

CHAPTER-I

INTRODUCTION

1.1 Background of the study

Industrialization is an important factor for achieving basic objectives of a country's economic and social progress. Industrialization is a comparatively new phenomenon in Nepal. Industrial development in Nepal, however, started getting regular attention of the government since the development plans was started. Several industries were established under the public sector with the technical assistance of foreign countries were seen in existence in the public sector also. But the financial position is not growing as the growth of the numbers.

Inventory is the stock of the materials or products which frequently occur in the manufacture organization. When the materials are purchased by an organization they have to be stored until they are in to the production process. When the production is over the finished, production have to be stored again until they are sold. So, inventory involves high amount of cash in terms of occupying the space and locking the capital. However, we cannot avoid inventories because without inventory it is effect even badly by creating obstacles on continuous production and ultimately on supply requirements. So, inventory should be maintained in appropriate quantity so as to avoid under stock and over stock, situation. For this propose, inventory management is necessary.

Inventory management involves planning of the optimum level of inventory and control by and appropriate structure which is staffed by trained person by the top management. It involves financial dimation as well as physical dimantion are interreleated can not be looked in

isolation. Because of large size of inventory maintained by firms, a considerable of funds is required to be committed in them. It is there fore, absutely improve to manage inventories efficently and effectivly in order to avoid unneccery investment in them. An undertaking neglecting the management of inventories will be jeopardizing its long run profitability and may fail ultmatly.

Thus, management should play adequate attention to the inventory management to reduse the cost of production. Therefore, inventory management is primarily concerned with minimizing cost of investment in inventory. Both the physical as well as financial dimension of inventory should be effectively managed. Thus, the real task of top management lies in formulating the plan and police that will lead to optimum inventory investment for the attainment of desire objectives.

The growing number of companies 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 to manage the inventory decisions (Dangol, Guring & Dongal, 2065: 35). Models and techniques have so far developed. The area of inventory management covers the following individual phases: determining the size of inventory table carried establishing time schedules. Procedures and a lot of sizes for new order, determining minimum safety levels and co-ordination of sale production and inventory policies of 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 activity (Kuchal, 1970: 227).

The various forms in which inventories exist in a manufacturing company are: raw material, work in progress, and finished goods. Raw materials are those basic inputs that are converted into finished product through the manufacturing process. Raw material inventories are those units, which have been purchased and stored for future production. Work in progress inventories are semi-manufactured products. They represent product that need more work before they become-finished product for sale. Finished goods inventories are those completely manufactured products, which are ready for sale. Stock of raw material and work in progress facilitate production, while stock of finished goods is required for smooth marketing operation (Poudel & Baral 2009: 257). Thus, inventories serve as a link between the production and consumption of goods.

1.2 Introduction of Bottlers Nepal (Terai) Limited (BNTL)

Bottlers Nepal (Terai) Limited is one of the manufacturing company which is manufacturing the soft drinks under the brand name of Coca Cola. It is the subsidiary company of Bottlers Nepal Limited, Balaju, Kathmandu. BNTL was established in 1987 under the Company Act 1964. It is a Public Limited Company and duly listed on NEPSE with 90.78% shares being held by Bottler Nepal Limited. BNTL is one of the leading figures of Nepalese industrial sector. The company is located in Gondrang of Bharatpur Municipality in Chitwan District, Nepal. It represents the first large-scale multinational manufacturing company of Chitwan, Nepal.

The company has authorized share capital of Rs.121,000,000 and paid up value per share is Rs.100. The issued paid up capital is Rs.121,000,000. Initially local management took responsibility till 1993 A.D. runs the company. Frase and Neave Singapore took responsibility of the company

management from 1993 to 2000 A.D. During the year 2000-2004, the company was run by the Coca Cola, Atlanta. At present South Africa Bottling Company, South Africa is taking the Responsibility of company management.

The company prepares flavor of the product. They are brought from countries like Singapore, India and Germany. All the spare parts are imports from Germany, Thailand, Switzerland and India also. BNTL covers more than 75% market in Terai region when compared with other brands of the similar product.

The company has a plant with the capacity of producing 350 bottles per minute. Coke, Sprite, Fanta and kinley are the major product of the company, packed in 250 ml returnable glass bottles. The products are marketed all over the country except in Bagmati Zone.

For the production of these products certain inputs are pre-requisites i.e. Crown Cock, Chemicals, Sugar etc which are not produced in the country. Therefore these inputs are imported from other countries like Singapore, Iran, Pakistan, Indonesia, German and India.

1.3 Statement of Problem

Inventory must be managed in such a way that it does not lead to disadvantage of production stoppage. Effective and efficient inventory management system can only yield expected profit of the company. It should be balance in such a way that should neither be excessive nor be inadequate. The excessive inventory results unnecessary tie up of the firm's funds and loss of profit, excessive carrying cost and risk of liquidity whereas the inadequacy of inventory causes either product holds up or failure to meet the demand of customers.

Most of the Nepalese companies have been suffering from the problem of poor performance in terms of productivity and profitability. The following question will be put forward during the period.

- How the inventories are managed in BNTL?
- What are the major problems related to inventory management of BNTL?
- Whether the company has adopted any techniques to control the inventory cost?
- To what extent inventory and sales are related?

1.4 Objectives of the study

The major objective of this study is to evaluate the current practices on inventory management and its effectiveness in Nepalese manufacturing enterprise. The other specific objectives are as follows:

- To analyze the different inventory management techniques followed by BNTL.
- To know the relationship of sales and inventories.
- To study the practice of procurement and sales of inventory.
- To identify the present inventory position of the BNTL.

1.5 Important of the study

Inventory management is an important concern for every business/manufacturing organization inventory helps the company quickly responding to the customers' demand, which is an important element of competitive strategy. Inventories of raw materials or partially

processed goods can help a company complete the production cycle in a much shorter time than would otherwise be possible.

BNTL is a manufacturing enterprise, that's why investment and cost of carrying inventory is required to reduce the total operating cost. The main objective of inventory management is to put the inventory at an appropriate level so that inventory cost can be minimized. This study is focused in the inventory management of BNTL. The study can provide the guideline and help to make the plan, policies and program for the effective management of BNTL.

Inventory is the major element of manufacturing organization. Without effective and efficient inventory management, no organization can achieve its goals. A firm cannot achieve its goal unless inventories are controlled effectively and capital is allocated properly. Proper inventory management helps to increase the profit of an organization. A slight change in the cost of inventories will bring a great change in the firm's profitability. Reduction in the material cost may result in high profit.

1.6 Limitation of the study

This study is being conducted for partial fulfillment of the requirement for Master Degree in Business Studies. There are following limitations of the study:

- This study is concentrated on the area of inventory management of BNTL.
- The study considers only BNTL and is based upon annual available reports of the BNTL.
- Time and resource for the study are the major constraints.

- This study covers a span of only five financial year covering from 2007/08 to 2011/12. Data beyond and after the period is also used wherever necessary.
- This is the case study, so it is not applicable in general situation or all types of manufacturing enterprises.
- This study concerns with the inventory and ignored other managerial functions.

1.7 Organization of the study

This study has been spread altogether into five chapters. A brief outline of each of these chapters has been given as follows:

Introduction:

It includes general background of the study, introduction of BNTF, statement of problem, objectives of the study, importance of the study and limitations of the study.

Review of Literature:

This chapter includes reviewed of literature. The researcher has divided this chapter into two portions, first being theoretical framework and second is review of previous studies.

Research Methodology:

This chapter includes research methodology, research design, nature and sources of data, data gathering procedure presentation and analysis of technique and tools. Research methodology consists of research design and research tools. Secondary data is used in this study.

Presentation and Analysis of Data:

Fourth chapter of this study is concern with data presentation and analysis. This is the main part of the study; obtained data are presented in the tabular and other forms. Various statistical presentations are used for analyzing the collected data from different sources. Actual results are obtained after analysis of data by using financial and statistical tools and techniques. Major findings are drawn after analysis of data.

Findings, conclusion and Recommendation:

This is the last chapter of study and includes, summary, conclusion, findings and some recommendations.

At the end of the study bibliography and appendix are also incorporated.

CHAPTER-II

REVIEW OF LITERATURE

Scientific research must be based on past knowledge. The previous studies cannot be ignored because they provide the foundation to the present study. Literature review is basically a stock taking of available literature in one's field of research. The review of literature provides the foundation for developing a comprehensive theoretical framework from which hypothesis can be developed for testing. The purpose of reviewing the literature is to develop some expertise in one's area, to see what new contributions can be made, and to receive some ideas for developing a research design (Wolff & Pant: 1999: 309).

This chapter attempted to present the review of literature regarding inventory management. This chapter is divided into two sub section Conceptual Framework (theoretical concept of inventory management) is presented in first section and review of related studies has been presented in the second section

2.1 Conceptual Framework

2.1.1 Inventory Management

An inventory is the stock of any idle item or resource in a firm for future use. In manufacturing organization, typically have inventories of raw materials, components, sub-assemblies, tools and equipment, semi-finished goods, finished goods etc. In other words, Inventory is composed of assets that will be in future in the normal course of business operation (Khan & Jain, 2003: 251). Inventory may be defined as the goods held for eventual resale by the firm. As such inventories are vital elements in the efforts, of the firm to achieve desired sales level.

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. 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 (Pandey, 1994: 865).

Executive in production, purchasing and marketing departments, take decisions relating to inventories. 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.

Inventory form a link between production and sale of product. The optimum level of inventories should be judged in relation to the flexibility if inventories. The lower level of inventory is the less flexibility of the firm, and higher level of inventory increase the flexibility of the organization.

2.1.2 Importance of Inventory Management

Inventory management is an important function of an organization cover various aspect input process i.e. it deals with the raw materials, procurement of machines and other equipment necessary for the production process and spare parts for the production process and spare parts for the maintains of the plant. Thus, in an production process

inventory management can be considered as an preliminary to transformation process, it involves planning and programming for the procurement of material and capital goods of desired quality and specification at reasonable price and at the required time, it is also concerned with market exploration for the items be purchase to have up to date information, storage and stock control, inspection of the material received in the enterprise, transportation and material handing operation related to materials and many other function (Goel, 1992:321). Inventory 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.

Importance of inventory management can be written as follows:

- Inventory helps in maintaining the economy by absorbing some of the fluctuations when the demand for an item fluctuates or is seasonal.
- Inventory provide service to the customers immediately or at a short notice.
- Inventory helps in smooth and efficient running of business.
- Inventory also acts as buffer stock when raw materials are received late and so many sales others are likely to be rejected.
- Inventory also reduced product cost because there is an additional advantage of batching and long smooth running production runs.
- Pipeline stocks (also called process and movement inventories) are also necessary where the significant amount of time is consumed in transshipment of items form one locality to another (Agrawal, 1998: 218).

2.1.3 Types of Inventory

Every business organization, however, it is big or small has to maintain some inventory. Inventory for any organization is necessary things and require careful planning and formulation of policies, keeping in the view for the best interest of organization. Depending upon the nature of the industry and firm, inventory may be durable or non-durable perishable or non-perishable, valuable and inexpensive.

Manufacturing firms generally hold four types of inventories (Van Horne, 1984: 112), which are as follows:

A) Raw Materials

Raw materials are those basic inputs that are converted into finished product through the manufacturing process. These are the goods that have yet committed to production in manufacturing firm. Raw materials inventories are those units which have been purchased and stored for future production. The level of raw materials inventories is influenced by anticipation production, seasonally of production, reliability of sources of supply and the efficiency of scheduling purchase and production operation (Pandey,1999: 938). It consists of item that firm purchases for use in its production process. It may consist of basic materials and manufactured goods maintaining adequate raw materials inventories provides a firm with advantage in both purchasing and production. Water, sager, Chemicals and Glasses are the main raw materials used by the company i.e. BNTL.

B) Work-in-process

These categories include those materials that have been committed to the production process but have not been completed. “Goods in process

include such items as components and sub assemblies that are not yet ready to be sold (Hampton, 1990: 241)”. Work-in-process inventories are semi-manufacturing products. They represent products that need more work before they become finished product for sale.

Goods in process include such items as components and sub-assemblies that are not yet ready to be sold. Works in process inventories are semi-manufactured products. They represent products that need more work before they become finished product for sale. Work-in-process is neither a finished product nor raw materials.

C) Finished Product

Finished goods are those completely manufactured products, which are ready for sale. In a manufacturing firm, they are final output of production process stock of raw materials and WIP facilitate production of finished goods. Finished goods are required for smooth marketing operation. Therefore, finished goods are completely goods a waiting for sale (Dangol & Guring, 2061 : 45) .

Bottlers Nepal (Terai) Limited has been producing different types of soft drinks and holds inventory of different types of soft drinks for smooth market operation.

D) Spare Parts and Supplies Inventories

Spare parts are those materials, which are used in maintenance, and repairing function and supplies are those materials, which are used in operating function. Bolts, wheels oil, lubricants, grease etc, represent the spare parts and supplies.

2.1.4 Motives of Holding Inventories

The question of managing inventories arises only when the company holds inventories. Manufacturing inventories involved trying of the company funds and incurrence of storage and holding cost, if it is expensive to maintain inventories, why do companies hold inventories? There are three motives for holding inventories (Martin & Miller, 1962: 256).

A) The Transaction Motives

It emphasizes the need to maintain inventories to facilitate smooth production and sales operation. A company should maintain adequate stock of materials for supply to the factory for continuous production. It is not possible for a company to procure raw materials whenever it is needed. A time lag exists between demand for materials and its supply. There also exists uncertainty in processing in time at many occasions. The procurement of raw materials may be delayed because of such factors as strike, transportation disruption or short supply. Therefore, the firm should maintain sufficient stock of raw materials at a given time to streamline production (Dongol, 2016:173).

B) Precautionary Motive

It necessitates the holding of inventories to guard against the risk of unpredictable change in demand and supply forces and other factors. Stock of finished goods has to be held because production and sales are not instantaneous. A firm cannot produce immediately when customers demand goods. Therefore, to supply finished goods on a regular basis their stock has to be maintained. Stock of finished goods has also to be maintained. Stock of finished goods has also to be maintained

for sudden demand from customers. In case the firm's sales are seasonal in nature substantial finished goods inventories should be kept to meet the peak demand. Failure to supply products to customers, when demanded would mean loss of the firm's sales to competition. "The level of finished goods, inventories would depend upon the coordination between sales and production as well as on production time (Pandey, 2002: 984)".

C) Speculative Motive

It influences the decision to increase or reduce inventory levels to take advantage of price fluctuation. Different factors which may necessitate, purchasing and holding of raw materials inventories quantity discount and anticipated price rise. The firm may purchase large quantities of raw materials that needed for desired production and sales level to obtain quantity discount of bulk purchasing (Khans & Jain, 2002:258).

2.1.5 Cost Assorted 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:

2.1.5.1 Carrying/Holding Costs

Total carrying cost 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.

∴ Carrying Costs = Average quantity × Carrying cost per unit

∴ Average Quantity = Order Size/2

The expenses involved in this cost are:

- Capital Opportunity Cost
- Handling Cost
- Storage Cost
- Spoilage and Shortage Cost
- Depreciation Cost
- Insurance and Taxes etc (Dangol & Dangol, 2061:187)

2.1.5.2 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.

It 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, 1985:419*).

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.

$$\therefore \text{Total Ordering Cost (TOC)} = O \times N$$

Where,

O= Fixed cost per order

N = No of order placed per year

2.1.5.3 Stock-out Costs

Stock out cost is associated with demand. 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 is 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.

2.1.6 Techniques of Inventory Control

To manage inventories effectively, a firm should use a system approach to inventory management a system approach considers in a single model all the factors that affect the inventory. The model called a system may have any number of sub systems tied together to achieve a single goal. In the case of inventory systems, the goal is to minimize the costs.

