INVENTORY MANAGEMENT AND CONTROL

A CASE STUDY OF NEPAL DRUGS LTD AND HERBAL PRODUCTION AND PROCESSING LTD

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Shanker Dev Campus

A Thesis Submitted To:

Office of Dean

Faculty of Management

Tribhuvan University

In partial fulfillment of the requirement for the degree of

Master of Business studies (M.B.S.)

Ramshah path, Katmandu July, 2009

RECOMMENDATION

This is to certify that the thesis

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Entitled

INVENTORY MANAGEMENT AND CONTROL

(With reference to Nepal Drugs Ltd and Herbal Production and Processing Co .Ltd)

Has been prepared as approved by this department in the prescribed format of the faculty of Management. This thesis is forwarded for examination.

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VIVA VOICE SHEET

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And found the thesis to the original work of the student written according to the prescribed format. We recommend the thesis to be accepted as partial fulfillment of the requirement for Master's Degree in Business Studies (M.B.S.)

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Member (External Expert) _____

ACKNOWLEDGEMENT

I am highly indebted to my thesis advisor Mrs. Amuda Shrestha, Professors and Mr. Govinda Thapa, Lecturer of Shanker Dev Campus, T.U; who are concrete supporters, advisors, guidance and inspiration to prepare and complete this thesis.

I would like to extend my appreciation to the staff of NDL and HPPCL for their kind co-operation in furnishing lot of information and data.

I would like to extend my gratefulness to the professors and teachers, staff of administration of Shanker Dev Campus, center library of T.U. and all my colleagues who extend their hands towards the accomplishment of this thesis.

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DECELERATION

I, hereby declare that the work reported in this thesis entitled "Inventory Management and Control of **Nepal Drugs Ltd and Herbal Production and Processing Co .Ltd",**And submitted to Shanker Dev Campus, Faculty of Management, Tribhuvan University, is my original research work done in the form of partial fulfillment of the requirement for the Master's Degree in Business under the supervision and guidance of Mrs. Amuda Shrestha, Professor and Mr. Govinda Thapa, lecturer of Shanker Dev Campus.

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ABBREVIATION

ABC	=	Always Better Control
CA	=	Current Assets
CCC	=	Corporation Co-ordination Council
CDM	=	Central Department Management
EOQ	=	Economic Order Quantity
FG	=	Finish Goods
FY	=	Finish Goods
HPPCL	=	Herbal Production and Processing Company Limited
IM	=	Inventory Management
ITR	=	Inventory Turnover Ratio
LTD	=	Limited
MRP (I)	=	Material Requirement Planning
MRP (II)	=	Manufacturing Resource Planning
NDL	=	Nepal Drugs Limited
PM	=	Packaging Material
RM	=	Raw Material
T.U	=	Tribhuvan University
WIP	=	Work-In-Progress

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CHAPTER I

INTRODUCTION

1.1Background of the Study

Economic development of the country is based on industrialization. So it is important for achieving the basic objectives of country's economic and social progress. Economic reforms initiated by the government during the last decades have been altering the industrial sectors of Nepal significantly. Present fast growing of globalization and present of multinational in the market have shown the industrial scenario in the country.

The economic policy and reforms have been affecting partly all the sector of the economy. These reforms are intended to reduce on productive controls, strengthen private investment and integrate the economy with the global economy.

In order to achieve security, stability and high standard of living the country must become industrialized. It is important for increase the national income. The manufacturing industries have to face many problems, such problems are arise due to the country being underdeveloped and landlocked, lack of trained and unskilled manpower, financial resources, inconvenience in transport and communication networks, shortage of capital, small size market, non-availability of assured energy at reasonable price, unawareness of the industrial potential, higher cost of production, low productivity of inputs, technology, instability in government policies and political situation plays the vital role.

The industrialization started very late in the country i.e. only after the second world war, with the established of Biratnagar jute mill in 1936. But 63 industries were opened with in a period of 10 years. Industrialization development in Nepal however started getting regular attention of the government under the aegis of development plan after the down of democracy in 1951 with the financial aid technical support of neighboring country. Several industries were established in public sector. The government gave the more priority to the development of the public enterprises, after the implementation of 5 year plan.

Public section manufacturing companies in Nepal have a problem of sufficient raw material and unsatisfactory utilization capacity. So industries in Nepal are running below their production capacity. Due to such problem some of the industries have been liquidated, amalgamated and privatized.

Now Nepal has got the membership of the world trade organization (WTO) and also adopted the policy of economic liberalization and privatization. To encourage the foreign investor, Nepal has brought the foreign direct investment policy. To be alive in present competitive environment of globalization today industries can sustain their existence and growth only through a continuous process of innovation in function, quality and product cost.

Different country in the world either development or underdeveloped have accepted the existence of public and private enterprises for the socio economic development of the country. Similarly, Nepal is an underdevelopment country among them. It has established different public and private enterprises. The concept of inventories should be accepted by the enterprises to run smoothly. Inventory management involves the planning of the optimal level of inventory and control of inventory cost supported by an appropriate organizational structure which is staffed by trained person and directed by the top management. It involves both financial as well as physical dimensions and these dimensions are inter-related and cannot be looked in isolation (Agrawal, 1995:30).

The term inventory refers to the stock pile of the product a firm is offering for the sale and the components that make up the product. In other words inventory is composed of assets that will be sold in future in the normal courses of business operation. Inventory may be defined as the goods held for eventual resale by the firm. As such inventories are vital element in the effort of the firm to achieve sales level (Hampton, 1990:220).

Inventory as current assets differ from the other current assets because only financial manager are not involved, rather, all the financial areas i.e. finance marketing, production and purchasing are involved. The views concerning the appropriate level of inventory would differ among the different functional areas (Khan & Jain 2003:142).

Inventory refers to the physical stock of goods. Which though remain idea in the store but is essential for smooth sailing of the company and hence has economic values? Inventory form a link between production and sales of product. The optimum level of inventories should be judge in relation to the flexibility inventories afford. If we hold constant the efficiency of inventory management, the lower the level of inventories, the less flexibility of firm. In evaluating the level of inventories, management must balance the benefits of economics of products, purchasing and increase product demand against the cost of carrying the additional inventory of particular concern to the financial manager is the cost of funds invested in inventory, which is a function of risk of a specific inventories involved(Van Horn,2003:225).

Stocks of any kind of items materials, products and goods reserved in stock for a certain period is generally called inventory. It is a kind of current assets. The materials are purchased by an organization will be stored until and unless they are into the production process. If the production is finish, it will be in store until and unless they are sold to the market. Thus inventories involves high amount of cost in terms of occupying the space and blocking the capital. But we can't avoid the inventories because without inventories it may affect even badly by creating obstacles on continuous production and ultimately on supply requirement. So, inventories should be maintained in appropriate quantity so as to avoid with under-stock and over-stock situation. To avoid the under and over situation, the inventory should be properly managed by the enterprises. The aim of the inventory management is to avoid excessive and inadequate level of inventory for the smooth production and sales operation. Thus, inventory management is primarily concerned with minimizing cost of investment in inventory, cost of maintaining desired level of inventory and minimizing total cost of inventory. Both the physical and financial dimension of inventory should be affectedly managed. Thus the real task of top level management is formulating the plans and policy that will to be optimal inventory investment for attainment of desired objectives.

The control of inventories deserves special attention is over-investment in inventories result storage of cash for other purpose like payment of maturing liabilities, carrying of accounts receivables, and expansion of fixed assets. Similarly, the consequences of investment in inventories are loss of regular customers, as they don't find selection of varieties and burden of unnecessary costs of operation due to shortage of raw materials. Therefore, inventory control involves the inventory decision model to determine the optimum investment on inventory.

1.2 Brief Profile of the Sample Company

Nepal Drugs Limited

"Nepal Drugs Limited" is a manufacturing public enterprise. It produces different kinds of drugs. It was established on 1st ashwin 2029 under the company act 2021. It had started its production in a small building of botany at thapathali of "Nepal Drugs Limited". It had started its production on its own building since 2032 B.S. which is situated at Babarmahal, kathmandu and covers 45 ropani lands. It had established with authorized capital of 1 corer and fifty lakh and paid- up capital of 63 lakhs and forty thousand.

"Nepal Drugs Limited" is producing different varieties of drugs during its 34 years period. It has classified its production into 6 types. They are tablets, liquid, capsule, powder, suspension and intravenous fluids. Different types of raw materials are required for the production of different varieties of drugs. Raw materials are imported from neighboring as well as other third countries. It has its own well-equipped laboratory and export technicians for quality control of both raw materials as well as finished products.

In the initial years of its establishment, it had sold Rs. 40 lakhs and 26 thousands value of drugs which increased to Rs. 6 corer 30 lakhs and ninety-three thousand values of drugs in the fiscal year 2063/64. Several fluctuations in sales of drugs can be observed due to the establishment of different private pharmacy, which fulfills the demand of customers. There are altogether 5 hundred and 77 persons are working in this limited. Out of them seventy-two are them in top level and five hundred and five are in assistant level.

The objectives of "Nepal Drugs Limited" are to provide qualitative drugs related with different types of disease, to help in health sector of country by providing different varieties of drugs according to market demands, to increase the employment opportunities and contribution in the government exchequer.

"Nepal Drugs Limited" has 250 items of raw materials for the preparations different kinds of drugs. Among them 80 items are used for the preparation of tablets. Most of the raw materials are imported from the India, Denmark, Singapore and China. About 5 percent of the raw materials are available in Nepal. However, due to the difficulties in transpiration and lack of knowledge of scientific technique of existing of raw materials, there is a problem in its qualitative availability raw materials are imported on the tender basis. Middleman is not used. Delay in receiving and spoilage of raw materials causes the considerable loss for "Nepal Drugs Limited". It has not kept work-in-process inventories due to the nature of the product. Therefore, the main inventories kept by the "Nepal Drugs Limited" raw materials and finished goods.

Herbal Production and Processing Company

Herbal Production and Processing Company has produced medicine and perfumery oil, it processes the herbal, which are collected from the Himalayan region. Due to the variation of climate and geographical structure of the country, different kinds of medicinal and aromatic plant are found in the country. There are valuable forest resources. It has had a good

recognition in the Indian market since ancient time. The highest peak of the world, Mount Everest and a series of Himalayan ranges found in the country are symbolic of assistance of the valuable medicinal and aromatic plants. During the past days the country's significant roles in trading of crude herbs till the date about 700 varieties' have been identified. The major thrust of the nation is to process the natural resources domestically balancing their depletion in nature with regeneration in inception of herbs production and processing company limited in 1981 A.D. as an undertaking of Nepal Government. After through research and dedication of the national core of scientists under the department of medicinal plants, this company was found. HPPCL is the first company in the country to harness the rich treasure of herbs and aromas for processing and production medicinal extracts essentials oils for drugs and perfumery industries and abroad. The painstaking research on selected herbal resources and flora of the country by modern scientific method resulted the introduction of the production of selective medicinal extracts and essential oil on a commercial scale. At present, the company is capable of exporting indigenous product like Suganda kokila oil, Targets oil and Jatamasi oil as well as the exotic varieties such as palmorosa oil, Citronella oil, Lemongrass oil and some crude drugs to neighboring and third countries.

This company was established in 1981 A.D. at Koteswor with authorized capital of 5 cores and paid-up capital of two corer seventy-five lakhs and seventeen thousand. There are 198 employees in HPPCL. Among them 23 employees are in officer lever and 145 employees are in assistant level.

The raw- materials for the production different kinds of perfumery oil are either purchased directly or taken from the cultivated area. There are no specific methods for the collection of the different kinds of the raw materials.

1.3 Statement of Problem

Inventories are stocks of the product kept by the company which deals with the manufacturing and selling of the product. They exist in the various forms in manufacturing companies representing investment of a firm's fund. The objective of the inventory is to maximize the firm's value. Thus, inventory must be managed as such as that it does not lead to the production stoppage.

Both excessive and constraint inventories are not preferable but management should maintain optimum level of inventory management control. Re-order level, minimum stock, maximum stock etc. are some of the factors which are to be considered to maintain desired level of inventory management.

NDL and HPPCL being the manufacturing company, they have the responsibility of making the ideal inventory management for the smooth flow of production. Production oriented enterprises should hold large size of inventory. The inventory should be managed in a balance manner so that excess does not tie-up firms probability and constraint affecting the productivity. Since profit, sales, value of share and so many other relevant factors of the manufacturing company are related to the proper handling of inventory, the topic related to inventory management has vital importance in every research report. It helps in achieving satisfactory result regarding company's level of profit and its effectiveness in generating overall maximization in terms of sales and value of shares.

Inventory management is important for any organization to meet the regular demand of the customer at optimum cost and increase the return on investment. So, inventory must be managed in such a way that it doesn't lead to disadvantages of production stoppage.

The study deals with following issues

- How inventory is managed in NDL and HPPCL?
- What technique is applied to maintain inventory management?
- To what extent inventory and sales are related?
- What are the tools for the inventory control management?
- What would be the effect due to the changing in the inventory on company's productivity and profitability?

1.4 Objective of the Study

The main objective of this study is to analysis the existing inventory management of NDL and HPPCL. The specific objectives are as follows:

- To identify the present inventory position of NDL and HPPCL
- To identify the inventory management system followed by NDL and HPPCL
- To study the present practices of collection and procurement procedures of raw materials in both companies.

- To examine the technique of the inventory management being employed by NDL and HPPCL
- To provide necessary suggestion and the recommendation based on the studies.

1.5 Significant of the Study

Inventory is current assets, so it is most important for any organization. Effective and efficient inventory management helps to achieve the goal where wrong inventory managements leads to heavy loss to any organization. Here in present study main focuses is to detail study about inventory management of NDL and HPPCL. Complete study about the objectives which are to identify the present inventory position of NDL and HPPCL, to evaluate the inventory tools and techniques, to analyze the raw materials and inventory system of NDL and HPPCL, to find out the impact of inventory on production, sales and profit and to provide appropriate recommendation. Other focus is about the weakness if the companies.

1.6 Limitation of the Study

The present study tries to find out the problems and impact of NDL and HPPCL. But the studies are based on certain limitations. The main limitations are:

- The study is concentrates only on inventory management.
- The study is based on the secondary data published by NDL and HPPCL.
- The study only covered 5 years data.
- The suggestion given in the study is not applicable for all manufacturing companies.
- Financial and statistical tools used to analyze the data have their own limitations

1.7 Organization of the Study

The overall study works has been divided into following 5 chapters.

Chapter One	**:**	Introduction
Chapter Two	**:**	Review of literature
Chapter Three	**:**	Research Methodology
Chapter Four	**:**	Presentation and Analysis of Data

Chapter Five : Summary, Conclusion and Recommendation.

The first chapter deals with the background of the study, profile of company, objective of the study, limitation of the study, significant of the study and organization of the study.

The second chapter deals with the conceptual frameworks, types of inventories, objectives of inventory, importance of inventory management, producer of inventory management, inventory management model, cost factor associated with inventory, technical framework, inventory models, EOQ, assumption , ABC inventory system planning, review of previous studies and research gap, review of books, articles and journals.

The third chapter deals with research design, population and sample, nature and sources of data, data gathering prouder and analysis of data.

The fourth chapter deals about presentation and analysis of data, inventory position of companies, relation of inventory with relevant topics, ratio analysis, correlation coefficient, inventory management and control techniques, EOQ of raw materials of total study period, trend line analysis of company and selective inventory control techniques.

The fifth chapter includes summary, conclusion and recommendation of overall study.

At the end on extensive bibliography and annexes are also included.

CHAPTER-II

REVIEW OF LITERATURE

2.1 Conceptual Framework

Inventory may be defined as the good held for eventual resale by the firm. Such inventories are vital element in the firm to achieve the desired sales level. Depending upon the nature of the industries and firms, inventories may be durable or endurable, perishable or undesirable, valuable or inexpensive (Hampton, 1990:220).

Inventory as current assets differ from the other current assets because only financial manager are not involved, rather, all the financial areas i.e. finance marketing, production and purchasing are involved. The views concerning the appropriate level of inventory would differ among the different functional areas (Khan & Jain 2003: 142).

Inventories form a line between production and sale of product. A manufacturing company must maintain a certain amount of inventory during production.

Types of Inventories

Every manufacturing company however big or small has to maintain some inventory. Inventories are the stock of the product in a company. They serves us cushion to observe the stock of error in demand factors and provides more efficient use of the resources. Inventories for an organization is necessary evil and require careful planning and formulation of policies keeping in views the best interest of organization. Depending upon the nature of the industry and firm, the inventory is dividing into four groups.

- Raw materials
- Work in progress
- Finish goods
- Supplies and spare parts.

Raw materials

These goods have not yet been committed to production in a manufacturing firm. Raw materials are those basic inputs that are converted in to finish goods through the manufacturing process. Raw materials inventories are those units which have been purchased and stored for future production (Pandey, 1994:55). The level of spare materials inventories is influenced by anticipation production, seasonally of production, reliability of sources of supply and the efficiently of scheduling purchase and production operation (Western and Copland 1992-395).

Work in-progress

These categories included 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 assembles that are not yet ready to be sold. Work in progress inventories are semi manufactured products. They represent products that need more work before they become finished product for sale (Pandey, 1994:56).

Finished goods

These are completed products waiting for sale. In a manufacturing firm, they are the final output of the production process. For retail firms and whole seller, they are usually referred to as the merchandise inventory.

Supplies and spare parts

Firm also maintain the fourth kind of inventory suppliers and plant clearing materials oil, fuel, lights and bulb like those materials that don't directly entered into production process. Usually these supplies are small part of total inventory and don't involved significant investment (Pandey, 1994:55).

2.2 Objectives of Inventory Management

The objective of inventory management should be to determine and maintain optimum level of inventory investment. The optimum level of inventory will lie between two danger points of excessive and inadequate inventories.

The objectives of the inventory management are listed as follows (Van Horne, 1979:212).

- To maintain optimum level of inventory for smooth production and sales operation.
- To maintain a minimum inventory in inventories to maximize profitability.
- To maintain adequate accountability inventory assets.
- To ensure an adequate supply of materials to the customer.

2.3 Importance of Inventory Management

Inventory management plays vital role in any manufacturing and non- manufacturing company. The needs of the inventory management are mainly defined as the transactional motive, precautionary motive and speculative motive (Star and David, 1997:118).

Transactional motive

Transactional motive emphasizes the need to maintain inventories to facilitate smooth production and sales operation.

Precautionary motive

The motives needs for holding of inventories to guard against to risk of unacceptable changes in demand and supply.

Speculative motive

The motive effects the decision to increase or decrease inventory level to take advantage in case of price fluctuation.

2.4 Procedure of Inventory Management

The procedures of inventory management cover the activities such as purchasing, receiving and store keeping, issuing and pricing the inventory items.

Purchasing

Purchasing in narrow sense refer merely to act of buying as items at a price and boarder sense purchasing makes it's a management activity that goes beyond the simple act of buying and including the planning and policy activities, research and development service –section. Management suggests that purchasing decision involve the weighting of alternatives possibilities and many of these alternatives involve the influence on the other function on the purchasing decision. A good purchasing management should pay more attention in the purchasing of inventories (i.e. raw materials, supplies and equipments.) we should purchase the right quantity of the right quality from the right origin at the right time and cost.

Objectives of purchasing

The objectives of purchasing should conform to overall objectives of an organization. The objectives of purchasing are like the objectives of integrated logistics. The efficient acquisition of products and services requires the right materials, in right quantity, in right condition, at the right time, from the right sources, with the right services, and right prices.

Procedures of purchasing

While industrial purchase may appear quite different this is general industry purchasing process. The process is described below.

- Recognized a need
- Identifying a supplier
- Qualifying and placing an order
- Monitoring and managing the delivery process
- Evaluating the purchase and the suppliers.

2.4 Inventory Management Models

Inventory management models can be divided in two parts

- Push inventory models
- Pull inventory model.

Push inventory model

Push inventory model schedule orders for production or order good in advance of customer demand. Manufactures push the finished products through the distributions channel to intermediaries and the final consumer. Economic order quantity (EOQ), material requirement planning (MRP), manufacturing resources planning (MRP II) and distribution requirement planning (DRP) are all push models.

Pull inventory model

Pull inventory models are based on making goods once customers demand is known. The product is pulled through the channel of distribution by the order. Recent trends suggest a movement to use pull inventory models to reduce inventory throughout the channel. JIT and Kanban are the most wildly used pull inventory system.

2.6 Cost Factors Associated with Inventory

After the great depression of 1930s and 2nd world war, American economy as well as old economy plagued by capital utilization, material storage, inflation and balance of cost lay heart of all the production and inventory control problems. The cost that is necessary inventory problem is not those reported in summary accounting records (Killeen 1969: 212).

