

# CHAPTER - I

## INTRODUCTION

### 1.1 Background

Nepal is still struggling to grow up in the path of development laying between two big economy having its circumstance only connected with land, which play a unfavorable role in development making apart from a significant involvement in trading and commercial activities with the world economy. The regional and rural development potential of an agricultural country such as Nepal may not be fully realized without a well-designed and well financed industrialization strategy. Industrialization plays crucial role in process of economic development and its importance is as a means of achieving economic growth and prosperity within the country.

Nepal Oil Corporation Limited (NOC) was established in 1970 A.D. (2027/09/26 B.S.) under the Company Act 2021 to import, store and distribute petroleum and Lubricant product in the country. It is a state owed enterprise whose main objective is to meet the energy requirement of the nation. According to the objective of fourth five year periodic plan the NOC was established with the investment of four government owned enterprises, National Trading Ltd., National Insurance Corporation, Rastriya Banijya Bank and Nepal Bank Ltd. which jointly owned 1.63% of total share of NOC and remaining 98.37% share is owned by government. At the beginning it has had 10 million authorized capital and 1.05 million paid-up capital.

Initially NOC was in the form of a dealer of Burma sells with the head office in Kathmandu. Government enterprise as the patron of the citizen, NOC has made the arrangement of different 2535 authorized dealers from private sector for the distribution of fuel energy.

Nepal doesn't have its own sources of petroleum products, so it depends totally on the import from foreign countries. At the beginning, NOC imported

petroleum products by buying crude oil from third countries such as Kuwait, Russia, Bahrain and handing then over to the Indian Oil Corporation (IOC) for refinement. IOC used to supply the finished products to NOC for distribution in Nepal from 1974/75 A.D. Transaction of petroleum products between Nepal and India began according to the agreement of 1974 A.D. There was a provision for the renewal of the agreement in each 5 years period and the last agreement was made on 31st March 2007 A.D. According to the agreement, NOC purchases the petroleum products from an international market paying foreign currency and provides it to IOC for the refinement then buys various petroleum products from IOC Calcutta equal to the cost which has given to IOC with international market price of the products, But right now due to the weak economic condition NOC is not able to purchase crude oil from international market, It purchases petroleum products directly from IOC in an adhoc basis as per requirement of the nation by paying the cost as determined by IOC with adjustment of international market, even NOC aims to do it in near future according to the agreement of 2007 A.D.

NOC is the sole supplier of fuel energy in the country. It supplies different petroleum products to meet a significant part of energy requirement of the country. Industrialization and development process require the energy as an essential input. So, NOC is struggling to meet the growth trend and changing consumption pattern in the energy sector. NOC has gathered its all efforts and resources for the availability and supply of fuel to meet the requirement. There should be transportation facility for the development of the sector in every aspect and it requires the energy. Industrialization, expansion of business and urbanization are the main influencing factors of increasing trends of demand of petroleum products. Although previous figure of sales was increasing due to different influencing factor the aggregate demand was in peak and now it is in decreasing trends while the national demand of petroleum product was increasing by 10-15% per year, to maintain the nation's requirement NOC has

expanded and strengthened its capacity. Now NOC's authorized capital has been increased up to 500m and paid up to 96.8 m (Prabhat, 2061).

NOC has various storage tanks in different parts of the country with total capacity 71558 kiloliter, which is sufficient to meet the demand for 35 days. Due to poor economic condition right now NOC is keeping the inventory of petroleum products nearly equal with full capacity in Kathmandu only and in other region 40-60% of capacity is maintained as inventory to fulfill the requirement of cash as working capital.

NOC is a non-manufacturing corporation. It has finished inventory in its store to sale to its customer. Super Kerosene Oil (SKO), High Speed Diesel (HSD), Motor Spirit (MS) and Aviation Turbine Fuel (ATF) are the inventory of NOC. Different kinds of petroleum products have been imported for domestic use, air service, industries and transportation. Among them cheap fuels like Kerosene, Diesel, Petrol and Aircraft Fuel (ATF) come to the front. Beside Light diesel oil, corporation also supplies furnace oil and cooking gas (Liquefied Petroleum Gas or LPG). NOC has invested in several companies in Nepal. Nepal Lube Oil Limited, Bitumen and Barrel Industry, Gorkhkali Rubber Udhyog are shared by NOC. NOC is involved indirectly to Lube Oil. Present condition of NOC is that it is suffering a loss of large amount daily and no adequate situation to adjust the price even it is paying revenue to the government as a main payer of revenue. It has paid 2649.2m in FY 2059/60, Rs 3198.1m in FY 2060/61 Rs 3338m. in FY 2061/62, Rs 3352.1m in FY 2062/63, Rs 3714m. in FY 2063/64 Rs. 3844m in FY 2064/65 and 4170.3m in FY 2065/66 as revenue to the Nepalese government. Since the year 2059/60, NOC Limited is losing its general reserve due to unadjusted price of petroleum products.