The financial manager should aim at an optimum level of inventory on the basis of the tradeoff between cost and benefit, to maximize the owner's wealth. Many sophisticated mathematical techniques are available to handle inventory problems. But, they are more, approximately a part of production management (Khan & Jain, 2002:305).

Following are the inventory control techniques:

2.1.6.1 Economic Order Quantity (EOQ)

This technique 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).”

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 lot; (*Martin & Miller, 1956:66*).

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

Approaches to Set EOQ

The EOQ model can be illustrate by:

- Mathematical (short-cut) formula method.
- The long analytical approach or tabulation method or trial and error approach.
- Graphical approach.

2.1.6.2 ABC Analysis

The ABC system is widely used classification technique to identify various items of inventory for purpose of inventory control. This

technique is based on the assumption that a firm should not exercise the same degree of control on all items of inventory. It should rather keep more rigorous control on items that are the most costly and the slowest turning, while items that less expensive should be given less control effort (Khan & Jain, 1994:314).

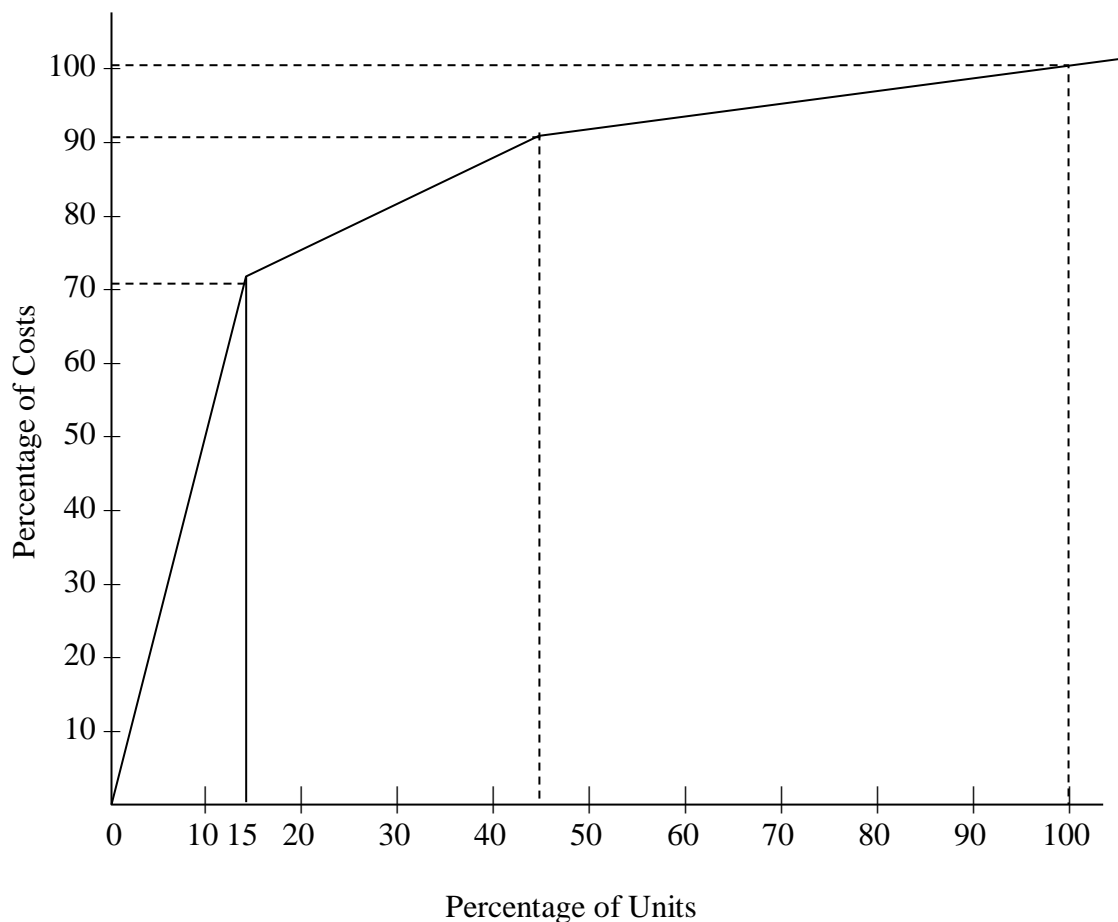
- A) High priced inventories A
- B) Medium price inventories B
- C) Low priced inventories C

The item included in group 'A' involves largest investment and would be under tightest control by management. Therefore, inventory control should be most rigorous and intensive and the most sophisticated inventory control techniques should be applying these items. The 'C' group consists of items of inventory, which involve relatively small investment although the number of items fairly large. These items deserve minimum attention. The lower level of managers may be given authority to exercise control over these items. The 'B' group stands midway. It deserves less attention than 'A' but more than 'C'. The 'B' items fall in between these two categories and responsibility to control these inventories may be given to middle level managers. The typical break down of inventory item is as shown below:

Table 2.1
ABC Analysis

Group	Units of items (%)	Inventory value (%)
A	15	70
B	30	20
C	55	10
Total	100	100

Figure 2.1
Graphic Presentation of ABC Analysis



Some point stand out graph presented above while group 'A' is the least important in terms of the number of items, it is by far the most important in terms of the investment involved. With only 15% of the number, it account for as much as 70% of total value of inventory. The firm should

direct most of its control efforts to the items included in this group. The items comprising B group account for 20% investment in inventory, they deserve less attention than 'A', but more than 'C'. C involves only 10% of the total value although number-wise its share is as high as 55 percent.

2.1.6.3 Just In Time System (JIT)

JIT system is a relatively new approach to inventory control which has been developed by Japanese firms more than 30 years ago by Toyota Motors Corporation and has gained significant popularity throughout the world. The objective of JIT is to eliminate waste by timing the delivery of products from a supplier to a purchaser at the instant they are needed to implement a JIT inventory system, a purchasing firm must find a suppliers (or network of suppliers) that can provide quality products on short notice and with the assurance the products will be delivered on time. Thus, coordination is critical for JIT systems to be beneficial to both the suppliers and the purchaser.

JIT expects to achieve high volume production using minimum inventories of raw materials, Work-in-process and finished goods. JIT means producing what is needed, when it is needed and no more. It assumes stable environment and anything over the minimum need is viewed as waste. JIT works with zero-idle inventories and zero unnecessary lead time to avoid waste.

JIT inventory control, as the name implies, the idea is that inventories are acquired and inserted in production at the exact times they are needed. This requires efficient purchasing, very reliable suppliers, and an efficient inventory-handling system. One thing that has made this possible is the advent of instant information through sophisticated computer networks.

Hence better synchronization and coordination between suppliers and purchaser is very necessary for JIT inventory control. Purchasers primarily consider the reliability and flexibility of suppliers delivering products that conform to quality specification with respect to response to orders rather than price of the product. Modern technology helps monitor inventory levels, inventory patterns analyzed and suppliers' better plan shipments to purchasers. Hence JIT system has improved morale of employees. Both the suppliers and purchaser need to formally make strategic plan both in the short and the long-run. JIT inventory management can improve productivity and product quality and ultimately results in greater profit due to reduced inventories and waste.

2.1.6.4 KANBAN system

KANBAN is an inventory management techniques operating under JIT system. The words KANBAN means a visual instruction card in Japanese language. It is simple system of inventory control use in JIT system of production. It is designed to produce only the no of units needed by a pull or demand feeding process. Thus, KANBAN is applicable in pull manufacturing systems. The following are kinds of KANBAN card in KANBAN system.

- Withdrawal KANBAN
- Production ordering KANBAN

The withdrawal KANBAN shows the quantity of item that subsequent process should withdrawal from the preceding process. The production ordering KANBAN shows the quantity preceding process should produce. These cards are used within the plants and within the suppliers' plant. No complex record keeping is required since each part is produced

only in the number of required to feed the next operation and just in time for use.

Through the two cards KANBAN is most efficient inventory control tools under JIT production system, single card KANBAN is most often use in Japanese industries. Single card KANBAN system uses only withdrawal KANBAN and no production KANBAN. Following two methods are generally use for measuring the performance of manufacturing process.

- Flow through time
- WIP inventory level

Flow through time is the amount of time it takes one unit to pass through the entire process, from start to finish (on average). In the KANBAN system, both of these measures are at list partially depending upon lot sizes. For example, if a KANBAN system uses 25 work stations and a lot size of 4, the average WIP will be near 100 units. If the cycle time for a balanced load is, say, two minutes per items (using lot size of four), flow through time will be close to 200 minutes(allowing for some variation) i.e. one unit product will flow through the system in 200 minutes.

However there are some factors that make the KANBAN difficult. They are

- Fluctuation of demand
- Lack of material
- Lack of facilities
- Management labor relationship etc. (Sthapit, yadab, et al,2010 :136-138)

2.1.6.5 Stock Level Subsystem

Carrying too much and too little inventories is deterring mental to the firms. If the inventory is too little, the firm will face frequent stock outs involving high reordering cost and if the inventory level is too high, it will be necessaries of capital. Therefore, an efficient inventory management requires that a firm should maintain 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 (Agrawal, 1998: 220).

A) Minimum Level

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

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

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

B) Maximum Level

Maximum level represents the maximum quantity of item of inventory that can be hold in stock 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.
- Golden 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 of 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.

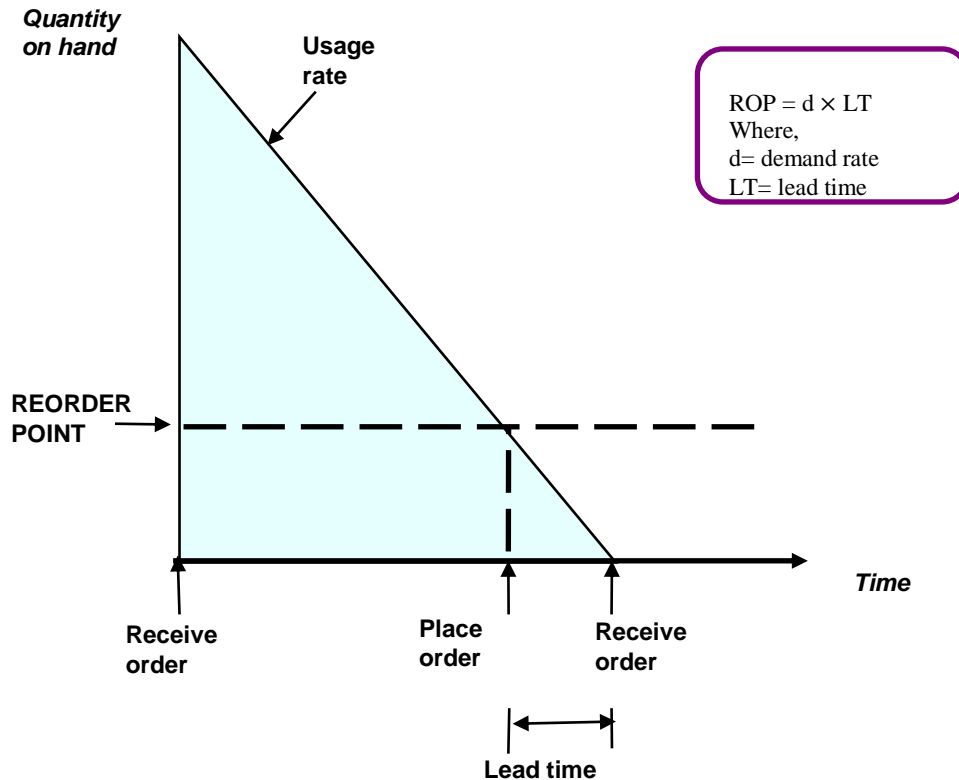
∴ Maximum Stock Level = Re-order Level + Re-ordering quantity –
(Minimum consumption × Minimum Re-ordering period)

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 2.2

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*).

$$\therefore \text{Ro - Order Level} = \text{Safety Stock Lead} + (\text{Time} \times \text{Daily consumption})$$

"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) Usages Rate

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 place an order for the procurement of inventory is made to the actual receipt of the inventory by the firm. It is also called procurement time of inventory. It is expressed in days, weeks and months.

iii) Safety Stock Level

The minimum level of inventory may be expressed in days, this level can be computed by multiplying the usage rate times and the numbers of days that the firms want to hold as a protection against shortage.

D) Average Stock Level

Average stock is calculated as:

$$\therefore \text{Average Stock Level} = \text{Minimum stock level} + \frac{1}{2} \text{ of Re-order Quantity}$$

E) 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 arrangements to get the material, which reach at their danger levels so that the production may not stop due to shortage of materials.

∴ Danger Level = Average Consumption × Maximum Re-order period

2.1.7 Co-ordination between Sales, Production and Inventory

The manager must plan an optimum co-ordination between productions, inventory and sales. An efficient co-ordination, production plan is necessary for optimum production and sales. There may be high pressure from both sales and manufacturing for high inventory level. The production budget and inventory policies provide the basis for obtaining this co-ordination.

Production manager must translate the quantity in the sales budget into unit production requirement for the budget period for each product while considering the management of inventory policies. An efficient plan should represent the optimum co-ordination between sales budget, essential inventory levels and production levels.

2.2 Review of Previous Studies

During the study period, it is tried to trace out some studies conducted by different agencies, expert, scholars related with inventory management of manufacturing enterprises in Nepal. Some studies have been made in the subject of inventory management but only few studies are review in this chapter.

2.2.1 Review of Thesis

Some studies were made in the subject of inventory management but few recent studies were review.

Upadhyay (2007), entitled “A Study on Inventory Management in Janakpur Cigarette Factory Limited” His major finding was that JCF faced the problem of overstocking of raw materials and finished goods. This overstocking of inventories raised the problem of working capital management and he concluded that this was because of lack of proper sales planning on the one hand and defective procurement and production policy on the others.

Objectives:

- To analyze the performance of JCF on the basis of demand and supply trend regarding inventory management.
- To identify the present practice of procurement of raw materials, maintenance of work in process stock and finished stock etc.

Major finding

- The factory highly dependent upon raw material suppliers; it means that the company is unable to find competitive sources of raw materials.
- The company is always facing stock out, overstock and under stock problems, it is all due to lack of proper management of inventory.
- The top level management should pay attention in budgetary and financial analysis along with purchasing, production and financial aspects of inventory management to boost up the organization.

Pathak (2008) carried out a research study on “Inventory Management of Hetauda Cement Industry Limited”. The data and other necessary information’s were using secondary as well as primary sources of data. In the research Pantha has founded that Hetauda Cement Factory limited was in the problem of over stocking of raw materials and work in progress, inventory management techniques were not used properly. This might be the outcome of inefficient management system of inventories. Due to this fact, she conducted that production and sales plan of the factory was not practicable and realistic.

Objectives:

- To examine the profitability and affection HCIL regarding inventory management.
- To find out the efficiency level, investigate various inventory related factors collection of material, storage and supply.

Major Findings:

- HCIL is not running in full phase due to the material shortage.
- The company could not able to keep proper balance between yearly demands and supply so the inventory stock fluctuating every year.
- The company could not apply the inventory management system.

Shrestha (2004) conducted a research study “Inventory Management of Nepal Lube Oil Limited”. Shrestha has collected almost all data from secondary sources i.e. published/unpublished records of the company. He has also conducted inquiries and informal talk with the management head to gather primary data. The researcher used various financial and statistical approaches to analyze the gathered data.

Objectives:

- To analysis on of the profitability and control of stock items of NLOL.
- To indict the study was to identify the strength and weakness of NLOL regarding inventory management.

Major finding:

- NLOL could not use its available capacity due to top competition and liberalization policy of government of Nepal.
- Efficiency of inventory management in term of ratios is not fruitful.
- NLOL has to adopt effective service oriented strategy with marketing and distribution so that to compete with others and has to apply proper inventory control system to strengthen stock level to serve the customers in required time.