There are many cost associated with the size of inventory directly either advocating to decrease the inventory size or suggesting an increase in the inventory size for an effective inventory analysis and the control of the system. Once should have clear picture about the behavior of costs associated with different factors. The main costs associated with inventories are

- Materials Cost
- Ordering Cost
- Carrying Cost

Materials Cost

The price pay to the supplier for buying items of inventories is cost of items which directly affects the cost of production. These are the cost of purchasing of the goods plus

transportations and handling. This may be calculated by adding the purchase price (less and discount), the directly charges and sales tax (if any).

Ordering Cost

Ordering cost is also known as procurement cost. It includes these costs, which are incurred for placing orders or the set up cost of goods are manufacture. These are variable costs. Each separate shipment involves certain expenses connected with requesting and receiving materials. Examples of this cost are the tying of the order and the inspection of goods after arrived. The fewer the orders, the lower the ordering cost will be for the firm. Ordering cost = Annual requirement/Quantity order size × Ordering cost per unit.

Symbolically,

Ordering cost (O) = A/Q ×O

Carrying Costs

Carrying cost is incurred for keeping stocks in the store. So, these are the expenses of storing goods. Once the good have been accepted, they become a part of the firms inventories. These cost refer to cost related to holding of inventory over a given time period it includes rent, insurance, security, heat, light and power, taxes, thefts, leakage, spoilage etc.

- **Rent cost**: it includes such costs which are taken on rent, like house rent, land, vehicles etc.
- **Insurance**: in spite of best precaution, firms must protect themselves against such hazards as fire or accidents in the warehouse. Larger amounts of inventory require larger amount of insurance. The insurance premium represents a carrying cost inventory.
- **Storage Cost:** the firm must provide for storage space, usually through the operation of a warehouse or supply room. The firm must employ workers to more. Clean, count, record and protect the goods. All of these activities dealing with the physicals holding of the goods are considered storage cost.
- **Property tax:** as with insurance property tax are levied on the assessed values of the firm, assets, the greater the inventory value, the greater the assets value and consequently the higher is the firm tax bill.
- **Obsolescence and deterioration:** when firms hold goods, they expose themselves to the possibility that the goods will not be salable when the time arrives. Obsolescence

is the cost of being unable to sell goods because of current market factor deriving from changes in style, tests or other factors. If a product is no longer wanted the firm must sell it at a fraction of its value or destroy it. Spoilage occurs when a product is not salable because of deterioration during storage, such as foods that rot, plants that die, garments that are attracted by months, candles that discolor or the chemical that decompose.

- **Damage or theft:** although a firm makes every effort to protect goods against damage and safeguard items against pilferage, goods are demand and stolen. A portion of those expenses in not covered by insurance and are losses to the firm. In some business, particularly retail stores and producing luxury products such as alcoholic beverages, damage and theft may constitute major carrying cost.
- **Cost of Funds tied up in inventory:** whenever the firm commits its resources to inventory, it is using funds that otherwise might be available for other purpose. A portion inventories is financed by trade credit from suppliers and involves no costs. If the firm buys clothing on terms of net 30, the clothing may be sold before the firm must pay its supplies. The balance of the inventory must be financed from the firms' general funds and involves a cost. If the firm is considering an expansion of inventories and plans to borrow obtain funds, the will have to pay interest on the additional debt. If the firm finances additional inventory through the sale of common stock an opportunity cost is involved. The firm has lost the use of funds for others, profit making process. Whatever the sources of funds inventories represent an unneeded cost.
- **Costs of running out of goods**: whenever a firm incurs shortages of production, it incurs cost. If the firm is unable to fill an order, it risks losing sale. If the firm runs out of raw materials, it may force costly shout down of the production process. Adequate inventory helps reduce additional costs and lost revenues due to shortage.

2.7 Technical Framework

Technical formulation includes the questions, which reduces the cost and increase in profitability. The problem, which is common to all, is how much to estimate and execute inventory policies. How much should they buy at a time? How low should they let, inventory to fall before they replenish it? From whom they should buy and how should they ensure for getting the lowest price available. Therefore, the main problem is to a large number to stock

keeping item but it is not possible to answer all the questions. It has been possible to answer these varied question or problem faced by the business units (Adam, 1993:114).

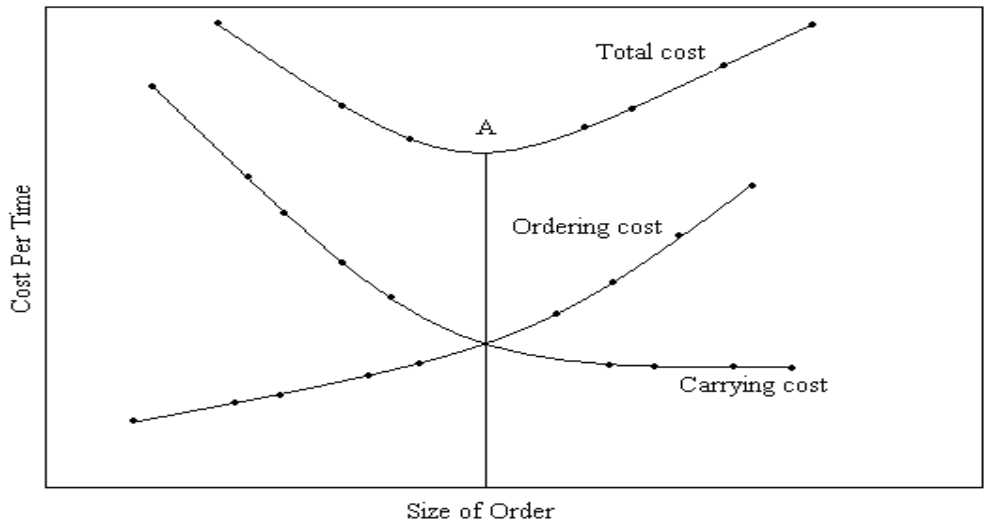
2.8 Inventory Models

We have already discussed about the different form of costs then let's see how the production manager attack the problem fixed unit of given items of lowest price or produced for stock at a given time. The large quantity purchase enables the management to reduce the order placing cost incurred in a given period. Buying a bulk of items also makes it possible to take advantages of quantity discount and lower handling cost. We know that the procurement cost decreases, the carrying cost will increases. This is the cost tradeoff between the two. If we add the cost graphically, we will obtain the total cost curve. The optimal order quantity is the point at which annual total cost is at a minimum. The purchase of large amounts of materials at one time raises the inventory carrying charges because of the increased size of the average inventory maintained which is shown below (Magee, 1995:110).

Since order placing cost are largely independent of the size of the order. Ordering cost goes down as the order size is increased because fewer order are placed to reduce the inventory cost.

To solve the relationship between those costs let us consider the case of printing press that needs 1000 tons of newsprint. If the process of orders from the manufacture in quantities of 100 tons at a time means that less order must be placed whereas only two orders are needed for an order size of 500 tons. As consequences inventories cost such as storage, insurance and interest, which vary with inventory level will be lower and are economic that belongs to large orders such as quality discount lower ordering cost and lower receiving cost, a balance must be stock between the inventory carrying cost and order size for this firm, which will result in a minimum total annual cost, will reflect a compromise and accommodation between the two cost patterns. This compromise occurs at the lowest point in the total cost curve 'A' shown in figure.

Figure No:2.1
Order size and cost relationship



Source: (Ross and Paul, 1979:120).

2.9 Economic Order Quality (EOQ)

When we purchase raw materials then the EOQ concept comes together. This is important in the storage of finished goods and transit inventories. To determine the optimal order quantity for a particular item of inventory given its forecasted usage3 ordering cost and carrying cost. Ordering can mean either the purchase of the item of its production.

EOQ is one of the important inventory control technique. It is widely used in these days in many countries irrespective of under-developed or developing countries. This model determines the optimal order quantity of individual items of inventory, gives its forecasted usage, ordering cost and carrying cost. Economic order quantity is that level of inventory order. This minimizes the total cost associated with the inventory management. Total cost consists of ordering cost and carrying cost (Khan & jain 1994:110).

How much to order, or purchase is one of the main problems of inventory management. That is, the determination of a quantity for which the order should be placed is one of the important problems concern with inventory management.

For the determination of Economic Order Quantity we need to know the per unit carrying cost for one year (C), the cost of placing one order (O) and yearly demand for the products (A). The Economic Order Quantity can be calculated as:

$$\textbf{EOQ} = \sqrt{2AO/C}$$

Where, EOQ = Economic Order Quantity

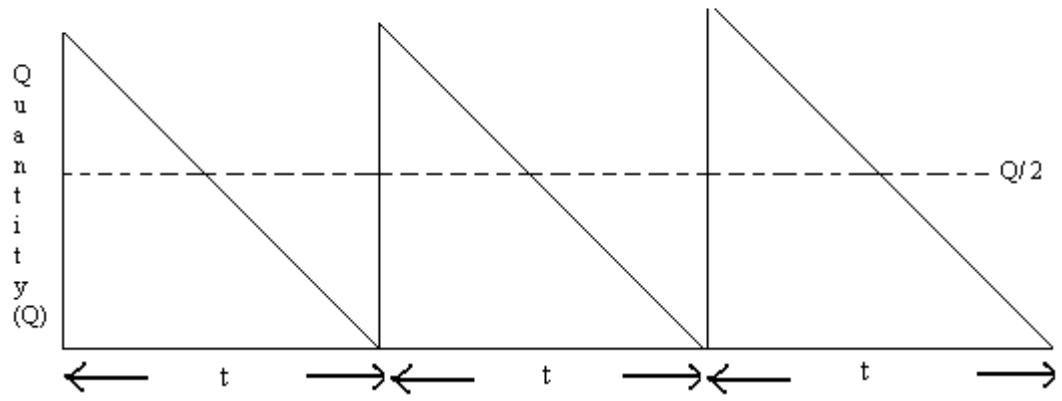
A = Annual Requirement of the Product

O = Ordering cost per order

And C = Carrying cost per unit.

This is the formula method of calculating EOQ, we can flow many other methods like trial and error method or tabular method, graphic method.

Figure No:2.2
A Graphic Representation Model



Source: (Ross and Paul, 1979:122).

Above figure is the graphic presentation of the basic element of this example of inventory. It is assumed in this simplified model that orders are placed at fixed periodic intervals equal to 'T' and that the materials order are abstemiously received. The amount order is designed as "Q" which is equal to the rate of the usage multiplied by the interval between orders. The average inventory held throughout the year would be Q/2 as illustrated by dashed line, therefore placed in a year is D/Q.

If the company orders EOQ units each times, it will minimize total inventory costs. The following example shows how the calculation can be used.

A large manufacturer, major motor uses the 100000 tires (A) a year the production of their 2238 sports car. The ordering cost (O) is $135 and the carrying cost (c) is $ 0.75. The optimal quantity can be calculated as (Handerson,1996)

$$\text{EOQ} = \sqrt{\frac{2Ao}{C}} = \sqrt{\frac{2\times100000\times135}{0.75}} = 6000$$

Number of order = A/Q

= 100000/6000

= 16.7 times

Major motors require 100000 tires, it will be necessary to place 16.7 or 17 orders per year to satisfy the demand. And time between the orders is 15 (250/17 = 14.7 or 15) days (250 days assumed as the total working days per year.)

Assumption

The EOQ model relies on several assumptions.

- There is a continuous, constant and known demand rate.
- The lead time / replacement cycle is known and constant.
- The constant purchase price is independent of the amount ordered.
- Transportation costs are constant no matter the amount moved or distance traveled.
- No stock outs are permitted.
- There is no inventory in transit.
- All inventory parts are independent of each other.
- The planning horizon is infinite.
- There is no limit on the amount of capital availability.

Prerequisite for EOQ

Following facts are to be considered as prerequisites for determinations of EOQ.

- Holding cost per unit per (period) year.
- Ordering cost per order.

- Annual requirement or quantity required per year (period)
- Cost per unit.

2.10 Fixation of Stock Level

Reorder Point

It is the point at which the storekeeper should initiated purchase requisition for fresh supply. Wherever on item of stock touches re-order level, the purchase procedure is automatically activated so that fresh stock can be procured in time. Reorder level depends upon the lead time, rate of consumption and economic order quantity.

The problem how much to be ordered is solved by determining the EOQ. The second problem is when to be order. This question is related to determine the reorder point. It is also known as ordering point or optimal reorder point or reordering level or ordering level. It is the point at which its stock of material falls down then the storekeeper initiates the purchase requisition for fresh supply of material. This level is fixed somewhere between the maximum and minimum level in a such a way that the difference between reordering level and maximum level will be sufficient to meet the requirement of producing up to time the fresh supply of materials is received.

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

- **Usage Rate**: This is the rate per day at which the item consumed in production. It is expressed on units.
- **Lead time**: This is the amount of time between placing an order and receiving the goods. This information is usually produced by the purchasing department. The time allow for order to arrive may be estimated from a check of the company's records and the time taken in the part for different suppliers to fill orders.
- **Safety stock level**: The minimum level of inventory may be expressed in terms of several days' sales. The level can be calculated by multiplying the usage rate times the number of days that the firms to hold as a protection against shortage.
-

Reorder point under Certainty

Here lead time is the normally taken in replenishing inventory after the order has been placed. This formula is taken under certainty condition i.e. usage and lead times do not fluctuate.

Reorder point = lead time × Average daily usage

Reorder point under uncertainty

We can't predict lead time and usage accurately. The demand for material fluctuates day to day and delivery time may be varies. If the actual usage increases delivery time is delayed. The firm can face stock out problem. To solve the stock out problem, the firm should maintain safety stock.

Reorder level can calculate by applying the following formula

ROP: (Lead time × average usage) + safety stock.

Reorder level = minimum level + consumption during lead time.

Maximum Stock Level

Maximum stock level is a stock that can be maintained on the basis of requirement. It is a quantity that can be maintained on the basis of need. It is the stock level above which stock should not be allowed to rise. It is an upper limit beyond which the quantity of any item is not normally allowed to rise. The maximum stock level is affected by availability of financial resources, stores space, lead time and nature of material, reasonability of material and government control. The maximum level is fixed by considering the following points:

- Re-order level
- Maximum consumption rate during lead time.
- Maximum lead time or reorder period.
- Reorder quantity

Maximum stock level: reordering level + reordering quantity – (maximum consumption ×minimum reorder period)

Minimum Stock Level

This is the lower limit below which the stock of any item should not normally be allowed to fall. Carrying of minimum stock avoids a situation of stock out resulting in the stop page of production. This stock is a buffer stock or safety stock to be used only under abnormal condition on it an emergency. In the determination of minimum stock level, the following points are taken into consideration.

- Reorder level.
- Average rate consumption and
- Average lead time – the period of time between ordering and replenishment (reorder period)
- Minimum stock level = re-order level- (average/normal consumption ×average /normal lead time/ reorder period)

Average Stock Level

An average stock level indicated the average stock held by the firm. It is calculated by the following formula.

Average stock level = minimum level + ½ of reorder quantity.

Danger Stock Level

This is a level of which normal issues of the materials are stopped and issued are made only under specific instructions. This is the level below the minimum quantity. It is signal to the concerned people to arrange for the procurement of materials urgently to avoid stock out. It is applying the following formula.

Danger level = Average consumption × maximum reorder period for emergency purchase.

2.11 ABC Inventory System Planning

A firm maintains large number of inventories of several types. It is impractical and impossible to control all these inventories with equal attention, the main reason is that all inventories are not equally important to firm from the view points of cost, profit; sales availability etc. therefore, firm should pay attention to those items whose value is the highest.

Therefore, always better control (ABC) analysis is a technique, which concerns with classification of inventory into three groups:

- Group A: it includes few items with large value.
- Group B: it includes items with moderate value.
- Group C: it includes items with high volume with small value.

Breakdown of group A, B and C of items, depends on individual business conditions as follows.

Category	Percentage of item	Annual value of inventory
A	10-20	70-85
B	20-30	10-25
C	60-70	5-15

The classification is based on actual percentage of inventory items and annual value of such item by plotting in a group called ABC distribution curve (Pareto Curve)

The comparison of A, B and C items are as follows

Group A	Group B	Group C
Maintain close control	Moderate control	Loose
Size of order based on calculated requirement	Size of order based on usage	Size of order based on inventory level
Keep record of receipt and use	Keep record of receipt and use	No records are kept
More effort to reduce load time	Moderate effort	Minimum effort
Frequently ordering	Less frequently ordering	Bulk ordering
High consumption value	Average consumption value	Low consumption value

The producers of ABC analysis are summarized below

Step 1: obtain data as the annual usage (or consumption) rate along with the unit cost of each inventory item of these items.

Annual Value = unit cost × Average usage rate

Step 2: Arrange these item in a descending order on the basis of their respect usage values.

Step 3: Explain the annual value of each item a percentage of the total value of all items. Also compute the cumulative percentage of annual usage values.

Step 4: Obtain the percentage value for each of items i.e. if there are 10 items, then each item would represent 100 = 100% of the total items also cumulative these percentage value.

Step 5: draw a graph between percentage of items, (on X- axis) and annual percentage of value (on Y-axis) and mark cutoff points where the graph changes its slope and determines appropriate decision for A,B and C as given below.

2.12 Review of previous studies

2.12.1Articles and Institutional Reports

Here are some related articles and institutional reports with the topics. They are as follows
Dr. G.R. Agrawal has made study related to the Nepalese public enterprises stated that inventory management is the weakest aspects of management in Nepal the tools and techniques for controlling inventory have not been applied in Nepalese enterprises for controlling their physical as well as financial dimensions (Agrawal, 1980).

CEDA has made a study relating to the Nepal Transport Corporation concerning with various aspects. According to this study, inventory management of this factory is rather simple but due to the mismanagement of stocking of this spear parts hamper the smooth operation of these enterprises (CEDA, 1973).

CEDA has conducted as study in management problem in public sector manufacturing company in Nepal. One of the most important finding was the inventory management public enterprises suffer from the lack of planning, high carrying cost, poor recording and store management and virtual absence of controlling system (CEDA, 1974).

Industrial services centre has conducted a study regarding the performance of Birtnagar Jute Mill Ltd. The major findings of this study were that the store keeping and control stock level of various items are not fixed up. Bin cards are not mentioned and ledgers are not kept up to date (I.S.C. 2036).

Corporation co-ordination council conducted a comprehensive study of Bansbari Leather and shoe factory. From this study, the major finding was inventory planning is out of scope of the factory. Because of this, some of the materials are not available. Some are procured in time resulting in the bottleneck in the smooth flow of production function (CCC, 2033).

From above reviews, it is implied that most of the Nepalese manufacturing enterprises are not much serious regarding the inventory and material management. The enterprises should be serious towards the inventory management to be successes in their targets.

2.12.2 Review of Thesis

Various studies have been made about the inventory management. Some of them are review here under

Gaire (1996) had made study about the inventory management and control of Nepal Drugs Limited. His objectives, Methodology and major findings are given below:

Objectives

- To study the inventory management system followed by RDL
- To study about the techniques and method used by the company
- To study the present practices of collection and procurement procedure of raw materials of company
- To provide necessary recommendation to the company

Methodology

- He use the secondary data only
- Data are collected from Report and financial statement of the factory, published official records and article
- Among many populations he used the NDL as a sample
- For data analysis he use different Ratios, Correlation regression, Mean, average, Deviation etc

Findings

- NDL estimates its order haphazardly. Purchase quantity made by limited differs year to year.
- EOQ model is not applied by NDL. The safety stock level is fluctuated and estimated roughly.
- The NDL has been able to produce good quality medicine because of its quality control.
- The NDL has not categorized its inventory for the purpose of controls and paid equal attention for all the inventories.

Recommendations

On the basis of this study he has recommended followings:

- The NDL should define goals and objectives clearly concerning its inputs and outputs separately. I.e. the quantity, time period should be specified.
- The NDL should follow the EOQ model for optimal level of inventories to minimize the cost. Re-order point, safety stock level and lead time should be specified.
- The NDL should apply ABC inventory system to control the cost and time according to their value and quantity.
- The frequency changing of the General Manager has also affected the management. It creates unstable environment. Therefore, the post of the manager should be professionalized and it should be far from political interfering.

Pant (1999) has conducted a research work on "impact of Inventory over the profit: A case study of Gorkhapatra corporation." His major findings and recommendation are given below.

Objectives

- To study the inventory management system followed by GorkhaPatra Corporation
- To study about the techniques and method used by the company
- To study the present practices of collection and procurement procedure of raw materials of company
- To provide necessary recommendation to the company

Methodology

- On this study both Primary as well as secondary data have been used.
- Data are collected from Report and financial statement of the factory, published official records and article
- Among huge populations he used the Gorkhapatra Corporation as a sample
- For data analysis he use different Ratios, Correlation regression, Mean, average, Deviation etc

Findings

- Gorkhapatra Corporation has not been used the optimal inventory to produce the required inputs.
- Profit margin is inconsistence in various years. Inventory turnover is flexible over the study period.
- In previous years, return on total assets is more flexible but slightly constant in latter year.
- Regression and co-relation analysis have shown the positive relationship between inventory cost and profit.

