Objectives

- To find out applied techniques used to manage the inventory in NEBICO.
- To present and analyze the inventory management system of NEBICO.
- To compare sales revenue with production unit and Raw-material cost.

His Major Findings

- The company does not follow the proper target for material purchase.
- The company is unable to utilized its existing capacity in the production of Biscuits and confectionary.
- The company has ignore about vital item, essential items and desirable items analysis.
- The company has not applied just in time management concept which helps to reduce extra expenditure for inventory.

His Major Recommendations

- The company should follow the proper target for material purchase.
- The company should increase its existing capacity.
- The company should considered its vital item, essential items and desirable item.

- The company should apply JIT management concept which helps to reduce extra expenditure for inventory**.**

Subash Chaudhary (2010). has conducted a research on **"Effectiveness of Inventory Management of Dabur Nepal Pvt. Ltd.(A case study of Dabur Nepalk Pvt. Ltd. The main objective of his study is to highlight the polices, functions and activities regarding inventory management. Finally, he came to know that factory is going on profit.)",** *an* unpublished master level thesis submitted to Shanker Dev Campus, Faculty of Management, T.U. He had used from B.S. 061/062-2065/066 years.

2.11 Research Gap

Various studies were made relating to inventory management of different organizations. But there are few studies related to inventory management in Nepalese context. Those studies show the relationship of inventory with purchase and sales.

CHAPTER - III

RESEARCH METHODOLOGY

3.1 Research Design

This study has used available data from the secondary source. Analytical as well as descriptive research designs were adopted to clarify the situation through presentation and analysis of various data. And, explanatory research design also was used to provide the meaning of items. Used in the analytical and other parts and to show the cause the effect relationship between the variables.

3.2 Populations and Sample

Population

A population is an entire collection of people, animals, plants or things from which data are collected. It is the entire group for description based on which conclusions are drawn.

In order to make any generalizations about a population, a sample, that is meant to be representative of the population, is often studied.

For each population there are many possible samples. A sample statistic gives information about a corresponding population parameter. For example, the sample mean for a set of data would give information about the overall population mean. In this thesis all the Dairy Milk industries of Nepal are taken as population which is almost near to 4,750.

Sample

A sample is a group of units selected from a larger group (the Population). By studying the sample it is hoped to draw valid conclusions about the larger group. A sample is generally selected for study because the population is too large to study in its entirety. The sample should be representative of the general population. This is often best achieved by random sampling.

In this thesis only two, The Government owning DDC and private owning SGML is taken as a sample among all the Dairy Milk industries of Nepal.

3.3 Sources of Data

Information is the lifeblood of any research; together the information data collection is a major task. Both primary as well as secondary data have been used to achieve the objectives of this study. Information collected through personal observations and interviews and officials were taken as primary data and secondary data were as follows.

- Reports and financial statements of the both factories provided by the officials.
- Both published and unpublished documents related to Dairy Development Corporation and Sitaram Gokul Milk Private Limited.
- Articles, books, magazines & previous dissertation of Dairy Development Corporation and Sitaram Gokul Milk Private Limited.

3.4 Data Collection Method

Primary data were collected through questionnaires. All the gathered data have been used according to need and requirement of this study. And, 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.

3.5 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.

3.5.1 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 x Time Required for Fresh Delivery)

Another formula given by Weldon in his book 'Cost Accounting Methods' is as follows:
Re-order Level = Maximum Consumption x 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:

- **On Situation When Demand Rate Varies**

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

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

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

- **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,

- Inventory to Total Assets Ratio = $\frac{\text{Inventory}}{\text{Total Fixed Assets}}$
- Inventory to Sales Ratio = $\frac{\text{Inventory}}{\text{Net Sales}}$
- Inventory to Current Assets Ratio = $\frac{\text{Inventory}}{\text{Current Assets}}$
- 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 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 farmable to earn profit by it.

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

3.5.2 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 b_{yx}.

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

$\Sigma y = na + b \Sigma x$

$\Sigma xy = a\Sigma x + b\Sigma x^2$

Where,

n is the number of pair observation

This Topic is Related with the Analysis of the Relationship between

- Inventory purchase and sales, where sale is the dependent variables y and inventory purchase is the independent variable x.
- Sales expenses and sales, where sale is the dependent variables y and sales expenses is the independent variable x.
- Closing stock and sales, where sales are the dependent variables y and closing stock is the independent variable x.

- Closing stock and net profit, where net profit is the depended variable y and closing stock is independent variable x.
- 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 are 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:

- To describe the multiple regression equation which provides estimate of the dependent variables from the values or two or more independent variables?
- To examine the measure of error (i.e. the multiple standard error of estimate).
- 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,

$X_1 = a + b_1 . X_2 + b_2 . X_3$ .....(.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 varialbes Y on “n" independent variables $X_1, X_2, X_3, \ldots\ldots\ldots\ldots X_n$ can generally be expressed as:

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

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 ABC Analysis

ABC Analysis is a widely used classification technique to identify various items of inventory for the purpose of Inventory control. This analysis is important that a firm should not exercise the same degree of control on all types of Inventory. It can be classify all types of raw material on the basis of nature and involve the investment and importance of it. In this analysis we have categories A, B and C class. Generally Group A involve the largest investment therefore I have to apply most rigorous and sophisticated inventory control Group C involves relatively small investment although the items of this inventory may large. So I give less attention to control the inventory management. The Group B stands midway. It deserves less attention that A but more than C.

In ABC Analysis firstly, I have to plan properly of all inventories items into three categories.

In the context of DDC and SGML 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

"According to companies' collection department" from the above data available group A is most important in terms of investment, which is 75 % of total value. But group C holds more quantity but lower value of total inventory. The items of B groups hold middle investment and quantity also lies in middle lesser attention is given to category.

The ABC analysis of classification of various items of inventory for determining degree of inventory control efforts is very useful techniques. It should however an

item of inventory may be very cheap under ABC analysis cheapest items have given less attention. But it is very critical in the production process to give important on any kind of inventories. In the production process in C category inventories we should give more attention. But in ABC analysis, I have to give least attention in such inventories. This is a limitation of ABC analysis.

Such division reflects I should not give same type of efforts to control the inventory management. First priority I have to given such items of inventory in which have invested more money and the main inventory for the purpose of production, which materials do not available easily and do not enough sources or it is difficult to supply. In this regard, both companies have used three categorized of raw materials. But in calculation main problem is classified inventory because some hold kg. Some hold liters, some packet some cup and some pot.

Procedure

- First, is ascertained annual usage, then the quantity (number of units) of the item consumable in one year is multiplied by its unit price.
- Arranging all inventory items, first items will show maximum annual wage in rupees, the second item- the second maximum, the third item- the third maximum and so on. After having done this, total of annual wage in rupees is put at the bottom of the list.
- Inventory items are categorized on the basis of annual usage and its price which item has more annual wage and higher its price, these items is categorized as item, which contributes lesser than categories A. 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 of this classification.

4.2 EOQ

To calculate EOQ, only one raw material (milk) is considered. But DDC and SGML used three types of raw materials, which include milk additive and packing material. To calculate the EOQ of additive is difficult. Because this material is collected

through annual tender method and tender holders delivered the items. So calculation of ordering and carrying cost is difficult company provides ordering cost and carrying cost data on the basis of tender price not in quantity. Calculation of EOQ of packing material is also difficult. Packing material includes many types of material which are measured in different units such as pieces, big, small, liters, cup, kg., packing jar, tin etc. So, measuring equivalent unit item is not possible. Additive and packing materials were not included in calculation of EOQ.

Table 4.1

Production and Sales Table of DDC

(in metric tonne)

Years	Opening Stock	Productions	Sales	Closing Stock
2064/065	9203	1,20,251	55,524	64,727
2065/066	64,727	1,18,729	55,450	1,28,006
2066/067	1,28,006	7,78,109	3,31,584	5,74,531

Source: DDC

Components of Carrying Cost

All those cost which are incurred when we carry (keep) the inventory in the store for a certain period of time are known as total carrying cost. It is the cost of holding the materials in the store. The carrying cost include the following costs:

a. Clerical cost/ store administrative overhead cost
b. Insurance and rent charges of inventory
c. Transportation cost in relation to stock
d. Cost of spoilage in store of handling
e. Cost of storage space
f. Interest on capital or loan blocked on material
g. Opportunity cost
h. Cost of maintaining the material
i. Losses and theft
j. Inventory taxes

Ordering Cost

All those costs which are related with the purchases activities of inventory are ordering costs. It is the cost of placing order for the purchase of material. Ordering cost varies with the number of order.

The examples of ordering cost are:

a. Cost of staff in the purchasing department, inspection section and payment department.
b. Cost of stationery, postage and telephone charges
c. Cost of floating tender
d. Cost of paper work

Calculation of Economic Order Quantity (EOQ)

(i)EOQ = $\sqrt{\frac{2AO}{C}}$

Where,

A = Annual requirement/needs/usage of material

O = Ordering cost per order

C = carrying cost/ inventory holding cost per unit

(ii) No. of order = $\frac{A}{EOQ}$

(iii) Total cost of EOQ = $\sqrt{2AOC}$

Or = Ordering Cost + Carrying Cost

EOQ Determination of Milk for Fiscal YEAR 2062/063

1. For DDC

On the basis of DDC records, the following data are available.

a) Mathematical Formula Method

Annual Requirement (A) = 7,17,24,000 ltr

Ordering Cost per Order (O) = Rs. 30,048

Carrying Cost per Liters (C) = Rs. 1.12

No. of Orders = 363 times

Applying formula,

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

$$= \sqrt{\frac{2 \times 71724000 \times 30048}{1.12}}$$

= 19, 61,760.66 liters

By multiplying A (71724000) and O (Rs. 30048) with 2 and dividing 1.12 and taking square of this figure, the result comes 1961760.66 liters.

b) Trial and Error Method/Tabulation Method

To calculate EOQ by Trial and Error method I have to develop following formula.

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

$$= \frac{71724000}{1961760.66}$$

= 36 Times

Calculation of EOQ of DDC

No. of order	Order Size (liters)	Average Inventory (liters)	Ordering Cost (Rs.)	Carrying Cost (Rs.)	Total Cost (Rs.)
5	1,43,44,800.00	71,72,400.00	1,50,240.00	80,33,080.00	81,83,320.00
15	47,81,600.00	23,90,800.00	4,50,720.00	26,77,696.00	31,28,416.00
25	28,68,960.00	14,34,480.00	7,51,200.00	16,06,617.60	23,57,817.60
35	20,49,257.14	10,24,628.57	10,51,680.00	11,47,584.00	21,99,264.00
36	19,92,333.33	9,96,166.66	10,81,728.00	11,15,706.66	21,97,434.66
363	1,97,586.77	98,793.38	1,09,07,424.00	1,10,648.59	1,10,18,072.59

Source: DDC

2. For SGML

On the basis of SGML records, the following data are available.

a) Mathematical Formula Method

Annual Requirement (A) = 1, 11,84,000 Litres

Ordering Cost per Order (O) = Rs. 30,525

Carrying Cost per Litres (C) = Rs. 1.00

No. of Orders = 362 Times

Applying formula,

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

$$= \sqrt{\frac{2 \times 11184000 \times 30525}{1.00}}$$

= 8,26,306.96 liters

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.

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

$$= \frac{11184000}{823606.96} = 13 \text{ Times}$$

Table 4.2

Calculation of EOQ of SGML

No. of Order	Order size (Liters)	Average Inventory (Liters)	Ordering Cost (Rs.)	Carrying Cost (Rs.)	Total Cost (Rs.)
5	22,36,800.00	11,18,400.00	1,52,625.00	11,18,400.00	12,71,025.00
10	11,18,400.00	5,59,200.00	3,05,250.00	5,59,200.00	8,64,450.00
13	8,60,307.69	4,30,153.84	3,96,825.00	4,20,153.84	8,26,978.84
15	7,465.00	3,72,800.00	4,57,875.00	3,72,800.00	8,30,675.00
362	30,895.02	15,447.51	1,10,50,050.00	15,447.51	11,06,549.75

Source: SGML

From the tabulation method, it is clear that the lowest inventory cost of DDC is 219434.66, which includes total ordering cost of Rs. 1081728 and total carrying cost 1115706.66 and it takes 36 times in a year. In other words when DDC place order 36 times in a year there will be total cost minimizes. Likewise the lowest inventory cost of SGML is 826978.84, which includes total ordering cost of Rs. 396825 and total carrying cost or Rs. 430153.84 and it takes 13 times in a year. In order words when we place order 13 times in a year there will be total cost minimizes.