Dahal (2009) has carried out a research study on “A Compare study on Inventory Management of Dabur Nepal P. Ltd. and Nepal Liver Ltd.” The data and other necessary information’s were using secondary as well as primary sources of data. The researcher used various financial and statistical approaches to analyze the gathered data.

Objective:

- To examine and find out the present position of inventory management of both the companies.
- To identify the present practice of procurement of raw materials, maintenance of work in process stock and finished stock etc.

Major Finding:

- The organizations taken for study use raw material from local sources, India and other countries.
- Purchasing of raw material in UNL is fluctuated whereas DNPL management of demand and supply.

Baral (1994) has also made study regarding “Inventory Management; A case study of Gandaki Noodles Pvt. Ltd.” The main objective of his study was to highlight the company's policies and objectives, functions and activities regarding inventory management. Finally, Baral came to know that the factory is following neither economic order quantity model in its purchasing decision nor ABC analysis in inventory managements.

Objectives:

- To highlight the Co.'s policies and objectives, functions and activities regarding inventory management.
- To assess the status of companies towards utilizing inventory resources.

Major Finding:

- He came to know that the factory is following neither economic order quantity model in its purchasing decision nor ABC analyze in inventory management.
- The company could not apply the inventory management system.

Rawal (2009) has carried out a research study on “A Compare study on Inventory Management of Dairy Development Corporation and Sitaram Gokul milks Pvt.Ltd”. Rawal has collected almost all data from 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.

Objective

- To carry out a comparative analysis of the present inventory management position of DDC and Sitaram Gokul Milk Priavte Ltd.
- To examine the inventory management practice and to analyze its impact in profitability of the sampled two companies.
- To assess the status of companies towards utilizing inventory resources.

Major finding

- There is not proper and timely improvement in inventory management in Dairy Development Corporation and Sitaram Gokul Milk Private Ltd.
- The economic order quantity model is not followed in the purchasing decision by both of the companies.
- The inventory turnover ratio of the companies was not satisfactory.
- There is no significant relationship between Inventory and profit of both companies.

Chaudhary (2010) conducted a research study on “Effectiveness of Inventory Management of Dabur Nepal Pvt. Ltd.”Chaudhary has collected almost all data from secondary sources i.e. published or unpublished records of the company. He has also conducted inquiries and informal talk with the management head to gather primary data. The researcher used various financial and statistical approaches to analyze the gathered data.

Objective

- To identify the present inventory position of Dabur Nepal Pvt. Ltd.
- To know the relationship of sales and inventories.
- To know the relationship of purchase and inventories
- To identify the problem faced by the Dabur Nepal Pvt. Ltd. in the management of inventory.

Major finding

- There is no systematic and scientific system to determine ordering cost and carrying cost based on the question asked by researcher with responsible person.
- Policy and ineffective demand forecast. Demand and sales of company is fluctuating.

Adhikari (2010) conducted a research study on “Inventory Management of Nepal Oil Corporation.” Adhikari has collected almost all data from secondary sources i.e. published/unpublished records of the company. He has also conducted inquiries and informal talk with the management head to gather primary data. The researcher used various financial and statistical approaches to analyze the gathered data.

Objective

- To know the procurement procedures of NOC.
- To study the trend of purchases, sales and distribution of petroleum production in NOC.
- To know the relationship between purchase and sales.
- To study the pricing mechanism of petroleum products in NOC.
- To analyze the quality control mechanism of NOC.

Major finding

- In the NOC the economic order quantity model is not applied in the study period. The corporation has maintained the safety stock for 35 day. The safety stock is estimated roughly. Therefore it is found fluctuating.
- Problem of storage capacity also exists. Although storage capacity has been increased, it is not adequate in emergency period.
- The company has not categorized its inventories for the purpose of control and paid equal attention for all inventories held by corporation.
- Scientific tools and techniques are not used by NOC in order to forecast purchase and sales, it is prepared on adhoc basis.

Bhusal (2010) has carried out a research study on “Inventory Management of Unilever Ltd”. Bhusal has collected almost all data from primary and secondary data and information which is collected from the management through observation, informal discussion and supplementary questionnaire; it become clear that Unilever Ltd. is suffering from a number of internal and external problems in the way of inventory management.

Objective

- To examine the existing inventory system applied by ULL.
- To determine optimal inventory level of major raw materials.
- To analyze the relationship among purchase, sales and inventories.
- To examine the techniques being employed to the manager to manage the inventory of ULL.
- To identify the relationship between inventory and different components of profit planning covering production budget, purchase budget by focusing inventory policy.

Major finding

- ULL is used the bin card techniques to control the store in order to minimize the cost of holding materials. The bin cards are maintained by store keeper.
- The pricing of the issues can be determined by value as weighted average cost method at the lower cost or market price.
- The carrying cost, ordering cost, order size, safety stock maintained was unsatisfactory and unscientific. It did not give attention to the lead-time. Therefore all these functions lead to increase in total cost of the company.

2.2.2 Research Gap

In this globalized business age so many computerized software's have been launched to maintain inventory management. Beside it, so many tools and techniques were introduced to optimize cost of inventories. However, so many business houses are operating in Nepal and they are somehow managing their inventory system but maximum business houses are not implementing scientific inventory management system.

As stated above, many studies have reported that, implementation of scientific inventory management is essential in Nepalese business organization. However, there has been very little research reported on the effectiveness of inventory management. Application of scientific inventory management tools is most essential to improve the organizational effectiveness along with well trained and experienced professionals. The purpose of the present study was to explain impact on cost on account of effective use of inventory management compared to traditional inventory management.

CHAPTER-III

RESEARCH METHODOLOGY

Research methodology is the process of arriving at the solution of a problem through a planned and systematic dealing with the collection, analysis and interpretation of the facts and figures. The objectives of this study are to analyze the inventory management of Bottlers Nepal (Terai) Limited.

This chapter presents research methodology adopted in achieving the objectives stated in the earlier chapter. This chapter contains research design, population and sample, nature of data, data gathering procedure and presentation and analysis techniques.

3.1 Research Design

The research design is plan structure and the strategy for investigation research design for this study will be more analyzing in the sense that it will concentrate on analyzing the management of inventory item-wise separately, to precise its causes and effects in other areas. In other words, the research design is the plan structure and strategy for investigation of the facts in order to arrive at conclusion. The plan is the overall scheme of program of research. It includes and outlines of what the investigation will do from writing the hypothesis and their operational implication to the financial analysis of data (Wolf & Pant, 2005).

This study focuses on the quantitative aspects of effectiveness of inventory management and theoretical prescriptions are elaborated, whenever necessary. In this respect, the present study has followed the descriptive as well as analytical, approach to achieve the objectives.

This study entitles ‘Inventory Management of BNTL’ deals with procurement, sales and distribution procedure, trends of inventory management of BNTL, which were the variables under the study, so the analytical and descriptive research have been applied as research design.

3.2 Population and Sample

There are large numbers of manufacturing companies in Nepal but only one company BNTL has been selected for this study.

3.3 Nature and Sources of Data

Information is the lifeblood of any research. Secondary information has been used to achieve the objectives of this study. While secondary data were collected from the following sources.

- Studying and analyzing the annual reports of BNTL.
- Books, articles, magazine and official records of BNTL.
- Published and unpublished documents related to BNTL.

3.4 Data Gathering Procedures

Data gathering is very difficult activity of the whole research process but it is most important part of the research. Data gathering consists of obtaining information from somebody’s hand. The secondary data are directly obtained from various sources mentioned above for the purpose of data an analysis are taken form official records, published and unpublished documents, books, articles, magazines. The researcher has to make frequent visits to BNTL office in order to collect the required data from officials.

3.5 Period of Study

The study covers the period of Five years i.e.2007/08 to 2011/12 A.D.

3.6 Methods of Data Analysis

Inventory management involves determining how many inventories to hold? When to place order? How many units to order at a time? In order to achieve the organizational goal there is a need of effective inventory management system. In this study, data collected from various sources were managed, analyzed and presented in proper way including tables, figures and graphs with proper interpretation and explanation. The inventory management techniques applied in this study is Economic Order Quantity (EOQ), Re-order level, inventory turnover ratio and ABC analysis that are the part of the financial analysis. However the statistical techniques included in the study are mean, standard deviation, co-efficient of variation, Karl-Pearson's co-efficient of co-relation and trend analysis.

3.6.1 Inventory Management Tools

Inventory management tools are used to analyze the inventory management aspects of BNTL. The inventory management tools applied in the study is as follows:

A) Economic Order Quantity (EOQ)

An EOQ technique is the most important of inventory management. It attempts to establish the most economic balance between the carrying costs and ordering costs determining the quantities to be ordered. The economic order quantity is that inventory level, which minimizes the total of ordering and carrying costs. The relationship between the ordering

costs and carrying costs are called cost factor. EOQ is calculated in Rupees due to the unavailability of data in quantity.

EOQ can be determined by following way:

i. Formula Method

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

Where,

EOQ= Economic Order Quantity

A = Annual requirement

O = Ordering cost

C = Carrying cost

Thus, EOQ mainly depends on two types of costs.

ii. Table Method

$$\text{Order Size} = \frac{\text{Annual Requirement}}{\text{Number of Order}}$$

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

Total Carrying Cost = Carrying Cost per Unit × Average Inventory

Total Ordering Cost = Total Cost of an Order × Number of Order

B) Inventory Turnover (IT)

Inventory turnover is calculated to show the rate of turnover of stock. This will show how many times the stock has turned over, when the figure of number of times is going on increasing, indicating a trend that the stock is fast moving from reference point of view. This ratio should be 7 to 18 times. This ratio is worked out by dividing the COGS with the average inventory. We can write this as

$$\text{Inventory Turnover} = \frac{\text{COGS}}{\text{Average Inventory}}$$

This measures the efficiency on inventory management and how quickly inventory can be sold. It indicates the relationship between the cost of goods and the inventory level.

3.6.2 Statistical Tools

Some important statistical tools are used to achieve the objective of this study. In this study, statistical tools such as Standard deviation, Coefficient of variation, Karl Pearson's, Correlation Coefficient, Time series/Trend analysis and probable error. The brief descriptions of each of these are made below.

A) Standard Deviation (S.D.)

The standard deviation measures the absolute dispersion (or variability) of distribution. The greater the amount of dispersion (of variability) the greater the standard deviation and the greater will be magnitude of deviations of the values from their mean. A small standard deviation is extremely useful in judging the representatives of the mean. In this study standard deviation of ratios of both the public Enterprise has been

calculated to analyze the dispersion of BNTL Standard Deviation (S.D.) is defined as the positive square root of the mean of the square of the deviations taken from the arithmetic mean. It is denoted by σ .

$$\text{S.D.}(\sigma) = \sqrt{\frac{\sum (X - \bar{X})^2}{N - 1}}$$

Where,

X = Value of Observation.

\bar{X} = Mean of Observations.

N = No. of observations

B) Coefficient of Verification (C.V.)

The standard deviation as stated above is an absolute measure of dispersion; the corresponding relative measure is known as the coefficient of variation. It is used in such problems where we want to compare the variability of two or more series. The series for which the coefficient of variation is greater, is said to be more variable or conversely less consistent, less uniform, less stable or less homogeneous and vice versa. Since the present study is related with the two series of ratios of corresponding manufacturing public enterprises, coefficient of variation has been calculated to compare the variability of the series of ratios. The formula used for determining the coefficient of variation is as follows:

$$\text{Coefficient of Variation (C.V.)} = \frac{\text{S.D.}}{\text{Mean}} \times 100 \%$$

C) Karl Pearson's Correlation Coefficient

This method popularly known as Pearson's coefficient of correlation is widely in practice. This is a mathematical method of measuring the degree of association between two variables say x and y.

According to the Karl Pearson's, correlation coefficient is calculated as follows:

$$r = \frac{N\Sigma xy - \Sigma x.\Sigma y.}{\sqrt{N\Sigma x^2 - (\Sigma x)^2} \sqrt{N\Sigma y^2 - (\Sigma y)^2}}$$

CHAPTER-IV

PRESENTATION AND ANALYSIS OF DATA

The basic objective of this study is to analyze present practice of inventory management system of BNTL. To achieve the said objective, collected data are analyzed in this chapter by applying inventory management tools and technique.

On the basis of official recorded data of BNTL, the researcher has tried to explore the existing problems of inventory management and control system. The researcher has made analysis and diagnosis of the collected data to provide the suggestions and recommendations to the BNTL.

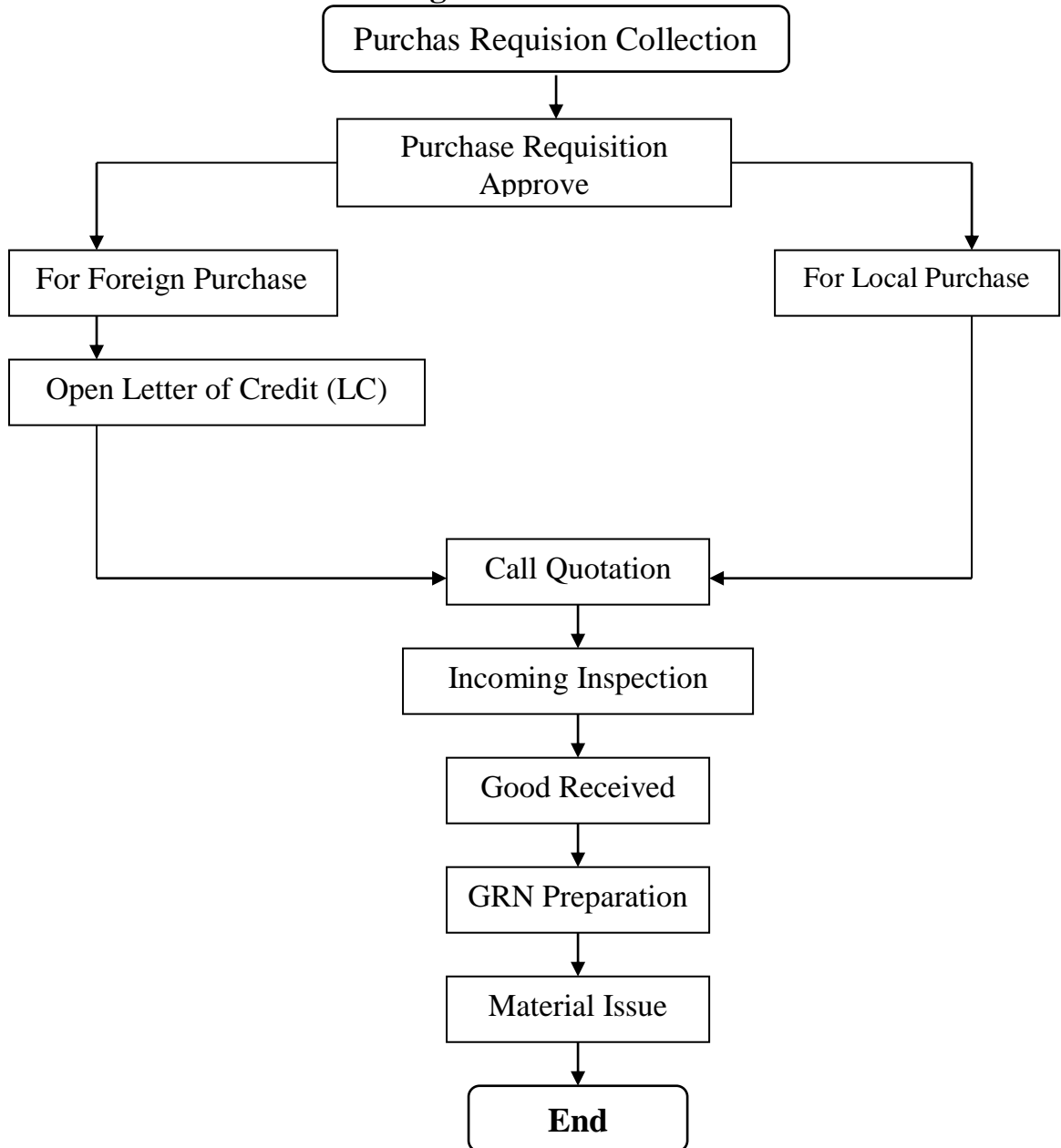
4.1 Purchasing Procedure Practice in BNTL.