Recommendation

- Regarding the optimal level of inventory, the corporation should be applied the appropriate tools and techniques.
- Corporation needs to adopt the reliable procurement procedure for the important materials with the help of good purchase plane to avoid the possible crises of stock-out.
- The formality of making decision regarding the tender procedure and planning the order should be shortened to increase its competitiveness.
- The recruitment and selection procedure of qualified personnel should be done to handle the inventory. Regular training should be given to the techniques.
- The vision of the top level should be clear for solving the problems appeared in cources of inventory management system.

Pandey (2000) has conducted the research work on the topic of "inventory management: A case study of Gorkhapatra corporation." On her study, the following major findings and recommendation are as follows.

Objectives

- To study the inventory management system followed by GorkhaPatra Corporation
- To study about the techniques and method used by the company
- To study the present practices of collection and procurement procedure of raw materials of company
- To provide necessary recommendation to the company

Methodology

- In this research both Primary and secondary data were included.
- Data are collected from Report and financial statement of the factory, published official records and article
- For his studies he used only data of Gorkhapatra sasthan of several years.
- For data analysis he use different Ratios, Correlation regression, Mean, average, Deviation etc

Findings

Major findings in her study are tentative solution for the question about how much to buy and when to order and how to maintain proper balance of inventory to fulfill the corporation's requirement.

Recommendations

- Corporation should follow the EOQ model for minimizing the inventory.
- To maintain the inventory smoothly, ABC classification should be adopted by the corporation.
- Ledger card can be used by the corporation to manage inventory. It contains the column for inserting the data or order and its receipts with date and quantity issued and sold. In this card, name of the item number, unit price, usage rate, supplier's name, the percentage of carrying cost and the ordering cost should be maintained.

- The scarp material (unsold stock or wastage) should be recycled within the corporation, so that, cost of some possible extent can be cut-down. Hence, the corporation should setup the recycling sector.
- For getting skilled technicians, the process of requirement and selection should be unbiased.
- Record keeping system should be scientific, so that, the corporation can located the past records which are also helpful for the researcher.

Shrestha (2000) made the topic of "Inventory management of manufacturing industries of Nepal" (with special reference to quick foods). According to his study the objective of study, methodology of the study and the major findings and recommendation are as follows:

Objectives

- To study the inventory management system followed by Nepalese Companies
- To study about the techniques and method used by the companies
- To study the present practices of collection and procurement procedure of raw materials of companies
- To provide necessary recommendation to the companies

Methodology

- He use only secondary data
- Data are collected from Report and financial statement of the factory, published official records and article
- For his study he used many manufacturing companies of Nepal
- For data analysis he use different Ratios, Correlation regression, Mean, average, Deviation etc

Findings

- Classification of inventories has not done by the company. The company is using for bin card for inventory.
- The company does not know about how to order and when to order. The company does not apply the EOQ model.
- Raw material turnover ratio of some inventories is increasing year to year but this ratio was satisfactory.

Recommendations

- Company should define its goal and objectives very clearly regarding to its input and output separately.
- Record keeping system should be scientific. Company should keep its past records.
- Some raw materials were imported from Japan, New Zealand, Singapore, India, Korea and China. Alternative sources should be searched within the nation as possible.
- The company should follow the scientific techniques i.e. EOQ and economic lot size formula which help to reduce the relevant total cost for manufacturing the products.
- Company should conduct ABC analysis for its inventory.

Niroula (2003) has conducted a research work on the topic of"A study of Inventory Management" According to his study the objective of study, methodology of the study and the major findings and recommendation are as follows

Objectives

- To analyze the inventory level maintained by the company.
- To examine whether the inventory management system is satisfactory or not.
- To maintained inventory and other consequence on cost and profit.
- To suggest proper inventory model of companies based on the analysis.

Methodology

- He uses only secondary data.
- Data are collected from Report and financial statement of the factory, published official records and article.
- For his study he used many manufacturing companies of Nepal.
- For data analysis he uses different Ratios, Correlation regression, mean, average, Deviation etc.

Findings

- The corporation management is not census about the application of inventory management techniques to control and reduce the cost of inventories.
- A minimum profit is earned but is in decreasing trend.
- While purchasing milk, no techniques of inventory management are used and no any exercises are made by corporation about different stock levels, re-order quantity etc.

- The pre-caution and preventive efforts are not made to product the destroyable dairy products and it is the main cause which impact to the earning of corporation.

Recommendations

- The company should follow the inventory management techniques like EOQ.
- The company needs to follow the ABC analysis for classification of its inventory.
- Before applying the techniques deep exercises should be made.
- Company should maintain the quality of products insisted of earning only profit.

Pradhan (2004) has conducted a study for master degree thesis on significance of inventory management of Nepalese manufacturing enterprises. His objectives, methodology, major findings and recommendation are as follows:

Objectives

- To examine the existing inventory system applied by the company.
- To determine optimal inventory level of major raw materials.
- To assess the relevant financial ratios.
- To analyzed the relationship between inventory, material cost and profit.

Methodology

- On this study both Primary as well as secondary data have been used.
- Data are collected from Report and financial statement of the factory, published official records and article
- For this study he uses several manufacturing company as a sample.
- For data analysis he uses different Ratios, Correlation regression, mean, average, Deviation etc.

Findings

- Purchase of raw materials is on the agreement and local tender basis. Materials are imported from India, Thailand and some materials are taken from the market.
- The factory is not following the EOQ model in purchasing decision.

- ❖ The ratio of consumption of raw materials and the production of raw materials is increasing and the production of cigarette is decreasing.
- ❖ EOQ model is not following by the company.
- ❖ Inventories are not classified according to the ABC analysis.
- ❖ The company is unable to utilize its capacities in the production of cigarette.

Recommendations

- ❖ Company should define its goals and objectives very clearly.
- ❖ The company should follow the scientific techniques because with the application of EOQ formula and economic lot size formula cost would be minimized.
- ❖ ABC analysis should be followed by the company for managing its inventory smoothly.
- ❖ The post of the general manager should be professionalized and it should be far from the political interfere.

Bohara (2006) made the topic of "Inventory management of UNI-Lever Nepal limited. According to his study the objective of study, methodology of study, the major findings and recommendation are as follows:

Objectives

- ❖ To identify the current inventory position of ULL.
- ❖ To evaluate the inventory tools and techniques used by ULL.
- ❖ To analyze the raw material and inventory system of ULL.

Methodology

- ❖ On this study he used both Primaries as well as secondary data have been used.
- ❖ Data are collected from Report and financial statement of the factory, published official records and article
- ❖ For this study he uses ULL as a sample company.
- ❖ For data analysis he uses different Ratios, Correlation regression, mean, average, Deviation etc.

Findings

- ➢ ULL is used to take the centralized purchasing producer. Overall company's policy of maintaining inventory is inappropriate.

- Fluctuation is found in each case, lake of appropriate inventory policy and ineffective demand forecast.
- Company has not followed any system of inventory as well as production.
- Company has faced some problems on managing proper inventories in using pull system because there is uncertainty about the future supply of materials, operation of factory, Nepal bandas, Lock out, strikes, geographical problems, fluctuation of materials, prices etc.

Recommendations

- Company has not been able to utilize the optimum capacity i.e. not been able to satisfy the level of customer demand; hence it is quite important for the company to use optimal capacity which has been idle now.
- Objectives should be well defined and followed with regarding to its inputs and outputs.
- Company should use EOQ model for optimum level of inventory management system.
- Company should apply ABC classification approach for better inventory control.

2.13 Research Gap

From the review of above-mentioned literature it has been observed that many thesis and dissertations have been written on the topic of Inventory Management. But Inventory Management system could not be found. Which system is suitable for what types of inventories is not mentioned. Inventory Management status is not clarifies and mentioned for the betterment of manufacturing industry. The rationale to make this study is to fulfill the gap of previous studies in terms of identification of the key elements, which reduce and control the cost study trend of sales and distribution and providing necessary suggestion and recommendation for the betterment of BIP ltd. For that purpose this study will try to study various system and their applications according to ABC classification of inventories including EOQ calculation.

This study will be fruitful to those interested persons, teachers, businessman and government for academically as well as policy perspective.

CHAPTER III

RESEARCH METHODOLOGY

Research methodology is the process of arriving at the solution of problems through a planned and systematic dealing with the collection, analysis and interpretation of the facts and figure. The basic objectives of the study are to analyze the present position of the inventory management, present procurement procedure of raw materials and goods of Nepal Drugs Limited and Herbal Production and Processing Company Limited. Through this chapter Ratio analysis, Co-relation, Proportion, Average and Deviation are used for research methodology.

3.1 Research Design

Planning structuring and making strategy for investigating of the information in order to research a conclusion is research design. The research design of this study is descriptive as well as analytical. The study is primarily based on secondary data. Here the study is concerned with NDL and HPPCL. Things related with NDL and HPPCL like material collection, consumption and inventory position of product groups are variable under study.

3.2 Population and Sample

There are different manufacturing companies in the country. The huge mass of these companies are called population. The different company produces different products. But some of them produce similar types of product only their names are different. They are competitor for each other. They try to make different from one and another. Even though, all these companies altogether are called population. In our practical life there are various types of population.

Among huge mass population, the fewer selected items are called sample. For this research among many manufacturing companies the researcher chooses NDL and HPPCL. They are sample for this research. So, we can say that sample is small part of population. Adding many samples population will be formed.

3.3 Natures and Sources of Data

The sources of data are both primary and secondary. We can use both data in this study. Primary data are collected through the personal observations and informal discussions with

the staffs of the Royal Drugs Limited and Herbal Production and Processing Company Limited where as the secondary data are collected from the following sources.

- Report and financial statement of the factory.
- Published and unpublished official records and books.
- Articles
- Magazines
- Annual reports.

3.4 Data Gathering Procedure

Without use of data the research cannot be completed. Data can be collected from different sources. On that process many data gathering procedure can be used. Data gathering procedure consists the important activists of the research work in order to collect the required data from the official record of the factory. The researcher should visit the factory personally to collect the data from journals, magazines published. Financial statement and annual reports of the company are mainly used as the sources of secondary data. Regarding the primary sources, personnel observations and personal discussions methods are used.

3.5 Analysis of Data

Inventory management is the major function of general management. In order to achieve the organizational goal, there is a need of effective inventory management system. In this study, the bibliography cards have been prepared first on the basis of available literature, journal, reports and data. Then the accumulated literature, reports and data were reviewed and tabulated accordingly with the objectives. To analyze the collected facts and figures, various accounting tools are used to effectiveness of inventory management and control wherever necessary. The techniques includes are statistical tools, graph, mean, Karl person coefficient and correlation. And the inventory management techniques applied in this study EOQ, different stock levels, inventory turnover ratio and ABC analysis. The short descriptions of these tools are as follows.

Karl Pearson's coefficient and correlation

One of the widely used mathematical methods of calculating the correlation coefficient between two variables is Karl Pearson's correlation coefficient. It is denoted by r_{xy} or simply r is denoted by

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

Diagrammatic and Graphic Presentation

After collecting the numerical data for statistical equity, the next step is to classify and tabulate them. Figures are not always interesting. When their sizes increase, they became confusing and uninteresting such that no one would care to study them. To avoid this difficulty, the next method of presenting numerical data is the use of diagrams and graphs.

Diagram and graphics are nothing but the presentation of statistical data in the form of geometrical figures like points, lines, bars, rectangles, circles etc.

Mean ($\ddot{x}$)

The measurement of central tendency is designed to measure central value around which most of the data tend to concentrate. The following are the measure of the data to concentrate. The following are the measures of central tendency or measure of location.

$$\ddot{x} = \frac{\sum x}{n}$$

Where,

n = the number of observations.

$\sum$x = Sum of the number observations.

ABC Analysis

A firm maintains large number of inventories of several types. It is impractical and impossible to control all these inventories with equal attention, the main reason is that all inventories are not equally important to firm from the view points of cost, profit; sales availability etc. therefore, firm should pay attention to those items whose value is the highest.

Therefore, always better control (ABC) analysis is a technique, which concerns with classification of inventory into three groups:

- Group A: it includes few items with large value.

- Group B: it includes items with moderate value.
- Group C: it includes items with high volume with small value.

Financial Analysis

Effective planning and control are central to enhancing enterprises value. Financial plans may take many forms, but nay good plan must be related to the firms existing strengths and weakness. The strengths must be recognized if corrective action is to be taken. For example, are inventories adequate to support the projected level of sales? Does the firm have too heavy an investment in accounts receivables, and does this condition reflect a lax collection policy? For effective operations, does the firm have too much or too little invested in plant and equipment? The financial manager can plan future financial requirements in accordance with the forecasting and budgeting procedures, but the plan must begin with the type of financial analysis. Financial analysis can be undertaken by management of the firm, or by parties outside the firm, viz. owners, creditors, investors, suppliers of long term debt, government and others. In shorts, there are the uses of the ratios.

The probable uses ratios of this research are as follows:

Inventory turnover ratio = Sales / Inventory

Raw Materials Turnover Ratio = Cost of RMC/Cost of Average RM

Packaging Material Turnover ratio = Cost of PM/Cost of Average PM

EOQ Analysis

EOQ is one of the important inventory control technique. It is widely used in these days in many countries irrespective of under-developed or developing countries. This model determines the optimal order quantity of individual items of inventory, gives its forecasted usage, ordering cost and carrying cost. Economic order quantity is that level of inventory order. This minimizes the total cost associated with the inventory management. Total cost consists of ordering cost and carrying cost

For the determination of Economic Order Quantity we need to know the per unit carrying cost for one year (C), the cost of placing one order (O) and yearly demand for the products (A). The Economic Order Quantity can be calculated as:

$$\textbf{EOQ} = \sqrt{2AO/C}$$

Where, EOQ = Economic Order Quantity

A = Annual Requirement of the Product

O = Ordering cost per order

And C = Carrying cost per unit.

This is the formula method of calculating EOQ, we can flow many other methods like trial and error method or tabular method, graphic method.

Probable Error (P.E)

Probable error of the correlation coefficient denoted by P.E. is the measure of testing the reliability of the calculated value of r. if r be the calculated value of r from a sample of n pair of observations, then P.E. is denoted by

$$\text{P.E.} = 0.6745\,\frac{1-r^2}{\sqrt{n}}$$

It is used in interpretation whether calculated value of r is significant or not.

i) If r<6 P.E., it is insignificant. So, perhaps there is no evidence of correlation

ii) If r< 6 P.E., it is significant.

In other cases, nothing can be concluded.

The probable error of correlation coefficient may be used to determine the limits within the population correlation coefficient lies. Limits for population correlation coefficient are r ± P.E.

CHAPTER-IV

PRESENTATION AND ANALYSIS OF DATA

The main objective of this study is to examine the present practice of inventory management system in NDL and HPPCL. To achieve these objectives, collected data are analyzed in this chapter by applying inventory management tools and techniques.

On the basis of official recorded data of NDL and HPPCL, the researcher has tried to explore the existing problem of inventory management and control system and the researcher has analysis and diagnosis of the collected data and to provide the suggestion and recommendation to NDL and HPPCL.

4.1 Inventory Position of NDL and HPPCL

4.1.1 Relation Between Inventory and CA

All inventories are currents assets but all current assets are not inventories. Keeping both more & less inventories in the company is dangerous. All current assets can be change in to cash within the year but all inventories could not be changed within the year. The relation between inventory and current assets shows that the % of inventory in total current assets. These types of relation of these two factors play the vital roles for the company.

Table 4.1

Relation between Inventory and CA

	NDL				HPPCL			
Year	INV	CA	% of INV on CA	% of Deviation on Average	INV	CA	% of INV on CA	% of Deviation on Average
2059/60	3819.9	10382.8	36.79	16.68	2939.5	5675.5	51.79	56.32
2060/61	4368.8	11890.7	36.74	16.52	1445.3	3895.2	37.1	11.98
2061/62	6403.0	13341.7	47.99	-84.87	1361.2	5690.2	23.92	-27.8
2062/63	4809.5	12608.5	38.14	20.96	1834.4	7123.3	25.75	-22.24
2063/64	6026.5	14630.2	41.19	30.64	2394.1	8845.4	27.07	-18.29
Average	4885.5	12570.6	31.19		1994.9	6245.9	33.13	

Source: Annual Report of NDL and HPPCL

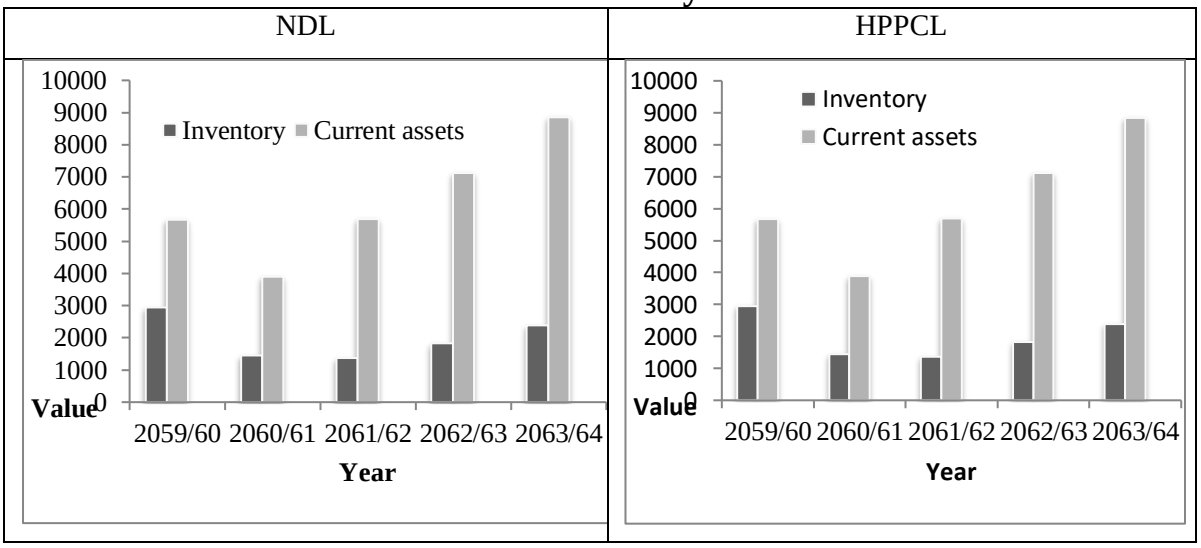
% of inventory on Current Assets = Inventory/Current Assets

From the above table it is observed that the inventory to current assets ratio of NDL during the study period is 36.79 %in FY 2059/60, 36.74% in FY 2060/61, 47.99% in FY 2061/62, 38.14% in FY 2062/63 and 31.19% in FY2063/64% whereas, inventory to current assets ratio of HPPCL during the study period is 51.79%in FY 2059/60, 37.10% in FY 2060/61, 23.92% in FY 2061/62, 25.75% in FY 2062/63 and 27.07% in FY2063/64%. Above table also shows the deviation of percentage of inventory in current assets over the study period. The highest positive deviation of inventory on current assets is for the fiscal year 2063/64 which is 30.64% of NDL and for HPPCL it is 56.325 in FY 2059/60. Highest negative deviation of inventory on current assets is for the year 2061/62 which is (84.87) % of NDL and for HPPCL is in FY 2061/62 which is 33.13%.

From the above analysis it is also observed that share of inventory is highest in FY 2061/62 and the highest current asset is in FY 2063/64 of NDL where the highest inventory and current of HPPCL is 51.79% in FY 2059/60 and 23.92% in FY 2061/62 respectively. These figures indicate that the company has not been adopting appropriate inventory policy. The graphic representation of level of inventory and current assets over the study period is as follows.

Figure 4.1

Level of Inventory and CA



4.1.2 Proportion of Packaging Materials on Total Inventory

Packaging materials are such type of inventories which are kept in packet. If such types of materials are not kept in packet they will be damage. They became useless. These types of

materials could not be kept in open environment. Therefore, packaging material on total inventory shows how much % of packaging materials covers on total inventory.

Table: 4.2

Proportion of Packaging Materials on Total Inventory

Source: Annual Report of NDL and HPPCL
% of inventory on Packaging Material = Packaging Materials/Inventory×100%
.

	NDL				HPPCL			
Year	PM	INV	% of PM on Total INV	% of Deviation on Average	PM	INV	% of PM on Total INV	% of Deviation on Average
2059/60	1140.2	3819.94	29.85	13.93	423.3	2939.5	14.4	30.55
2060/61	1279.2	4368.78	29.28	11.76	215.2	1445.3	14.89	35.00
2061/62	1390.9	6403.04	25.74	-01.75	125.21	1361.2	03.20	-70.99
2062/63	1083.5	4809.48	22.52	-14.05	227.65	1834.4	12.41	12.51
2063/64	1423.5	6026.48	23.62	-3.85	244.92	2394.1	10.23	-07.25
Average	1263.4	4885.54	26.20		222.21	1994.9	11.03	

From the above table ,it is observed that share of packaging materials on total inventory during the study period of NDL is 29.85 % for the FY 2059/60, 29.28 for the FY 2060/61, 25.74% for the FY 2061/62, 22.52% for the FY 2062/63 and 23.62% for the fiscal year 2063/64 where, share of packaging materials on total inventory during the study period of HPPCL is 14.40 % for the FY 2059/60, 214.89 for the FY 2060/61, 3.20% for the FY 2061/62, 12.41% for the FY 2062/63 and 10.23% for the fiscal year 2063/64

Whereas the average percentage of packaging material in total inventory in the overall studies period is 26.20% and 11.03% of NDL and HPPCL respectively.