II) For Fiscal Year 2063/064

1. For DDC

On the basis of DDC records, the following data are available.

a) Mathematical Formula Method

Annual Requirement (A) = 7,28,35,722 liters

Ordering Cost per Order (O) = Rs. 30,348

Carrying Cost per Liters (C) = Rs. 1.1424

No. Of Orders = 363 Times

Applying formulas,

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

$$= \sqrt{\frac{2 \, x \, 72835722 \, x \, 30348}{0.1424}} = 1967175 \text{ Liters}$$

By multiplying A (72835722) and O (Rs.30348) with 2 and dividing 1.1424 and taking square of this figure, the result comes 1967175 liters.

b) Trial and Error Method/Tabulation Method

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

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

$$= \frac{72835722}{1967175} = 37 \text{ Times}$$

Table 4.3

Calculation of EOQ of DDC

No. of Order	Order Size (Liter)	Average Inventory (Liter)	Ordering Cost (Rs)	Carrying Cost (Rs)	Total Cost (Rs)
5	1,45,67,144	72,83,572	1,51,740	8,32,0752	84,72,492
15	48,55,714	24,27,857	4,55,220	27,73,584	32,28,804
20	36,41,786	18,20,893	6,06,960	20,80,188	26,87,148
27	26,97,619	13,48,809	8,19,396	15,40,880	23,60,276
37	19,68,533	9,84,266	11,22,876	11,24,426	22,47,302
40	18,20,893	9,10,446	12,13,920	10,40,094	22,54,014
363	2,00,649	1,00,324	1,10,16,324	1,14,610	1,11,30,934

Source: DDC

2. For SGML

On the basis of SGML records, the following data are available:

a) Mathematical Formula Method

Annual Requirement (A) = 1,13,51,760 Liters

Ordering Cost per Order (O) = Rs. 30982

Carrying Cost per Liters (C) = Rs. 1.20

No. Of Orders = 362 Times

Applying formula,

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

$$= \sqrt{\frac{2\,x\,11351760\,x\,30982}{1.20}} = 7{,}65{,}615 \text{ Liters}$$

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.

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

$$= \frac{11351760}{765615} = 15 \text{ times}$$

Table 4.4

Calculation of EOQ of SGML

No. of Order	Order Size (Liter)	Average Inventory(Liter)	Ordering Cost (Rs)	Carrying Cost (Rs)	Total Cost (Rs)
5	22,70,352	11,35,176	1,54,910	13,62,212	15,17,122
10	11,35,176	5,67,588	3,09,820	6,81,105	9,90,925
15	7,56,784	3,78,392	4,64,730	4,54,070	9,18,800
20	5,67,588	2,83,794	6,19,640	3,40,553	9,60,193
362	31,358	15,679	11,21,548	18,815	11,40,363

Source: SGML

From the tabulation method it is clear that the lowest inventory cost is 2247302 includes total ordering cost of Rs. 1124426 and total carrying cost Rs. 1122876 and it takes 37 times in a year. In other words when we place order 37 times in a year there will be total cost minimizes. Likewise, the lowest inventories cost of SGML is 918800, which include total carrying cost of Rs. 454070, and it takes 15 times in a year. In other words when we place order 15 times in a year there will be total cost minimizes.

III) For Fiscal Year 2064/065

1. For DDC

On the basis of DDC records, the following data are available.

a) Mathematical Formula Method

Annual Requirement (A) = 7,39,64,675 liters

Ordering Cost per Order (O) = Rs. 30,742

Carrying Cost per Liters (C) = Rs. 1.16

No. of Orders = 363 Times

Applying formulas,

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

$$= \sqrt{\frac{2 \, x \, 73964675 \, x \, 30742}{1.16}} = 19,79,995.66 \text{ liters}$$

By multiplying A (73964675) and O (Rs. 30742) with 2 and dividing 1.16 and taking square of this figure, the result comes 1979995.66 liters.

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.

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

$$= \frac{73964675}{1979995.66} = 37 \text{ Times}$$

Table 4.5

Calculation of EOQ of DDC

No. of Order	Order Size (Liter)	Average Inventory (Liter)	Ordering Cost (Rs)	Carrying Cost (Rs)	Total Cost (Rs)
5	73,96,467.5	73,96,467.5	153,710	85,79,902	87,33,612
15	49,30,978.33	24,65,489.16	4,61,130	28,59,967.43	33,21,097.43
25	29,58,587	14,79,293.5	7,68,550	17,15,980.46	24,84,530.46
37	19,99,045.27	99,95,22.63	11,37,454	11,59,446.26	22,96,900.26
363	2,03,759.43	1,01,879.71	11,59,346	1,18,180.47	11,277,526.47

Source: DDC

2. For SGML

On the basis of SGML records, the following data are available.

a) Mathematical Formula Method

Annual Requirement (A) = 1,14,99,333 liters

Ordering Cost per Order (O) = Rs. 31,385

Carrying Cost per Liters (C) = Rs. 1.22

No. of Orders = 362 Times

Applying formula,

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

$$= \sqrt{\frac{2\,x\,11499333\,x\,31385}{1.22}}$$

b) Trial and Error Method/Tabulation Method

To calculate EOQ by trial and Error method we have to develop the following formula,

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

$$= \frac{11499333}{769187.95} = 15 \text{ Times}$$

Table 4.6

Calculation of EOQ of SGML

No. of Order	Order Size (Liter)	Average Inventory (Liter)	Ordering Cost (Rs)	Carrying Cost (Rs)	Total Cost (Rs)
5	22,99,866.6	11,49,933.3	1,56,925	14,02,918.6	15,59,843.63
10	11,49,933.30	5,74,966.65	3,13,850	7,01,459.31	10,15,309.31
11	10,45,393.91	522,696.95	3,45,235	637690.28	9,82,925.28
15	766,622.2	3,83,311.1	4,70,775	47,639.54	9,38,414.54
21	5,47,587.28	2,73,793.64	6,59,085	3,34,028.24	9,93,113.24
362	31,766.11	15,883.056	1,13,61,370	19,377.32	1,13,80,747.33

Source: SGML

From the above tables, it is clear that the lowest total inventory cost of DDC 2296900.26 which includes total ordering cost of Rs. 1137454 and total carrying cost Rs. 1159446.26 and it takes 37 times in a year, there will be total cost minimizes. Whereas the lowest total inventory cost of SGML is Rs. 93814.54, which includes total ordering cost of Rs. 470775 and total carrying cost of Rs. 467639.54 and it takes 15 times in a year there will be total cost minimizes.

DDC should order 37 times in a year but the company has placed an order with 363 times, which involves total inventory cost Rs. 11277526.47. This amount is very high as compared with EOQ cost. SGML should order 15 times in a year but the company

has placed 362 times which involves total inventory cost Rs. 11380747.33. This amount is very high as compared with EOQ cost.

Iv)For Fiscal Year 2065/066

1. For DDC

On the basis of DDC records, the following data are available.

a) Mathematical Formula Method

Annual Requirement (A) = 75148110 Liters

Ordering Cost per Order (O) = Rs. 31173

Carrying Cost per Liters (C) = Rs. 1.18

No. Of Orders = 363 Times

Applying formula,

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

$$= \sqrt{\frac{2 x 75148110 \ x 31173}{1.18}} = 1992610 \text{ Liters}$$

By multiplying A (75148110) and O (Rs. 31173) with 2 and dividing 1.18 and taking square of this figure, the result comes 1992610 liters.

b) Trial and Error Method/Tabulation Method

To calculate EOQ by Trial and Error method we have to develop following formula.

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

$$= \frac{75148110}{1992610} = 37 \text{ Times}$$

Table 4.7

Calculation of EOQ of DDC

No. of Order	Order Size (Liter)	Average Inventory (Liter)	Ordering Cost (Rs)	Carrying Cost (Rs)	Total Cost (Rs)
5	1,50,29,622	75,14,811	1,55,865	88,67,476.98	90,23,341.98
15	50,09,874	25,04,937	4,67,595	29,55,825.66	34,23,420.66
25	30,05,924.4	15,02,962.2	7,79,325	17,73,495.39	25,52,820.39
37	20,31,030	10,15,515	11,53,401	11,98,307.7	23,51,708.7
40	18,78,702.75	9,39,357.37	12,46,920	11,08,434.62	23,55,354.62
363	2,07,019.58	1,03,509.79	1,13,15,799	1,22,141.55	11,437,940.56

Source: DDC

2. For SGML

On the basis of SGML records, the following data are available.

a) Mathematical Formula Method

Annual Requirement (A) = 11660323 Liters

Ordering Cost per Order (O) = Rs. 31855

Carrying Cost per Liters (C) = Rs. 1.2383

No. of Orders = 362 Times

Applying formula,

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

$$= \sqrt{\frac{2\,x\,11660323\,x\,31855}{1.2383}} = 774544 \text{ Liters}$$

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.

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

$$= \frac{11660323}{774544} = 15 \text{ times}$$

Table 4.8

Calculation of EOQ of SGML

No. Of Order	Order Size (Liter)	Average Inventory (Liter)	Ordering Cost (Rs)	Carrying Cost (Rs)	Total Cost (Rs)
5	23,32,046.4	11,66,023.20	1,59,275	14,43,886.53	16,03,161.53
10	11,66,023.2	5,83,011.6	3,18,550	7,21,943.26	10,40,493.26
13	8,96,940.92	4,48,470.46	4,14,115	5,55,340.97	9,69,455.97
15	7,77,348.8	3,88,674.40	4,77,825	4,81,295.50	9,59,120.50
362	32,210.58	16,105.29	1,15,31,510	19,943.18	11,55,143.18

Source: SGML

From the tabulation method, it is clear that the lowest inventory cost of DDC is 2351708.7, which includes total ordering cost of Rs. 1153401 and total carrying cost 1198307.7 and it takes 37 times in a year. In other words when DDC place order 37 times in a year there will be total cost minimizes. Likewise the lowest inventory cost of SGML is 959120.50, which includes total ordering cost of Rs. 477825 and total carrying cost or Rs. 481295.5 and it takes 15 times in a year. In order words when we place order 15 times in a year there will be total cost minimizes.

V) For Fiscal Year 2066/067

1. For DDC

On the basis of DDC record, the following data are available.

a) Mathematical/Formula Method

Annual Requirement (A) = 7,63,50,480 Liters

Ordering Cost per Order (O) =Rs. 31640

Carrying Cost per Liters (C) = Rs. 1.25

No. of Orders = 363 Times

Applying formulas,

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

$$= \sqrt{\frac{2 \, x \, 76350480 \, x \, 31640}{1.25}} = 19,66,002.72 \text{ Liters}$$

b) Trial and Error Model/Tabulation Method

To calculate EOQ by trial and error method we have to develop the following formula.

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

$$= \frac{76350480}{1966002.72} = 39 \text{ Times}$$

Total Carrying Cost = Average Inventory × Carrying Cost per Unit

Total cost = Average Inventory × Carrying Cost per Unit.

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

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

Table 4.9

Calculation of EOQ of DDC

No. of Order	Order Size (Liter)	Average Inventory (Liter)	Ordering Cost (Rs)	Carrying Cost (Rs)	Total Cost (Rs)
10	76,35,048	38,17,524	3,16,400	47,71,905	50,88,305
20	38,17,524	19,08,762	8,32,800	23,85,952.5	30,18,752.5
30	25,45,016	12,72,508	9,49,200	15,90,635	25,39,835
39	19,57,704.6	9,78,852.3	12,33,960	12,23,565.3	24,57,525.3
50	15,27,009.6	7,63,504.8	15,82,000	9,54,381	25,36,381
363	2,10,331.9	1,05,165.95	1,14,85,320	1,31,457.4	1,16,16,777.4

Source: DDC

2. For SGML.

On the basis of SGML records, the following data are available.

a) Mathematical Formula Method

Annual Requirement (A) = 11835228 Liters

Ordering Cost per Order (O) = Rs. 32365

Carrying Cost per Liters (C) = Rs. 1.258

No. of orders = 363 times

Applying formulas,

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

$$= \sqrt{\frac{2\,x\,11835228\,x\,32365}{1.258}} = 780370.41 \text{ Liters}$$

b) Trial and Error Method/Tabulation Method

To calculate EOQ by Trial and Error method we have to develop the following formula.

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

$$= \frac{11835228}{780370.41} = 15 \text{ Times}$$

Table 4.10

Calculation of EOQ of SGML

No. of Order	Order Size (Liter)	Average Inventory (Liter)	Ordering Cost(Rs)	Carrying Cost(Rs)	Total Cost (Rs)
5	23,67,045.6	11,83,522.8	1,61,825	14,88,871.68	16,50,696.68
10	11,83,522.8	5,91,761.4	3,23,650	7,44,435.84	10,68,085.84
15	7,89,015	3,94,507	4,85,475	4,96,290.56	9,81,765.56
17	6,96,189.88	3,48,094.94	5,50,205	4,37,903.4	9,88,108.43
23	5,14,575.13	2,57,287.56	74,4395	3,23,667.75	10,68,062.75
362	32,694	16,347	1,17,16,130	2,05,64.53	1,17,36,694.53

Source: SGML

From the above tables, it is clear that the lowest total inventory cost of DDC is Rs. 2457525.3 which include total ordering cost of Rs. 1233960 and total carrying cost Rs. 1223565.3 and it takes 39 times in a year, there will be total cost minimizes where as the lowest total inventory cost of SGML is Rs. 981765.56 which include total ordering cost of Rs. 485475 and total carrying cost Rs. 496290.56 and it takes 15 times in a year there will be total cost minimizes.