BNTL is a manufacturing company so; purchasing is the first important function of inventory management. Manufacturing company requires different types of raw materials such as Crown Cock, Closure, Sugar etc. for the production of different types of soft drinks.

BNTL needs regular supply of different types of raw materials for the continuous production operation. In purchasing procedure, a purchasing manager does different types of activities, which are important in production.

Figure 4.1

Purchasing Procedure in BNTL



A) Collection of Purchase Requisition

Purchasing procedure starts immediately with the collection of purchase requisition from the respective department for the supply of essentials.

B) Approval of Purchase Requisition

When the purchase requisition is received by the purchasing departments, then purchasing manager decides what, when and how much to buy.

Once the concerned department experiences the deficit of raw materials, it fills the purchase requisition form. Store departments check the availability of that raw material in store. If it is available in sufficient quantity at the store then the process is canceled at this stage. But if not it will be further proceed to finance department and then to general manager for its approval. Finally purchase department will be prepared for purchase of the goods.

C) Opening of Letter of Credit (LC)

It is generally applicable for import of materials from foreign countries. Opening of LIC starts with the request for Performa invoice to the bank. After receiving such Performa invoice, it will be submitted to concern bank along with LC opening form. At the end the bank provides LC approval.

D) Purchase Order

Purchasing is the first important function of inventory management in any manufacturing company. So, BNTL also requires different types of raw materials such as Crown Cock, Chemicals, Closure, Sugar etc. for the production.

BNTL needs regular supply of different types of raw materials and WIP materials for the continuous production operation. Approval of purchase requisition now leads to call for quotation so that the given quality and quantity of materials could be supplied at the minimum possible cost. If

any dissatisfaction arises during verifying and checking for specification of goods quotation will be re-called otherwise purchase order will be issued to qualified suppliers specifying the delivery time and then store will be informed for date and quantity of goods arrival.

E) Incoming Inspection

Once the incoming material is received along with the bills by the store, the concerned department has to be informed for quantity inspection. The responsibility of verifying the weight, count or measurement is that of the receiving department, but the responsibility to see whether that goods have been received according to purchase order specifications, is that of the inspection department. Therefore, the concerned department then checks the incoming materials, which must be taken to ensure the correct material of specified quality at correct amount.

F) Goods Receiving

Once the incoming goods are accepted after inspection for its quality and quantity, they are received. After receiving the goods from purchase the related departments have to be informed for its acceptance. Then it finally will go to storage form where the concerned department acquires as per it needs.

4.2 Store Control Device

Store keeping function includes the function of keeping the materials in the store and keeping their movements. The cost of materials holding in the store directly affects the total cost associated with holding inventories. To minimize the cost of holding materials in the store, all company generally use different types of controlling device. Some of the store

control device adopted by BNTL is Bin cards, Store Ledger and ABC analysis. The brief descriptions of these are presented as follows.

4.2.1 Bin Cards

A bin card makes a record of the receipts and issue of materials and it is kept for each item of stores carried. The storekeepers maintain these cards and he is responsible for any difference between the physical stock and the balance shown in the bin card. These cards are used not only for recording receipts and issues of stores but also assist the storekeepers to control the stock. Bottlers Nepal Terai Limited (BNTL) is using the bin cards in the form of loose sheets to keep the complete records of the receipts and issues of each item of material in terms of quantity as well as balance quantity.

For each item of store, minimum quantity, maximum quantity and ordering quantity are stated on the card. By seeing the bin card the storekeeper can send the material requisition for the purchase of material in time.

4.2.2 Store Ledger

This ledger is kept in the costing department and it is identical with bin card except that receipts issues and balanced are shown along with their money values. This contains an account for every item of stores and makes a record of the receipts issues and the balances, both in quantity and value. Thus, this ledger provides the information for the pricing of materials issued and the monetary value of any time of each item of stores.

4.2.3 ABC analysis

ABC analysis is a widely use classification technique to identify various items of inventory for the purchase of inventory control. This analysis is important that a firm should not exercise the small degree of control on all types of inventory. We have to classify of all types of raw materials on the basis of nature and involve the investment and importance of it. Manufacturing organization finds it useful to divide materials into three categories for the purpose of exercising selective control of materials. ABC analysis measures the cost significance of each item of materials may contribute to a larger percentage of the value of consumption and on the other hand a large percentage of items may represent a smaller percentage of the value items consumed. Between these two extremes will fall those items the percentage is more or less equal to their value of consumption. Thus, items falling in the first category are treated as ‘A’ second category as ‘B’ and third category is taken as ‘C’. Such analysis of materials is known as ABC analysis.

BNTL has not classified the material in different groups for control purpose. It is seen that company has given equal attention to high value and critical materials as well as less value and non-critical materials. This attitude leads to increase the holding cost of inventory and investment of inventory.

4.3 Inventory Valuation

Inventories are valued at the lower cost and net realizable value, after making due allowance for obsolete and slow moving items. Net realizable value is the price at which inventories can be sold in the ordinary course of business less the estimate cost of completion and the cost necessary to make the sale.

The cost incurred in bringing inventories to its present location and condition is accounted as follows:

Raw material – At actual cost on FIFO

Finish goods – At the cost of direct material, direct labor and an appropriate proportion of fixed production overheads.

Consumable and Spares – At actual cost on weighted basis.

Advertising materials – At actual cost on weighted basis.

Store, spares and loose tools – At actual cost on weighted basis.

Goods in Transit – At actual cost. (*Source: Annual Report of BNTL*)

4.4 Relation between Sales and Inventory

The table 4.1 shows the relationship between sales and Inventory. The table gives the picture of sales and Inventory from FY 2007/08 to 2011/12.

Table 4.1 shows that sales were increased over the period but inventory was not that trend. It was increased in first year but decreased slightly in second year and after then increased over the period up to FY 2011/12. During the period the lowest inventory was 69.427million in FY 2008/09 and highest inventory was 183.405million in FY 2011/12. However, change in both variables is not well defined; there is intermittent rise and fall in both variables during the five years. The table also depicted that the increase sales resulted into increase in inventory. This may be due to lower purchase to meet the lower projected demand.

Table 4.1

Relation between Sales and Inventory (Rs in Million)

Year	Sales(Rs)	Inventory(Rs)
2007/08	475.109	74.537
2008/09	621.174	69.427
2009/10	845.258	85.677
2010/11	954.009	124.632
2011/12	1155.473	183.405
Average	810.2	107.5
Standard Deviation (σ)	240.47	42.57
Coefficient of Variation (C.V.)	29.68%	39.6%
Correlation coefficient (r)	0.9	

Source: Annual Report of BNTL and Appendix 2

Mean, standard deviation and coefficient of variation are calculated to analyze the nature of variability of sales and inventory. The average sale of BNTL for given five years was Rs810.2million. The average inventory of BNTL for given five years was Rs 107.5 million. Standard deviation was 240.47 and 42.57 for sale and inventory respectively. This signifies show that inventory is more consistent compared to sales. But C.V. indicates that inventory fluctuates more than the sales.

Coefficient of correlation for these two variables was +0.9. Here highly positive sign indicates the highly positive relation between sales and inventory. We know that if the value lying between 0.5 to 0.9 prove a

high degree of positive correlation. Table 4.1 also presents the calculation of mean, standard deviation, coefficient of variation and coefficient of sales and inventory.

Testing of significant of calculated r

$$\text{Probable error of } r = 0.6745 \times \frac{1-r^2}{\sqrt{n}}$$

$$= 0.6745 \times \frac{1-0.9^2}{\sqrt{5}}$$

$$\text{P E (r)} = 0.095$$

$$\text{Now, } 6 \times \text{P E (r)}$$

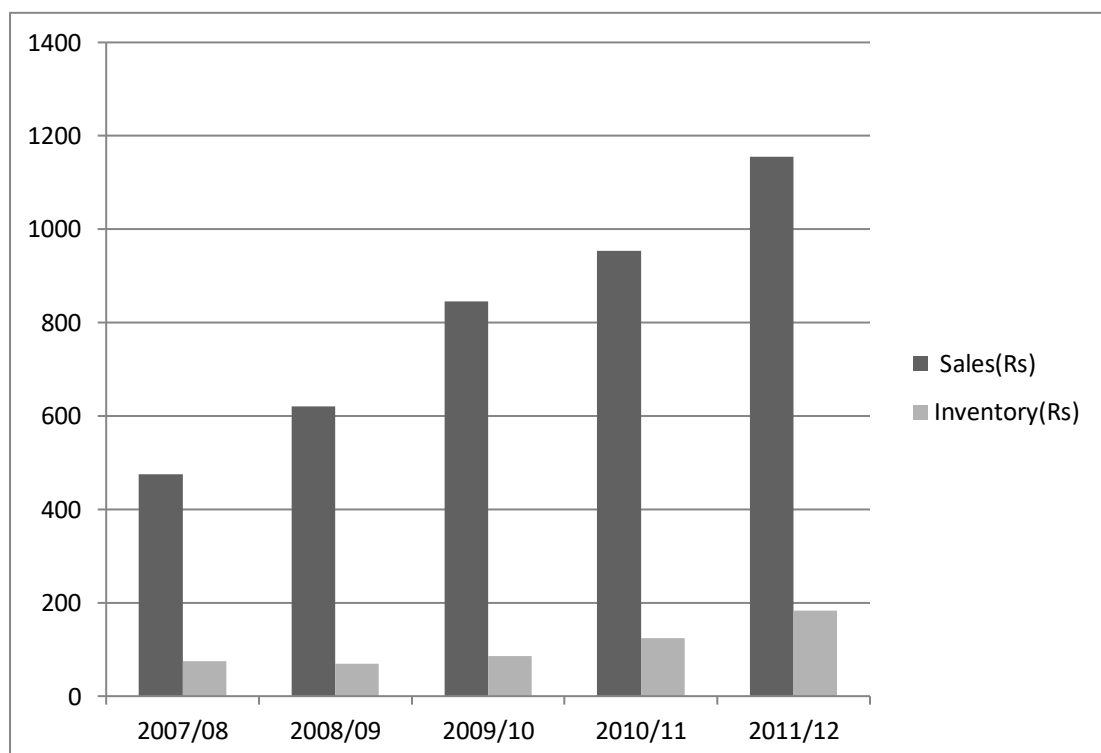
$$= 6 \times 0.095$$

$$= 0.57$$

Here, $r > 6 \times \text{P E (r)}$. This shows that calculated value of correlation coefficient is significant.

Figure No. 4.2

Relation between Sales and Inventory (Rs in million)



The above figure 4.2 shows that sales and inventory was increasing trend. That indicates, company enhanced its production capacity. Sales were increasing rapidly than inventory.

4.5 Relation between profit and Inventory

The table 4.2 shows the relationship between profit and Inventory. The table gives the picture of profit and Inventory from FY 2007/08 to 2011/12.

The table shows that in FY 2007/08 inventory was Rs 74.537 Million and in the same year, the company accrued Rs. 13.818 Million profit. From FY 2007/08 to FY 2011/12 net profit is in increasing trend.

Table 4.2 shows that profit which was increased over the period but inventory was not that trend. It was increased in first year but decreased slightly in second year and after then increased over the study period.

However, change in both variables is not well defined; there is intermittent rise and fall in both variables during the five years.

Table 4.2
Relation between profit and inventory (Rs in Million)

Year	Profit(Rs)	Inventory(Rs)
2007/08	13.818	74.537
2008/09	78.585	69.427
2009/10	133.179	85.677
2010/11	146.995	124.632
2011/12	206.923	183.405
Average	115.9	107.5
Standard Deviation (σ)	65.36	42.57
Coefficient of Variation (C.V.)	56.39%	39.6%
Correlation coefficient (r)	0.85	

Source: Annual Report of BNTL and Appendix 3

Mean, standard deviation and coefficient of variation are calculated to analyze the nature of variability of profit and inventory. The average profit of BNTL for given five years was Rs115.9 million. The average inventory of BNTL for given five years was Rs 107.5 million. Standard deviation was 65.36 and 42.57 for profit and inventory respectively. This signifies show that inventory is more consistent compared to profit. But C.V. indicates that Profit fluctuates more than the inventory.

Coefficient of correlation for these two variables was +0.85. Here highly positive sign indicates the highly positive relation between profit and inventory. We know that if the value lying between 0.5 to 0.9 prove a high degree of positive correlation. Table 4.2 also presents the calculation of mean, standard deviation, coefficient of variation and coefficient of profit and inventory.

Testing of significant of calculated r

$$\text{Probable error of } r = 0.6745 \times \frac{1-r^2}{\sqrt{n}}$$

$$= 0.6745 \times \frac{1-0.85^2}{\sqrt{5}}$$

$$P E (r) = 0.1387$$

$$\text{Now, } 6 \times P E (r)$$

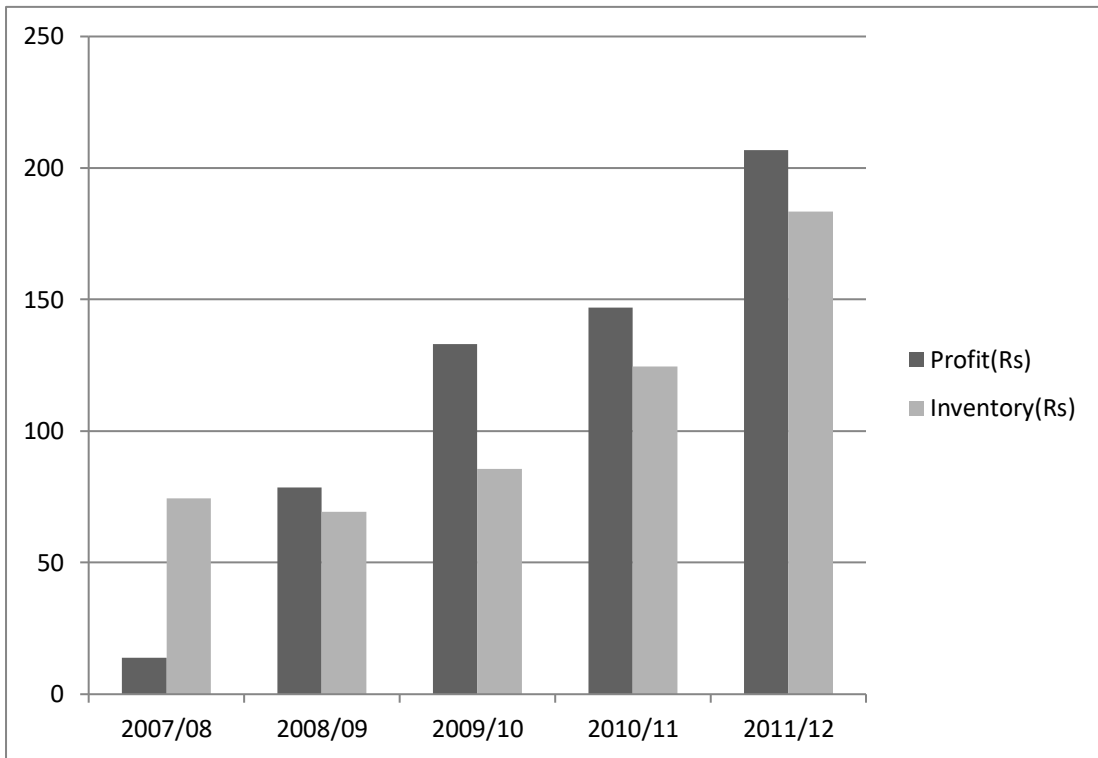
$$= 6 \times 0.1387$$

$$= 0.83$$

Here, $r > 6 \times P E (r)$. This shows that calculated value of correlation coefficient is significant.