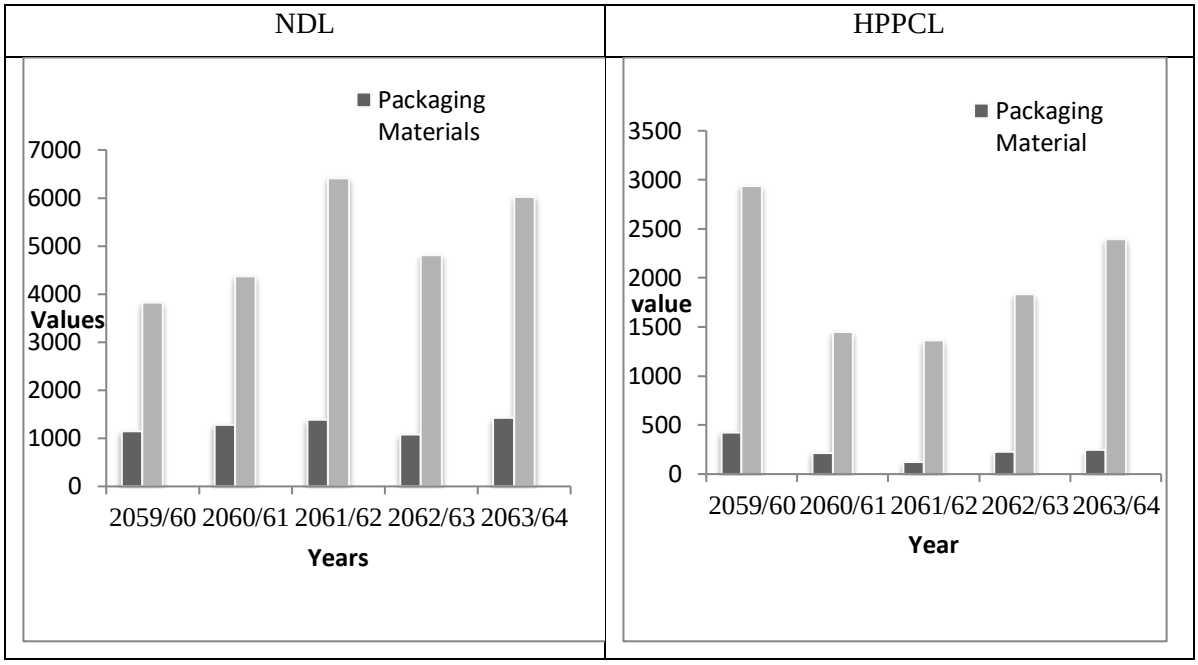
Above table also shows the deviation of percentage of packaging materials from the average packaging material over the study period. The highest deviation of packaging materials is 13.93% in FY 2059/60 and the highest negative value is (14.05%) in FY 2062/63 for NDL and the highest deviation and the highest negative value are 35% in FY 2060/61 and (70.90%) in FY 2061/62 respectively of HPPCL.

From the above analysis it is observed that the ratio on packaging material in the company is erratic. This result shows that there is no fixed policy of purchasing of packaging materials.

The graphic presentation of level of packaging materials on total inventory is as follows

Figure: 4.2

Level of packaging Materials on Total Inventory



4.1.3 Proportion of Raw Materials on Total Inventory

Raw materials are such types of materials which will be used for further processing. After use of some processing they will become finished goods/products. Raw materials play the vital role. Lack of raw materials the company could not run continuously. Both higher and lower raw material creates negative performance of the company. So, the company should maintain and kept proper raw material. This material on total inventory shows the % of raw material on total inventory. This means that how much % of inventory is in the form of raw material.

Table 4.3

Proportion of Raw Materials on Total Inventory

Year	NDL				HPPCL			
	RM	INV	% of RM on Total INV	% of Deviation on Average	RM	INV	% of RM on Total INV	% of Deviation on Average
2059/60	1551.48	3819.94	40.62	-12.46	1432.21	2939.50	48.72	-05.18
2060/61	2147.12	4368.78	49.15	00.62	652.60	1445.30	45.15	-12.13
2061/62	2049.14	6403.04	38.03	-18.02	750.31	1361.20	55.12	07.28
2062/63	2517.63	4809.48	52.35	12.85	1020.10	1834.40	55.61	8.40
2063/64	3122.26	6026.48	51.81	11.68	1252.60	2394.13	52.32	1.83
Average			46.39		1021.56	1994.91	51.38	

Source: Annual Report of NDL and HPPCL

% of RM on Inventory = RM/Inventory

From the above table it is observed that Raw Material on total inventory during the study period is 40.62 %in FY 2059/60, 49.15% in FY 2060/61, 38.03% in FY 2061/62, 52.35% in FY 2062/63 and 51.81% in FY2063/64%. The average raw material on total inventory in overall study period is 46.39% OF NDL. Similarly, Raw Material on total inventory during the study period is 48.72 %in FY 2059/60, 45.15% in FY 2060/61, 55.12% in FY 2061/62, 55.61% in FY 2062/63 and 52.32% in FY2063/64%. The average raw material on total inventory in overall study period is 51.38% of HPPCL.

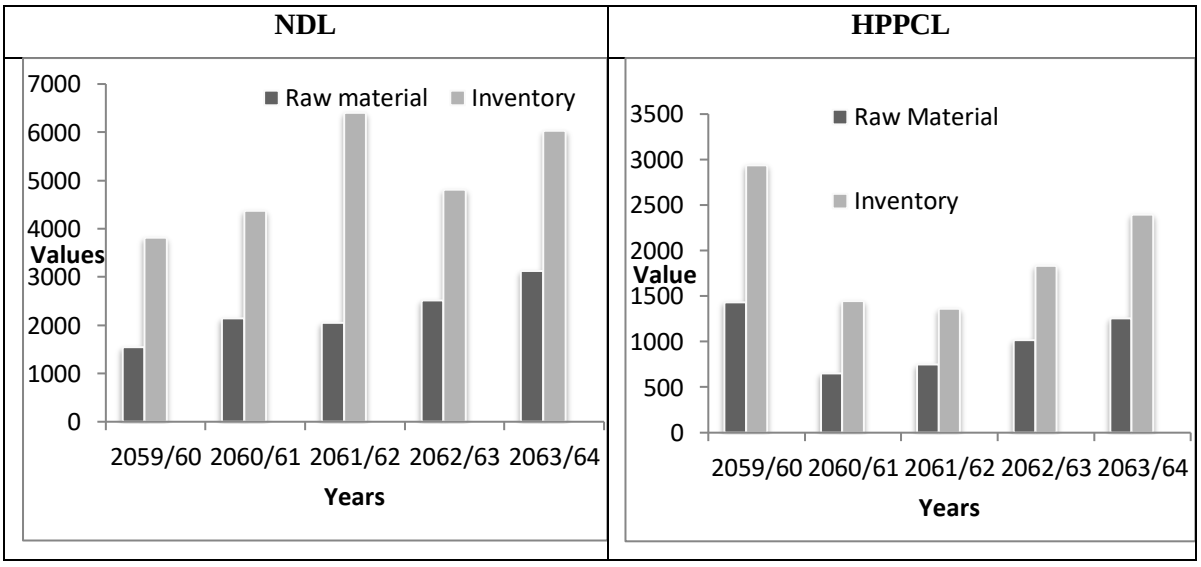
Above table also shows the deviation of percentage of inventory in current assets over the study period. The highest positive deviation of percentage of raw material from the average inventory is 11.68% in fiscal year 2063/64.and the highest negative deviation is (18.02%) in FY2061/62 of NDL. Similarly HPPCL has 8.40% in FY 2062/63 and (12.13%) in FY 2060/61 respectively.

Above study concludes that RM consumption is fluctuating, which shows poor purchasing policy of RM.

The graphic presentation of level of raw material on the total inventory is as follows

Figure 4.3

Level of Raw Materials on Total Inventory



4.1.4 Proportion of WIP on Total Inventory

These categories include those materials that have been committed to be production process but have not been completed. Goods in progress include such items as component and sub assembles that are not yet ready to be sold. Work-in-progress inventories are semi manufactured products. They represent products that need more work before they became finished products for sale. WIP on total inventory shows the % of WIP on total inventory i.e. how much % of WIP covers on total inventories.

Table 4.4

Proportion of WIP on Total Inventory

	NDL				***HPPCL***			
Years	***WIP***	***INV***	***% of WIP on Total INV***	***% of Deviation on Average***	***WIP***	***INV***	***% of WIP on Total INV***	***% of Deviation on Average***
2059/60	163.11	3819.94	4.27	31.79	142.32	2939.5	4.84	31
2060/61	100.28	4368.78	2.3	-29.01	85.52	1445.3	5.92	30.68
2061/62	130.62	6403.04	2.42	-25.31	61.75	1361.2	4.54	0.22
2062/63	177.48	4809.48	3.7	14.3	92.12	1834.4	5.02	10.82
2063/64	211.92	6026.48	3.52	8.64	56.23	2394.13	2.35	-48.12
Average			3.24		87.57	1994.91	4.53	

Source: Annual Report of NDL and HPPCL

NDL has been using smaller portion of WIP on total Inventory. From the above table it is observed that the portion of WIP on total inventory during the study period is 4.27% in FY 2059/60, 2.30% in FY 2060/61, 2.42% in FY 2061/62, 3.70% in FY 2062/63 and 3.52% in FY 2063/64.Where as the average percentage of WIP on total inventory during the whole study period is 3.24%. Similarly, HPPCL has been using different kinds of herbals plants to produce the final product. The similar portion of WIP on total inventory is used by the company. From the above table, it can be concluded that similar portion of WIP on total inventory is used by the company. Average percentage of WIP material in total inventory in the overall study period is 4.53%

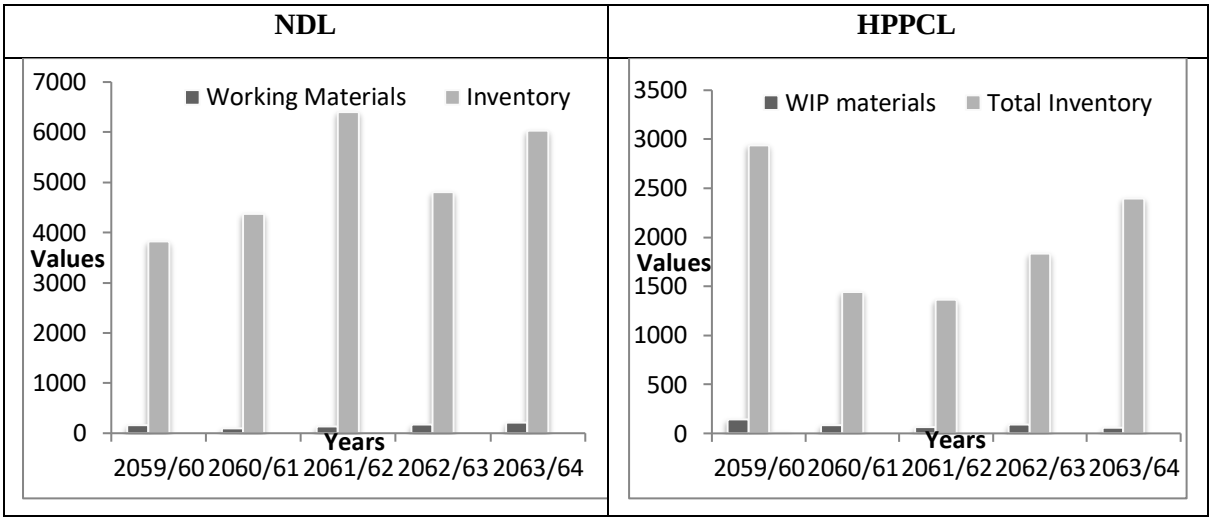
Above table also shows that, the deviation of WIP materials in total inventory over the study period. The highest positive deviation in WIP material from the average WIP inventory is 31.79% in FY 2059/60 and the highest negative deviation is (29.01%) in FY 2060/61 NDL and the highest positive deviation in WIP materials from the average WIP inventory of HPPCL is 31.00% in the fiscal year 2059/60 and the highest negative deviation is (48.12%) in FY 2063/64 which is only one negative value from the overall Average deviation.

Same case of fluctuation can be seen here too, which in case of inventory position is not considered as good from the point of view of inventory management.

The graphic presentation of WIP Materials on total Inventory is as follows.

Figure 4.4

Proportion of WIP on Total Inventory



4.1.5 Proportion of Finished Goods on Total Inventory

Finished products 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 facilitates production of finished goods in required for smooth marketing operation. Therefore finished goods are completely goods waiting for sale. The proportion of finished goods on total inventory shows how much % of inventory covers by finished goods.

Table 4.5

Proportion of Finished Goods on Total Inventory

	NDL				*HPPCL*			
Years	***FG***	***INV***	***% of FG on INV***	***% of Deviation***	***FG***	***INV***	***% of FG on INV***	***% of Deviation***
2059/60	152.80	3819.94	04.00	-55.36	786.20	2939.50	26.75	-11.42
2060/61	485.21	4368.78	11.11	24.00	412.31	1445.30	28.53	-05.53
2061/62	520.12	6403.04	09.63	07.48	544.42	1361.20	40.00	32.45
2062/63	493.12	4809.48	10.25	14.40	490.23	1834.40	26.72	-11.52
2063/64	591.91	6026.48	09.82	03.60	694.61	2394.13	29.01	-3.940
Average			8.96		585.55	1994.91	30.20	

Source: Annual Report of NDL and HPPCL

% of inventory on Finish Goods = Finish Goods/ Inventory

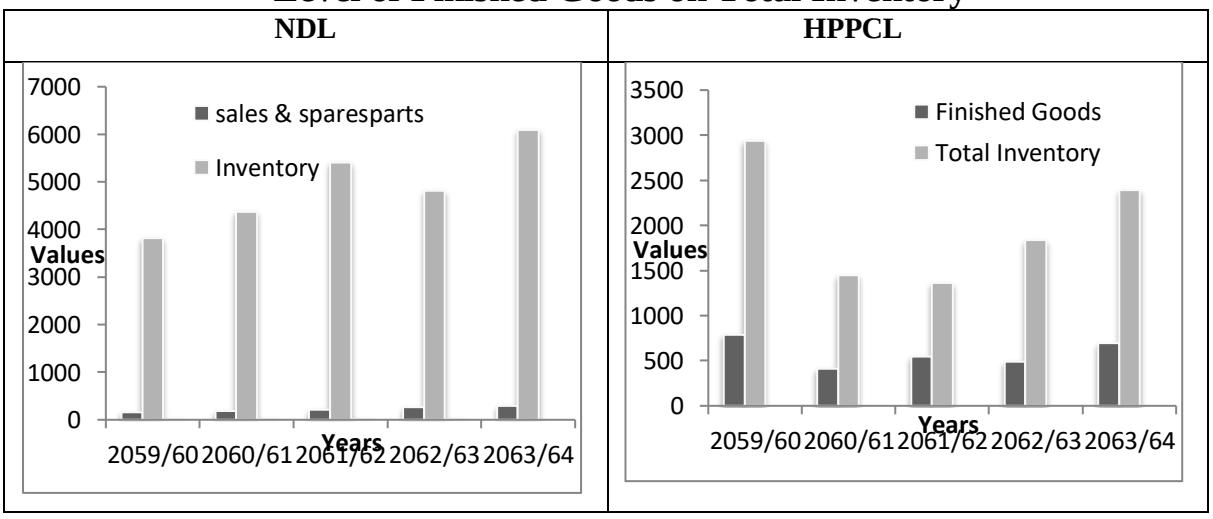
From the above table it is observed that the portion of Finish goods on total inventory during the study period is 4% in FY 2059/60, 11.11% in FY 2060/61, 9.63% in FY 2061/62, 1025% in FY 2062/63 and 9.82% in FY 2063/64.Where as the average percentage of Finish Goods on total inventory during the whole study period is 8.96% of NDL. Similarly, the portion of Finish goods on total inventory during the study period is 426.75% in FY 2059/60, 28.53% in FY 2060/61, 40.00% in FY 2061/62, 26.72% in FY 2062/63 and 9.82% in FY 2063/64.Where as the average percentage of Finish Goods on total inventory during the whole study period is 30.20% of HPPCL.

Above table also shows that, the deviation of Finish Goods in total inventory over the study period. The highest positive deviation in Finish Goods from the average Finish Goods inventory is 24.00% in FY 2060/61 and the highest negative deviation is (55.36%) in FY 2059/60 of NDL and The highest positive deviation in Finish Goods from the average Finish Goods inventory is 32.45% in FY 2061/62 and the highest negative deviation is (11.52%) in FY 2062/63 of HPPCL.

Percentage of finish goods materials on total inventory is not consistent. It is due to fluctuation of sales and demand of the company. The graphic representation of level of finish goods on total inventory is as follows:

Figure 4.5

Level of Finished Goods on Total Inventory



4.1.6 Proportion of Storage and Spare Parts on Total Inventory

All inventories are kept in warehouse. May be they are RM, FG, PM and spare parts. Here storage and spare parts means those inventory which are used after the replacement of damage parts. If the company does not store the spare parts previously they will suffer by huge loss. Machine and other things can be damage anywhere in any time. In this case recently the replacement is needed. So, the company should maintain certain % of store and spare parts already in the warehouse. The proportion of storage and spare parts shows how much % of spare parts is kept in the warehouse among total inventory.

Table 4.6

Proportion of Storage and Spare Parts on Total Inventory

	NDL				*HPPCL*			
Years	***S and SP***	***INV***	***% of S & SP on INV***	***% of Deviation***	***S and SP***	***INV***	***% of S & SP on INV***	***% of Deviation***
2059/60	160.16	3819.94	-34.56	-7.08	158.90	2939.50	5.41	-03.39
2060/61	182.28	4368.78	-00.71	-7.74	126.20	1445.30	8.73	55.90
2061/62	211.15	6403.04	17.06	-11.28	70.60	1361.20	5.19	-07.32
2062/63	260.11	4809.48	-00.81	19.70	118.70	1834.40	6.47	15.54
2063/64	290.21	6026.48	19.02	06.64	052.30	2394.13	2.18	-61.07
Average	2538.3			4.52	105.34	1994.91	5.60	6.80

Source: Annual Report of NDL and HPPCL

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

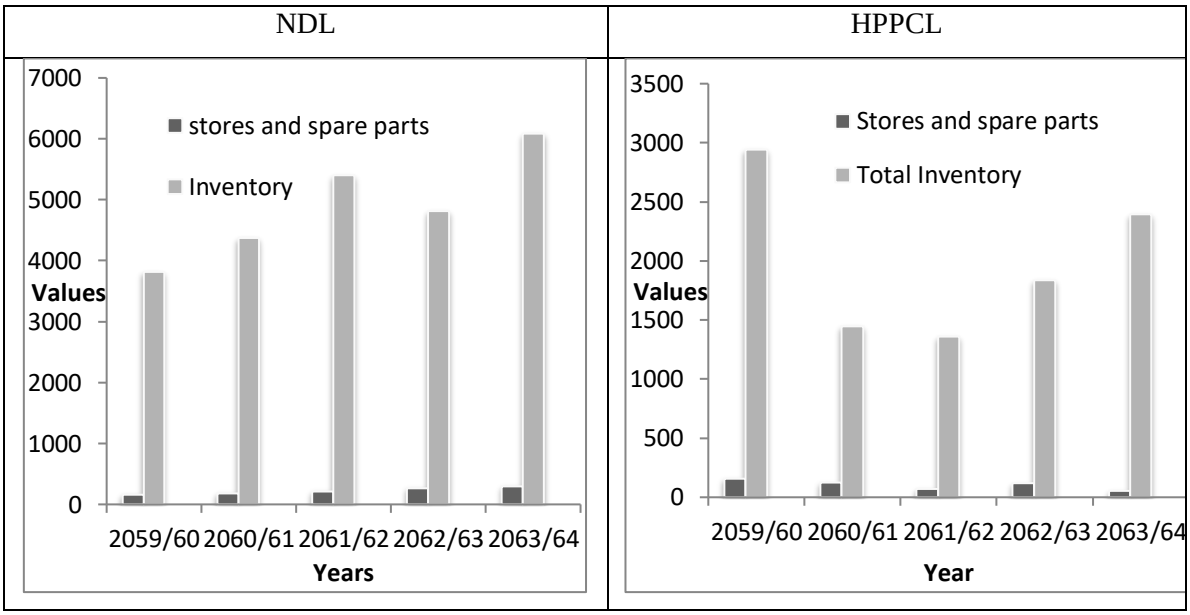
From the above table it is observed that the portion of stores and spare parts on total inventory during the study period of NDL is 4.20% in FY 2059/60, 4.17% in FY 2060/61, 4.01% in FY 2061/62, 5.41% in FY 2062/63 and 4.82% in FY 2063/64.Where as the average percentage of WIP on total inventory during the whole study period is 4.52% whereas the portion of stores and spare parts on total inventory during the study period of HPPCL is 5.41% in FY 2059/60, 8.73% in FY 2060/61, 5.19% in FY 2061/62, 6.47% in FY 2062/63 and 2.18% in FY 2063/64.Where as the average percentage of WIP on total inventory during the whole study period is 6.80%

From the above analysis, it is shown that, the quantity of stores and spare parts used by the company is irregular during the study period. Since the company production is totally

dependent on stores and spare parts, it obviously fluctuates over the study period. The graphic representation of level of stores and spare parts in total inventory is as follows.