DDC should order 39 times in a year but the company has placed an order with 363 times, which involve total inventory cost Rs. 11616777.4 This amount is very high as compared with Rs. 2457525.3 SGML should order 15 times in a year but the company has placed 362 times which involves total inventory cost Rs. 11736694.53. This amount is very high as compared with 981765.56. According to both companies they had placed an order in every day because they need daily fresh material (milk) to provide consumer good fresh product.

Above table shows that if DDC order less than 39 times in a year that results carrying cost increased and ordering cost decreasing and finally total inventory cost increased. If DDC order more than 30 times in a year, that results carrying cost decreased and ordering cost increased. Likewise, if SGML orders less than 15 times in a year, that result carrying cost increased and increased. When the carrying and ordering costs are likely same or equal to it at that point the total inventory costs will minimizes. In inventory management two costs i.e. carrying 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 4.11

Findings of EOQ of DDC, and SGML

Fiscal Year	EOQ of Researcher (DDC)	EOQ of Researcher (SGML)	EOQ of Company (DDC)	EOQ of Company (SGML)
2062/063	19,61,760.66	8,26,306.96	1,97,586.77	30,895.02
2063/064	19,67,175	7,65,615	2,00,649	31,358
2064/065	19,79,995.66	7,69,187.95	2,03,759.43	31,766.11
2065/066	1,99,2610	7,74,544	2,07,019.58	32,210.58
2066/067	19,66,002.72	7,80,370.41	2,10,331.9	32,694

Source: SGML & DDC`

Figure 4.1
Graphical Presentation of EOQ of DDC

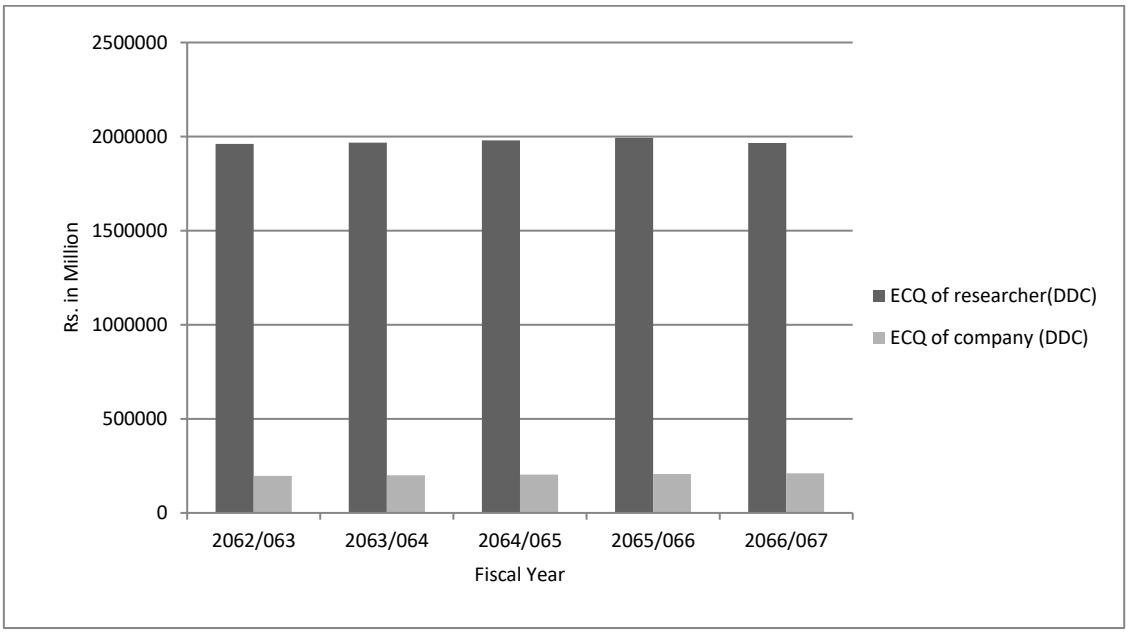
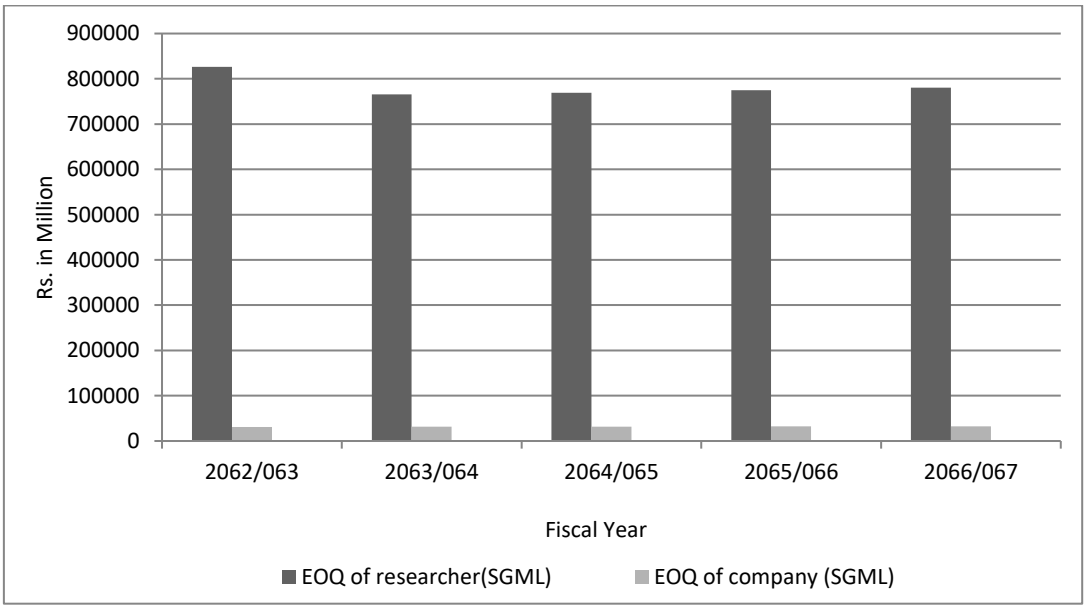


Figure 4.2
Graphical Presentation of EOQ of SGML



The EOQ obtained through our calculations and research differs from the existing EOQ of the company. The company need to calculate its cost of EOQ and apply the optimal order quantity as suggested, which will reduce cost of inventory of the company.

Budgeted annual requirement and actual annual requirement are different. So, EOQ are different.

4.3 Re-Order Point of Milk in DDC and SGML

Re-order is that level of inventory the firm places an order with the suppliers for procuring additional inventory equal to economic order quantity when the inventory reaches the re-order point. The researcher try to analyze the re-order point of milk on the basis of lead time safety stock kept by the Company as well as daily usage rate of 5 years i.e. 2060/061 to 2064/065.

Some formula, to calculate Re-order point

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

Re-order Point (ROP) = Usage Rate x Safety stock

[When safety stock is not mention]

Re-order Point (ROP) = Usage Rate × [Lead-time + Safety Stock]

(if safety stock is mentioned)

Table 4.12

Calculation of Re-order Point of DDC

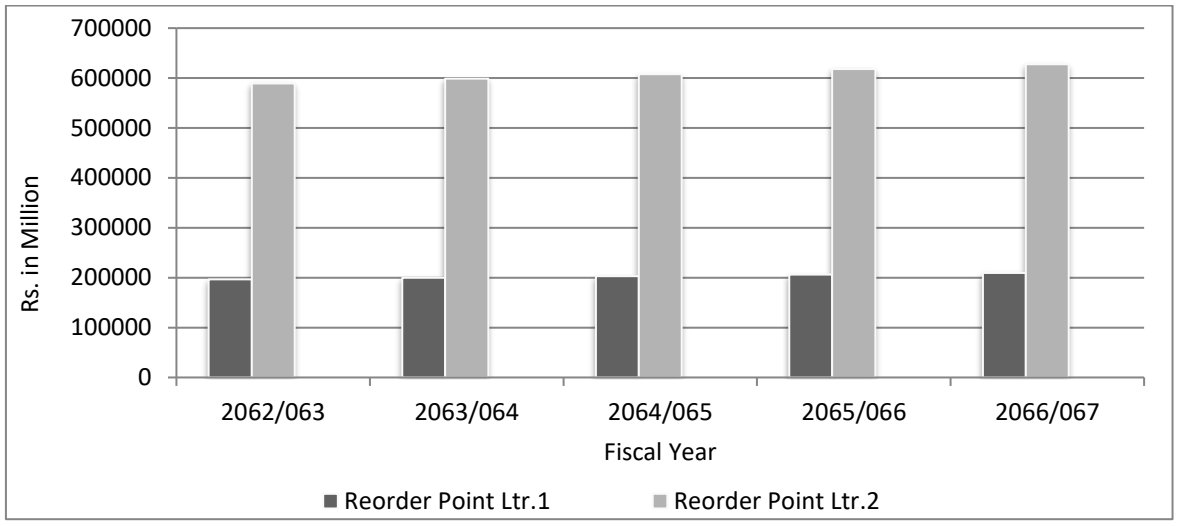
Fiscal Year	Usage Rate (Ltr.)	Lead Time (days)	Re-order Point (Ltr.)	Safety Stock (days)	Safety Stock (Ltr.)	Safety stock + Lead time (days)	Re-order Point (Ltr.)
2062/063	1,96,385	1	1,96,385	2	3,92,770	3	5,89,155
2063/064	1,99,550	1	1,99,550	2	3,99,100	3	5,98,650
2064/065	2,02,643	1	2,02,643	2	4,05,286	3	6,07,929
2065/066	2,05,885	1	2,05,885	2	4,11,770	3	6,17,929
2066/067	2,09,179	1	2,09,179	2	4,10,358	3	6,27,537

Source: DDC

Figure 4.3

Graphical Presentation of Re-order Point

(With Lead Time and Lead Time + Safety Stock)



This data is given by DDC collection and processing department. DDC need Daily fresh milk so lead time days and it have 2 day safety stock all day hold safety stock for the view point of strike in Nepal.

Re-order point (ltr.) 1 is without safety stock and re-order point (ltr.) 2 is with safety stock. So, Re-order point (ltr) 1 and 2 are different.

Table 4.13

Calculation of Re-order Point of SGML

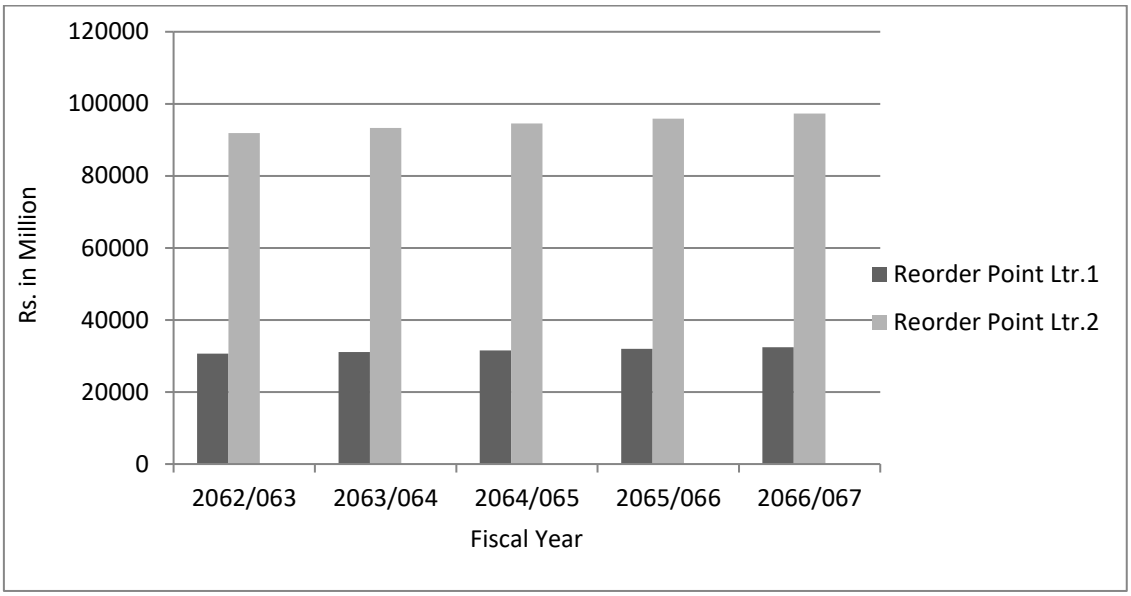
Fiscal Year	Usage Rate (Ltr.)	Lead time (days)	Reorder Point (Ltr.) 1	Safety Stock (days)	Safety Stock (Ltr.)	Safety Stock+ Lead time(days)	Re-order Point (Ltr.) 2
2062/063	30,641	1	30,641	2	61,282	3	91,923
2063/064	31,100	1	31,100	2	62,200	3	93,300
2064/065	31,505	1	31,505	2	63,010	3	94,515
2065/066	31,946	1	31,946	2	63,892	3	95,838
2066/067	32,425	1	32,425	2	64,850	3	97,275

Source: SGML

Figure 4.4

Graphical Presentation of Re-order Point

(With Lead Time and Lead Time + Safety Stock)



Note: This data is given by SGML Collection and processing department. SGML need daily fresh milk so lead time one day and it have 2 day safety stock all day it hold safety stock for the view point of stricken Nepal.