Figure No. 4.3

Relation between Profit and Inventory (Rs in million)



The figure 4.3 shows relation between profit and inventory. Net profit and total inventory is increasing trend. That indicates, company enhanced its production capacity.

4.6 Relation between Total assets and Inventory.

The table 4.3 shows the relationship between total assets and inventory. The table gives the picture of Total assets and inventory from FY 2007/08 to 2011/12. Inventory is important components of total assets so that total assets are depend into inventory. Total assets and inventory have important relationship. Total assets will increase, If inventory increase.

The table 4.3 shows that in FY 2007/08 total assets was Rs436.227 Million and in the same year, the company had Rs. 74.537 million inventory, and from FY 2007/08 to FY 2011/21 Total assets was in

increasing trend but inventory was not that trend. It was increased in one year but decreased slightly in second year and after then increased over the study period. However, change in both variables was not well defined; there is intermittent rise and fall in both variables during the five years.

Table 4.3

Relation between Total assets and inventory (Rs in Million)

Year	Total Assets(RS)	Inventory(Rs)
2007/08	436.227	74.537
2008/09	654.951	69.427
2009/10	889.830	85.677
2010/11	1079.917	124.632
2011/12	1506.068	183.405
Average	913.39	107.5
Standard Deviation (σ)	367.2	42.57
Coefficient of Variation (C.V.)	40%	39.6%
Correlation coefficient (r)	0.94	

Source: Annual Report of BNTL and Appendix 4

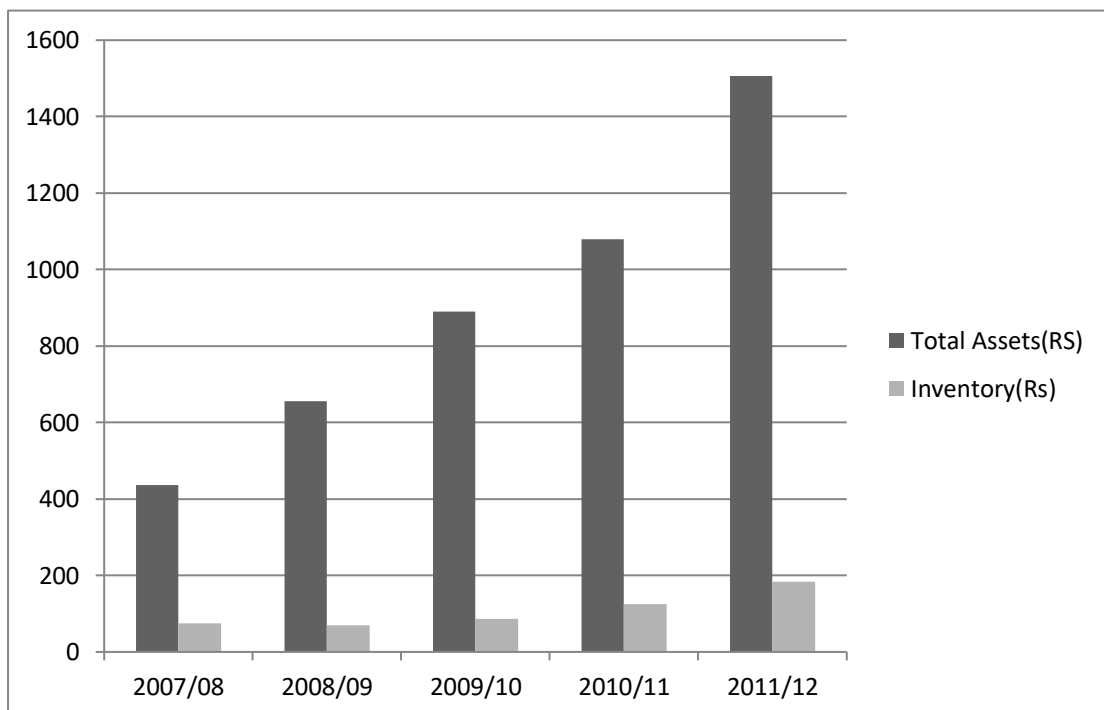
Mean, standard deviation and coefficient of variation are calculated to analyze the nature of variability of total assets and inventory. The average total asset of BNTL for given five years was Rs 913.39 million. The average inventory of BNTL for given five years was Rs 107.5 million. Standard deviation was 367.2 and 42.57 for Total assets and inventory respectively. This signifies show that inventory is more consistent

compared to Total assets. A coefficient of variable was 40% and 36.6% for Total assets and inventory. C.V. indicates that total assets fluctuate more than the inventory.

Coefficient of correlation for these two variables was +0.94. Here highly positive sign indicates the highly positive relation between total asserts and inventory. We know that the value lying between 0.5 to 0.99 prove a high degree of positive correlation. Table 4.3 also presents the calculation of mean, standard deviation, coefficient of variation and coefficient of Total Assets and Inventory.

Figure No. 4.4

Relation between Total Assets and Inventory (Rs in million)



The above figure 4.4 shows that total assets and total inventory was increasing trend. That indicates, company enhanced its production capacity. Total assets were increasing rapidly than total inventory.

4.7 Annual Requirement and Annual Purchase of Raw materials

Table 4.4 shows the annual requirement and annual actual purchase of raw materials made by the company from FA 2007/08 to 2011/12. Here, there was increasing trend both annual requirement and annual purchase of raw materials for the given year. The annual requirements of raw materials of whole five years show that there was increasing trend. Similarly, annual purchase of raw material made by the company has also shown increasing trend.

Table 4.4

Annual Requirement and Annual Purchase of Raw Material (Rs in Million)

Year	Annual Requirement ((Rs)	Annual Purchase ((Rs)	% Change
2007/08	182.895	152.892	16.4
2008/09	234.326	251.464	(7.3)
2009/10	295.09	303.727	(2.9)
2010/11	333.625	338.066	(1.33)
2011/12	378.124	378.804	(0.18)
Average	284.812	284.99	-
Standard Deviation (σ)	69.327	78.157	-
Coefficient of Variation (C.V)	24.34%	27.42%	-
Correlation Coefficient	0.98		-

Source: Annual Report of BNTL and Appendix 5

From above table 4.4, we compared between annual requirement of raw material and annual purchase of raw materials, we can see annual purchase of raw material always exceeded than annual requirement of raw material over the period excepted for the FY 2007/08. In the FY 2007/08, annual require of raw material exceed then annual purchase of raw material. In FY 2007/08, annual requirement of raw material were exceeded 16.4%.

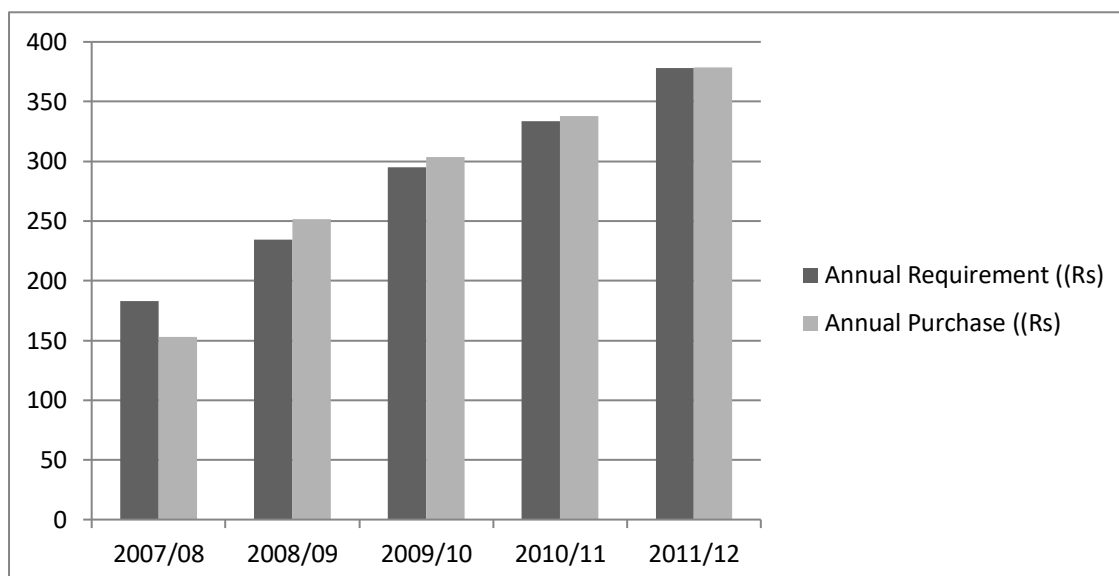
Mean, standard deviation and coefficient of variation are calculated to analyze the nature of variability of annual requirement and annual purchase. The average annual requirement of BNTL for five years was 284.812 and other annual purchase was 284.99. Standard deviation for annual requirement and annual purchase of raw material was found 69.327 and 78.157 respectively. This signifies that annual requirement was more consistent compared to annual purchase. C.V for annual requirement and annual purchases of raw material was found 24.34% and 27.42% respectively. In short we concluded that annual requirement is more reliable than annual purchase.

Coefficient of correlation for these two variables was +0.98. Here highly positive sign indicates the highly positive relation between annual requirement and annual purchase of raw material.

Figure No. 4.5

Annual Requirement and Annual Purchase of Raw Material

(Rs in million)



The above figure 4.5 shows that raw material requirement and purchase in the company was slightly different. From FY 2008/09 raw material purchase is more than raw material requirement. It indicated that the company has sound planning or forecasting of raw material. It helps to minimize production cost.

4.8 Relation between Inventory of Raw material and Total Inventory

Table 4.5

Proportion of Inventory of R/M on Total Inventory (Rs in million)

Year	Raw material(Rs)	Total Inventory(Rs)	% of Raw material on Total Inventory
2007/08	20.129	74.537	27
2008/09	37.125	69.427	53.4
2009/10	45.433	85.677	53
2010/11	48.859	124.632	39.2
2011/12	49.588	183.405	27
Average	40.226	107.535	39.9

Source: Annual Report of BNTL.

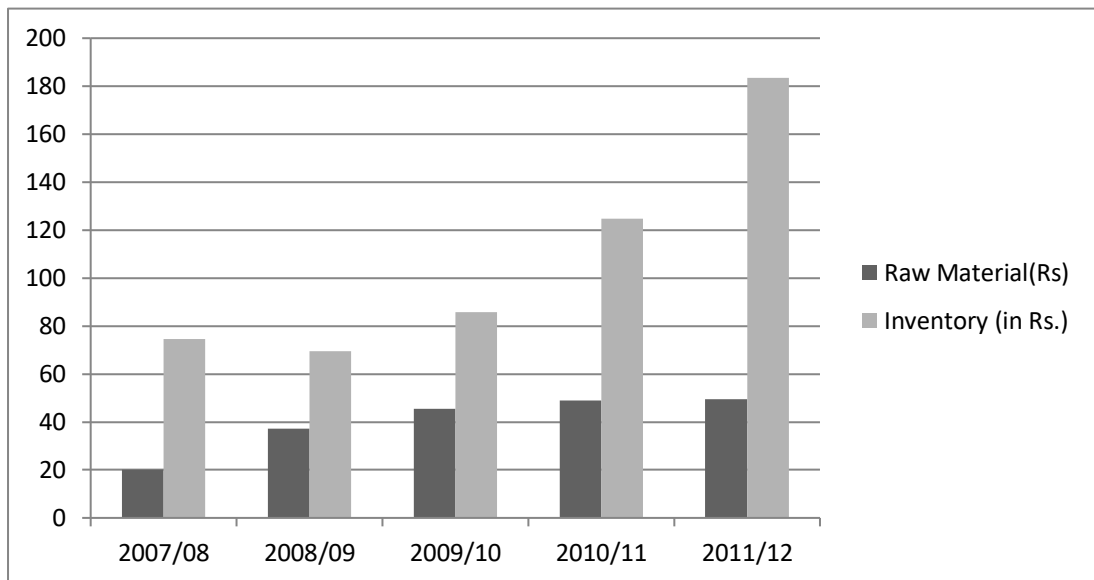
The above table 4.5, shows that, the percentage of raw material on total inventory during the study period were 27% in the FY 07/08, 53.4% in the FY 08/09, 53% in the FY 09/10, 39.2% in the FY 10/11 and 27% in the FY 11/12.

The average inventory of the overall study period was Rs.107.535Million, the average inventory of raw material of the overall study period was Rs.40.226 million and the average percentage of R/M in total inventory of the overall study period was 39.9%.

Figure No. 4.6

Relation between Inventory of R/M and Total Inventory

(Rs in million)



The above figure 4.6 shows that raw material consumption in the company was increasing trend. Demand of production is increasing day to day, so that parching of raw material increased at the result inventory of raw material was increasing trend.

4.9 Relations between Inventory of WIP and Total Inventory

Table 4.6

Proportion of Inventory of WIP on Total Inventory (Rs in Million)

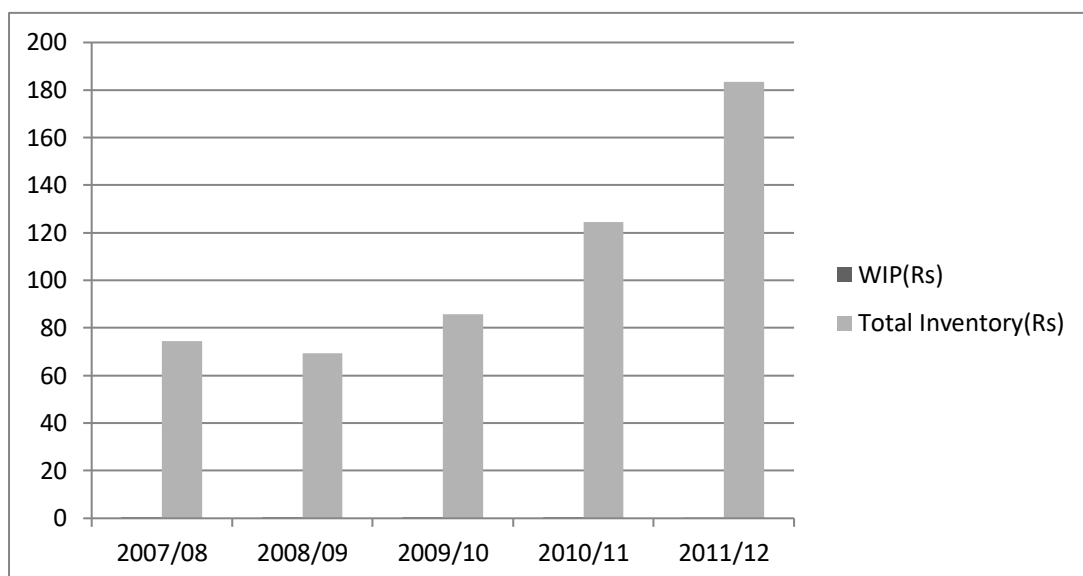
Year	WIP(Rs)	Total Inventory(Rs)	% of WIP on Total Inventory
2007/08	0.47	74.537	0.6
2008/09	0.612	69.427	0.8
2009/10	0.505	85.677	0.5
2010/11	0.613	124.632	0.4
2011/12	-	183.405	-
Average	0.44	107.535	0.5

Source: Annual Report of BNTL.