Figure 4.6

Proportion of Storage and Spare Parts on Total Inventory



4.1.7 Position and Relation of Raw Materials and Finished Goods

Both Raw Materials and Finished goods are inventories. Raw materials are those inventories which will be converted in finished goods after some process. Finish goods are those inventories after changing raw materials. For any business organization inventory like raw materials and finished goods plays vital role. Finished goods are made after changing Raw materials. If there is no enough raw materials there will be no any finished goods. Without finished goods business houses could not sell the goods. Lack of chief raw materials there is no way of finished goods too. There is positive relation of finished goods and Raw materials. So, the raw materials and finished goods take the highest position for any organization.

Table 4.7

Position and Relation of Raw Materials and Finished Goods

	NDL				*HPPCL*			
Years	***RM***	***FG***	***% Change RM***	***% Change FG***	***RM***	***FG***	***% Change RM***	***% Change FG***
2059/60	1661.18	152.80	-34.56	-65.94	1432.21	786.20	40.20	34.27
2060/61	2520.19	485.21	-00.71	08.15	0652.60	412.31	-36.12	-29.59
2061/62	2971.32	520.12	17.06	15.94	0750.31	544.42	-26.55	-07.02
2062/63	2517.63	493.12	-00.81	09.92	1020.10	490.23	-00.14	-16.28
2063/64	3021.17	591.91	19.02	31.94	1252.60	694.61	22.62	18.63
Average	2538.300	448.63			1021.56	585.55		

Source: Annual Report of NDL and HPPCL

The table shows that the position of Raw Material and Finish Goods from the FY 2059/60 to 2063/64. From the above table it is observed that average value of raw material is 2538.30lakhs and average value of Finish goods is Rs. 448.63lakhs during the study period of NDL. The average value of raw material of HPPCL is 1021.56lakhs and average value of Finished Good is 585.55lakhs during the period.

Above table also shows the percentage deviation of average raw materials and finish goods during five periods.

The highest positive deviation of Raw Materials from average Raw Materials is 17.06% in FY 2061/62 and the highest negative deviation is (34.56%) in FY 2059/60. Similarly, the highest positive deviation of finished goods from average finish goods is 31.94% for FY 2063/64 and the highest negative deviation is (65.94%) for FY 2059/60 of NDL. As the same way the highest positive deviation of Raw Materials from average Raw Materials is 40.20% in FY 2059/60 and the highest negative deviation is (36.12%) in FY 2061/62. Similarly, the highest positive deviation of finished goods from average finish goods is 34.27% for FY 2063/64 and the highest negative deviation is (29.59%) for FY 2060/61 of HPPCL.

The above table also shows that the investment on raw materials and finish goods was fluctuating during the study period. This indicates that the company has not been follow appropriate systems of keeping inventory as well as production.

Result of r, r2, PE and 6PE NDL and HPPCL

NDL						HPPCL					
r	r2	PE	6PE	Result	Remarks	r	r2	PE	6PE	Result	Remarks
0.6196	0.3839	0.1885	1.131	r<6PE	Insignificant	0.9127	0.833	0.0051	0.0302	r>6PE	Significant

Source:

Appendix-2

Two variables are said to have "correlation", when they are so related that change in the value of one variable is accompanied by the change in the value of other. As the same here the change in the price of RM also changes the price of finished goods. Here the correlation between RM and FG is positive. The correlation between raw material and finished goods of NDL and HPPCL has been observed to be 0.6196 and 0.9127 respectively. Where, the correlation of RM with FG of both companies is positives. But problem error of the calculation coefficient denoted by P.E. is the measure of testing the reliability of the calculated value of r. it is used in interpretation whether calculated value of r is significant or not. If r is < 6PE, it is significant and if r<6PE It is insignificant. So, here r of NDL is less than 6×PE so there is insignificant relation of raw material with finished goods of NDL. But in case of HPPCL r is greater than 6×PE so there is significant relation of raw material with finished goods.

4.1.8 Position and Relation Between Sales and Net Profit

Sales mean exchanging service and goods with money. Without transferring service and goods with money there will no meaning of sales. Profit means earning excess then investment. If we earn more than our investment then we can say there will be profit otherwise we will suffer from loss. To survive itself for any business organization sales and profit is necessary. Here net profit means earning after deducting all expenses. Profit is out com of investment and selling. If we invest proper way and able to sell large amount then there will be obviously comes profit. If we sell large amount of product profit can be earn and vice versa.

Table No: 4.8

Position and Relation Between Sales and Net Profit

	NDL				*HPPCL*			
Years	***Sales***	***Average***	***Net profit***	***% Change***	***Sales***	***Average***	***Net profit***	***% Change***
2059/60	15013.59	-34.64	-152.12	-63.86	14245.21	06.10	380.21	30.63
2060/61	18175.23	-20.88	-318.82	-24.26	11462.45	-14.63	255.56	28.13
2061/62	22429.16	-02.36	-1057.65	01.56	12321.25	-08.23	350.21	-38.22
2062/63	28469.62	23.93	-0085.51	-79.68	15293.31	13.90	420.50	-43.78
2063/64	30771.20	33.95	-490.52	16.54	13810.56	02.86	526.12	-36.77
Average	22971.76		-420.92		13426.56		199.45	

Source: Annual Report of NDL and HPPCL

Above table shows the position of sales and net profit. The sales of both companies are fluctuating. During the study period the highest sales of NDL is Rs. 30771.20lakhs and the highest sales of HPPCL is Rs. 15293.31lakhs.

Above table also shows the position of net profit. NDL is on loss during overall study period. During the study period the highest loss is in FY 2063/64 which is Rs. (490.52Lakhs) and the lowest loss is Rs. (85.51Lakhs) in FY 2602/63.Whereas, the profit of HPPCL is fluctuating. During the study period the highest profit of HPPCL is Rs. 526.12Lakhs and lowest profit of HPPCL during the study period is Rs. 199.45lakhs.

Similarly the above table shows the percentage deviation of sales and net profit from average net profit respectively. The highest positive deviation of sales from average sales and average sales of NDL is 33.95% in the FY 2063/64 and highest negative deviation is (34.64%) in the FY 2059/60. The highest positive deviation of net profit from average net profit of NDL is 16.54% in FY 2063/64 and highest negative deviation is (79.68%) in FY 2062/63. Whereas, the highest negative deviation of HPPCL from an average sale is (14.63%) in FY 2060/61 and highest negative deviation from an average net profit is (38.22%) in FY 2059/60.

From the above analysis it is observed that the sale of NDL is increasing continuously. But net profit (loss) of the firm is fluctuating. In other hand the sales of HPPCL sales is in fluctuating order that results the fluctuation in net profit too.

Result of r, r2, PE and 6PE NDL and HPPCL

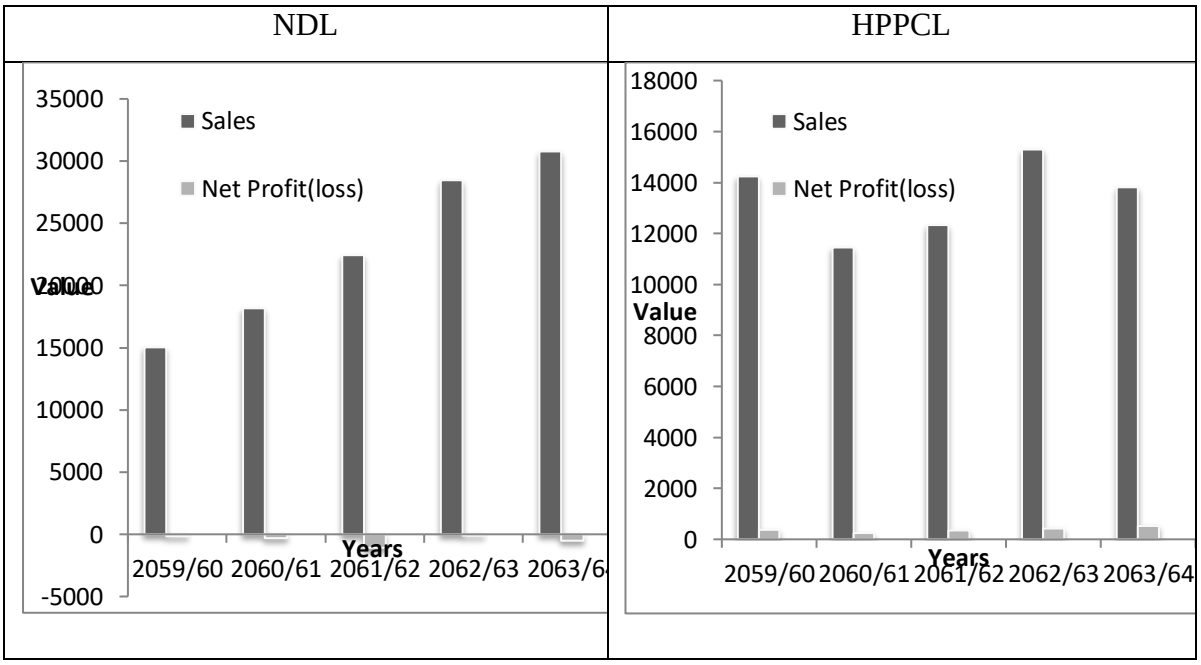
NDL						HPPCL					
r	r2	PE	6PE	Result	Remarks	r	r2	PE	6PE	Result	Remarks
-0.0727	0.0003	0.03	0.18	r<6PE	Insignificant	0.6752	0.456	0.164	0.9846	r<6pe	Insignificant

Source: Appendix-2

The correlation between Sales and Net Profit of NDL has been observed to -0.0727. Similarly, the correlation of HPPCL is 0.6752. But here 6×PE of both companies are less than r. Therefore, there is an insignificant relation of sales with Net profit.

Figure 4.7

Level of Sales and Net Profit



4.1.9 Position and Relation Between Inventory and Net profit

The term inventory refers to the stock pill of the product a firm is offering the sales and the components that make up the product. In other words inventory is composed of assets defined as the goods held for eventual resale by the firm. Net profit means earning of deducting all expenses of investment. The position and relation between inventory and net profit most be positive. If there is negative relation between them the company may suffer from loss. So the investor must maintain inventory in proper way that makes company profitable.

Table 4.9

Position and Relation Between Inventory and Net profit

	NDL				HPPCL			
Years	Inventory	Average	Net profit	% Change	Inventory	Average	Net profit	% Change
2059/60	3819.94	-20.89	-152.12	-63.86	2939.50	47.35	380.21	30.63
2060/61	4368.78	-14.09	-318.82	-24.26	1445.30	-27.55	255.56	28.13
2061/62	6403.04	25.91	-1057.65	1.56	1361.20	-31.77	350.21	-38.22
2062/63	4809.48	-5.43	-85.51	-79.68	1834.40	-08.05	420.50	-43.78
2063/64	6026.48	18.48	-490.52	16.54	2394.13	20.01	526.12	-36.77
Average	5085.54		-420.92		1994.91		199.45	

Source: Annual Report of NDL and HPPCL

From the above table it is observed that the average inventory during the study period of NDL is Rs.5085.54 millions and Net Profit is Rs. (420.92) millions. The highest positive deviation from an average inventory is 25.94% in FY 2061/62 and highest positive deviation from an average Net profit is 16.54% in FY 2063/64. In case of HPPCL the average inventory during the study period is Rs.1994.91 millions and Net Profit is Rs. 199.45 millions. The highest positive deviation from an average inventory is 47.35in FY 2059/60 and highest positive deviation from an average Net profit is 30.63% in FY 2059/60

Similarly, it can be seen that inventory and net profit were fluctuating during the study period of both companies. In case of NDL from the above table net profits of the company are negative or the company is in loss during the study period. That is due to the poor management of inventory and many other reasons. Therefore, there is no specific policy of investment on inventory and inventory management too. But in case of HPPCL net profit is fluctuating but there is no loss figure during the study period.

Result of r, r2, PE and 6PE NDL and HPPCL

NDL						HPPCL					
r	r2	PE	6PE	Result	Remarks	r	r2	PE	6PE	Result	Remarks
-0.5762	0.332	0.199	1.1964	r<6PE	Insignificant	0.9123	0.8323	0.0506	0.304	r>6PE	Significant

Source: Appendix-2

From the above calculation correlation between the inventory and net profit of NDL is -0.5762 and correlation of HPPCL is 0.9123. But here 6×PE of NDL is greater than r so, there is an insignificant relation. Similarly, 6×PE of HPPCL is less than r. So, there is significant relation of inventory with net profit.

4.2 Ratio Analysis of NDL and HPPCL

Ratio analysis is the process of determining and interpreting the relationship between two figures in the financial statements. Inventory ratio analysis may help the organization to know the efficiency for the management of inventory. Inventory turnover ratio is also known as stock turnover ratio. This ratio measures the turnover of times. Higher turnover indicates the better efficiency.

4.2.1 Inventory Turnover Ratio

Inventory Turnover Ratio is calculated by dividing sales by inventory. The unit of inventory turnover ratio is times. This ratio told that how much inventory was kept in warehouse with respect to sales.

Table 4.10

Inventory Turnover Ratio of NDL and HPPCL

	NDL				***HPPCL***			
Years	***Sales***	***Inv***	***Inv Turnover***	***% Change***	***Sales***	***Inv***	***Inv Turnover***	***% of Change***
2059/60	15013.59	3819.94	3.93	-15.48	14245.21	2939.50	4.85	-19.03
2060/61	18175.23	4368.78	4.16	-10.54	11462.45	1445.30	7.93	32.39
2061/62	22429.16	6403.04	4.15	-10.75	12321.25	1361.20	3.05	-49.08
2062/63	28469.62	4809.48	5.92	27.31	15293.31	1834.40	8.34	39.23
2063/64	30771.2	6026.48	5.11	03.89	13810.56	2394.13	5.77	-03.67

Average			4.65		13426.56	1994.91	5.99	

Source: Annual Report of NDL and HPPC

Inventory Turnover Ratio =Sales/Inventory

From the above table, it is observed that the inventory turnover ratio of NDL during the study period is 3.93 times in FY 2059/60, 4.16 times in FY 2060/61, 4.15times in FY 2061/62, 5.92times in FY 2062/63and 5.11times in FY 2063/64.whereas the average inventory ratio during the study period is 4.65times. There is highest inventory turnover ratio in FY 2062/63, which is 5.92times. For this year, percentage deviation of inventory turnover ratio from average inventory turnover is 27.31%. This is the highest positive deviation. The highest inventory turnover ratio indicates fast consumption of raw material, work in progress and fast sales of finished goods. In this year low level of inventory is kept in the company. There is lowest inventory turnover ratio in the FY 2059/60, which is 3.93times. For this year there is the highest negative deviation of inventory turnover ratio from the average inventory turnover ratio, which is (15.48%).

This indicates the low consumption or raw material or low utilization of raw material, WIP material and low sales of finished goods. The graphic representation of inventory turnover ratio is as follows. Similarly, Inventory Turnover ratio of HPPCL has been seen that in the FY 2062/63 is highest i.e. 8.34 times and in this year positive deviation from the average inventory turnover ratio is 39.23%. In this year low level inventory is kept in the company due to the fast consumption and sales of raw material and finished goods. In the FY 2059/60 and 2061/62 inventory turnover ratio is lowest i.e. 4.85 and 3.05 times respectively. Similarly, in this year the highest negative deviation from the average turnover is (19.03%) and (49.08%) which indicates slow consumption of raw material or low utilization of raw material, WIP materials and low sales of finished goods

Result of r, r2, PE and 6PE NDL and HPPCL

NDL						HPPCL					
r	r2	PE	6PE	Result	Remarks	r	r2	PE	6PE	Result	Remarks
-0.0727	0.0053	0.03	1.8	r<6PE	Insignificant	0.9123	0.8323	0.0506	0.3036	r>6PE	Significant

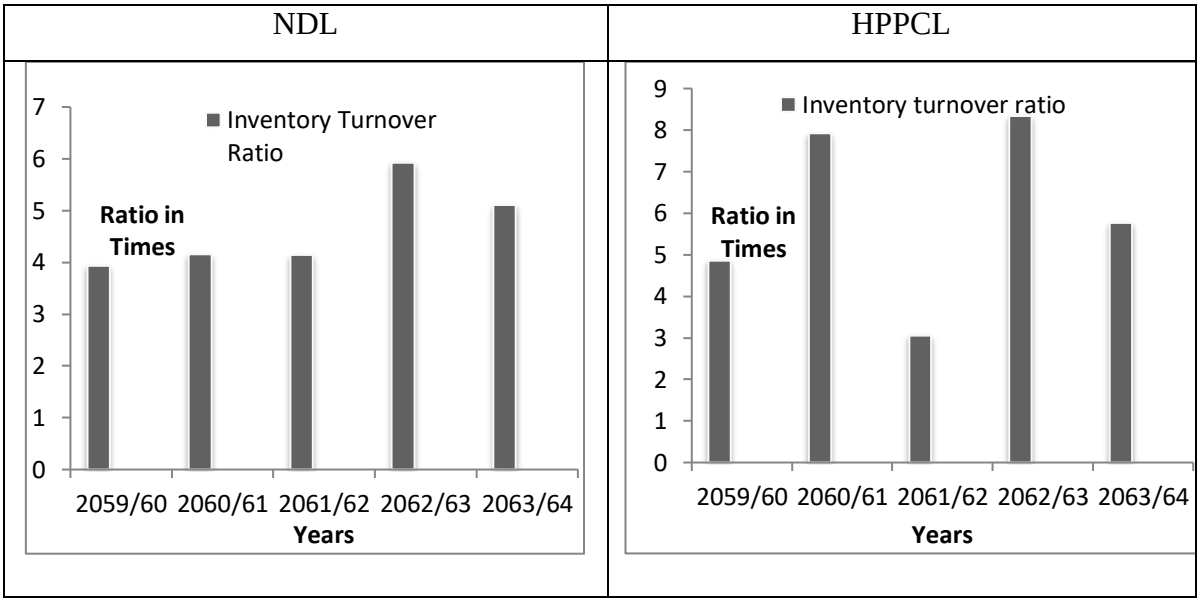
Source: Appendix-2

From the above calculation it is observed that the correlation between sales and inventory of NDL is 0.5430 and HPPCL is -0.9123. But here r of NDL is less than 6×PE so there is insignificant relation of sales with inventory. In other hand r of HPPCL is greater than 6×PE

so, there is significant relation. The graphical presentation of inventory turnover ratio is as follow

Figure 4.8

Inventory Turnover Ratio



4.2.2 Relation Between Raw Materials and Raw Material Consumed

All these two materials are the types of inventory. Raw materials are those parts which are kept in the store before changing finished goods and raw materials consumed means those parts of raw materials which are used for making finished goods. In other words raw materials consumed are a portion of raw materials. So, in this topic the researcher is trying to show materials turnover ratio. Raw material turnover ratio shows the relationship between cost of raw material consumed and average cost of raw material.

The ratio of raw materials consumed against raw materials i.e. called raw material turnover Ratio.

Table 4.11

Raw Material Turnover Ratio

	NDL				HPPCL			
Years	Cost of RMC	Average	RM Turnover Ratio	% Change	Cost of RMC	Average	RM Turnover Ratio	% Change
2059/60	10501.97	1851.21	5.67	5.19	7156.5	865.5	8.27	32.53
2060/61	12111.29	2146.49	5.64	4.64	4452.2	983.6	4.53	-27.40
2061/62	13950.91	2415.21	5.77	7.05	4513.5	712.5	6.33	01.44

2062/63	14250.28	2860.71	4.98	-7.60	5800.2	872.3	6.65	06.57
2063/64	14918.46	3061.75	4.87	-9.65	5536.3	1020.4	5.42	-13.14
Average			5.39				6.24	

Source: Annual Report of NDL and HPPCL

From the above table, it is observed that raw material turnover ratio of NDL during the study period is 5.67times in FY 2059/60, 5.64times in FY 2060/61, 5.77 in FY 2061/62, 4.98times in FY 2062/63 and 4.87times in FY 2063/64. Whereas the average inventory turnover ratio during the study period is 5.39times. The highest inventory turnover ratio is 5.77times in FY 2061/62. In Case of HPPCL it is observed that the average RM turnover ratio is 6.24 times. In fiscal year 2059/60 and in FY2062/63 the RM turnover ratio is higher i.e. 8.27 and 6.65 times and in this year the highest positive deviation from on an average of RM turnover ratio is 32.52% and 6.57%.