Re-order point (ltr.) 1 is without safety stock and re-order point (ltr.) 2 is with safety stock. So, Re-order point (ltr) 1 and 2 are different.

The above table includes calculation of ROP including and excluding safety stock. The highest re-order point in which safety stock excluding and including is 209179 Liters and 627537 liters in year 2066/067. And the lowest re-order point in which safety stock excluding and including is 196385 liters and 589155 liters respectively in year 2062/063. While the highest re-order point in which safety stock excluding and including is 32425 liters and 97275 liters respectively in year 2066/067 of SGML. And the lowest re-order point in which safety stock excluding and including is 30641 liters and 91923 liters respectively in year 2062/063.

In year 2064/065; DDC has procured 1966002.72 liters of milk in a year with the number of order 39 times. According to ROP when the balance remains for 1 day's

consumption (209179 liters) another order for 1966002.72 liters should be placed. And every 10 days next fresh order should be made in other words next orders should be placed in the difference of 10 days i.e. practices used by the company for the safety stock is equal to 2 days consumption. If we consider this safety stock, the order should be place by keeping 3 days consumption (i.e. 3x 209179=627537 liters). It means, when the inventory falls to 617655 liters that another order for 1966002.72 liters has to be placed. While SGML has procured 780370.41 liters of milk in a year with the number of order 15 times, according to ROP when the balance remain for one day consumption (32425), another order for 780370.41 liters should be placed. And every 28 days, next fresh order should be made.

In other words, next order should be placed in the difference of 28 days, i.e. the practices used by the company 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 (3x 32425 = 97275 liters). It means when the inventory falls to 97275 liters that another order for 780370.41 liters has to be placed. In this way, we can compute ROP for next remaining days.

4.4 Ratio Analysis

Financial Analysis is an evaluation of both a firm's post financial performance and its prospects for the future. Financial statement analysis involves the calculation of various ratios. In mathematics a ratio is the relationship between two quantities figures. The ratio analysis is the financial tool by which the financial strength and weakness are measured by relating two accounting data.

4.4.1 Inventory to Total Assets Ratio

Here, inventory means closing inventories of raw materials, finished goods, other stock and constructing material and spare parts. And total fixed assets include these assets, which observed the depreciation cost year by year. The formula to calculated the relation between inventory to total fixed assets is:

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

Table 4.14

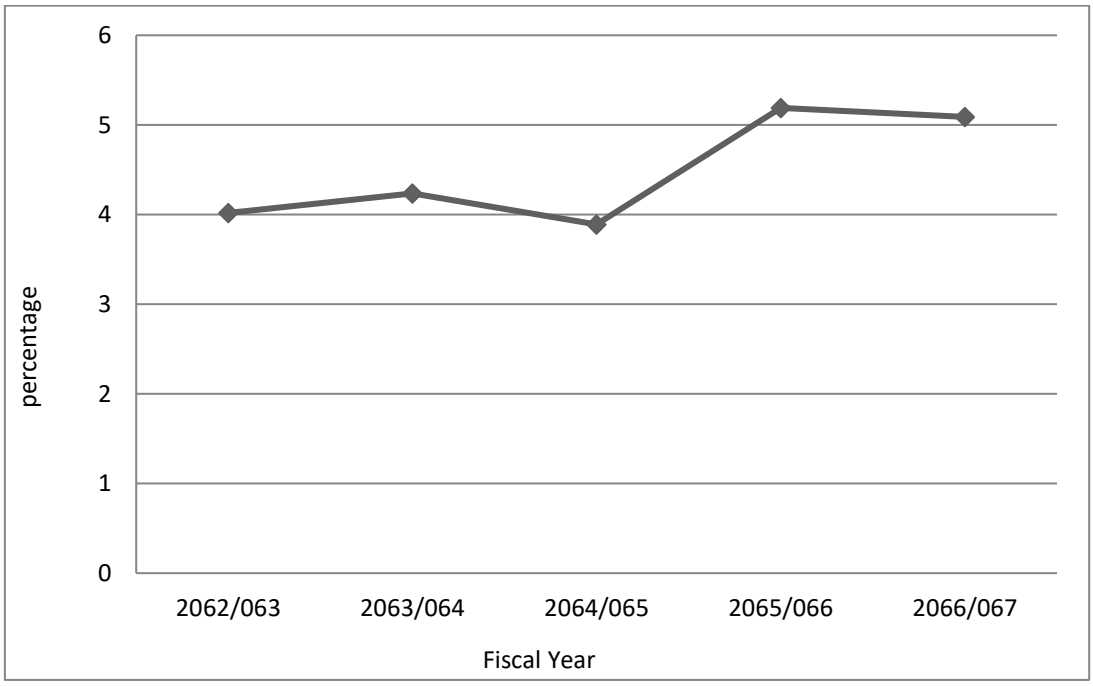
Calculation of Inventory to Total Fixed Assets Ratio of DDC

Fiscal Year	Inventory	Total Fixed Assets	Inventory to Total Assets Ratio
2062/063	6,62,13,470	1,64,72,55,274	4.019
2063/064	7,14,21,310	1,68,54,32,428	4.237
2064/065	5,16,60,386	1,32,64,56,560	3.89
2065/066	8,64,81,254	1,66,54,03,886	5.19
2066/067	8,90,75,692	1,74,86,74,080	5.09

Source: DDC

Figure 4.5

Graphical Presentation of Inventory to total Assets Ratio of DDC



From the study of DDC, we know that minimum inventory to total fixed assets ratio 3.89% in year 2064/065. Maximum inventory holds as an assets is 5.19% in year 2065/066. In year 2063/064 the inventory to total fixed assets ratio is good. In other words the company has minimum inventory level in relation to total fixed assets.

Table 4.15

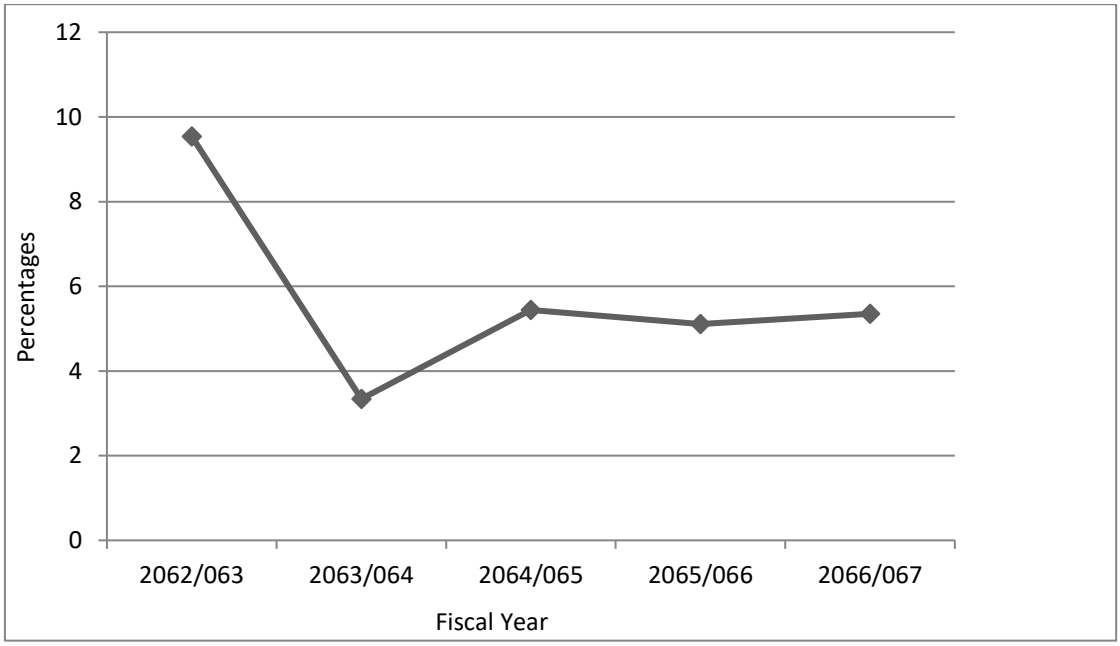
Calculation of Inventory to Total Fixed Assets Ratio of SGM

Fiscal Year	Inventory	Total Fixed Assets	Inventory to Total Assets Ratio
2062/063	25,23,150	26,43,72,512	9.54
2063/064	95,88,306	28,64,55,122	3.34
2064/065	14,84,732	27,25,45,256	5.44
2065/066	145,37,686	28,42,55,320	5.11
2066/067	1,59,73,817	29,84,68,086	5.35

Source: SGML

Figure 4.6

Graphical Presentation of Inventory to Total Assets Ratio of SGML



From the study of SGML, we know that minimum inventory to total fixed assets ratio 3.34 percent in year 2063/064. Maximum inventory holds as an assets is 9.54 in year 2062/063. In year 2063/064 the inventory to total fixed assets ratio is good. In other words the company has minimum inventory level in relation to total fixed assets.

According to our 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 2063/064 ratio is being good and other year also ratio being little befit. While in year 2063/064, ratio of SGML is being good and other year little fluctuate. It means that both companies not being hold high amount of money in the field of inventory. If company needs money, we can't immediate change in to cash. So enough money invested in inventory not so good for the company.

4.4.2 Inventory to Sales Ratio

Inventory to sales ratio is wanted low is manufacturing Industries.

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

Here, inventories include closing stock of raw material, finished goods, other stocks and stores and spare parts. Net sales mean that sales amount or actual amount which comes from the sale of milk and milk product at DDC and SGML.

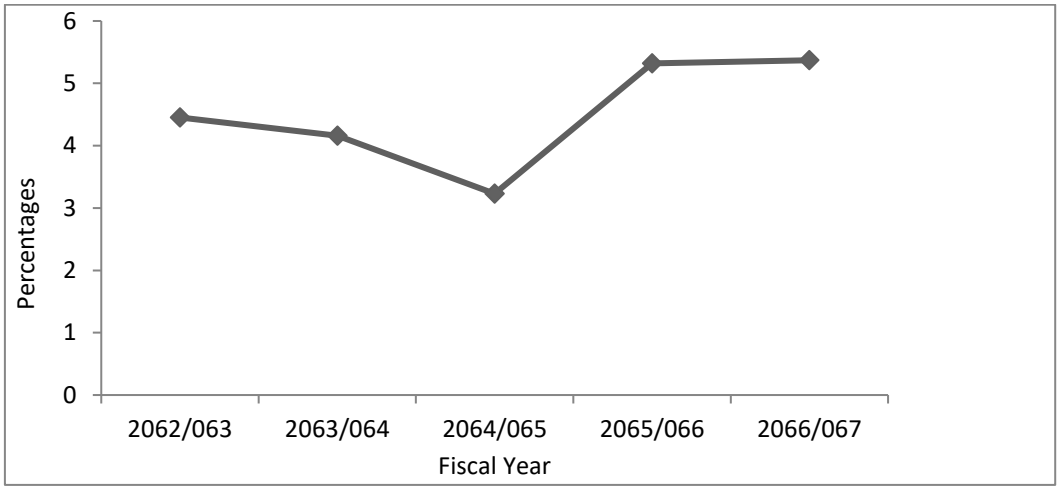
Table 4.16

Calculation of Inventory to Sales Ratio of DDC

Fiscal Year	Inventory	Net Sales	Inventory to Sales Ratio
2062/063	66,43,470	1,48,47,71,891	4.45%
2063/064	66,43,470	1,54,82,39,961	4.16%
2064/065	5,16,60,386	1,59,59,06,712	3.23%
2065/066	8,64,81,254	16,25,429,845	5.32%
2066/067	8,99,40,504	1,67,41,92,740	5.37%