The above table 4.6 shows that the percentage of WIP on total inventory during the study period was 0.6% in the FY 07/08, 0.8% in the FY 08/09, 0.5% in the FY 09/10, 0.4% in the FY 10/11 and there was no WIP in the fiscal year 11/12.

The average percentage of WIP on the total inventory of the overall study period was 0.5%. Similarly, average inventory of the overall study period was Rs 107.535 million, the average WIP of the overall study period was Rs 0.44 million.

Figure 4.7
Relations between Inventory of WIP and Total Inventory
(Rs in Million)



From the above figure 4.7 analysis, it is observed that WIP of the company are fluctuating during the study period. Such fluctuation in inventory position is not considered as good from the point of view of inventory management. Fluctuation in demand and sales of company products, lack of appropriate inventory policy and ineffective demand forecast were the main reasons of such fluctuation

4.10 Relation between Inventory of Finished Goods and Total Inventory

Table 4.7
Proportion of Inventory of Finished Goods on Total Inventory
(Rs. in Million)

Year	Finished Goods(Rs)	Total Inventory(Rs)	% of Finished goods on Total Inventory
2007/08	4.488	74.537	6
2008/09	1.202	69.427	1.7
2009/10	0.015	85.677	0.01
2010/11	9.664	124.632	7.7
2011/12	7.032	183.405	3.8
Average	4.48	107.535	3.8

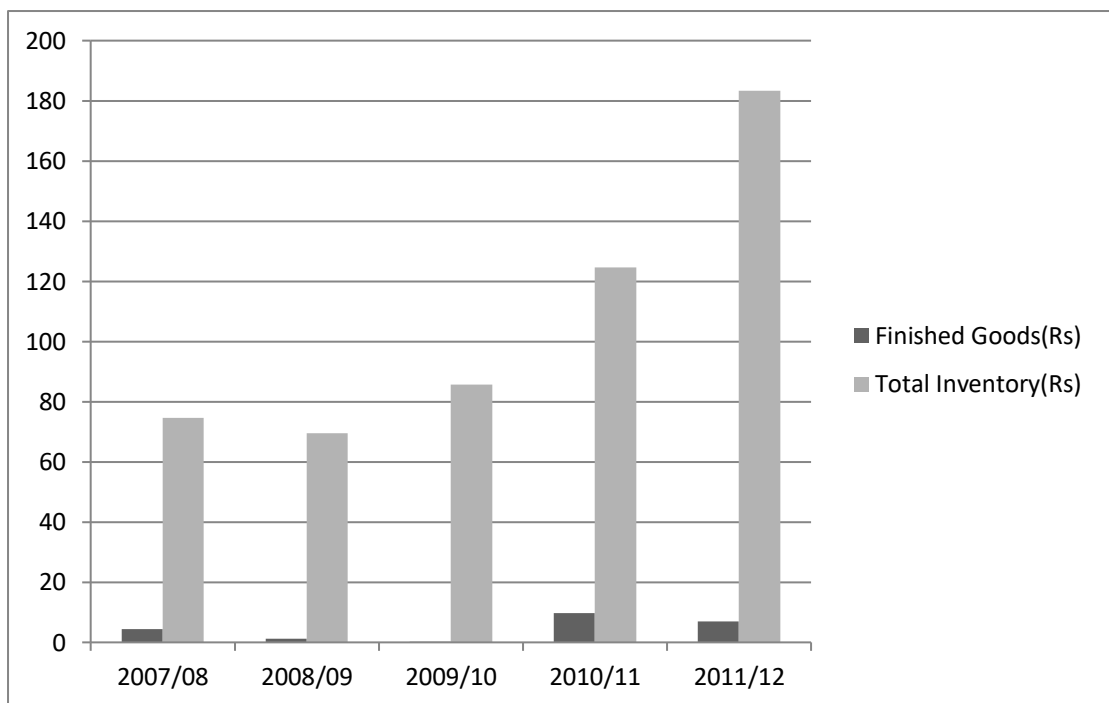
Source: Annual Report of BNTL.

The above table 4.7 shows that the percentage of finished goods on total inventory during the study period was 6% in the FY 07/08, 1.7% in the FY 08/09, 0.01% in the FY 09/10, 7.7% in the FY. 10/11 and 3.8% in the FY 11/12.

When as the average percentage of finished goods inventory in total inventory in overall study period was 3.8%. Similarly, average inventory of the overall study period was Rs 107.535 million, average inventory of finished goods of the overall study period was Rs 4.48 million.

Figure 4.8

**Relation between Inventory of Finished Goods and Total Inventory
(Rs in Million)**



The above figure 4.8 shows that the total inventory was increasing from the FY 2007/08 to 2011/12. But In the inventory of finished goods was highly fluctuation. Fluctuation of demand and sales of the company was the main reason of such situations.

4.11 Relation between Inventory of Stores & spare parts and total inventory

Table 4.8

**Proportion of Inventory of Stores & Spare Parts on Total Inventory
(Rs In Million)**

Year	Store & spare parts(Rs)	Total Inventory(Rs)	% of Store & Spare parts on Total Inventory
2007/08	30.409	74.537	40.7
2008/09	29.245	69.427	42.1
2009/10	21.315	85.677	24.8
2010/11	27.227	124.632	21.8
2011/12	27	183.405	14.7
Average	27.	107.535	28.8

Source: Annual Report of BNTL.

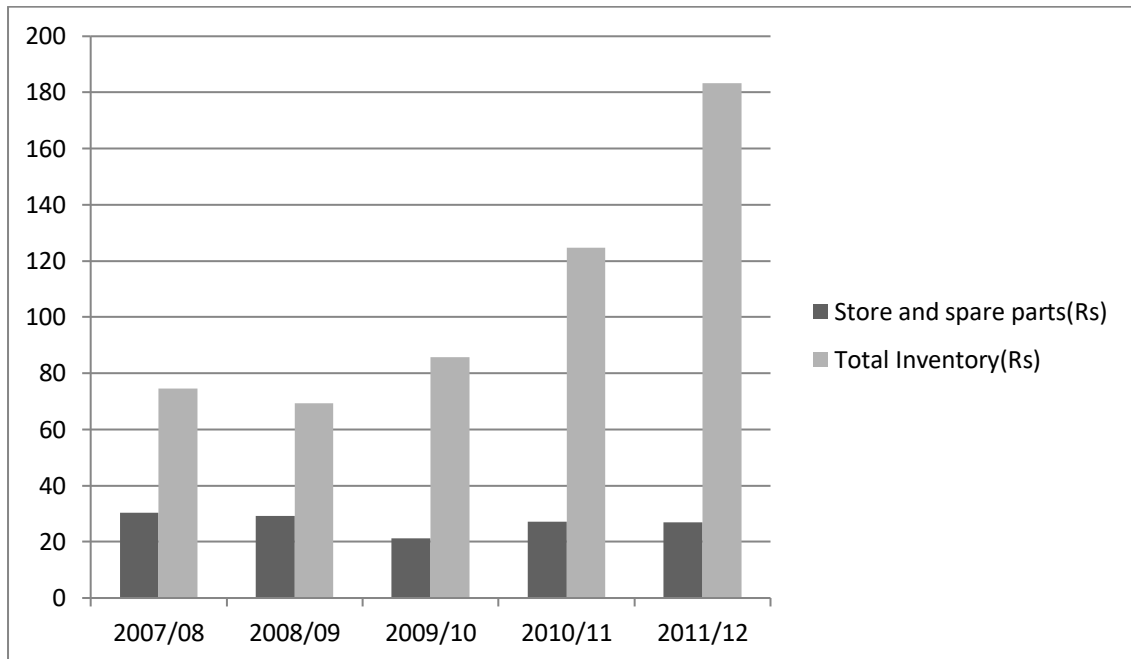
Stores and spares parts are not directly entered production. It facilitates the smooth production process. Stores and spare parts are comparatively less and don't require significant investment.

The above table 4.8 shows that the percentage of stores and spare parts on total inventory during the study period were 40.7% in the FY 07/08, 42.1% in the FY 08/09, 24.8% in the FY 09/10, 21.8% in the FY 10/11 and 14.7% in the FY 11/12.

When as, the average percentage of stores and spare parts inventory on total inventory of the overall study period was 28.8%. Similarly, average total inventory in overall study period is RS 107.535 million, average inventory of stores and spare parts of the overall study was R s27.039 million.

Figure 4.9

**Relation between Inventory of Stores & Spare Parts and Total Inventory
(Rs. In Million)**



The above figure 4.9 shows that, the quantity of stores and spare parts used by the company was irregular during the study period. Since the company's production is totally dependent on stores and spare parts, it obviously fluctuates over the study period.

4.12 Inventory Turnover

Inventory turnover measures the activity or liquidity of firm's inventory. The company should maintain optimum level of inventory for the production of good inventory management. This measures the efficiency on inventory management and how quickly inventory can be sold. It indicates the relationship between the cost of goods and the inventory level.

Table 4.9
Inventory Turnover of BNTL

(Rs. in million)

Year	Sales (Rs.)	Inventory (Rs.)	Inventory turnover ratio (Times)	% deviation on average inventory turnover ratio
2007/08	475.109	74.537	6.37	(18.6)
2008/09	621.174	69.427	8.94	14.3
2009/10	845.258	85.677	9.86	26
2010/11	954.009	124.632	7.65	(2.2)
2011/12	1155.473	183.632	6.30	(19.5)
Average	810.2	107.5	7.824	-

Source: Annual Report of BNTL

The above table 4.9 shows that in the FY 09/10 the inventory turnover ratio was highest i.e. 9.86 times. So, in this year, low level of inventory was kept in the company due to fast consumption and sales of raw materials and finished goods. In the FY 11/12, the inventory turnover ratio was the lowest, i.e. 6.30 times. Similarly, in these years, the highest negative deviation from the average of inventory turnover ratio was (19.5%), which indicates the slow consumption of raw material or low utilization of raw material, WIP materials and low sales of finished goods. The average inventory turnover for the study period was 7.823 times.

4.13 Inventory Conversion Period

The inventory conversion period measures the length of time required to convert materials in to finished goods and then to sell those goods. It is the amount of time the products remains in inventory in various stages of

production. The table 4.10 shows the inventory conversion period of BNTL for the study period of five FY 2007/08 – 2011/12. The table 4.10 shows the inventory conversion period on days. The inventory conversion period of the company FY 2007/08 was 107 days, it was decline to 76 days for the FY 2008/09 and 2009/10 respectively. Again, there was increase inventory conversion period for the FY 2010/11 resulted into the conversion period of 89 days. The highest conversion days recorded for the entire study period was for the FY 2011/12 with 126 days. The average conversion period for the study period was 95 days. It means that average length of time required converting materials into finished goods and then the sell those goods required 95 days.

Table 4.10
Inventory Conversion Period of BNTL

(Rs. In Million)

Year Conversion	Inventory	COGS	Days in year	Inventory Period (in days)
2007/08	74.537	250.803	360	107
2008/09	69.427	326.514	360	76
2009/10	85.677	406.073	360	76
2010/11	124.632	447.92	360	89
2011/12	183.405	523.618	360	126
Average				95

Source: Annual Report of BNTL.

4.14 Inventory Management and Control Techniques

Economic order quantity (EOQ)

The optimal level of raw material has been determined by the application of “Economic Order Quantity” model. EOQ can be calculated by using three methods.

- i) Formula method,
- ii) Tabular method (trial and error method)
- iii) Graphical method.

4.14.1 Calculation of EOQ of the FY 2007/08

Formula Method

On the basis of company's records, the following data are available:

Annual requirement (A) = 343000 liters

Ordering cost per order (O) = Rs. 135000

Carrying cost per liter (C) = Rs. 9/liter,

$$\therefore \text{EOQ} = \sqrt{\frac{2AO}{C}} = \sqrt{\frac{2 \times 343000 \times 135000}{9}} = 101440 \text{ liters}$$

$$\therefore \text{EOQ} = 101440 \text{ liters}$$

$$\therefore \text{No. of order} = \frac{\text{Annual Requirement}}{\text{EOQ}} = \frac{343000}{111440} = 3.38 \approx 3 \text{ times}$$

From the above calculation, the EOQ was 1101440 liters under the formula method, which minimize the total ordering and carrying cost with the no. of order 3 times a year. Which is also clear the following tabular method.

Table 4.11

EOQ of the FY 2007/08

No. of Order	Order Size (liters)	A. Inventory (liters)	Total C. C. (Rs.)	Total O.C. (Rs.)	Total Cost (Rs.)
1	343000	171500	1543500	135000	1678500
2	171500	85750	771750	270000	1041750
3	114333	57166	514498	405000	919198
4	85750	42875	385875	540000	925875

Source: Annual Report of BNTL

The above table 4.11 shows that the carrying cost was decreasing and ordering cost was increasing with the increasing number of order. The table shows that minimum total inventory cost of R/M was Rs. 919198 whereas the total carrying cost was RS 514498 and total ordering cost was Rs. 405000 with the no. of order was 3 times per year. So, it is clear that, if the company wants to minimize total inventory cost of R/M it should order only 3 times during the year.

So, it becomes clear from formula as well as tabular method, that the company should order 3 times during the year.

4.14.2 Calculation of EOQ of the FY 2008/09

Formula Method

Annual requirement (A) = 449000 liters

Ordering cost per order (O) = Rs. 115000

Carrying cost per liter (C) = Rs. 8/liter

$$\therefore \text{EOQ} = \sqrt{\frac{2AO}{C}} = \sqrt{\frac{2 \times 449000 \times 115000}{8}} = 113617 \text{ liters}$$

$$\therefore \text{EOQ} = 113617 \text{ liters}$$

$$\therefore \text{No. of order} = \frac{\text{Annual Requirement}}{\text{EOQ}} = \frac{449000}{113617} = 3.95 \approx 4 \text{ times}$$

From the above calculation, the EOQ was 113617 liters under the formula method, which minimize the total ordering and carrying cost with the no. of order 4 times a year. Which is also clear the following tabular method.

Trial and Error Method

Table 4.12

EOQ of the FY 2008/09

No. of order	Order Size (liters)	A. Inventory (liters)	Total C.C (Rs.)	Total O.C.	Total Cost (Rs.)
1	449000	224500	1796000	115000	1811000
2	224500	112250	898000	230000	1128000
3	149667	74833	598664	345000	943664
4	112250	56125	449000	460000	909000
5	89800	44900	359200	575000	934200

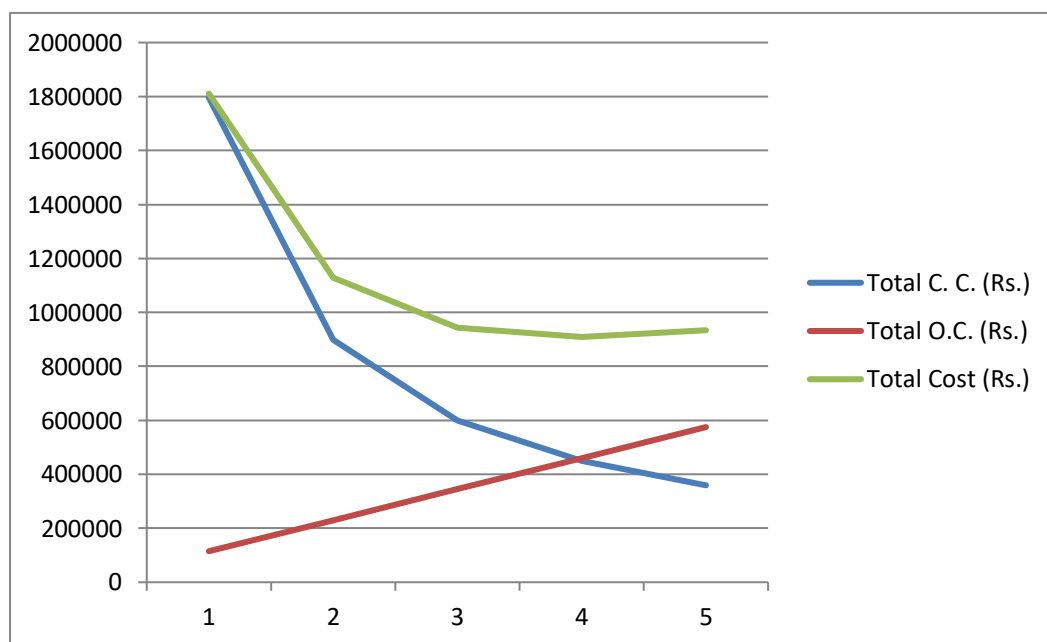
Source: Annual Report of BNTL

The above table 4.12 shows that the carrying cost was decreasing and ordering cost was increasing with the increasing number of order. The table shows the minimum total inventory cost of R/M was Rs. 909000 whereas the total carrying cost was RS 449000 and total ordering cost was Rs. 460000 with the no. of order was 4 times a year. So, it is clear that, if the company wants to minimize total inventory cost of R/M, it should order only 4 times during the year.