Result of r, r2, PE and 6PE NDL and HPPCL

NDL						HPPCL					
r	r2	PE	6PE	Result	Remarks	r	r2	PE	6PE	Result	Remarks
0.167	0.0279	0.2932	1.6882	r<6PE	Insignificant	0.0672	0.0045	0.3003	1.8017	r<6pe	Insignificant

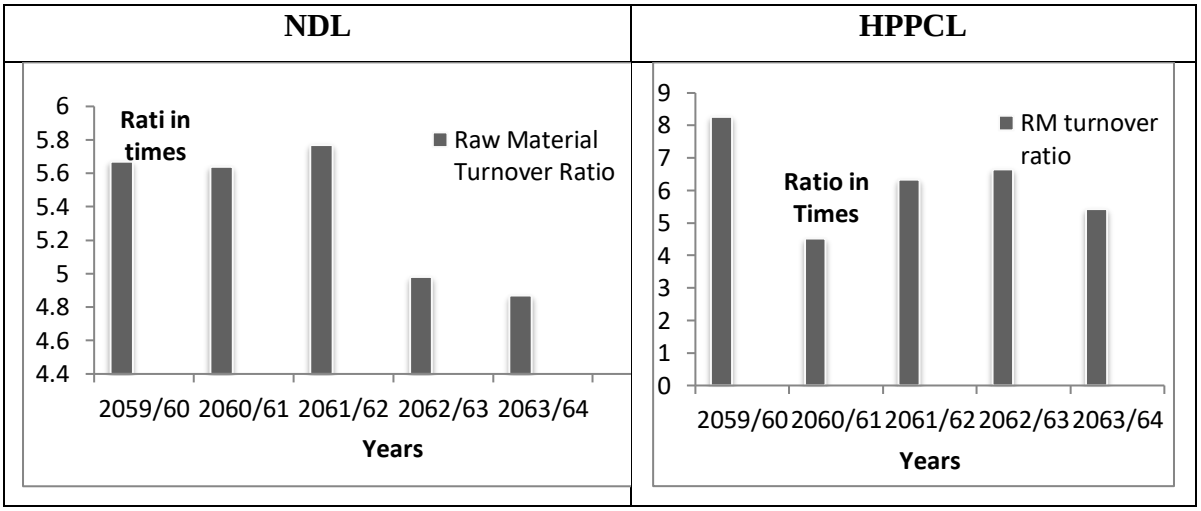
Source: Appendix-2

From the above calculation, it is observed that correlation between cost of raw material consumed and cost of average raw material of NDL is 0.1670 and correlation of HPPCL is 0.0279. Here, r of both companies is less then 6×PE, therefore there is insignificant correlation of raw material consumed with cost of average raw material.

The graphical presentation of raw material and raw material consumption is as follows.

Figure No: 4.9

Raw Material Turnover Ratio



4.2.3 Relation Between PM and Cost of APM

Packing material turnover ratio shows the relationship between cost of packing material consumed and cost of average packing material. Higher packing material turnover ratio shows higher consumption and utilization of packing material and vice versa.

Table No: 4.12

Relationship Between PM and Cost of APM

	NDL				*HPPCL*			
Years	***Cost of PMC***	***Average***	***PM Turnover Ratio***	***% of Change***	***Cost PMC***	***Average***	***PM Turnover Ratio***	***% of Change***
2059/60	2012.21	719.05	2.8	-7.89	2375.3	354.2	6.71	-03.45
2060/61	2590.11	914.37	2.83	-6.91	1656.2	326.3	5.08	-26.91
2061/62	3061.88	1051.11	2.91	-4.28	1321.9	175.4	7.54	08.49
2062/63	3850.23	1190.30	3.23	0.06	1451.6	178.6	8.13	16.98
2063/64	4245.75	1230.15	3.45	13.49	1476.4	202.5	7.30	05.04
Average			3.04				6.95	

Source: Annual Report of NDL and HPPCL

Packing material turnover ratio shows the relationship between cost of packing material consumed and cost of average packing material. Higher packing material turnover ratio shows higher consumption and utilization of packing material and vice versa.

From the above table it is observed that packing material turnover ratio of NDL during the study period is 2.80times in FY 2059/60, 2.83times in FY 2060/61, 2.91times in FY 2061/62, 3.23times in FY 2062/63 and 3.45times in FY 2063/64, Whereas the average packing material turnover ratio of is 3.04 times. In other hand it is observed that the average PM turnover ratio of HPPCL is 6.95times. In FY 2062/63 the PM Turnover Ratio is highest, i.e. 8.13 times and in this year the highest positive deviation from on an average on PM turnover Ratio is 16.98%.in this year low level of PM is kept in the company and fast moving the PM. Similarly, the lowest PM turnover ratio is in FY 2060/61 i.e. 5.08 times.

The highest packing material turnover ratio of NDL is 3.45times in FY 2063/64. In this year, there is highest positive deviation of packing material turnover ratio from average packing material turnover ratio. These figures indicate that there is higher consumption and utilization of packing material. For HPPCL the highest negative deviation from on an average PM turnover ratio is (26.91%) in FY 2060/61.this indicates the low consumption or low utilization of PM

Result of r, r2, PE and 6PE NDL and HPPCL

NDL						HPPCL					
r	r2	PE	6PE	Result	Remarks	r	r2	PE	6PE	Result	Remarks
0.98	0.96	0.011	0.06	r>6PE	Significant	0.8533	0.728	0.82	0.4921	r>6PE	Significant

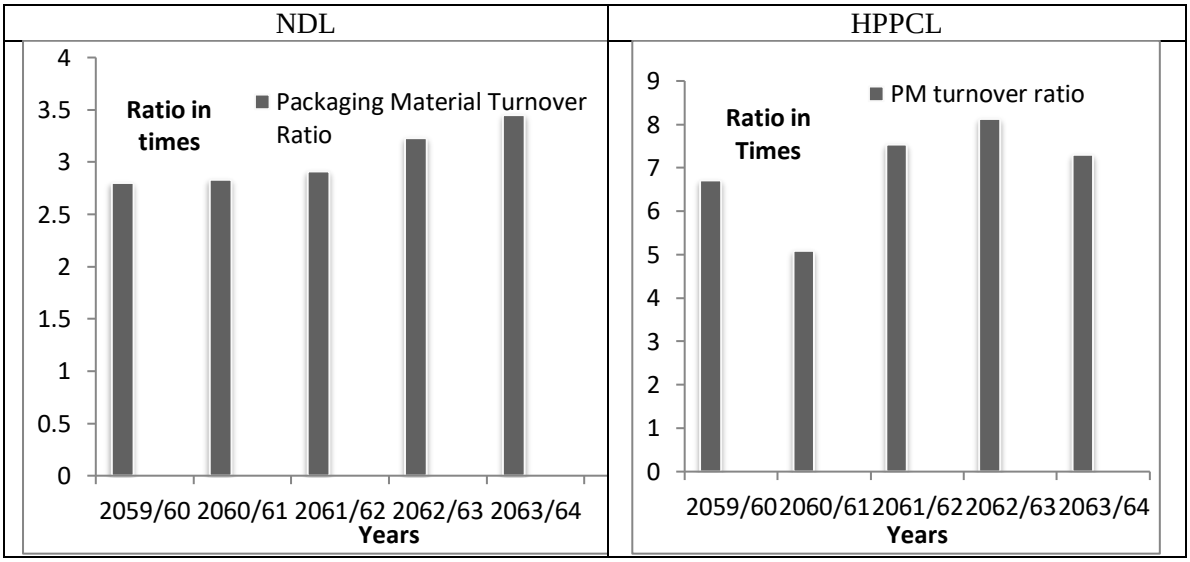
Source: Appendix-2

From the above calculation, correlation co-efficient between cost of packing material consumed and average cost of packing material of NDL is 0.9813 and HPPCL is 0.8533. r of both companies are greater than 6×PE. Therefore, there is significant relation of packaging material consumed with average cost of packaging material.

The graphic representation of packing material turnover ratio is as follows

Figure No: 4.10

Packaging Material Turnover Ratio



4.2.4 Inventory Management and Control Techniques of NDL and HPPCL

The companies never use any techniques to identify proper quantity for the company. According to this study the researcher recommended these companies to use some techniques for proper inventory management. These are EOQ and ABC analysis. The researcher has already discussed according to these techniques before.

Table No: 4.13

Calculation of EOQ of Total Study Period

Company	NDL				HPPCL			
Years	AD	OC	CC	EOQ	AD	OC	CC	EOQ
2059/60	15520	135212	1250	1832	25143	152380	1560	2216
2060/61	20145	142812	1425	2009	21215	142810	1422	2064
2061/62	25693	152318	1750	2115	19510	148210	1395	2036
2062/63	30128	168310	2150	2173	28316	155310	1618	2336
2063/64	35816	170590	2415	2249	18615	151280	1235	2157

Note: Carrying Cost = Average inventory×Carrying Cost Per unit

Ordering Cost = No. of Order×Ordering Cost per Order

AD=Annual Demand

CC=Carrying Cost

OC=Ordering

EOQ is one of the important inventory control technique. It is widely used in these days in many countries irrespective of under-developed or developing countries. This model determines the optimal order quantity of individual items of inventory, gives its forecasted usage, ordering cost and carrying cost. Economic order quantity is that level of inventory order. This minimizes the total cost associated with the inventory management. Total cost consists of ordering cost and carrying cost. So, the researcher calculated the EOQ of both companies. This was shown in annex-1.

In this way all other FY's EOQ of both companies can be calculated. EOQ can be also calculated by tabular method which is shown in annex at last.

4.2.5 EOQ of Raw Materials in Total Study Period

The researcher only presented the five years data of both NDL and HPPCL. According to these data the accurate EOQ was calculated which is perfect order for the company. That was never done by these companies before. That was shown in appendix at the end of this thesis.

Table No: 4.14

EOQ of Raw Materials in Total Study Period

Years	EOQ In Tons(NDL)	EOQ In Tons(HPPCL)
2059/60	1832	2216
2060/61	2009	2064
2061/62	2115	3036
2062/63	2173	2332
2063/64	2249	2157

From the above table, it can be interpreted that there is no similar size of EOQ during the study period of NDL. In the fiscal year 2059/60 the EOQ of Raw material is 1832tons, in 2060/61 the EOQ of raw material is 2009tons, in 2061/62 the EOQ is 2115tons, in 2062/63 the EOQ is 2173tons and in 2063/64 it is 2249tons. There is fluctuation in EOQ size during the study period due to various reasons. This type of fluctuation in ordering costs is due to fluctuation in demand.

Here during the study period the highest EOQ is in FY 2063/64 which is 2249 tons and the lowest EOQ is in FY 2059/60 which is 1832 tons.

It can be also interpreted that there is no similar size of EOQ during the study period of HPPCL. In the fiscal year 2061/62 the EOQ of RM is very high i.e.3030 tons, while in fiscal year 2060/61 EOQ of RM is very low i.e. 2064 tons. There is fluctuation in EOQ size during the study period due to various reasons. This type of fluctuation in ordering costs is due to fluctuation in demand.

4.2.6 Trend Line Analysis of Annual Demand of Raw Materials

The trend analysis has been employed to the trend of purchase of raw materials. So, in this part, attempt has been to analyze the purchasing trend of raw materials by using trend lines. The trend line between the dependent variable Y and the independent variable x (i.e. time) be represented by Y= a+ b x Then, for any given value of independent variable x the estimate value of Y demand by y_c given by above equation is

y_c= a + b x Where,

a = y independent or value of y when x=0

b = slope of the trend line or amount of change that comes in y for a unit change in x.

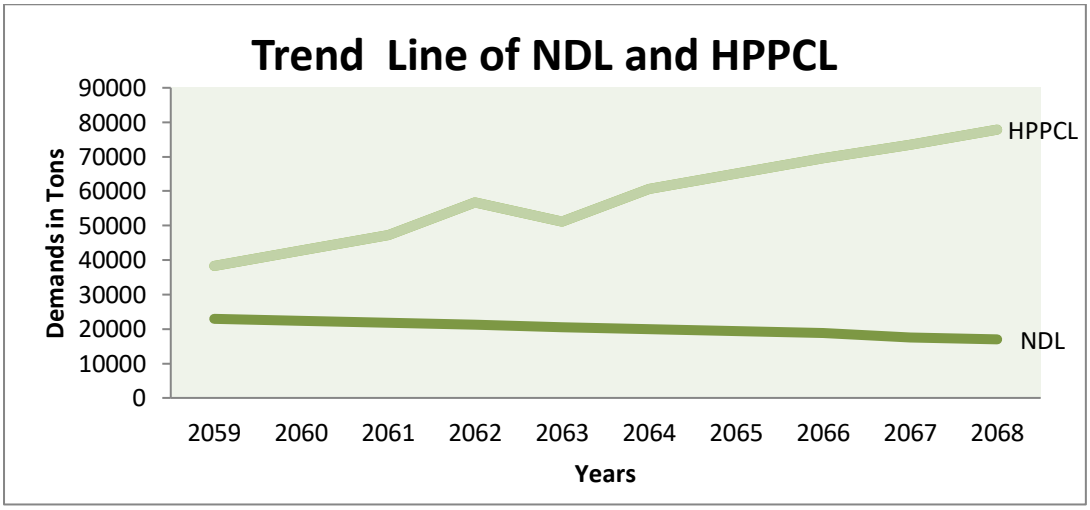
To determine the straight line trend we have to determine the values of a and b which is presented in appendix.

Table No: 15

Trend of Annual Demand of RM

Year	Company	
	NDL	HPPCL
2059	15345.80	22950.80
2060	20403.30	22355.30
2061	25460.80	21759.80
2062	35575.80	21164.30
2063	30518.30	20574.80
2064	40633.30	19973.30
2065	45690.80	19377.80
2066	50748.30	18782.30
2067	55805.80	17591.30
2068	60863.30	16995.80

Figure No: 4.11



Therefore, the forecasting annual demands of NDL for future five years 2064, 2065, 2066, 2067 and 2068 will be 19973.30, 19377.80, 18782.30, 17591.30 and 16995.80. In case of HPPCL the forecasting annual demand of 2064, 2065, 2066, 2067 and 2068 will be 19973.30, 19377.80, 18782.30, 17591.30 and 16995.80. From the above trend values and line we can say that the trend of demand of NDL is in increasing order but the trend of HPPCL is

in decreasing order. This shows that the demand of NDL will be increasing every year but the demand of HPPCL will be decreasing order in every year.

4.2.7 Selective Inventory Control (ABC Analysis)

As the term ABC implies Always Better Control which states that fewer items of high investment value should be paid more attention that a bulk of items having lower value and having a lower investment in capital. Category 'A' includes the most important item and recognized for special attention. Category 'B' includes lesser important and category 'C' consists of the least important and lower value items.

According to the above descriptions the classification of items into A, B and C categories is based upon the product value and usage rate. The classification of items of two individuals companies are as follows.

Classification of Inventory of NDL

Division of items	Inventory items
A	Ascorbic Acid, Codin sulphate, Nicotinamide, Sodium Thiacastazone, mebandazole, Albendazole, thiamine monotrate,
B	Isinizide, Asprine, Diazopam, Primaguin phosphate, metronidazole, selbutanol, pyrazinamide etc
C	Paracetamole, Vitamin B, Vitamin B2, Vitamin B6, Folic Acid, Ethambutol, Arymophylin, Ferrous Pyrazinamide, Pipeazin adipate etc.

Source: NDL, Babarmahal,

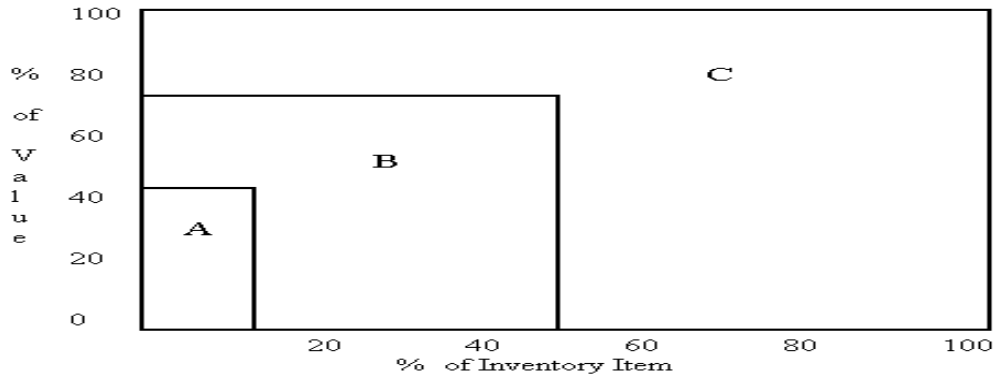
Comparisons of Items with values

Table No: 4.16

Category	Items (Tons)	Items (%)	Value (Rs)	Value (%)
A	6350 Tons	7.15	8020115	60.71
B	32250 Tons	36.31	3050211	23.09
C	50221 Tons	56.54	2141113	16.20
Total	88821 Tons	100	13211439	100

Classification of Inventory of NDL according to ABC Analysis

Figure No: 4.13



The graphic presentation includes that 'Item A' forms minimum proportion i.e. 7.15% of total units but it represents the highest value of 60.71%. On the other hand, 'Items C' consists 56.54 % of total items but only 16.20 % of total value. Similarly, 'Item B' consists 36% of the volume and 23.09% of the total value.

This division of inventory items reflects the concept of inventory control according to their value and cost. It is clear that a strict control should be exercised on 'Item A' in order to minimized inventory cost hence maximize profit. On its investment 'Item A' should be traced at first and most carefully. In case of 'Item C' simple control will be sufficient.

Similarly, for the production of different kinds of products, twenty size kinds of raw materials are used.

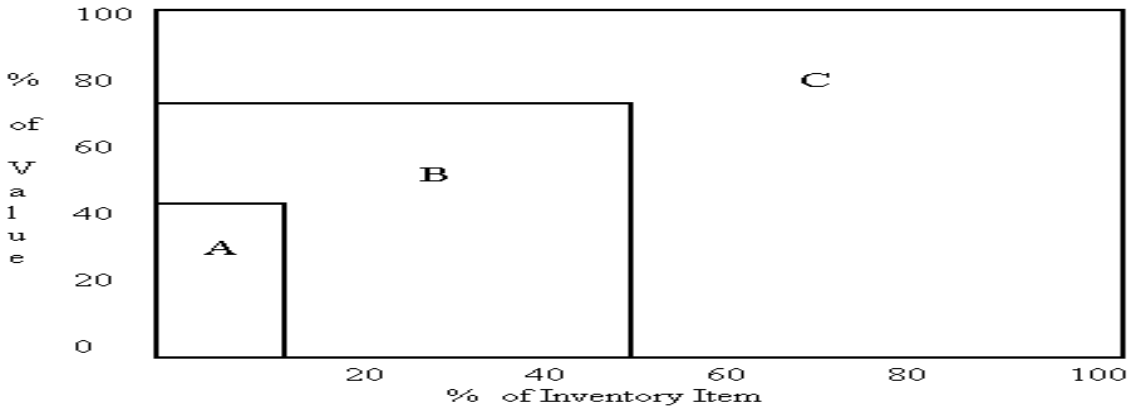
Classification of the Inventory of HPPCL

Division of items	Inventory items
A	Jetamasi oil, Junifer Berry oil, Anthapogan oil, Cammomile oil, Xenthoxylen oil, cinamomum oil, texus resin, Juniper besi oil etc.
B	Lemon grass, Sugantha koki oil,Tageles oil, Winter green oil, Palmarosa oil, Calamus oil, Shilajeet etc
C	Citronella oil, Turpentine oil, mentha oil, curuma zedoaria oil, rosin, Eucalyptus oil, Kashur oil, Matricaria flower etc.