Figure 4.7

Graphical Presentation of Inventory to Sales Ratio of DDC



Source: DDC

Table 4.17

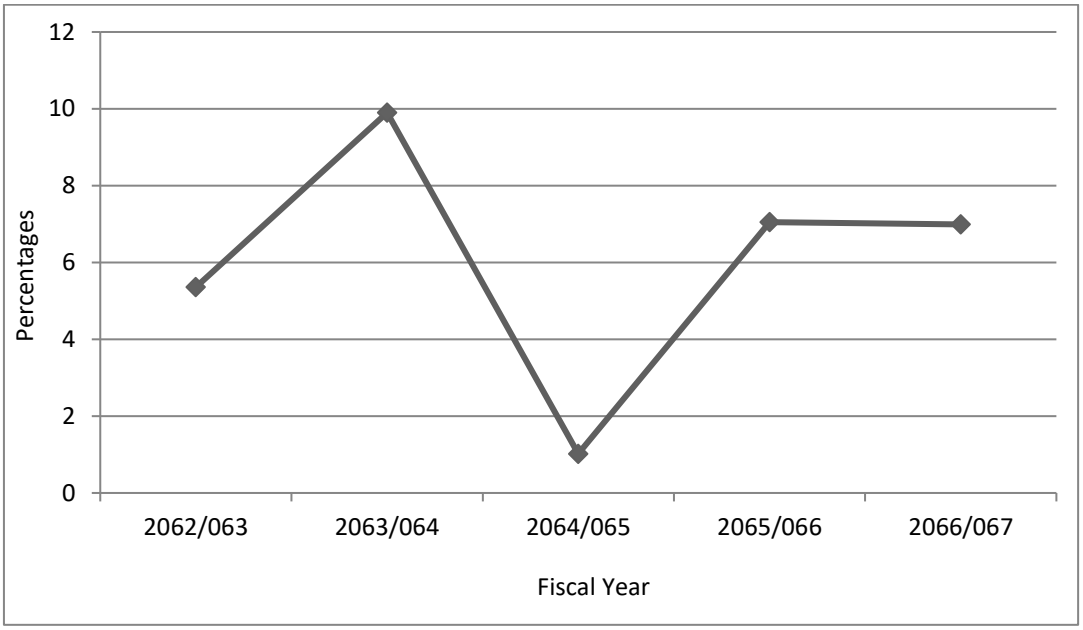
Calculation of Inventory to Sales Ratio of SGML

Fiscal Year	Inventory	Net Sales	Inventory to Sales Ratio
2062/063	25,23,150	4,70,56,747	5.36%
2063/064	95,88,306	9,67,93,500	9.90%
2064/065	14,84,732	14,52,90,750	1.02 %
2065/066	1,45,37,686	20,60,09,280	7.05 %
2066/067	1,52,64,570	21,83,69,837	6.99%

Source: SGML

Figure 4.8

Graphical Presentation of Inventory to Sales Ratio of SGML



According to our requirement we focused our study on Inventory management for requiring fulfillment we calculate the DDC and SGML inventory management efficiency thought the inventory to sales ratio.

Inventory to sales ratio we calculate in above table. By the calculation we know the relationship between Inventory and sales are negative. If sales are increase inventory are decreases and if sales are decrease inventory are increases. Therefore, firm always want to minimize the closing inventory in the firm. So, low inventory to sales are necessary to the firm. According to the above table of inventory to sales, it is clear that highest ratio of DDC is 5.37 in 2066/067, while highest ratio of SGML 9.90 in the year 2063/064 and other year relationship with sales is little bad.

4.4.3 Inventory to Current Assets Ratio

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

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

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 4.18

Calculation of Inventory to Total Fixed Assets Ratio of DDC

Fiscal Year	Inventory	Current assets	Inventory to Current Assets Ratio
2062/063	66,43,470	8,62,58,570	76.67%
2063/064	7,14,21,310	8,90,27,520	80.22%
2064/065	5,16,60,386	8,34,26,268	61.92 %
2065/066	8,64,81,254	9,20,25,580	93.97 %
2066/067	9,08,05,317	9,75,47,115	93.08 %

Source: DDC

Table 4.19

Calculation of Inventory to total Fixed Assets Ratio of SGML

Fiscal Year	Inventory	Current assets	Inventory to Current Assets Ratio
2062/063	25,23,150	1,28,51,600.85	19.63%
2063/064	95,88,306	1,48,96,695.58	64.36%
2064/065	14,84,732	1,67,58,943.47	88.59 %
2065/066	1,45,37,686	1,86,43,240.25	77.97 %
2066/067	1,49,73,817	1,95,75,402	76.49 %

Source: SGML

From the above tabulation it is clear that both companies have not any satisfactory situation about inventory to current assets ratio throughout the study period one or two years. The standard inventories to current Assets ratio should about 45 to 50%. But both companies not have such ratio. As that situation we can conclude the companies hold more inventory as current assets whenever more inventories kept by the company. 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 company. Blocked

amount in inventory, both companies can't reinvest in other areas. So they lose the return of that blocked amount inventory.

According to above table of inventory to current assets it is clear that the highest ratio of DDC is 93.97% in 2065/066. Likewise the highest ratio of SGML is 88.59% in 2064/065. In the context of DDC and SGML have satisfactory level in no year. All the year both companies had bad position in respect of inventory to current assets ratios.

4.4.4 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 an SGML. 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:

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

Table 4.20

Calculation of Inventory to Profit Ratio of DDC

Fiscal Year	Inventory	Net Profit	Inventory to Profit Ratio
2062/063	7,48,77,72,64	(151623866.76)	Negative
2063/064	7,68,60,41,49.5	(227756810.76)	Negative
2064/065	7,97,22,43,12.5	(218824939.35)	Negative
2065/066	8,17,37,62,44	(242785045.46)	Negative
2066/067	8,58,24,50,56	(252496447)	Negative

Source: DDC

Table 4.21

Calculation of Inventory to Profit Ratio of SGML

Fiscal Year	Inventory	Net Profit	Inventory to Profit Ratio
2062/063	5,44,21,500	(20820000)	Negative
2063/064	5,21,09,500	(18394000)	Negative
2064/065	78,2,31,000	(11151000)	Negative
2065/066	10,99,66,000	(4686000)	Negative
2066/067	11,32,64,980	(4920300)	Negative

Source: SGML

From the above table it is clear that the ratios are negative. It means companies didn't generate the profit. Both are suffering from loss year by year. So no ratio can be calculated in negative position. In other hands companies need high positive in this ratio. Both companies earn loss year by year. So both companies suffer bad condition year.

4.5 Turnover Ratio

4.5.1 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 4.22

Calculation of Inventory Turnover Ratio of DDC

Fiscal Year	Cost of Goods Sold (Rs.)	Average Inventory (Rs)	Turnover Ratio(Times)
2062/063	14,97,55,45,28	61,22,55,40	24.45
2063/064	15,37,20,82,99	68,81,73,90	22.33
2064/065	15,94,44,86,25	6,15,40,84,8	25.90
2065/066	16,34,75,24,48	6,90,70,820	23.66
2066/067	16,83,79,50,21	72,52,43,61	**23.21**

Source: DDC

Table 4.23

Calculation of Inventory Turnover Ratio of SGML

Fiscal Year	Cost of Goods sold	Average Inventory	Turnover Ratio (Times)
2062/063	10,88,43.000	44,35,330	24.54
2063/064	10,42,19.000	60,55,723	17.21
2064/065	15,64,62.000	55,36,518	28.26
2065/066	21,99,32.000	80,11,209	27.45
2066/067	22,65,29,960	84,91,881	26.67

Source: SGML

Similarly, 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.

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 goods 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.

From the above table it is clear that inventory turnover ratio is fluctuating every year. In case of DDC, in year 2066/067, Turnover Ratio is very low. 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 25.90 times in 2064/065 fiscal year. And also next remaining year inventory turnover ratio is below but little good. Likewise in year 2063/064 inventory turnover ratio of SGML is very low; it means more inventories are kept its stock. It direct effect on the profitability of the company from the study of five fiscal years period, the high turnover ratio is 28.26 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 and Sitaram Gokul Milk Private Limited's efficiency in inventory is poor. Both are not able to change their inventory into receivable/cash through sales. So they have to give more attention in inventory management.

4.5.2 Inventory Holding Days (DIH)

Inventory holding days represent how many days company 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 4.24

Calculation of Inventory Holding Days of DDC

Fiscal Year	Cost of Goods Sold	Average Inventory	Turnover Ratio (Times)
2062/063	14,97,55,45,28	61,22,55,40	15
2063/064	15,37,20,82,99	68,81,73,90	16.34
2064/065	15,94,44,86,25	6,15,40,848	14
2065/066	15,94,44,86,25	6,90,70,820	15.42
2066/067	16,83,79,50,21	7,25,24,361	15.72
		Mean	15.30

Figure 4.9

Graphical Presentation of Inventory Holding Days of DDC

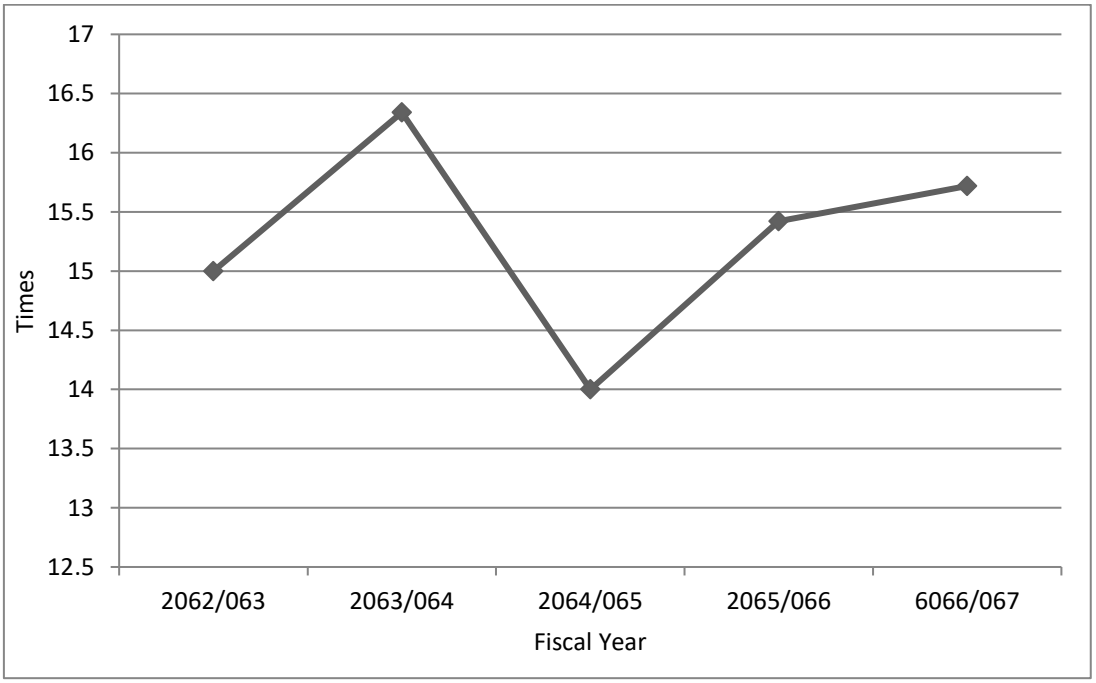


Table 4.25

Calculation of Inventory Holding Days of SGML

Fiscal Year	Cost of Goods Sold	Average Inventory	Turnover Ratio (Times)
2062/063	10,88,43.000	44,35,330	14.87
2063/064	10,42,19.000	60,55,723	21.20
2064/065	15,64,62.00	55,36,518	13
2065/066	21,99,32.000	80,11,209	13.29
2066/067	22,65,29,960	84,91,881	13.68
Mean			15.20

Source: SGML

Inventory holding days represented the how many days company 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.

At 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 company not able to earn profit by it.

From the above table inventory holding day of DDC from 2062/063 to 2066/067 fiscal year being represented the mean of inventory holding days 15.30. In other words the project holds average inventory 15.30 days in regards of mean. In 2062/063 and 2066/067 fiscal years, DIH had crossed the mean, whereas in the rest of the years, DIH has remained below the mean.

Likewise, inventory holding days of SGML from 2062/063 to 2066/067 fiscal year being represented, the mean of inventory holding days is 15.20. In other words, the project holds average inventory 15.20 days in regard of mean. In 2062/063, 2066/067 and 063/064 fiscal year DIH has remained below the mean.

Statistical Tools

4.6 Regression Analysis

Regression analysis in the general sense means the estimation or predication 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.

This topic is related with the analysis of the relationship between closing stock and sales. Main inventory purchase and sales, sales expenses and sales and closing stock and net profit of DDC and SGML based on the historical data.