Graphic Method

Under this method carrying and ordering cost are plotted in graphs and the point, where carrying cost and ordering cost is equal that quantity is taken as EOQ.

Figure 4.10
Graphic Presentation of EOQ of the FY 2008/09



The above figure 4.10 shows, OX axis denotes the no. of orders and OY axis denotes the total cost of ordering and carrying. Ordering cost is going up and carrying cost is going downward. When ordering size is increasing, the carrying cost is decreasing and ordering cost is increasing. The point where the ordering cost curve and carrying cost curve intersect each other is economic order point. So, it becomes clear from the formula, tabular method as well as graphical method, the company should order 4 times during the year.

4.14.3 Calculation of EOQ of the FY 2009/10

Formula Method

Annual requirement (A) = 611000 liters

Ordering cost per order (O) = Rs. 140000

Carrying cost per liter (C) = Rs. 8.70/liter,

$$\therefore \text{EOQ} = \sqrt{\frac{2AO}{C}} = \sqrt{\frac{2 \times 611000 \times 140000}{8.7}} = 140230 \text{ liters}$$

$$\therefore \text{EOQ} = 140230 \text{ liters}$$

$$\therefore \text{No. of order} = \frac{\text{Annual Requirement}}{\text{EOQ}} = \frac{611000}{140230} = 4.35 \approx 4 \text{ times}$$

From the above calculation, the EOQ was 140230 liters under the formula method, which minimized the total ordering and carrying cost with the no. of order 4 times a year. Which is also clear the following tabular method.

Trial and Error Method

Table 4.13
EOQ of the FY 2009/10

No. of Order	Order Size (liter)	A.Inventory (liter)	Total C.C. (Rs.)	Total O.C. (Rs.)	Total Cost (Rs.)
1	611000	305500	2657850	140000	2797850
2	305500	152750	1328925	280000	1608925
3	203667	101833	885947	420000	1305947
4	152750	76375	664462	560000	1224462
5	122200	61100	531570	700000	1231570

Source: Annual Report of BNTL

The above table 4.13 shows that the carrying cost was decreasing and ordering cost was increasing with the increasing number of order. The table shows the minimum total inventory cost of R/M was Rs. 1224462 whereas the total carrying cost was RS 664462 and total ordering cost was Rs. 560000 with the no. of order was 4 times a year. So, it is clear that, if the company wants to minimize total inventory cost of R/M it should order only 4 times during the year.

So, it becomes clear from formula as well as tabular method that the company should order 4 times during the year.

4.14.4 Calculation of EOQ of the FY 2010/11

Formula Method

Annual requirement (A) = 690000 liters

Ordering cost per order (O) = Rs. 160000

Carrying cost per liters (C) = Rs.9.50/liter

$$\therefore \text{EOQ} = \sqrt{\frac{2Ao}{C}} = \sqrt{\frac{2 \times 690000 \times 160000}{9.5}} = 152454 \text{ liters}$$

$$\therefore \text{EOQ} = 152454 \text{ liters}$$

$$\therefore \text{No. of orders} = \frac{\text{Annual requirement}}{\text{EOQ}} = \frac{690000}{152454} = 4.52 \approx 5 \text{ times}$$

From the above calculation, the EOQ was 152454 liters under the formula method which minimize the total ordering and carrying cost with no. of orders 5 times, which is also clear from the following tabular method.

Trial and Error Method

Table 4.14

EOQ of the FY 2010/11

No. of order	Order Size (liters)	Average Inve.(liters)	Total C. C. (Rs.)	Total O.C. (Rs.)	Total Cost (Rs.)
1	690000	345000	3277500	160000	3437500
2	345000	172500	1638750	320000	1958750
4	172500	86350	819375	640000	1459375
5	138000	69000	655500	800000	1455500
6	115000	57500	546250	960000	1506250

Source: Annual Report of BNTL

The above table 4.14 shows that the carrying cost was decreasing and ordering cost was increasing with the increasing no. of order. The above table shows the minimum total inventory cost of R/M was 1455500 whereas the total carrying cost was Rs 655500 and total ordering cost was Rs. 800000 with the no. of order 5 times a year. So it is clear that, if the company wants to minimize total cost of inventory of R/M it should order 5 times during the year.

So, it becomes clear from formula as well as tabular method that the company should order 5 times during the year.

4.14.5 Calculation of EOQ of the FY 2011/12

Formula Method

Annual requirement (A) = 835000 liters

Ordering cost per order (O) = Rs 185000

Carrying cost per liter (C) = Rs 10/liter

$$\therefore \text{EOQ} = \sqrt{\frac{2AO}{C}} = \sqrt{\frac{2 \times 835000 \times 185000}{10}} = 175770 \text{ liters}$$

$$\therefore \text{EOQ} = 1757700 \text{ liters}$$

$$\therefore \text{No. of order} = \frac{\text{Annual requirement}}{\text{EOQ}} = \frac{835000}{175770} = 4.75 \approx 5 \text{ times}$$

The above calculation, the EOQ was 175770 liters under the formula method which minimizes the total ordering and carrying cost with no. of orders 5 times which is also clear from the following tabular method.

Trial and Error Method

Table 4.15
EOQ of the FY 2011/12

No. of Order	Order Size (liters)	Average Inve. (liters)	Total C. C. (Rs.)	Total O.C. (Rs.)	Total Cost (Rs.)
1	835000	417500	4175000	185000	4360000
2	417500	208750	2087500	370000	2457500
4	208750	104375	1043750	740000	1783750
5	167000	83500	835000	925000	1760000
6	139167	69583	695830	1110000	1805830

Source: Annual Report of BNTL

The above table 4.15 shows that the carrying cost was decreasing and ordering cost was increasing with the increasing no of order. The table shows the minimum total inventory cost of R/M was Rs. 1760000 whereas the total carrying cost was 835000 and the total ordering cost was Rs. 925000 with the no. of order nearly 5 times a year. So it clear that if the company wants to minimize total cost of inventory of R/M it should order 5 times during the year.

4.15 Economic Order Quantity of Inventory in Total Study Period

Table 4.16

EOQ of Inventory in Total Study Period

Fiscal Year	No or Order (Approx.)	EOQ in liters
2007/08	3 times	101430
2008/09	4 times	113617
2009/10	4 times	140230
2010/11	5 times	152454
2011/12	5 times	175770

From the above table 4.16, it can be interpreted that, there was no similar size of EOQ during the study period.

In the FY 2011/12, the EOQ of inventory was high i.e. 175770 liters, while in the FY 2007/08 the EOQ of inventory was very low i.e. 1675 101430 liters. There was high fluctuation in EOQ size during the study period due to various reasons. This type of fluctuation of EOQ size was due to fluctuation in demand.

4.16 Major Finding of the Study

Inventory management planning and control are highly complicated task since it affects the profitability of manufacturing industries. On the basis of the data presentation and their financial and statistical analysis of BNTL, the major finding related to this study has been presented below.

- Requires raw materials for the production of different types of soft drinks are imported from the foreign countries like Iran, Pakistan, Indonesia, Germany and India. The major raw materials of the company are chemicals, sugar, water etc.
- Letter of credit is used to import raw material from foreign countries.

- In purchase procedure; purchase manager should maintain all the necessary records keeping in mind the most important objectives of the purchase department i.e. purchasing right quality and quantity of material at the reasonable rate at proper time to help smooth running of the production function.
- Store Control Device Practice: In BNTL, the store control device is adopted in Bin card and store ledger. The company has not applied ABC analysis techniques to control various types of inventory in the stores.
 - Bin cards: In context of BNTL with its help the storekeeper can send material requisition for the purchased of material in time.
 - Store ledger: The store ledger is systematically maintained by BNTL. This ledger provides the information for the pricing of material issued and money value at time for each item maintained in store.
- Demand and sales of company are very fluctuating. The main reason for such fluctuating is season. The season is main reason that types of demand fluctuation.
- There is no systematic and scientific system to determine ordering cost and carrying cost based on the question asked by researcher with responsible person.
- Major problems faced by BNTL while operating and managing the inventories are those Political crisis and especially Nepal Bandh, uncertainty about the future supply of materials, operation of factory strikes, fluctuation of material prices and lockout organized by different pressure groups directly affect the company and its

inventory management while geographical barriers and transportation problems are other problem faced by BNTL.

- The company was not following scientific inventory management techniques i.e. economic order quantity model for purchasing different types of raw materials.
- The higher value of standard deviation for sales indicates its inconsistent nature compared to inventory. However, value of C.V. indicates that inventory fluctuates more than sales. The value of correlation coefficient +0.9 means the positive relationship between these two variables i.e. increase inventory result into increase in sale and vice versa.
- The average inventory during the study period is Rs 107.5 million and the average net profit during the study period is 115.9 million. The higher value of standard deviation for profit indicates is inconsistent nature compared to inventory. Value of C.V. also indicates that profit fluctuates more than inventory. The value of correlation coefficient +0.85 means the positive relationship between these two variables i.e. increase in inventory result into increase in profit and vice versa.
- The average total assets during the study period are Rs 913.39 million. The higher value of standard deviation for total assets indicates its inconsistent nature compared to inventory. Value of C.V. also indicates that total assets fluctuate more than inventory. The value of correlation coefficient +0.94 means the positive relationship between these two variables.
- In average, there is more or less balance between the annual requirement and purchase. By coefficient of variation, the annual purchase is inconsistent i.e. annual purchase is more inconsistent than the annual requirement. This is the symbol of poor estimation of

annual requirement. Value of S.D. also indicates that Annual purchase of raw materials fluctuate more than Annual requirement of raw materials. The value of correlation coefficient +0.98 means the positive relationship between these two variables.

- Inventory conversion period. In BNTL, the average length of time requires converting material into finished goods and then to sell these goods required 95 days.
- Inventory turnover: Inventory turnover ratio is an indicator of the efficiency of management. The inventory turnover for the study period was fluctuating with the average 7.824 times. The highest ratio signifying the most efficient inventory management was recorded in 2009/10 and the lowest signifying the worst inventory management situation was recorded in 2011/12 within the study period.
- The average inventor of raw material on total inventory, inventory of WIP on total inventory, inventory of finished goods on total inventory and inventory of spare parts on total inventory are 39.9%, 0.5%, 3.8% and 28.8% respectively.
- EOQ is not similar during the study period. This type of fluctuation is due to variation of ordering cost and fluctuation in demand but the company has not used EOQ model to manage and control of the inventory.
- The EOQ of inventory in the FY 2011/12 was high i.e. 175770 liters, while in the FY 2007/08 the EOQ of inventory was very low i.e. 101440 liters. There was high fluctuation in EOQ size during the study period.

CHAPTER - V

SUMMARY, CONCLUSION AND RECOMMENDATION

Inventory management is one of the most important functions in any organization. Without effective and efficient inventory management, no one organization can achieve its goal. Success of any enterprises basically depends on the efficiency and effectiveness of systematic management. Inventory management is the most important part for manufacturing company. The company has invested the most of amount for inventory, where the functions are associated as purchasing, storing, selling, distribution etc.

The details about inventory management and introduction of the study have been already presented in the first chapter. The second chapter describes about framework and review of literature. Similarly, the research methodology of the study is described in the third chapter. All the available data related to inventory decision sorted out by issues of inventory management of Bottlers Nepal (Terai) Limited are presented, analyzed and the major findings of the study has been also presented in the chapter four.

Summary of the study and recommendation on the basis of the main findings are studied in this concluding chapter which is derived from the analysis of financial statement of BNTL and conclusion is presented.

5.1 Summary

Inventory management is the most important part for manufacturing company. A firm cannot achieve its goal unless inventories are controlled effectively and capital is allocated efficiently. Inventory functions are associated with production, marketing, finance, and administration etc.

inventory constitutes the most significant part of current assts. It should be managed efficiently to avoid unnecessary investment. Bottlers Nepal (Terai) Limited is the leading multinational company among the manufacturing and processing company, which was established in 1987, BNTL supplies the quality product at right time at reasonable price. To earn profit, it is necessary to run the company efficiently, economically as well as profitability. To ensure this situation in BNTL, the efficient management of inventory takes vital role. So, this study is concerned with in what extent the company is applying the inventory management technique to minimize the cost of inventory, which directly affect the price of product.

The basic problem area of this study is to examine the inventory management system practiced by the company, which is unscientific. The carrying cost, ordering costs, order sizes, safety stock maintained are unsatisfactory and unscientific. It is not paying much attention to the lead-time. Therefore all these functions lead to increase total cost of the company.

Most of manufacturing and trading company invests a huge amount of money in the form of inventory. BNTL is also being the manufacturing company, which invests huge amount of capital in form of inventory and cost of carrying inventory, is higher out of total inventory cost. The cost of inventory directly affects the cost of production and profitability of company. It means slight reduction in cost of inventory, decrease the production cost and ultimately increases the profitability at remarkable rate. For this, the efficient management of inventory is desirable.

This study is based on the inventory management of BNTL. It is done with a view to solve the problem arises on achieving the objectives of the

BNTL. Here, the main objectives of the study are to analyze the present inventory position of BNTL and to study the practice of procurement and sales of inventory. To make this study, the related literature has been reviewed. Review of literature gives the concept of inventory management and framework from various books, journals and articles.

This study is to examine the inventory management system practiced by the company. The carrying cost, ordering cost, order size, safety stock maintained was unsatisfactory and unscientific. It did not give attention to the lead-time. Therefore all these functions lead to increase in total cost of the company.

This study attempts to identify the inventory position of BNTL, by evaluating the relationship between sales and inventories their trends, to assess the inventories and their consequences on profitability of BNTL.

This study was based on secondary data. Secondary data collected from annual reports of BNTL. All the collected data were analyzed by using EQQ model, Inventory turnover ratio, correlation coefficient, average percentage tables and figures were also used to present the relevant data. The analysis was done on year wise basis and the average figure was also obtained.

5.2 Conclusion

The study stresses the need for a good inventory system to maintain a suitable level of inventory so; it is able to fulfill the company's requirement on time. The growing number of Manufacture Company in Nepal is facing problems of inventory. Due to lack of proper inventory policies, there are many companies where large amount of capital has been blocked up and very little measures have been taken to manage the

inventories on the basis of inventory decision models and techniques that have so far developed. The main objectives of this study are to analyze the inventory management practices of BNTL and problem faced by BNTL in the management of inventory. For the purpose of this study, the data and the necessary information were collected from the records and annual reports provided by the company.

BNTL has applied only bin cards and store ledger as the inventory control techniques but not applied the ABC analysis. The company does not classify the inventory cost into carrying cost and ordering cost. The company does not follow the economic purchase order, so the total cost of carrying and ordering the inventory is higher. By the analysis, the average inventory conversion period BNTL is 95 days. The average inventory turnover ratio is 7.824 times, which indicates that BNTL has maintained higher level of inventory as compared to the total cost of goods sold. By the overall analysis, it can be concluded that BNTL should maintain the economic order size, which helps to minimize the inventory cost and to increase the profile of the company.