Source: HPPCL, koteswor

Classification of Inventory of HPPCL According to ABC Analysis

Figure No: 4.14



Comparisons of item with values

Table No: 4.17

Category	Items (Tons)	Items (%)	Value (Rs)	Value (%)
A	15000 Tons	15.68	6120255	51.08
B	30415 Tons	31.81	3545132	29.59
C	50225 Tons	52.51	2315613	19.33
Total	23640 Tons	100.00	11981000	100.00

The graphic representation indicates that 'Item A' forms minimum proportion is volume i.e. 15.68 % of total volume but represents the highest value of 51.08 % on the other hand, 'Item B' consists 31.81 % of total volume and 29.59% of total value. Similarly, 'Item C' consists of large volume of items that is 52.51% but it has least % of value i.e. 19.33%

This division of inventory items reflects the concepts of inventory control according to their value and cost. It is clear that a strict control should be exercised on 'Item A' in order to minimized inventory cost hence maximized profit. On its investment 'Item A' should be traced at first and most carefully. In case of 'item C' and 'Item B' simple control will be sufficient.

Similarly for the production of different kinds of products twenty-three kinds of raw materials are used.

4.3 Major Findings of the Study

The following findings can be made from this study about the inventory management and control of NDL and HPPCL.

1) The relations between Inventory and CA of both companies have fluctuating. But in average the current assets ratio of HPPCL is higher than NDL. So, the current assets ratio of HPPCL is variability than NDL.
2) The proportion of Packaging materials on total inventory of NDL and HPPCL is also fluctuating order. Both companies have in decreasing order. But in average NDL has higher proportion of PM over Inventory then HPPCL.
3) The proportion of raw materials on total inventotries to know how much % of inventories are in the form of raw materials. Here in this context the average proportion of raw material of NDL is 46.39% and HPPCL has 51.38%. This shows HPPCL has higher proportion of raw materials over inventory then NDL.
4) WIP on total inventory of NDL Vs HPPCL, both companies have in fluctuating order. But in average HPPCL has higher WIP (i.e.4.53%) Vs NDL (i.e. 3.24%). This shows that HPPCL has need more work before they become finished products for sale.
5) Comparing Finish goods of NDL and HPPC, the % of FG on total inventory in average, HPPCL has higher FG (i.e. 30.20%) then NDL (i.e. 8.96%). This shows that HPPCL has more finished goods in stock then NDL. HPPCL can sell more goods in time if there is high demand in the market.
6) After the analysis of storage and spare parts of both companies, the average % of storage and spare parts of NDL is 4.52% and more storage and spare parts then NDL.

7) Overall study of finished goods of NDL and HPPCL shows the price of raw materials and finished goods is increasing year by year. Every year the price is also increasing order. That is because of recession and shortage of raw materials. Where there is shortage of raw materials obviously finished goods also become expensive.
8) NDL and HPPCL both companies should not use inventory tools and techniques to control inventory. They order and kept inventory whenever they like. So, both companies are in loss.
9) Raw material turnover ratio of both companies has in fluctuating order. The average RM turnover ratio of HPPCL is higher than NDL. This shows that raw material consumed of HPPCL is higher than NDL

10) According to the analysis of Packaging Materials of NDL and HPPCL, the packaging material turnover ratio of NDL is 3.04% and HPPCL has 6.95% this shows that HPPCL has higher packaging material turnover ratio than NDL.

CHAPTER-V

SUMMERY, CONCLUSION AND RECOMMENDATIONS

5.1 Summery

Inventory is one of the most important assets to most of the organization. Large percentage of total capital is invested in inventory. Inventory is vital element in the efforts of the firms to achieve desires sales. A firm cannot achieve its goal unless inventories are controlled effectively and capital is allocated efficiently. Perfect management of inventory leads to achievement of organizations goals.

In present context, public enterprises provides the goals and services which are provide by private enterprises are more effective. Public enterprises face two types of challenges, the first one is to meet public responsibility of providing goods and services cheaply and the second is to utilize the scarce resources more effectively. In this context, the study is concerned to appraise Nepal Drugs Limited and examine that in what extent the company is applying inventory management and control system so as to minimize the cost that ultimately affects the price of drugs. Most of the manufacturing and trading company invests a huge amount of money in inventories such as purchasing, handling, storage and record keeping in large. This is recent years, the subject 'inventory management' and extensive literature has evolved which encompass statistical tools like economic order quantity for how much to purchase together with the re-order point.

There are certain problems of study. Therefore, the basic problem of this study is to examine the inventory management system practiced by the company. The order size, carrying cost, ordering cost, safety stock are determined unscientifically by the company and is not given proper attention to the lead time and all these functions lead to increase the total cost of the company.

Here both NDL and HPPCL invest a huge amount of capital in the form of inventory. The main objectives of this study is to find out what techniques have been used by the NDL and HPPCL to manage the inventory and provide suggestions to use the scientific techniques to help in the reduction the cost and getting profit. For this purpose, the researcher interviewed with officials and observes the inventory system personally and data were collected from various sources. Quantitative tools were applied in this study to analyze the collected data.

All the collected data and facts are analyzed on the basis of inventory management theory and with the help of ABC analysis, EOQ model, and re-order level as well as safety stock. For making certain type of inventory management decision, many mathematical tools and techniques have been available for controlling the inventory but these companies have not applied any sort of techniques for managing their inventories.

5.2 Conclusion

From the various reasons presented in chapter four, the researcher has concluded the following conclusions according to its main objectives.

The present inventory position of NDL and HPPCL is in increasing order per year but relation with other objectives is in fluctuating order.

The relations between Inventory and CA of both companies have fluctuating. But in average the current assets ratio of HPPCL is higher than NDL. So, the current assets ratio of HPPCL is variability than NDL.

The proportion of Packaging materials on total inventory of NDL and HPPCL is also fluctuating order. Both companies have in decreasing order. But in average NDL has higher proportion of PM over Inventory then HPPCL.

Raw materials are also a type of inventory. But all raw materials are inventory but all inventories are not raw materials. These proportion raw materials on total inventory try to know how much % of inventories are in the form of raw materials. Here in this context the average proportion of raw material of NDL is 46.39% and HPPCL has 51.38%. This shows HPPCL has higher proportion of raw materials over inventory then NDL.
WIP are semi manufacturing products. Comparing WIP on total inventory of NDL with HPPCL, both companies have in fluctuating order. But in average HPPCL has higher WIP (i.e.4.53%) then NDL (i.e. 3.24%). This shows that HPPCL has need more work before they become finished products for sale.

Finish goods are those manufactured products which are ready to sale. Comparing NDL and HPPCL the % of FG on total inventory in average, HPPCL has higher FG (i.e. 30.20%) then

NDL (i.e. 8.96%). This shows that HPPCL has more finished goods in stock then NDL. HPPCL can sell more goods in time if there is high demand in the market.

Storage and spare parts means those inventory which are used after the replacement of damage parts. After the analysis of storage and spare parts of both companies, the average % of storage and spare parts of NDL is 4.52% and more storage and spare parts then NDL.

Raw materials need some future actions to become finished goods. Finished goods are ready to sell. This proportion of raw materials with finished goods shows how much % of raw materials are converted in to finished goods and how much raw materials should be order. Here, overall study of NDL and HPPCL shows the price of raw materials and finished goods is increasing year by year. Every year the price is also increasing order. That is because of recession and shortage of raw materials. Where there is shortage of raw materials obviously finished goods also become expensive.

Profit is depending on sales. If there is high price in sales there should be profit but making price high in sales there is problem of selling. To make smooth profit large amount of sale is required in reasonable price. Sales and net profit has positive relationship. Here, from the analysis of NDL sales are increasing every year but profit is decreasing every year or they are in loss. In case of HPPCL some year they are in profit and some year they are in loss. In aggregate the performance of HPPCL is quite better than NDL.

Better inventory management is sine of profit. Better inventory management plays a vital role to the company. So inventory should be managed in proper way. Here both companies should not use inventory tools and techniques to control inventory. They order and kept inventory whenever they like. So, both companies are in loss.

Inventory turnover ratio shows % of inventory on total sales. Ordering extra inventory is depending on sales. If there is high % of sales there should be need other inventories. If there is low % of sales inventory should be spoilt. Here both companies sales are in increasing order so it shows that order of inventory are also increasing year by year.

The relation between raw material and raw material consumed shows that how much % of raw material is used for finished goods. Here raw material turnover ratio of both company have in fluctuating order. The average RM turnover ratio of HPPCL is higher than NDL. This shows that raw material consumed of HPPCL is higher than NDL

Packaging material turnover ratio shows the relationship between costs of packaging materials consumed and cost of average packaging material. Higher packaging material turnover ratio shows higher consumption and utilization of packaging materials and vice versa. According to the analysis of NDL and HPPCL, the packaging material turnover ratio of NDL is 3.04% and HPPCL has 6.95% this shows that HPPCL has higher packaging material turnover ratio than NDL.

Inventory management and control techniques play the vital role for the company. But here both companies never use any techniques. According to the research the researcher suggest to these companies to use some techniques like, EOQ and ABC analysis techniques for better inventory management and control.

Both companies should not use EOQ as well as ABC techniques. According to this research over these companies EOQ of these companies are calculated over their real data. But the researcher found that sometime they order high quantity of inventory and some time they order low unit of quantity.
Before doing some action everyone should study the future results too. For this he/she should realized the past and present action and forecast the future action and result. Estimate the future plans. Both company NDL and HPPCL have not done this till today.

Inventory management system plays the vital role for any organization. To manage and control inventory companies can follow some techniques like EOQ and ABC analysis. According to this research, the researcher did not find any techniques followed by these companies.

These companies did not use any scientific present techniques for collection and procurement procured of raw materials. They order raw materials whenever they like. They have no idea of safety stock, re-order period, re-order level as well as danger level.

The researcher has already told these companies have used any scientific techniques like EOQ and ABC analysis. They used their own idea for collection and procurement procured. So, the result of study shows these companies always suffered from loss.

To make profit and to provide the products to the costumers in time efficiently and effectively both companies need for a good inventory system to maintain a suitable level of inventory and their control. NDL and HPPCL do not follow any scientific techniques. So, the ordering of different kinds of raw materials has randomly. If it continues, cost will be maximized. Due to lack of adequate data, research could not be used fully for find out the necessary operation of the company although all models, formula are available.

There are no techniques for inventory management is possible to apply for calculation of when to buy and how much to order because of lack of planned and systematic methods of collection of materials. If these companies are not concrete to steps for managing the inventory it will be very difficult to predict about the re-order point, how much to maintains safety stock properly for the companies and future researchers. Therefore the real situation of the operator of the company regarding their inventory management and control could not be found properly. Regarding the inventory management and control both companies are facing the same problems.

Other obstacles like Nepal bandhs, lockouts, strikes, geographical problems, fluctuation in material prices etc. has caused problems in smooth management of inventory.

5.3 Recommendations

Management of inventory in NDL and HPPCL are not only necessary but compulsory for the better performance of the companies. On the basis of study the following suggestions may be recommended for the consideration.

- Both Companies has not been able to utilize the optimum capacity i.e. not been able to satisfy the level of customer demand. Hence, it is quite important for the company to use optimal capacity which has been ideal now.
- NDL and HPPCL should define their goals and objective clearly concerning its inputs and outputs separately. I.e. the quantities, time should be specified.
- The quantity of raw materials can be calculated by the help of EOQ model. But both companies are not using EOQ model, which increases the total cost. Researcher recommended to following EOQ model to reduce unnecessary cost.
- For managing inventory in a simple way, ledger cards can also be used by both companies. In this card, the name of items, items numbers, unit price. Usage rate

suppliers, name the percentage of carrying cost and the ordering cost, date of order and its receipts with date, quantity used and issuance of raw materials are mentioned.

- Expert technicians are needed for the production of quantitative products. So the process of selection and recruitment of the technicians should be unbiased.
- Job evaluation should be launched in certain time interval so that hardworking employees can be rewarded for encouragement.
- In case of HPPCL, the encouragement should be done to the farmers to cultivate herbal plants.
- Finally, from ABC classification, in order to minimize invest any cost of 'A' items should be controlled carefully and should be paid more attention that 'B' and 'C' items. 'B' lies in between 'A' and 'C' items. I.e. requires neither carefully nor simple but a moderate control system is adequate for this items.

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Appendix-1

1. Inventory management and control technique of NDL

1.1 Economic order Quantity of RM on FY 2059/60

Annual requirement (A) = 15520Tons

Ordering cost (O) = Rs.135212

Carrying Cost (C) = 1250 per Tons

By applying EOQ Formula,

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

$$= \sqrt{\frac{2\times15520\times135212}{1250}}$$

$$= 1832.37 \approx 1832\ tons$$

I) EOQ = 1832Tons

II) No of Orders =Annual Requirement/EOQ= 15520/1832=8.47times

Note; Average Inventory= Order size/2

Carrying Cost = Average inventory×Carrying Cost Per unit

Ordering Cost = No. of Order×Ordering Cost per Order

Total Cost = Total Carrying Cost + Total Ordering Cost

Table No: 1.1

Trial and Error Approach of EOQ (Tabular Method) of 2059/60

No of order	Order size (in Tons)	Average Inventory(in Tons)	Total Carrying Cost	Total Ordering Cost	Total Cost
1	15520	7760	9700000	135212	9835212
2	7760	3880	4850000	270424	5120424
5	3014	1507	1883750	676060	2559810
8	1940	970	1212500	1081696	2294196
10	1552	776	970000	1352120	2322120

1.2 Economic order Quantity of RM on FY 2060/61

Annual requirement (A) = 20145Tons

Ordering cost (O) = Rs.142812

Carrying Cost (C) = 1425 per Tons

By applying EOQ Formula,

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

$$= \sqrt{\frac{2 \times 20145 \times 142812}{1425}}$$

$$= 2009.43$$

$$\approx 2009$$

I) EOQ = 2009Tons

II) No of Orders = $\frac{Annual\ Requirment}{EOQ} = \frac{20145}{18322009}$ =10times.

Table No: 1.2

Trial and Error Approach of EOQ (Tabular Method) of 2060/61

No of order	Order size (in Tons)	Average Inventory(in Tons)	Total Carrying Cost	Total Ordering Cost	Total Cost
1	20145	10072.5	14353312.5	142812	14496124.5
2	10072.5	5036.25	7176656.25	285624	7462280.25
5	4029	2014.50	2870662.50	714060	3584722.50
8	2518.125	1259.06	1794160.50	1142496	2936656.50
10	2014.5	1007.25	1435331.25	1428120	2863451.25

1.3 Economic order Quantity of RM on FY 2061/62

Annual requirement (A) = 25693Tons

Ordering cost (O) = Rs.152318

Carrying Cost (C) = 1750 per Tons

By applying EOQ Formula,

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

$$= \sqrt{\frac{2 \times 25693 \times 152318}{1750}}$$

$$= 2114.84$$

$$\approx 2115$$

I) EOQ = 2115Tons

II) No of Orders = $\frac{Annual\ Requirment}{EOQ} = \frac{25693}{2115}$ =12.14times.

Table No: 1.3

Trial and Error Approach of EOQ (Tabular Method) of 2061/62

No of order	Order size (in Tons)	Average Inventory(in Tons)	Total Carrying Cost	Total Ordering Cost	Total Cost
1	25693.00	12846.50	22481375.00	152318	22633693.00
5	5138.60	2569.30	4496275.00	761590	5257865.00
8	3211.63	1605.82	2810185.00	1218544	4028729.00
12	2141.08	1070.90	1874075.05	1827816	3701891.50
14	1835.21	987.6	1605800.00	2132452	3738252.00

1.4 Economic order Quantity of RM on FY 2062/63

Annual requirement (A) = 30128Tons

Ordering cost (O) = Rs.168310

Carrying Cost (C) = 2150 per Tons

By applying EOQ Formula,

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

$$= \sqrt{\frac{2 \times 30128 \times 168310}{2150}}$$

$$= 2172.88$$

$$\approx 2173$$

I) EOQ = 2173Tons

II) No of Orders = $\frac{Annual\ Requirment}{EOQ} = \frac{30128}{2173}$ = 13.86times. ≈ 14times

Table No: 1.4

Trial and Error Approach of EOQ (Tabular Method) of 2062/63

No of order	Order size (in Tons)	Average Inventory(in Tons)	Total Carrying Cost	Total Ordering Cost	Total Cost
1	30128.00	15064	32387600	168310	32555910
5	6025.60	3012.80	6477520	841550	7319070
10	3012.80	1506.40	3238760	1683100	4921860
14	2152.00	1076.00	2313400	2356340	4669740
16	1883.00	941.50	2024225	2692960	4717185

1.5 Economic order Quantity of RM on FY 2063/64

Annual requirement (A) = 35816Tons

Ordering cost (O) = Rs.170590

Carrying Cost (C) = 2415 per Tons

By applying EOQ Formula,

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

$$= \sqrt{\frac{2 \times 35816 \times 170590}{2415}}$$

$$= 2249.43$$

$$\approx 2249$$

I) EOQ = 2249Tons

II) No of Orders = $\frac{Annual\ Requirment}{EOQ} = \frac{35816}{2249} = 15.90. \approx 16$times

Table No: 1.5

Trial and Error Approach of EOQ (Tabular Method) of 2063/64

No of order	Order size (in Tons)	Average Inventory(in Tons)	Total Carrying Cost	Total Ordering Cost	Total Cost
2	17908.00	8454.00	20416410.00	341180	20757590.00
6	5969.33	2984.67	7207978.05	1023540	8231518.05
10	3581.60	1790.80	4324782.00	1705900	6030682.00
16	2238.50	1119.25	2702988.75	2729440	5432428.75
18	1989.78	994.89	2402659.35	3070620	5473279.35

2. Inventory Management and Control Techniques (HPPCL)

2.1 Economic order quantity of RM on FY 2059/60

Annual Demand (A) = 25143 Tons

Ordering cost (0) = Rs.152380 per Order

Carrying Cost (C) = Rs. 1560 per tons

By, applying EOQ Formula

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

$$=\sqrt{\frac{2\times25143\times\times152380}{1560}}$$

$$= 2216.28$$

$$\approx 2216$$

I) EOQ =2216 tons

II) No of Order = Annual Requirement /EOQ

= 25143/2216

= 11.35

≈11 times

Table No: 2.1

Trial and Error Approach of EOQ Tabular method (2059/60)

No of Order	Order Size(tons)	Average Inventory(tons)	Total Carrying Cost(Rs.)	Total Ordering Cost (Rs.)	Total Cost
1	25145	12572.5	19613100	152380	19765480.00
4	6286.25	3143.13	4903282.80	609520	5512802.80
8	3143.13	1571.57	2451649.20	1219040	3670689.20
11	2285.91	1142.96	1783017.60	1676180	3459197.60
12	2095.42	1047.71	1634427.6	1828560	3462987.60

Sources: Annual Report of HPPCL

2.2 Economic order quantity of RM on FY 2060/61

Annual Demand (A) = 21215 Tons

Ordering cost (0) = Rs.142810 per Order

Carrying Cost (C) = Rs. 1422 per tons

By, applying EOQ Formula

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

$$= \sqrt{\frac{2\times21215\times142810}{1422}}$$

= 2064.26

≈ 2064 tons

I) EOQ =2064 tons

II) No of Order = Annual Requirement /EOQ

= 21215/2064

= 10.27

Table No: 2.2

Trial and Error Approach of EOQ Tabular method (2060/61)

No of Order	Order Size(tons)	Average Inventory(tons)	Total Carrying Cost(Rs.)	Total Ordering Cost (Rs.)	Total Cost
1	21215	10607.5	15083865.00	142810	15226675.00
3	7071.67	3535.84	5027964.48	428430	5456394.48
8	2651.88	1325.94	1885486.68	1142480	3027966.68
10	2121.50	1060.75	1508386.50	1428100	2936486.50
12	1767.92	883.96	1256991.12	1713720	2970711.12

Sources: Annual Report of HPPCL

2.3 Economic order quantity of RM on FY 2061/62

Annual Demand (A) = 19510Tons

Ordering cost (0) = Rs.148210 per Order

Carrying Cost (C) = Rs. 1395 per tons

By, applying EOQ Formula

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

$$= \sqrt{\frac{2 \times 19510 \times 148210}{1395}}$$

$$= 2036.08$$

$$\approx 2036 \text{ tons}$$

I) EOQ =2036 tons

II) No of Order = Annual Requirement /EOQ

= 19510/2036

= 9.58

≈10 times

Table No: 2.3

Trial and Error Approach of EOQ Tabular method (2061/62)

No of Order	Order Size(tons)	Average Inventory(tons)	Total Carrying Cost(Rs.)	Total Ordering Cost (Rs.)	Total Cost
1	19510	9755	13608225.00	148210	13756435.00
3	6503.33	3251.67	4536075.00	444630	4980705.00
8	2438.75	1219.38	1701028.13	1185680	2886708.13
10	1951	975.5	1360822.50	1482100	2842922.50
12	1625.83	812.92	1134018.75	1778520	2912538.75

Sources: Annual Report of HPPCL

2.4 Economic order quantity of RM on FY 2062/63

Annual Demand (A) = 28316 Tons

Ordering cost (0) = Rs.155310 per Order

Carrying Cost (C) = Rs. 1618 per tons

By, applying EOQ Formula

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

$$= \sqrt{\frac{2\times 28316\times 155310}{1618}}$$

= 2331.536

≈ 2332 tons

I) EOQ =2332 tons

II) No of Order = Annual Requirement /EOQ

= 28316/2332

= 12.14

≈12 times

Table No: 2.4

Trial and Error Approach of EOQ Tabular method (2062/63)