A. Simple Regression Analysis

4.6.1 Regression on Inventory and Sales

On the basis of variable derived from ANNEX inventory, which is main part of production process of DDC and SGML that is milk and this purchase. In other words main inventory purchase on sales of milk and milk product following result are obtained.

Here, in the analysis we assume the sales are the values of the dependent variable, which is denoted by Y, and inventory purchase by DDC and SGML 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 4.26

Calculation of Regression Result of DDC

(Rs. in "000000")

Fiscal Year	Net Sales (Y)	Inventory (X)
2062/063	148.4771891	176.2442848
2063/064	154.8239960	188.7786642
2064/065	159.5906712	194.8876252
2065/066	162.5429845	182.8644520
2066/067	167.4192740	188.3503856

Source: DDC

According to this data we calculate regression of Yon X be

a = 58.8613, b= 0.5354

y = 58.8613 + 0.5354 X

The above regression equation shows a positive relationship between Closing stock and sales.

Table 4.27

Calculation of Regression Results (SGML)

(Rs. in "00000")

Fiscal Year	Net Sales (Y)	Inventory (X)
2062/063	47.056747	136.3419487
2063/064	96.793500	154.436705
2064/065	145.290750	165.144471
2065/066	206.009280	182.887522
2066/067	218.369837	185.374752

Source: SGML

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

a = -440.5131, b = 3.00

Y = -440.5131 + 3.00X

The above regression equation shows a Positive relationship between closing stock and sales in case of DDC where as there is negative relationship between closing stock and sales in case of SGML. The slope coefficient of 0.5354 means that the marginal

propensity to earn sales revenue Rs 0.5354 meaning that if the value of inventory increase by a rupee on the average sales goes up by 0.5354. Likewise, In SGML the slope coefficient of 3.00 means that the marginal propensity to earn sales revenue Rs 3.00 meaning that if the value of inventions increases by a rupee on the average the sales goes by 3.00.

The intercept values 'a' 58.8613 and -440.5131 of DDC and SGML respectively means that the average expenditure on main material purchase should be 58.8613 and -440.5131 lakhs respectively.

4.6.2 Regression on Sales Expenses and Sales

On the basis of variable derived from Annex sales expenses is main part of expenses during the period of milk and milk product sales on sales obtained by DDC and SGML. Here, in the analysis we assume the sales is the values of the dependent variables which is denoted by y and sales expenses which actually spend in area of sales of milk and milk product by DDC and SGML are the values of independent variables which is denote by X.

Table 4.28

Calculation of Regression Result (DDC)

(Amount '000000)

Fiscal Year	Net Sales (Y)	Inventory (X)
2062/063	148.4771891	38.370438
2063/064	154.8239961	38.633228
2064/065	159.590.6712	40.905163
2065/066	162.5429845	45.64224
2066/067	167.419274	47.623482

Source: DDC

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

a = 91.110, b = 1.59723

y = 91.110 + 1.59723x

The above regression equation shows a positive relationship between sales and sales expenses.

Table 4.29

Calculation of Regression Result (SGML)

Amount '000000'

Fiscal Year	Net Sales (Y)	Inventory (X)
2062/063	47.056747	4.02178099
2063/064	96.793500	1.546654
2064/065	145.290750	4.805856
2065/066	206.009280	4.924536
2066/067	218.369837	5.123216

Source: SGML

According to this data, we calculated regression of Y on X be

a = 624.5465 b = -102.86089

Y = 624.5465 -102.86089 X

The above regression equation shows a negative relationship between sales and sales expenses.

In case of DDC the slope coefficient of 1.59723 means that marginal propensity to earn sales revenue Rs. 1.59723 meaning that if the value of sales expenses increases by a rupee on the average sales goes up by 1.59723. Likewise in SGML the slope coefficient of -102.86089 means that marginal propensity to earn sales revenue Rs. -102.86089 meaning that if the value of sales expenses increased by a rupee on the average sales goes up by Rs. -102.86089

The intercept value of 'a' 91.110 and 624.5465 of DDC and SGML respectively means the average value of sales expenses would be 91.110 and 624.5465 lakhs if the sales were zero.

4.6.3 Regression on Closing Stock and Net Profit

On the basis of variable derived from Annex the regression equation of net profit which both company actually earn year by year on closing stock, which hold the end of the fiscal year.

Here, in the analysis we assume the net profit is the values of dependent variables, which is denoted by 'y'. And closing stock, which holds the project end of the fiscal year, is the value of independent variables, which is 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 4.30

Calculation of Regression Result (DDC)

(Amount "000000")

Fiscal Year	Net Profit (Y)	Closing Stock (X)
2062/063	-105.902081	748.777264
2063/064	-76.132944	768.604149
2064/065	-8.931871	797.224312
2065/066	-55.475432	817.376244
2066/067	-50.425673	860.923457

Source: DDC

According to this data we calculate regression of y on x be

a = -415.89928 b =0 .4464

y = -415.89928 + 0 .4464 x

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

Table 4.31

Calculation of Regression Result of SGML

(Amount "000000")

Fiscal Year	Net Profit (Y)	Closing Stock (X)
2062/063	(20.820000)	54.421500
2063/064	(18.3940000)	52.109500
2064/065	(11.151000)	78.231000
2065/066	(4.686000)	109.966000
2066/067	(2.4315300)	98.564399

Source: SGML

According to this data we calculate regression of y on x be

a = -35.1516 b = 0.300

y = -35.1516+ 0.300 x

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

In case of DDC, the slope coefficient of 0.4464 means the marginal propensity to earn net profit Rs. 0.4464 meaning that if the value of closing stock increase by a rupee on the average the net profit increase by 0.4464. Likewise in SGML the slope coefficient of 0.300 means the marginal propensity to earn net profit 0.300 meaning that if the value of closing increase by a rupee on the average net profit increases by 0.300.

The intercept value of 'a' -415.89928 and -35.1516 of DDC and SGML means that the average value of closing stock would be -415.89928 and -35.1516 lakhs respectively if net profit were zero.

B. Multiple Regression Analysis

4.7 Multiple Regressions on Profit, Sales and Closing Stock 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 4.32

Analysis of Multiple Regression Result (DDC)

(Amount "000000")

Fiscal Year	Net Profit (X1)	Sales (X2)	Closing Stock (X3)	X_2^2	X_3^3
2062/063	(105.902081)	148.4771891	6.6213470	22045.4756	43.842236
2063/064	(76.132944)	154.823996	7.1421310	23970.4697	51.010035
2064/065	8.931871	159.590671	5.1660386	25469.1823	26.687954
2065/066	(55.475432)	162.542984	8.6481252	26420.1945	74.790069
2066/067	(50.425673)	167.419274	8.7346064	28029.21331	76.29334896
	ΣX^1 = -279.004259	ΣX^2 = 792.854114	ΣX^3 = 36.3122482	ΣX^2= 125934.5626	ΣX^3= 272.6236446

$X^1.X^2$	$X^1.X^3$	$X^2.X^3$
-15724.04331	-701.2144263	983.118991
-11787.20662	-543.7514595	1105.77326
1425.443286	46.14239036	824.451567
-9017.142256	-479.7584815	1405.69208
-8442.229565	-440.4484061	1462.34146
$\Sigma X^1.X^2$= 43545.1785	$\Sigma X^1.X^3$= 2119.030383	$\Sigma X^2.X^3$= 5781.37736

Source: DDC

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

a = 1918.967565 b1 =18.93420

b2 = –141.5009133

X1= 1918.967565 + 18.93420X2 – 141.5009133X3

Table 4.33

Analysis of Multiple Regression Result (SGML)

(Amount "000000")

FY	Net Profit (X1)	Sales (X2)	Closing Stock (X3)	X_2^2	X_3^2
2062/063	-20.82	47.056747	2.52315	2214.337438	6.366285923
2063/064	-18.394	96.7935	9.588306	9368.981642	91.93561195
2064/065	-11.151	145.29075	1.484732	21109.40204	2.204429112
2065/066	-4.686	206.00928	14.537686	42439.82345	211.3443142
2066/067	-2.43153	218.369837	14.828439	47685.38571	219.8826032
	ΣX_1=-57.48253	ΣX_2 = 713.520114	ΣX_3= 42.962313	ΣX_2^2 = 122817.9303	ΣX_3^2 = **531.7332444**

$X_1.X_2$	$X_1.X_3$	$X_2.X_3$
-979.7214725	-52.531983	118.731231
-1780.419639	-176.3673006	928.085697
-1620.137153	-16.55624653	215.717826
-965.3594861	-68.1235966	2994.89823
-530.9728098	-36.05579428	3238.08381
$\Sigma X_1.X_2$= 5876.61056	$\Sigma X_1.X_3$= 349.634921	$\Sigma X_2.X_3$= 7495.51679

Source: SGML

According to this data we calculate multiple regression of X_1 on X_2 and X_3 be

a =4.379380 b_1 = 0.116892 b_2 = - 0.09368

X1= 4.379380 + 0.116892X2 - 0.09368X3

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

In case of DDC, the slope coefficient of 18.93420 and –141.5009133 means that if the value of sales is increased and if the value of closing stock is decreased by a rupee on the average the net profit will also increased. Likewise in SGML the slope coefficient

of 0.116892 and -0.09368 means if the value of closing stock is increased and the value of sales is decreased by rupee on the average net profit will also increased.

The intercept value of 'a' 1918.967565 and 4.379380 of DDC and SGML means that the average value of sales and closing stock would be 1918.967565 and 4.379380 lakhs respectively if net profit were zero.

4.8 Analysis of Primary Data

An empirical investigation has been conducted in order to identify the problem face by the both companies (DDC and SGML). In the way of inventory management, the major tool used for this purpose is an opinion questionnaire. A total 10 sets of questionnaire were distributed to the five departments of the both companies. The responses received from various respondents have been arranged and analyzed in order to facilitate the descriptive analysis of the study. The questionnaires were asked either for a yes/no response or for ranking of choice according to the alternatives.

Groups of Respondents and Code Use

S.N.	Groups of Respondents	Sample size	Code use
1	Procurement Department	1	A
2	Production Department	1	B
3	Account Department	1	C
4	Finance Department	1	D
5	Administration Department	1	E

The result derived from the specific questionnaire it is as follows:

Problems of Inventory Management in DDC

S.N.	Items of Causes	No. of Respondents	Percentage
1	Determining the size of inventory	2	40
2	Inventory policies	1	20
3	Proper storage facility	1	20
4	Disbursement and procurement	1	20

Problems of Inventory Management in SGML

S.N.	Items of Causes	No. of Respondents	Percentage
1	Determining the size of inventory	2	40
2	Inventory policies	1	20
3	Proper storage facility	1	20
4	Disbursement and procurement	1	20

From the result, it becomes clear that the main problem of inventory management of both companies is determining the size of inventory followed by 40% of total respondent. Another reason is inventory policies, proper storage facility Disbursement and procurement of material.

It shows that material size is the main problem of both companies. Milk is the not durable material, it can hold only one day for safety stock. So both companies could not define size of inventory due to this huge amount expenses in carrying and ordering cost. The company could not apply EOQ and ABC model. By which both companies could not maintain proper inventory management.

Above result it is also clear that both DDC and SGML need to take care of facts and develop high level policy structure for effective operation of company, with clearly define jobs and authority.

The main material of dairy industry is milk. But it cannot be holding more than one day. Both companies have no any proper storage facility, by which company could not produce milk powder. Milk powder is imported from foreign country, for which company pays more money.

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 company also affect. Inventory cost decreases the profit. When inventory cost increase profit should be decrease both company pays more money as collection cost and storage their sensitive product, which decrease the profit.

From the collected information it also clear that the basic reason for keeping inventory in DDC is to meet variation in product demand/buffer stock and in SGML is to maintain independence of operations. But there are other various for keeping inventory in the company. Both companies are not seen serious in other alternative. So, it is also one of the main causes of ineffective Inventory management of both companies.

From the view of respondent, we found that there are so many problems like- no techniques for Inventory management is possible to apply to calculate one of the major decisions- When to buy? Because of, lack of planning and unsystematic methods of re-ordering cost. DDC and SGML have made re-order after stock is finished which increase carrying cost and ordering cost and if decrease. Company's profits, so both company attentions about effective inventory management system

4.9 Major Findings

After analysis in detail of primary and secondary data and information which is collected from the management through observation, informal discussion and supplementary questionnaire; it become clear that Dairy Development Corporation and Sitaram Gokul Milk Private Ltd. is suffering from a number of internal and external problems in the way of inventory management.

From the analysis of the companies' data; following findings are extracted about the inventory management system of Dairy Development Corporation and Sitaram Gokul Milk Private Ltd.:

- There is not proper and timely improvement in inventory management in Dairy Development Corporation and Sitaram Gokul Milk Private Ltd.
- Dairy Development Corporation and Sitaram Gokul Milk Private Ltd. have lack of study on effective and efficient inventory management system. Due to this, huge money is blocked in the inventory.