The company has faced some problems on managing proper inventories in using full system because there is uncertainty about the future supply of materials, operation of factory, Nepal Bandh, lockouts, strikes, geographical problems, fluctuation of prices etc.

5.3 Recommendation

The study stresses the need of a good inventory management system to the better performance of the company. So, analyzing the available data, some findings were extracted. Based on the major findings it may be appropriate to make some suggestions and recommendation for the

proper management of inventory in BNTL. Some of the recommendations based on the major findings are as follows:

- Co-ordination among Different Departments: Purchase plan should be prepared for different types of raw materials with the proper co-operation among the planning, purchasing, storing production, marketing and sales department to avoid the excess investment on inventory.
- Minimize the Inventory Cost: The popular scientific inventory management techniques should be applied by the company for purchasing different types of raw materials so as to maintain optimum level of inventory and to minimize the total inventory cost i.e. carrying cost and ordering cost.
- ABC Analysis: The Company should apply the selective inventory model (ABC analysis) to control the inventories in the store.
- Purchase Budget: The Company should make purchase budget because the entire departments need to fulfill their needs as per the budget allocated. This should be made on the basis of past experience.
- Inventory Conversion Period: In the context of BNTL, there is no fixed policy of inventory conversion period so the company should make plan to maintain the fixed inventory conversion period.
- Inventory Turnover Ratio: The average inventory turnover ratio is 7.824 times. It seems that the company maintained higher level of inventory as compared to the total cost of goods sold, so the company has to maintain the adequate level of inventory to meet the

demand. So the company should make the optimum inventory management policy, the higher inventory level makes the higher cost of inventory, so it is necessary to make the optimum inventory management plan.

- **Effective Management:** It is essential to give regular training on inventory management. For the changing environment, the training and seminars play a vital role to develop the employees' efficiency. Consequently, managerial forecasting ability of the concerned staffs will be enhanced.

BIBLIOGRAPHY

- Adhikari, S. (2010). Inventory Management of Nepal Oil Corporation Ltd. An Unpublished Master Degree Thesis Submitted to Prithvi Narayan Campus.
- Agrawal, G.R. (1998). *Marketing in Nepal: Fundamental Management and Strategy*. Kathmandu: Educational Enterprise Pvt. Ltd.
- Baral, P.R. (1994) .Inventory Management: A Case Study of Gandaki Noodles Pvt. Ltd. An Unpublished Master Degree Thesis Submitted to Nepal Commerce Campus Faculty of Management, TU.
- Bhusal, P.S. (2010). Inventory Management of Unilever Limited. An Unpublished Master Degree Thesis Submitted to Shankher Dev Campus Faculty of Management, TU.
- Chudhary, S.C. (2010). Effectiveness of Inventory Management of Dabur Nepal Pvt.Ltd. An Unpublished Master Degree Thesis Submitted to Shankher Dev Campus Faculty of Management, TU.
- Dabgol, R.M. (2056). *Cost and Management Accounting*, Kathmandu: Taleju Prakashan, Nepal.
- Dahal, M. (2009). A Compare Study on Inventory Management of Dabur Nepal P. Ltd. and Nepal Liver Ltd. An Unpublished Master Degree Thesis Submitted to Public Youth Campus, Faculty of Management, TU.
- Dangol, R. M . & Dangol, J.(2065). *Cost and Management Accounting*. Kathmandu: TalejuPrakashan

- Dangol, R.M. & Dangol, J. (2061). *Management Accounting*. Kathmandu: Taleju Prakashan.
- Dangol, R.M., Gurung, P. & Dangol, J. (2061). *Cost and Management Accounting*. Kathmandu: Taleju Prakashan
- Goel, B.S. (1992). *Production and Operation Management*, New Delhi: Pragati Prakashan.
- Hampton, J.J. (1996). *Financial Decision Making*, New Delhi: Prentice Hall of India Pvt. Ltd.
- Hampton, J.J. (1990). *Financial Decision Making*. New Delhi: Prentice Hall of India Pvt. Ltd.
- Khan, M.Y. & Jain, P.K. (1994). *Financial Management*, New Delhi: Tata Mc-Grawhill Publishing Co. Ltd.
- Khan, M.Y. & Jain, P.K. (2002). *Financial Management*, New Delhi: Tata Mc-Grawhill Publishing Co. Ltd.
- Khan, M.Y & Jain, P.K. (2003) *Financial Management*. New Delhi: Tata McGraw Hill Co. Ltd.
- Khan, M.Y. & Jain, P.K. (2002). *Management Accounting*. New Delhi: Tata McGraw Hill Publishing House Co.
- Kuchal, S.C. (1970). *Financial Management*. Ellhabad: Chaitanya Publishing House.
- Martin, K.S. & Miller, W.D. (1962). *Inventory Control: Theory and Practice*. Englewood Cliffs, New Jersey: Prentice Hall.
- Martin, K.S. & Miller, W.D. (1956). *Inventory Control: Theory and Practice*. Englewood Cliffs, New Jersey: Prentice Hall.

- Pandey, I.M. (1994). *Financial Management*. New Delhi: Vikash Publishing House Pvt. Ltd.
- Pandey, I.M. (2002). *Financial Management*. New Delhi: Vikas Publishing House Pvt. Ltd.
- Pathak, A. (2008). Inventory Management of Hetauda Cement Industry Limited. An Unpublished Master Degree Thesis Submitted to Shankher Dev Campus Faculty of Management, TU.
- Paudel, R.B, Baral, K.J. & Gautam, R.R. (2009). *Management Finance*, Kathmandu :Asmita Books & Distribution (P) Ltd.
- Rawal, D. (2009). A Compare Study on Inventory Management of Dari Development Corporation and Sitaraam Gokul Milks Pvt .Ltd. An Unpublished Master Degree Thesis Submitted to Shankher Dev Campus Faculty of Management, TU.
- Shrestha, R.K. (2004). Inventory Management of Nepal Lube Oil Limited. An Unpublished Master Degree Thesis Submitted to Shankher Dev Campus Faculty of Management, TU.
- Sthapit. A.B., Yadab, R.S., Tamang, G., Dhital, S., Adhikari, P. (2010). *Production And Operation Management*. Kathmandu: Asmita Books Publishers and Distribution.
- Upadhyay, P.R. (2007). A Study on Inventory Management in Janakpur Cigarette Factory Limited. An Unpublished Master Degree Thesis Submitted to Shanker Dev Campus Faculty of Management, TU.
- Van Horn, J.C. (1985). *Financial Management and Policy*. New Delhi: Prentice Hall of India Pvt. Ltd.
- Van Horne, J.C. (1984). *Financial Management and Policy* .New Delhi: Prentice Hall of India Pvt. Ltd.

Wolff, H.K. & Pant, P.R. (1999). *Social Science Research and Thesis Writing*. Kathmandu: Buddha Academic Publishers and Distributors Pvt. Ltd.

Wolff, H.K. & Pant, P.R. (2005). *Social Science Research and Thesis Writing*. Kathmandu: Buddha Academic Publishers and Distributors Pvt. Ltd.

Appendix – 1
Compiled Data of BTNL Related to Inventory

Rs. in Million

Particulars	2007/08	2008/09	2009/10	2010/11	2011/12
Sales	475.109	621.174	845.258	954.009	1155.473
COGS	250.803	326.514	406.073	447.9920	523.618
Profit	13.818	78.585	133.179	1146.995	206.923
Purchase of Raw Materials	152.892	251.469	303.727	338.066	378.804
Requirement of Raw Material.	182.895	234.326	295.090	333.625	378.124
Inventory	474.537	69.427	85.677	124.632	183.405
Finished Goods	4.488	1.202	0.015	9.664	7.032
Work in Process	0.470	0.612	0.505	0.613	-
Raw Material	20.129	37.125	45.433	48.859	49.588
Total Assets	436.227	654.951	889.830	1079.917	1506.068
Store and Spares parts	30.409	29.249	21.315	27.227	27.000

Appendix – 2
Correlation between Sales and Inventory.

Rs in Million

Year	Sales(x)	Inventory(y)	x^2	y^2	xy
2007/08	475.109	74.537	112285	1082	11025
2008/09	621.174	69.427	35731	1449	7182
2009/10	845.258	85.677	1229	476	(763)
2010/11	954.009	124.632	20681	294	2459
2011/12	1155.473	183.405	119213	57612	26208
Total	$\sum x = 4051$	$\sum y = 537.5$	$\sum x^2 = 289140$	$\sum y^2 = 9063$	$\sum xy = 46111$

Here,

$$x^2 = (X - \text{Mean of Sale}(\bar{X}))^2$$

$$y^2 = (Y - \text{Mean of Inventory}(\bar{Y}))^2$$

$$\therefore \text{S.D of Sales } (\sigma) = \sqrt{\frac{1}{n} \sum x^2} = \sqrt{\left(\frac{1}{5} \times 289140\right)} = 240.47$$

$$\therefore \text{C.V of Sales} = \frac{\sigma \text{ of Sales}}{\bar{X}} \times 100 = \frac{240.47}{810.2} \times 100 = 29.68\%$$

$$\therefore \text{S.D of Inventory } (\sigma) = \sqrt{\frac{1}{n} \sum y^2} = \sqrt{\left(\frac{1}{5} \times 9063\right)} = 42.57$$

$$\therefore \text{C.V of Inventory} = \frac{\sigma \text{ of Inventory}}{\bar{Y}} \times 100 = \frac{42.57}{107.5} \times 100 = 39.6\%$$

$$\therefore \text{Correlation between Sales and Inventory } (r) = \frac{\sum xy}{\sqrt{\sum x^2} \sqrt{\sum y^2}}$$

$$= \frac{46111}{\sqrt{289140} \sqrt{9063}}$$

$$\therefore r = 0.9$$

Appendix – 3
Correlation between Profit and Inventory.

Rs in Million

Year	Profit(x)	Inventory(y)	x^2	y^2	xy
2007/08	13.818	74.537	10421	1082	3358
2008/09	75.585	69.427	1394	1449	1418
2009/10	133.179	85.677	298	476	(376)
2010/11	146.995	124.632	967	294	532
2011/12	206.923	183.405	8285	57612	6908
Total	$\sum x = 579.5$	$\sum y = 537.5$	$\sum x^2 = 21365$	$\sum y^2 = 9063$	$\sum xy = 11840$

Here,

$$x^2 = (X - \text{Mean of Profit}(\bar{X}))^2$$

$$y^2 = (Y - \text{Mean of Inventory}(\bar{Y}))^2$$

$$\therefore \text{S.D of Profit } (\sigma) = \sqrt{\frac{1}{n} \sum x^2} = \sqrt{\left(\frac{1}{5} \times 21365\right)} = 65.36$$

$$\therefore \text{C.V of Sales} = \frac{\sigma \text{ of Sales}}{\bar{X}} \times 100 = \frac{65.36}{115.9} \times 100 = 56.39\%$$

$$\therefore \text{S.D of Inventory } (\sigma) = \sqrt{\frac{1}{n} \sum y^2} = \sqrt{\left(\frac{1}{5} \times 9063\right)} = 42.57$$

$$\therefore \text{C.V of Inventory} = \frac{\sigma \text{ of Inventory}}{\bar{Y}} \times 100 = \frac{42.57}{107.5} \times 100 = 39.6\%$$

$$\therefore \text{Correlation between Profit and Inventory } (r) = \frac{\sum xy}{\sqrt{\sum x^2} \sqrt{\sum y^2}}$$

$$= \frac{11840}{\sqrt{21365} \sqrt{9063}}$$

$$\therefore r = 0.85$$

Appendix – 4
Correlation between Total Assets and Inventory.

Rs in Million

Year	Total Assets(x)	Inventory(y)	x^2	y^2	xy
2007/08	436.227	74.537	227685	1082	15700
2008/09	654.951	69.427	66791	1449	9819
2009/10	889.830	85.677	555	476	514
2010/11	1079.917	124.632	27731	294	2847
2011/12	1506.068	183.405	351267	57612	44978
Total	$\sum x = 4567$	$\sum y = 537.5$	$\sum x^2 = 674029$	$\sum y^2 = 9063$	$\sum xy = 73858$

Here,

$$x^2 = (X - \text{Mean of Total Assets}(\bar{X}))^2$$

$$y^2 = (Y - \text{Mean of Inventory}(\bar{Y}))^2$$

$$\therefore \text{S.D of Total Assets } (\sigma) = \sqrt{\frac{1}{n} \sum x^2} = \sqrt{\left(\frac{1}{5} \times 674029\right)} = 367.2$$

$$\therefore \text{C.V of Total Assets} = \frac{\sigma \text{ of Total Assets}}{\bar{X}} \times 100 = \frac{367.2}{913.39} \times 100 = 40\%$$

$$\therefore \text{S.D of Inventory } (\sigma) = \sqrt{\frac{1}{n} \sum y^2} = \sqrt{\left(\frac{1}{5} \times 9063\right)} = 42.57$$

$$\therefore \text{C.V of Inventory} = \frac{\sigma \text{ of Inventory}}{\bar{Y}} \times 100 = \frac{42.57}{107.5} \times 100 = 39.6\%$$

$$\therefore \text{Correlation between Total Assets and Inventory } (r) = \frac{\sum xy}{\sqrt{\sum x^2} \sqrt{\sum y^2}}$$

$$= \frac{73858}{\sqrt{674029} \sqrt{9063}}$$

$$\therefore r = 0.94$$

Appendix – 5
Correlation between Annual Requirement and Annual Purchase of Raw Material.

Rs in Million

Year	Requirement of Raw material (x)	Purchase of Raw Material(y)	x^2	y^2	xy
2007/08	182.895	152.892	10387	17450	13462
2008/09	234.326	251.464	2449	1124	1659
2009/10	295.090	303.727	106	351	162
2010/11	333.625	338.066	2383	2817	2591
2011/12	378.124	378.804	8707	8801	8754
Total	$\sum x = 1424$	$\sum y = 1425$	$\sum x^2 = 24032$	$\sum y^2 = 30543$	$\sum xy = 26658$

Here,

$$x^2 = (X - \text{Mean of Annual Requirement of Raw Material } (\bar{X}))^2$$

$$y^2 = (Y - \text{Mean of Annual Purchase of Raw Material } (\bar{Y}))^2$$

$$\therefore \text{S.D of Annual Req. of R/M } (\sigma) = \sqrt{\frac{1}{n} \sum x^2} = \sqrt{\left(\frac{1}{5} \times 24032\right)} = 69.327$$

$$\therefore \text{C.V of Annual Req. of R/M} = \frac{\sigma \text{ of A.Req.of R/M}}{\bar{X}} \times 100 = \frac{69.327}{284.8} \times 100$$

100

$$\therefore \text{C.V} = 24.34\%$$

$$\therefore \text{S.D of Annual Pur. of R/M } (\sigma) = \sqrt{\frac{1}{n} \sum y^2} = \sqrt{\left(\frac{1}{5} \times 30543\right)} = 78.157$$

$$\therefore \text{C.V of Annual Pur. of R/M} = \frac{\sigma \text{ of A.Pur.of R/M}}{\bar{y}} \times 100 = \frac{78.157}{284.9} \times 100$$

$$\therefore \text{C.V} = 27.42\%$$

\therefore Correlation between Annual Req.of R/M and Annual Pur. of R/M (r)

$$= \frac{\sum xy}{\sqrt{\sum x^2} \sqrt{\sum y^2}}$$

$$= \frac{26658}{\sqrt{24032} \sqrt{30543}}$$

$$\therefore r = 0.98$$