No of Order	Order Size(tons)	Average Inventory(tons)	Total Carrying Cost(Rs.)	Total Ordering Cost (Rs.)	Total Cost
1	28316	14158	22907644	155310	23062954.00
3	9438.67	4719.34	7635884.03	465930	8101814.03
8	3539.50	1769.75	2863455.5	1242480	4105935.50
10	2831.60	1415.80	2290764.40	1553100	3843864.40
12	2359.67	1179.84	1908981.12	1863720	3772701.12

Sources: Annual Report of HPPCL

2.5 Economic order quantity of RM on FY 2063/64

Annual Demand (A) = 18615Tons

Ordering cost (0) = Rs.154280 per Order

Carrying Cost (C) = Rs. 1235 per tons

By, applying EOQ Formula

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

$$= \sqrt{\frac{2\times 18615\times 154280}{1235}}$$

= 2156.59

≈ 2157 tons

III) EOQ =2157 tons

IV) No of Order = Annual Requirement /EOQ

= 18615/2157

= 8.53

≈9 times

Table No: 2.5

Trial and Error Approach of EOQ Tabular method (2063/64)

No of Order	Order Size(tons)	Average Inventory(tons)	Total Carrying Cost(Rs.)	Total Ordering Cost (Rs.)	Total Cost
1	18615	9307.50	11494762.50	154280	11649042.5
5	3723	1861.50	2298952.50	771400	3070352.50
7	2659.29	1329.65	1642117.75	1079960	2722077.75
9	2068.33	1034.17	1277199.95	1388520	2665719.95
10	1861.50	980.75	1211226.25	1542800	2754026.25

Sources: Annual Report of HPPCL

Appendix-2

Table-2.1

Correlation between Raw Material and Finished Goods

Company	NDL					HPPCL				
Years	Raw Materials (x)	Finish Goods(y)	x^2	y^2	xy	'X' Raw Material	'Y' Finish Goods	X^2	Y^2	XY
2059/60	163.11	152.80	2759518.992	23347.84	253828.30	1432.21	786.20	2051225.48	618110.44	1126003.50
2060/61	100.28	485.21	6351357.636	235428.74	1222574.41	652.60	412.31	425886.76	169999.54	269073.51
2061/62	130.62	520.12	8828742.542	270524.81	1545442.96	750.31	544.42	562965.10	296393.14	408483.77
2062/63	177.48	493.12	6338460.817	243167.33	1241493.71	1020.10	490.29	1040604.01	240384.28	500144.83
2063/64	211.92	591.91	9127468.169	356357.45	1788260.74	1252.60	694.61	1569006.76	482483.05	870068.49
Total	$\sum$x=12691.49	$\sum$y=2243.16	$\sum x^2$ =30451748.15	$\sum y^2$=1128826.17	$\sum xy$ =6051600.12	$\sum X$=5107.82	$\sum$Y=2927.83	$\sum X^2$=5649688.11	$\sum Y^2$=1807370.45	$\sum$XY=3173774.10

Sources: Annual Report of NDL and HPPCL

Correlation between Raw Materials and Finish Good (NDL)

$$= \frac{N\sum xy - \sum x \sum y}{\sqrt{N\sum x^2 - (\sum x)^2} * \sqrt{N\sum y^2 - (\sum y)^2}}$$

$$= \frac{5 \times 6051600.12 - 12691.49 \times 2243.16}{\sqrt{5 \times 304451748.15 - 12691.49^2} \times \sqrt{5 \times 1128826.17 - 2243.16^2}}$$

$= \frac{1788957.89}{28874826.08} = \therefore Correlation = 0.6196$

Similarly,

Correlation between Raw Material and Finished Goods of HPPCL

= 0.9127

R, r2, PE and 6PE with RM and FG

r		r^2		PE		6×PE		RESULT		Remarks	
NDL	HPPCL	NDL	HPPCL	NDL	HPPCL	NDL	HPPCL	NDL	HPPCL	NDL	HPPCL
0.6196	0.9127	0.3839	0.8330	0.1885	0.0051	1.1310	0.0302	r<6E	r>6PE	Insignificant	Insignificant

Where,

PE = 0.6745 $\times \frac{1-r^2}{\sqrt{n}}$

For NDL: PE = 0.6745× $\frac{1-.3839r^2}{\sqrt{5}}$ = 0.1885

6×PE = 6× 0.1885 = 1.1310

Similarly,

PE of HPPCL = 0.0051

6×PE = 0.0302

Table-2.2

Correlation between sales and Net Profit

Company	**NDL**					**HPPCL**				
Years	**Sales X**	**Net Profit (loss) Y**	x^2	y^2	xy	**'X' Sales in Rs**	**'Y' Net Profit**	X^2	Y^2	**XY**
2059/60	15013.59	(152.12)	225407884.70	23140.49	(2283867.31)	14245.21	380.21	202926007.90	144559.64	5416171.29
2060/61	18175.23	(318.82)	330338985.60	101646.19	(5794626.83)	11462.45	255.56	131387760.00	65310.91	2929343.72
2061/62	22429.16	(1057.65)	503067218.30	1118623.52	(23722201.07)	12321.25	350.21	151813201.60	122647.04	4315024.96
2062/63	28469.62	(85.51)	810519262.90	7311.96	(2434437.21)	15293.31	420.50	233885330.80	176820.25	6430836.86
2063/64	30771.20	(490.52)	34686674.40	240609.87	(15093889.02)	13810.56	526.12	190731567.50	276802.25	7266011.83
Total	∑x=114858.80	∑y=(2104.62)	$\sum x^2$ =2216200101	$\sum y^2$=14913203	$\sum xy$ =(49329021.4)	$\sum X$=67132.78	∑Y=1932.6	$\sum X^2$=910743867.80	$\sum Y^2$=78614.09	∑XY=26357388.66

Sources: Annual Report of NDL and HPPCL

Correlation between Sales and Net Profit (NDL)

$$= \frac{N\sum xy - \sum x \sum y}{\sqrt{N\sum x^2 - (\sum x)^2} * \sqrt{N\sum y^2 - (\sum y)^2}}$$

$$= \frac{5 \times 49329021.44 - 114858.80 \times 2104.62}{\sqrt{5 \times 2216200101 - 114858.80^2} \times \sqrt{5 \times 1491332.03 - 2104.62^2}}$$

$$= \frac{-4910977.89}{67510816.85}$$

$$\therefore Correlation \quad = -0.0727$$

Similarly,

Correlation of HPPCL= 0.6752

R, r2, PE and 6PE with Sales and Net profit

r		r^2		PE		6×PE		RESULT		Remarks	
NDL	HPPCL	NDL	HPPCL	NDL	HPPCL	NDL	HPPCL	NDL	HPPCL	NDL	HPPCL
-0.0727	0.6752	0.0053	0.4560	0.030	0.1640	0.18	0.9846	r<6E	R<6PE	Insignificant	Insignificant

Table-2.3

Correlation between Inventory and Net profit

Company	NDL					HPPCL				
Years	Inventory	Net Profit	x^2	y^2	xy	Inventory	Net profit	x^2	y^2	xy
2059/60	3819.94	(152.12)	14591941.60	23140.49	(581089.27)	2939.50	380.21	8640660.25	144559.64	737417.30
2060/61	4368.78	(318.82)	19086238.70	101646.19	(1392854.44)	1445.30	255.56	2088892.09	65310.91	369360.87
2061/62	6403.04	(1057.65)	29192841.24	1118623.52	(5714525.26)	1361.20	350.21	1852865.44	122647.04	476705.85
2062/63	4809.48	(85.51)	23131097.87	7311.96	(411258.63)	1834.40	420.50	3365023.36	176820.25	771365.20
2063/64	6026.48	(490.52)	36318461.19	240609.87	(2956108.97)	2394.13	526.12	5731858.46	276802.25	1259599.68
Total	∑x=2442 7.72	∑y=(2104.6 2)	$\sum x^2$ =12232058 0.6	$\sum y^2$=14913320 3	$\sum xy$ =(1105583 6.57)	$\sum X$=9974. 53	∑Y=1932. 60	$\sum X^2$=21679299. 60	$\sum Y^2$=786140. 09	∑XY=361444 8.90

Sources: Annual Report of NDL and HPPCL

Correlation between Sales and Net Profit (NDL)

$$= \frac{N\sum xy - \sum x \sum y}{\sqrt{N\sum x^2 - (\sum x)^2} * \sqrt{N\sum y^2 - (\sum y)^2}}$$

$$= \frac{5\times(-11055836.57) + 2442.72\times 104.62}{\sqrt{5\times 122320580.60 - 24427.^2}\times\sqrt{5\times 1491332.03 - 2104.62^2}}$$

$$= \frac{-3868114.78}{67136695.39}$$

$$\therefore Correlation \quad = -0.5762$$

Similarly,

Correlation of HPPCL=-0.9123

R, r2, PE and 6PE with Inventory and Net Profit

r		r^2		PE		6×PE		RESULT		Remarks	
NDL	HPPCL	NDL	HPPCL	NDL	HPPCL	NDL	HPPCL	NDL	HPPCL	NDL	HPPCL
-0.5762	0.9123	0.3320	0.8323	0.1994	0.0506	1.1964	0.3036	r<6E	r>6PE	Insignificant	Significant

Table-2.4

Correlation between Inventory and Sales

Company	NDL					HPPCL				
Years	'X' Sales in Rs	Inventory	X^2	Y^2	XY	'X' Sales in Rs	'Y' inventory in Rs	X^2	Y^2	XY
2059/60	15013.59	3819.94	225407884.70	14591941.60	57350669.19	14245.21	2939.50	202926007.90	8640660.25	41873794.80
2060/61	18175.23	4368.78	330338985.60	19086238.70	79403450.26	11462.45	1445.30	131387760.00	2088892.09	16566678.99
2061/62	22429.16	6403.04	503067218.30	29192841.24	143614808.64	12321.25	1361.20	151813201.60	1852865.44	16771685.50
2062/63	28469.62	4809.48	810519262.90	23131097.87	136924067.99	15293.31	1834.40	233885330.80	3365023.36	28054047.86
2063/64	30771.20	6026.48	34686674.40	36318461.19 q	185442021.38	13810.56	2394.13	190731567.50	5731858.46	33064276.01
Total	∑x=114858.80	∑x=24427.72	$\sum x^2$ =2216200101	$\sum x^2$ =122320580.6	$\sum x^2$ =60273516.47	∑X=67132.78	∑Y=9974.53	$\sum X^2$=910743867.80	$\sum Y^2$=21679299.60	∑XY=136330483.20

Sources: Annual Report of NDL and HPPCL

Correlation between Sales and Net Profit $= \frac{N\sum xy - \sum x \sum y}{\sqrt{N\sum x^2 - (\sum x)^2} * \sqrt{N\sum y^2 - (\sum y)^2}}$

$$= \frac{5 \times 60273516.47 - 114858.80 \times 24427.72}{\sqrt{5 \times 2216200101 - 114858.80^2} \times \sqrt{5 \times 122320580.6 - 24427.72^2}}$$

$$= \frac{-4910977.89}{67510816.85} \quad \therefore Correlation = -0.0727$$

Similarly,

Correlation of HPPCL=-0.9123

R, r2, PE and 6PE with Inventory and Sales

r		r^2		PE		6×PE		RESULT		Remarks	
NDL	HPPCL	NDL	HPPCL	NDL	HPPCL	NDL	HPPCL	NDL	HPPCL	NDL	HPPCL
-.0727	-0.9123	0.0053	.8323	0.0300	0.0506	1.8	0.3035	r<6E	r>6PE	Insignificant	Significant

Table-2.5

Correlation between Raw Material and Raw Material Consumed

Company	NDL					HPPCL				
Fiscal Year	Cost of Raw Materials Consumed X	Cost of average Raw Materials consumed Y	x^2	y^2	xy	'X' Cost of RM Consumed	'Y' Cost of Average RM	X^2	Y^2	XY
2059/60	10501.97	1851.21	110291373.90	3426978.46	19441351.88	7156.50	865.5	51215492.25	749090.25	6193950.75
2060/61	12111.29	2146.49	146683345.50	4607419.32	25996762.87	4452.20	983.6	19822084.84	967468.96	4379183.92
2061/62	13950.91	2415.21	194627889.80	5833239.34	33694377.34	4513.50	712.5	20371682.25	507656.25	3215868.75
2062/63	14250.28	2860.71	203070480.10	8183661.70	40765918.50	5800.2	872.3	33642320.04	760907.29	5059514.46
2063/64	14918.46	3061.75	222560448.80	9374313.06	45676594.97	5536.3	1020.40	30650617.69	1041216.16	5649240.52
Total	∑x=65732.91	∑y=1233537	$\sum x^2$ =877233538.10	$\sum y^2$=62268411.88	$\sum xy$ =165575005.50	$\sum X$=27458.70	∑Y=4454.30	$\sum X^2$=155702197.10	$\sum Y^2$=4026338.91	∑XY=24497758.40

Sources: Annual Report of NDL and HPPCL

Note: Cost of Average Raw Materials = $\frac{Opening\ Raw\ Materials+Closing\ Raw\ Materials}{2}$

Correlation between Cost of Raw Materials consumed and cost of Average Raw materials (NDL) (r) = $\frac{N\sum xy-\sum x\sum y}{\sqrt{N\sum x^2-(\sum x)^2}*\sqrt{N\sum y^2-(\sum y)^2}}$

$$= \frac{5\times 16675005.50-65732.91\times 12335.37}{\sqrt{5\times 877233538.10-65732.91.^2}\times\sqrt{5\times 62268411.88-12335.37^2}}$$

$$= \frac{17035216.50}{101994189.80}$$

= 0.1670

∴Correlation = 0.1670

Similarly,

Correlation of HPPCL=.0672

R, r2, PE and 6PE with RM and RMC

r		r^2		PE		6×PE		RESULT		Remarks	
NDL	HPPCL	NDL	HPPCL	NDL	HPPCL	NDL	HPPCL	NDL	HPPCL	NDL	HPPCL
0.1670	0.0672	0.0279	.0045	0.2932	.3003	1.6882	1.8017	r<6E	r<6PE	Insignificant	Insignificant

Table-2.6

Correlation between Packaging Material and Packaging Material Consumed

Company	**NDL**					**HPPCL**				
Fiscal Year	**Cost of Packing Materials Consumed**	**Packing Materials**	x^2	y^2	xy	**'X' Cost of PM Consumed**	**'Y' Cost of Average PM**	X^2	Y^2	**XY**
2059/60	2012.21	719.05	4048989.08	517032.90	1446879.60	2375.30	354.20	5642050.09	125457.64	841331.26
2060/61	2590.11	914.37	6708669.81	836072.50	2368318.90	1656.20	326.30	2742998.44	106471.69	540418.06
2061/62	3061.88	1051.11	9375109.13	1104832.23	3218372.69	1321.90	175.40	1747419.61	30765.16	231861.26
2062/63	3850.23	1190.30	14824271.05	1416814.09	4582928.77	1451.60	178.60	2107142.56	31897.96	259255.76
2063/64	4245.75	1230.15	18026393.06	1513269.02	5222909.36	1476.40	202.50	2179756.96	41006.25	298971.00
Total	∑x=15760.18	∑y=5104.98	$\sum x^2$ =52983432.13	$\sum y^2$=5388020.74	$\sum xy$ =16839409.32	∑X=8281.40	∑Y=1237.00	$\sum X^2$=14419367.66	$\sum Y^2$=335598.7	∑XY=2171837.34

Sources: Annual Report of NDL and HPPCL

Note: Cost of Average Raw Materials = $\frac{Opening\ Raw\ Materials + Closing\ Raw\ Materials}{2}$

Correlation between Cost of Raw Materials consumed and cost of Average Raw materials

$$(NDL)\ (r) = \frac{N\sum xy - \sum x \sum y}{\sqrt{N\sum x^2 - (\sum x)^2} * \sqrt{N\sum y^2 - (\sum y)^2}}$$

$$= \frac{5 \times 16839409.32 - 15760.18 \times 5104.98}{\sqrt{5 \times 52983432.13 - 15760.18.^2} \times \sqrt{5 \times 5388020.74 - 5104.98^2}}$$

$$= \frac{3741642.91}{3182868.23}$$

$$= 0.9813$$

Correlation = 0.9813

Similarly,

$$\therefore Correlation\ of\ HPPCL = 0.8533$$

R, r2, PE and 6PE with PM and PMC

r		r^2		PE		6×PE		RESULT		Remarks	
NDL	HPPCL	NDL	HPPCL	NDL	HPPCL	NDL	HPPCL	NDL	HPPCL	NDL	HPPCL
0.9813	0.8533	.9629	.7281	0.0112	.08202	0.0672	0.4921	r>6E	r>6PE	Significant	Significant

Appendix -3

Trend Line Analysis of Annual Demand of Raw Materials

The trend analysis has been employed to the trend of purchase of raw materials. So, in this part, attempt has been to analyze the purchasing trend of raw materials by using trend lines. The trend line between the dependent variable Y and the independent variable x (i.e. time) be represented by Y= a+ b x

Then, for any given value of independent variable x the estimate value of Y demand by y_c given by above equation is

y_c= a + b x

Where,

a = y independent or value of y when x=0

b = slope of the trend line or amount of change that comes in y for a unit change in x.

To determine the straight line trend we have to determine the values of a and b.

Estimation of Trend line by least square Method (NDL)

Year(X)	Annual demand(y)	x=X-2061	x^2	xy	y_c= a+ b x
2059	15520	-2	4	-31040	Y=25460.8+5057.5×(-2) = 15345.8
2060	20145	-1	1	-20145	Y=25460.8+5057.5×(-1) = 20403.30
2061	25695	0	0	0	Y=25460.8+5057.5×(0) = 25460.8
2062	30128	1	1	30128	Y=25460.8+5057.5×(2) = 35575.80
2063	35816	2	4	71632	Y=25460.8+5057.5×(1) = 30518.30
	Σy=127304	Σx=0	Σx^2 =10	$\Sigma\ xy$=50575	

Here,

Σx=0, Σy=127304, Σx^2=10, $\Sigma\ xy$=50575

Since, Σx=0, so, a=$\frac{\Sigma y}{n}$ = $\frac{127304}{5}$ = 25460.8

b = $\frac{\Sigma xy}{\Sigma x^2}$ = $\frac{50575}{10}$ = 5057.5

Therefore, from 1 the trend line is Y= 25460.8 + 5057.5 × x

Then, forecasting of trend value of NDL of future 5 year's

year	Y = a + b x
2064	25460.80+5057.5×3=40633.30
2065	25460.80+5057.5×4=45690.80
2066	25460.80+5057.5×5=50748.30
2067	25460.80+5057.5×6=55805.80
2068	25460.80+5057.5×7=60863.30

Therefore, the forecasting annual demands of NDL for future three years 2064, 2065, 2066, 2067 and 2068 will be 40633.30, 45690.80, 50748.30, 55805.80 and 60863.30.

Estimation of Trend line by least square Method (HPPCL)

Year(X)	Annual demand(y)	x=X-2061	x^2	xy	y_c= a+ b x
2059	25143	-2	4	-50286	Y=21759.80+(-595.5)×−2=22950.80
2060	21215	-1	1	-21215	Y=21759.80+(-595.5)×−1=22355.30
2061	15510	0	0	0	Y=21759.80+(-595.5)×0 = 21759.80
2062	28316	1	1	28316	Y=21759.80+(-595.5)×2 = 21164.30
2063	18615	2	4	37230	Y= 21759.80+(-595.5)×1= 20574.80
	Σy=108799	Σx=0	Σx^2=10	Σxy= -5955	

Here,

Σx=0, Σy=108799, Σx^2=10, $\Sigma\, xy$= -5955

Since, Σx=0, so, a=$\frac{\Sigma y}{n}$ = $\frac{108799}{5}$ = 21759.8

b = $\frac{\Sigma xy}{\Sigma x^2}$ = $\frac{-5955}{10}$ = -595.5

Therefore, from 1 the trend line is Y = a + b x

$$Y= 21759.80 + (-595.5) \times x$$

Then, forecasting of trend value of NDL of future 5 year's

year	Y = a + b x
2064	Y=21759.80+(-595.5)×4 =19973.30
2065	Y=21759.80+(-595.5)×5 = 19377.80
2066	Y=21759.80+(-595.5)×6 = 18782.30
2067	Y=21759.80+(-595.5)×7 = 17591.30
2068	Y=21759.80+(-595.5)×8 = 16995.80

Therefore, the forecasting annual demands of NDL for future three years 2064, 2065, 2066, 2067 and 2068 will be 19973.30, 19377.80, 18782.30, 17591.30 and 16995.80.