- Both company have not categorized its inventory for the purpose of control and paid equal attention for all the inventories held in the time store.
- The economic order quantity model is not followed in the purchasing decision 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.
- Closing stock of any firm is a direct indicator of capital tie-up. If closing stock is huge, the more capital is located unnecessarily, which could have been used productively somewhere else. There is no uniformity in closing stock of Dairy Development Corporation and Sitaram Gokul Milk Private Ltd., which is one of the main reasons of loss.
- Dairy Development Corporation and Sitaram Gokul Milk Private Ltd. have made Re-order after stock is finished.
- The inventory turnover ratio of the companies was not satisfactory.
- There is no significant relationship between Inventory and profit of both companies.
- Sales and profit of the both companies are fluctuating. The amount of sales increased but amount of profit is not the positive, it suffers negative.
- The Dairy Development Corporation and Sitaram Gokul Milk Private Ltd.'s efficiency in inventory is poor. Both the companies have not changed their inventory in to receivable/ cash through sales.

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 subsection of the economy identified in agriculture area of Nepal. For example: fishing, pastoral, bee keeping, grain production, field crops, horticulture, livestock, and forestry. Milk production and supply is one of the activities in agricultural economies.

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, it has to be managed properly. 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 any enterprise basically depends upon the strength of management along with efficient management of the various functional aspects and modeling them to achieve the company is objectives. In other words, whatever may be the nature of business enterprises must important element i.e. management is basically concerned with getting the jobs done effectively and efficiently.

This study is concerned to appraise Dairy Development Corporation and Sitaram Gokul Milk Private Limited to examine the extent of inventory management and control system so as to minimize its cost, that ultimately affect the profit of the company.

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 functions associated with inventory such as purchasing, handling, 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 effective tools like economic order quantity for how much to purchase together with the re-order point. The basic problem of this study was to examine the inventory management system as practiced by the company. The order size, carrying cost, ordering cost, safety stock of the companies were unscientifically and were not given proper attention to the lead time and all those function increased the total cost of the company.

The main objective of this study was to find out what techniques were applied by those companies to manage the inventory and suggest to use the scientific techniques to help to reduce cost for this purpose. The researcher interviewed with officials and observed the inventory system personally data were collected from various sources. Quantitative tools were applied in this study to analyze the collected data.

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 companies have not applied any sort of techniques available for managing inventory.

5.2 Conclusion

On the basis of analysis of data and information collection from DDC and SGML separately the following conclusion have been drawn.

To meet the consumer demand effective and timely production is needed. The study focused on the need for a good inventory system to maintain a suitable level of inventory and also control the cost for the Dairy Development Corporation and Sitaram Gokul Milk Private Ltd.

The values maintaining proper stock of inputs as discussed previously are necessary to know the answer about when and how much to buy. The models and formula as

discussed previously are necessary for every manufacturing and non-manufacturing enterprise to reduce unnecessary cost incurred on ordering and carrying the inventory.

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 company because of the lack of adequate data. No technique for inventory management was applied to decide 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. Future researcher would not be able to predict the re-order period and maintain the safety stock properly. Thus, in the real situation of the operation of the company systematic inventory managing system could not be found.

5.3 Recommendations

The study stressed the need of a good inventory management system to the better performance of both the companies. If Dairy Development Corporation and Sitaram Gokul Milk Private Ltd. initiate steps to an appropriate management of inventory, certainly both the companies achieve their set objectives successfully.

The following suggestions are recommended for consideration-

- Dairy Development Corporation and Sitaram Gokul Milk Private Ltd. should define its goals and objectives clearly with regards to its inputs and outputs separately i.e. that quantities, time periods should be specified.
- The company should follow scientific tools and techniques i.e. economic order quantity and economic lot size, which help to reduce the relevant total cost for manufacturing the product. The output obtained from quantitative analyzes results the lowest cost and consumer can use with low cost than company can increase their selling.
- The easiest applicable model of ABC classification is another tool that can be applied for managing inventory smoothly. The ABC analysis help 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 and SGML are not adopting the ABC analysis.

- To manage inventory, ledge cards can also be used. It contains columns for inserting the data order and its receipt with data and quantity issued or sold. In the column receipt and issuance balance is maintained. In these cards, the name of the item, Item number, unit price, usage rate, vendor's or suppliers have, the percentage of carrying cost and the rates of ordering cost to carrying cost is maintained.
- Job evaluation should be-launched in certain time interval so that the hand-working employees can be taken action of Dairy Development Corporation and Sitaram Gokul Milk Private Ltd.
- In both companies, the recruitment and selection procedure of qualified personnel handling the inventory should be unbiased on the basis of which the corporation will be able to acquire the efficient and skilled technicians regular training on inventory and store management should be given.
- The post of General Manager should be professional and it should be far from political interfering.
- The scarp materials should be recycled with the companies so that cost of some possible extent can be cut down.
- As a whole, the government should take uniform system of inventory managing and controlling plan according to manufacturing and non-manufacturing nature and provide subsided annually in increasing ratio and not to put political base.
- Effort should be made to employ more computers and competent personal to handle it in order to keep the record of inventory and solve the problem of inventory control.

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APPENDICES

Annex- I

Questionnaire

This questionnaire is designed to avail the information relating to Inventory Management of DDC. Dissertation required to the MBS course to be submitted to the Tribhuvan University. The information to be provided here will be kept secret. I would be very much grateful for your kind cooperation.

Instruction: Please fill any one or more than one boxes for the following questions.

1. What are the basic reasons for keeping inventory in the Company?

(a) To maintain independence of operations. □

(b) To meet variation in product demand/buffer stock. □

(c) To allow flexibility in production schedule. □

(d) To provide safeguard for variation in raw material delivery. □

2. Which forms of inventory do maintain in your company

(a) Raw material. □

(b) Work in process. □

(c) Finished goods. □

(d) All types. □

3. Who determine the inventory in the company?

(a) Procurement department. □

(b) Production department. □

(c) Account department. □

4. What is the method of inventory determining?

(a) Personal judgment method. □

(b) Mathematical and statistical method. □

5. Does the company face any problem in inventory management?

(a) Yes □

(b) No □

6. If yes, what types of problem faced by the company?

(a) Determining the size of inventory. □

(b) Disbursement and procurement of material. □

(c) Proper storage facility. □

(d) Inventory policies. □

7. Has the company applied EOQ model?

(a) Yes □

(b) No □

8. Has the company apply ABC technique for storage of material?

(a) Yes □

(b) No □

9. If no what are the limitation of applying EOQ and ABC model?

(a) Lack of practices □

(b) Lack of knowledge □

(c) Nature of Raw material. □

10. Does the company calculate cost of inventory?

(a) Yes □

(b) No □

11. What do you think, is the relation between cost of inventory and Profit?

(a) Positive. □

(b) Negative □

(c) No-relationship. □

12. Does the company maintain desirable Safety Stock?

(a) Yes □

(b) No □

13. Do the transportation and other strike affect the inventory?

(a) Yes □

(b) No □

14. What suggestion do you make improve the inventory management in the manufacturing company?

Appendix- II

Calculation of Regression on Inventory and Sales (DDC)

Amount "000000"

FY	Net Sales (Y)	Inventory (X)	Y^2	X^2	XY
2062/063	148.4771891	176.24428	22045.47568	31062.04623	26168.25529
2063/064	154.823996	188.778666	23970.46974	35637.38489	29227.46749
2064/065	159.5906712	194.887625	25469.18233	37981.18646	31102.24691
2065/066	162.5429845	182.864452	26420.22181	33439.40781	29723.33379
2066/067	167.4192741	188.350386	28029.21334	35475.86776	31533.48483
	ΣY= 792.8541149	ΣX= 931.125409	Σ Y= 125934.5629	Σ X^{2} = 173595.8931	Σ XY = 147754.7883

Here, n = 5,

ΣY=792.8541149 ΣX=931.125409 Σ Y=125934.5629 Σ X^{2} = 173595.8931

Σ XY =147754.7883

Let regression equation Y and X b

Y = a + bx …… (i)

Then two normal equations estimating a and b are

EY = na + b X …… (ii)

And,

XY = a X + b X2 …….. (iii)

1.2 Putting the above calculating value in eq. no (ii) and (iii)

792.8541149 = 5a + b 931.125409…… (iv)

147754.7883 = a 931.125409 + b 173595.8931 …. (v)

Now multiplying (iv) by 177.92875 and then subtracting it from (v),

147817.0576 = a 932.18320 + b 173595.8931

147754.7883 = a 931.125409 + b 173595.8931

_ _ _

62.269256 = a 1.057791

a = 58.8673

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

792.8541149 = 5×58.8673 + b 931.125409

b = 0.5354

Substituting the values of and b in eq. (i) we get y = 58.8673 + 0.5354x.

Appendix-III

Calculation of Recession on Inventory and Sales (SGML)

Amount "000000"

FY	Net Sales (Y)	Inventory (X)	Y^2	X^2	XY
2062/063	47.056747	136.341949	2214.337438	18589.12698	6415.808585
2063/064	96.7635	154.436705	9363.174932	23850.69585	14943.8361
2064/065	145.29075	165.144471	21109.40204	27272.6963	23993.96405
2065/066	206.00928	182.88752	42439.82345	33447.84497	37676.52632
2066/067	218.36987	185.374752	47685.38571	34363.79868	40480.25438
	$\Sigma Y=$ 713.49014	$\Sigma X=$ 824.185397	$\Sigma Y^2=$ 122812.1236	$\Sigma X^2=$ 106524.1628	Σ XY= 123510.3894

Here, n = 5,

$\Sigma Y=713.490114$, $\Sigma X=824.185397$, $\Sigma Y^2=122812.1236$

$\Sigma X^2=106524.1628$ Σ XY=123510.3894

Let regression equation Y and X b

Y = a + bx …… (i)

Then two normal equations estimating a and b are

Y = na + b X …… (ii)

And,

XY = a X + b X2 …….. (iii)

Putting the above calculating value in eq. no (ii) and (iii)

713.490114= 6a + b824.185397 ---------- (iv)

123510.3894 = 824.185397a + 106524.1628b---------- (v)

Now multiplying (iv) by 137.36423833 and then subtracting it from (v),

98008.0221435=824.185397a + 113213.594771 b

123510.3894 = 824.185397a +106524.1628b

- - -

- 22502.3672 = 66894320b

b = -3.8123

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

= 713.490114=6a +-3.8123×824.185397

a = 642.5886

Substituting the values of 'a' and 'b' in eq. (i) we get y = 642.5886 + (-3.8123)x

Appendix-IV

Calculation of Regression on Sales expenses and Sales (DDC)

Amount "000000"

FY	Net Sales (Y)	Sales Expenses (X)	Y^2	X^2	XY
2062/063	148.4771891	38.370438	22045.47568	1472.290512	5697.134779
2063/064	154.823996	38.633228	23970.46974	1492.526306	5981.350737
2064/065	159.590671	40.905163	25469.18227	1673.23236	6528.082411
2065/066	162.542984	45.648224	26420.22165	2083.760354	7419.798543
2066/067	167.419274	47.623482	28029.21331	2267.996038	7973.088782
	ΣY= 792.8541141	ΣX= 211.18055	ΣY^2= 125934.5626	ΣX^2= 8989.80557	Σ XY= 33599.45525

Here, n = 5,

ΣY=792.8541141 ΣX=211.18055 ΣY^2=125934.5626

ΣX^2=8989.80557 Σ XY=33599.45525

Let regression equation Y and X b

Y = a + bx …… (i)

Then two normal equations estimating a and b are

Y = na + b X …… (ii)

And, XY = a X + b X2 …….. (iii)

Putting the above calculating value in eq. no (ii) and (iii)

792.8541141 = 5a + b 211.18055 …… (iv)

33599.45525 =211.18055a +8989.80557 b ……. (v)

Now multiplying (iv) by 42.569290 and then subtracting it from (v),

33751.2372 = a 212.846453 + b8989.80557

33599.45525 =211.18055a +8989.80557 b

- - -

151.781961 = 1.665918a

a = 91.110

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

□= 5×91.110 + b

b=1.59723

Substituting the values of and b in eq. (i) we get y = 91.110+ 1.5723x.

Appendix-V

Calculation of Regression Sales expenses and Sales (SGML)

Amount "000000"

FY	Net Sales (Y)	Sales Expenses (X)	Y^2	X^2	XY
2062/063	47.056747	4.02178099	2214.33748	16.174723	189.2519305
2063/064	96.7935	4.546654	9368.98162	20.672066	440.0865539
2064/065	145.29075	4.805856	21109.4024	23.096259	698.2464226
2065/066	206.00928	4.924536	42439.8235	24.251052	1014.500116
2066/067	218.36987	5.123216	47685.3851	26.247348	1118.755843
	ΣY= 713.52014	ΣX= 23.422043	ΣY^2= 122817.933	ΣX^2= 110.44148	Σ XY= 3460.840866

Here, n = 5,

ΣY=713.520114 ΣX=23.422043 ΣY^2=122817.9303

ΣX^2=110.44148 Σ XY=3460.840866

Let regression equation Y and X b

Y = a + bx …… (i)

Then two normal equations estimating a and b are

Y = na + b X …… (ii)

and XY = a X + b X^2 …….. (iii)

Putting the above calculating value in eq. no (ii) and (iii)

713.520114 = 5a + 23.422043 b …… (iv)

3460.840866=23.422043 a +110.44148 b …. (v)

Now multiplying (iv) by 4.715277 and then subtracting it from (v),

3364.44538 = a 23.5763878+110.44148 b

3460.840866=23.422043 a +110.44148 b

96.3955 = a 0.1543448

a = 624.5465

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

713.520114 = 5×624.5465 +23.422043 b

b=-102.86089

Substituting the values of a and b in eq. (i) we get y = 624.5465 - 102.86089x.

Appendix-VI

Calculation of Regression on Closing Stock and Net Profit (DDC)

Amount "000000"

FY	Net Profit (Y)	Closing Stock (X)	Y2	X2	XY
2062/063	-105.902081	748.777264	11215.25076	560667.3911	-79297.07046
2063/064	-76.132944	768.604149	5796.225162	590752.3379	-58516.09663
2064/065	-8.931871	797.604312	79.77831956	636172.6385	-7124.098824
2065/066	-55.475432	817.376244	3077.523556	668103.9243	-45344.30024
2066/067	-50.425673	860.923457	2542.748498	741189.1988	-43412.64472
	ΣY = -296.868001	ΣX = 3993.28543	ΣY^2= 22711.52629	ΣX^2 = 3196885.491	ΣXY= -233694.2109

Here,

n = 5,

ΣY = -296.868001 ΣX = 3993.28543

ΣX2 = 3196885.491 ΣXY = -233694.2109

Let regression equation Y and X b

Y = a + bx …… (i)

Then two normal equations estimating a and b are

Y = na + b X …… (ii)

and XY = a X + b X2 …….. (iii)

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

-296.868001 = 5a + b 3993.28543…… (iv)

-233694.2109= a 3993.28543+ b 3196885.491…. (v)

Now multiplying (iv) by 800.5652 and then subtracting it from (v),

-237662.2012 = a 4002.826178+ b 3196885.491

-233694.2109= a 3993.28543+ b 3196885.491

+ - -

-3967.990256 = 9.540748 a

a = -415.89928

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

-296.868001 = 5×-415.89928 + b 3993.28543

b = 0.4464

Substituting the values of and b in eq. (i) we get y = -415.899286+0.4464x.

Appendix -VII

Calculation of Regression on Closing Stock and Net Profit (SGML)

Amount "000000

FY	Net Profit (Y)	Closing Stock (X)	Y2	X2	XY
2062/063	-20.82	54.4215	433.4724	2961.699662	-1133.05563
2063/064	-18.394	52.1095	338.339236	2715.39999	-958.502143
2064/065	-11.151	78.231	124.344801	6120.089361	-872.353881
2065/066	-4.686	109.966	21.958596	12092.52116	-515.300676
2066/067	-2.43153	98.564399	5.912338141	9714.94075	-239.6622931
	ΣY= -57.4825	ΣX= 393.292399	ΣY2= 924.0273711	ΣX2= 33604.65092	Σ XY= -3718.874623

Here, n = 5,

ΣY= -57.4825 ΣX=393.292399 ΣY2=924.0273711

ΣX2=333604.65092 Σ XY= -3718.874623

Let regression equation Y and X b

Y = a + bx …… (i)

Then two normal equations estimating a and b are

Y = na + b X …… (ii)

and XY = a X + b X2 …….. (iii)

Putting the above calculating value in eq. no (ii) and (iii)

-57.4825 = 5a + 393.292399 b ---------- (iv)

-3718.874623 = 393.292399 a +333604.65092 b …. (v)

Now multiplying (iv) by 393.292399 and then subtracting it from (v),

-4911.562897 = a 427.222227+333604.65092 b□

-3718.874623 = 393.292399 a +333604.65092 b

\+ - -

-1192.688268 = a 33.929821

a = -35.1516

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

-57.4825 =5×-35.1516 +393.292399 b

b = 0.300

Substituting the values of and b in eq. (i) we get y = -35.1516+ 0.30x.

Appendix-VIII

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

Amount "000000"

FY	Net Profit (X1)	Sales (X2)	Closing Stock (X3)	X_2^2	X_3^2
2062/063	-105.902081	148.477189	6.621347	22045.47568	43.84223609
2063/064	-76.132944	154.823996	7.142131	23970.46974	51.01003522
2064/065	8.931871	159.590671	5.1660386	25469.18227	26.68795482
2065/066	-55.475432	162.542984	8.6481252	26420.22165	74.79006947
2066/067	-50.425673	167.419274	8.7346064	28029.21331	76.29334896
	ΣX1= -279.004259	ΣX2= 792.854114	ΣX3= 36.3122482	ΣX_2^2= 125934.5626	ΣX_3^2= 272.6236446

X1.X2	X1.X3	X2.X3
-15724.04331	-701.2144263	983.118991
-11787.20662	-543.7514595	1105.77326
1425.443286	46.14239036	824.451567
-9017.142256	-479.7584815	1405.69208
-8442.229565	-440.4484061	1462.34146
ΣX1.X2= -43545.1785	ΣX1.X3= -2119.030383	ΣX2.X3= 5781.37736

Let,

Profit = X1, Dependent Variable

Sales =X2, Independent Variable

Closing Stock =X3, Independent Variable

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

X2 and X3 is given by -

X1=a+b1. X2 + b2. X3

Then a, b1, and b2 can be obtained by solving following three normal equations simultaneously

ΣX1 =n. a +Σ b1 X2+Σ b2 X3 ……..(1)

ΣX1.X2 = a. Σ X2 +Σ b1 X_2^2+ b2 ΣX2.X3 ……. (2)

ΣX1.X3 = a. Σ X3 + b1 ΣX2.X3+ b2Σ $X3^2$ ……..(3)

Here,

n = 5,

ΣX1 = -279.004259, ΣX2 =792.854114, Σ X3 = 36.3122482,

ΣX_2^2=125934.5626, ΣX_3^2=272.6236446, ΣX1.X2=-43545.1785,

ΣX1.X3=2119.030383, Σ X2.X3=5781.37736

Substituting these values in equations 2, we get

-279.004259 =5a + b1.792.654114 + b2.36.3122482.....(3)

-43545.1785= a.792.854114+ b1.125934.5626+ b2.5781.37736.....(4)

-2119.030383=a.36.3122482+b1.5781.37736+ b2.272.6236446.....(5)

Now multiplying equation (3) by 158.5708228 and subtracting equation (4) from (3) we get,

-44241.93491=a.792.854114+b1.125723.5292+ b2.5758.063075

-43545.1785= a.792.854114+ b1.125934.5626+ b2.5781.37736

\+ – – –

-696.7564= - b1.211.0334 - b2.23.314285.....(6)

Again multiplying equation (3) by 7.26245 and then subtracting equation (5) from (3), we get,

-1300.009198=a.36.3122482+b1.5758.063075+b2.263.715873

-2119.030383 =a 36.3122482 + b1.5781.37736 + b2.272.6136446

\+ – – –

819.021185= - b1.23.314285–b2.8.90777..... (7)

Also multiplying equation (7) by 9.051703709 and subtracting equation (7) from equation (6) we get,

7413.51602= - b1.211.0334 - b2.80.630328

- 696.75641=- b1.211.0334 - b2.23.314285

\+ + +

– 8110.27243= - b2.57.316043

b2 = 141.5009133

Now, putting the value of b2 in equation (6) we get,

-696.75641 = - 211.0334×b1 -23.314285×-141.5009133

Or, b1 =18.93420

Again putting the value of b1, and b2 in equation (3) we get,

-279.004259 = 5×a1.+18.93420×792.854114-141.5009133×36.3122482

or, a = 1918.967565

Substituting the values of a, b1 and b2 in equation (1) we get the required multiple regression line.

X= 1918.967565 + 18.93420X2– 41.5009133X3

Appendix-IX

Calculation of Multiple Regressions on Net Profit, Sales and Closing Stock (SGML)

Amount "000000"

FY	Net Profit(X1)	Sales (X2)	Closing Stock (X3)	X_2^2	X_3^2
2062/063	-20.82	47.056747	2.52315	2214.337438	6.366285923
2063/064	-18.394	96.7935	9.588306	9368.981642	91.93561195
2064/065	-11.151	145.29075	1.484732	21109.40204	2.204429112
2065/066	-4.686	206.00928	14.537686	42439.82345	211.3443142
2066/067	-2.43153	218.369837	14.828439	47685.38571	219.8826032
	Σ X1= -57.48253	ΣX2= 713.520114	ΣX3= 42.962313	ΣX_2^2= 122817.9303	Σ_3^2= 531.7332444

$X^1.X^2$	$X^1.X^3$	$X^{2.}X^3$
-979.7214725	-52.531983	118.731231
-1780.419639	-176.3673006	928.085697
-1620.137153	-16.55624653	215.717826
-965.3594861	-68.1235966	2994.89823
-530.9728098	-36.05579428	3238.08381
$\Sigma X^1.X^2$= -5876.61056	$\Sigma X^1.X^3$ = -349.634921	$\Sigma X^{2.}X^3$= 7495.51679

Let,

Profit = X^1, Dependent Variable

Sales = X^2, Independent Variable

Closing Stock = X3, Independent Variable

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

X^2 and X^3 is given by -

$X^1=a+b1.\ X^2+b^{2\cdot}\ X^3$

Then a, b1,and b2 can be obtained by solving following three normal equations Simultaneously

$\Sigma X1 = n.\ a + b1\Sigma X^2 + b2\Sigma X^3$ ……..

$\Sigma X1.X2 = a.\ \Sigma X^2 + b1\Sigma X_2^2 + b2\ \Sigma X^2.X^3$ …….. (2)

$\Sigma X1.X3 = a.\Sigma X^3 + b1\ \Sigma X^{2.}X^3 + b2\ \Sigma X_3^2$ ……..

Here, n = 5,

$\Sigma X^1 = -57.48253$, $\Sigma X^2 = 713.520114$, $\Sigma X^3 = 42.962313$,

$\Sigma X_2^2 = 122817.9303$, $\Sigma X_3^2 = 531.7332444$, $\Sigma X^1.X^2 = -5876.61056$

$\Sigma X^1.X^3 = -349.634921$, $\Sigma X^2.X^3 = 7495.51679$

Substituting these values in equations 2, we get

-57.482536 =5a1 + b1.713.520114 + b2.49.962313.....(3)

-5876.61056= a1.713.520114+ b1.122817.9303+ b2.7495.51679.....(4)

-349.634921=a1.42.962313+b1.7495.51679 + b2.531.7332444.....(5)

Now multiplying equation (3) by 142.7040228 and subtracting equation (4) from (3) we get,

-8202.988272 = a1.713.520114 + b1.101822.1906 + b2.6130.894894

-5876.61056 = a1.713.520114 + b1.122817.9303 + b2.7495.51679

\+ – – –

- 2326.377712 = –b1.20995.7397– b2.1364.621896.....(6)

Again multiplying equation (3) by 8.592426 and then subtracting equation (5) from (3), we get,

-493.9164892 = a1.42.962313+b1.6130.894894+ b2.369.1520677

-349.634921= a1.42.962313+b1.7495.51679+b2.531.733244

\+ – – –

-144.2815682 = - 1364.6228 × b1 - 162.5811767×b2.....(7)

Also multiplying equation (7) by 15.385746 and subtracting equation (7) from equation (6) we get,

-2326.377712 = – b1.20995.7397 – b2.1364.621896

-2219.879561= – b1.20995.7397 – b2.2501.432689

\+ + +

-106.498151 = b2×1136.810793

b^2 = -0. 09368

Now, putting the value of b2 in equation (6) we get,

-2326.377712 = - 20995.739 × b1-1364.621896 ×-0.09368

Or, b1= 0.116892

Again putting the value of b1, and b2 in equation (3) we get,

-57.48253 = 5.a+713.520114×0.116892+42.962313×-0.09368

Or, a = 4.379380

Substituting the values of a, b1 and b2 in equation (1) we get the required multiple Regression line

X= 4.379380 + 0.116892X2 -0.09368X3