The main function of NOC is to purchase and sale the petroleum products for its regular supply. It is most necessary to keep the petroleum products in stock. For this purpose it is essential to build storehouse in different places because

Nepal as a land locked country should be ready to face with natural disaster and shortages caused by different factors as well no home production it has.

## **1.2 Organizational Structure of NOC**

For the physical existence, every organization should maintain its organization structure.

Division of labour and placement of right man in right place depends upon the organizational structure which is required to increase the managerial and operational efficiency practically in all enterprises. The officers of sections and sub-sections should be assigned specific authority, responsibility and accountability for the effective operations of the sub-sections and sections.

There should be specified scope and interrelationship of the responsibility of each individual for the efficient and effective performance with mutual interest. The organizational structure of the corporation is in the combined shape of line and staff and functional which is presented in appendix- I.

## **1.3 Inventory Management**

Inventory is one of the most important assets to all organizations. It is a vital element in the effects of the firms to achieve desired sales level or objectives of organization. Inventory indicates an element of current assets, which is most important to function the operation in a regular basis. Different materials and supplies are required and large amount of capital is invested in it. An inventory is stock of “goods” that is held for future use. An organization holds a number of items at a time ranging from small items like pen, to large items like machine and raw materials depending upon the nature of the organization (Shrestha and Silwal; 2001).

Inventories collectively allow the company to be flexible, “Raw materials inventory gives the firm flexibility in its purchasing, finished goods inventory,

allows the firm flexibility in its production scheduling and its marketing” (Van Horne 1998),

Inventory management involves planning of the optimal level of inventory and control of inventory cost supported by an appropriate organization structure. In manufacturing organization, there are four types of inventories, raw materials, work-in process, finished products and office supplies material. But non-manufacturing organizations and merchandising organizations have only finished goods or stock in trade as inventory.

Inventories are stock of the product a company is manufacturing for sale and components that make up the product. The various forms in which inventories exist in a manufacturing company are: raw material, work-in progress and finished goods “(Pandey; 1998). Managerial team of every organization should pay adequate attention to the inventory management to reduce the inventory management for reducing the cost of production (manufacturing), sales (non-manufacturing) and working capital requirement. Maximum level of inventory is harmful in terms of non-productive usage of cash caused to increase in carrying cost. Minimum level of inventory also affects the regular operation and supply of products in different situation and scenario with opportunity. So inventory should be maintained in appropriate quantity to avoid both under stock and over stock situation. For this purpose inventory management is necessary because of the aim of maintaining optimal level of inventory for the smooth production, sales and operation. Therefore inventory management maintains desired level of inventory and minimizes the total cost of inventory.

To avoid both excessive and inadequate level of inventory and to maintain sufficient inventory for smooth sales operation and efficient customer service, proper inventory management is necessary.

“The growing number of corporation in Nepal is facing problem of inventory management. Due to the lack of proper inventory policies, there are many corporations where large amount of capital has been blocked up and very little

measures have been taken to manage the inventory decisions, models, and techniques that have so far developed” (Shrestha, 2037).

Inventory management enables the management of the industry to plan the production operation in such a way that labour and machine can be utilized efficiently and effectively. Timely modernized inventory management may increase the profitability of the firm with continuous supply of inventory. Sufficient stock level of inventory finally helps to achieve the goal of owner’s wealth maximization by reducing the total cost.

#### **1.4 Inventory Management in NOC**

NOC has to deal with the product, as inventories are Super Kerosene Oil (SKO), High Speed Diesel (HSD), Motor Spirit (MS) and Aviation Turbine Fuel (ATF). These are stored for the regular supply of energy to the customers.

NOC has the capacity to store the different petroleum products. In eastern region is 11750 kilolitres (KLs), central region 46580 (KLs), western region 7103 (KLs), mid- western region 3565 (KLs), and far western region 2540 (KLs), totals 71558 (KLs).

Even the total capacity is 71558 KLs that equals to the demand of about 35 days. NOC is presently maintaining 40 to 60% stock of its capacity in stores out of Kathmandu and around 90% of total capacity as the inventory is maintained in the valley (Central office of NOC).

To manage the scarcity of cash, NOC is reducing its stock level that makes the inflow of funds as source. The proper inventory management system is necessary in NOC for the regular supply, assessable availability of working capital and survival in this present critical situation. In the NOC, the inventory management is the process of purchasing, store keeping, selling, distribution and controlling of petrol products to achieve the corporation’s objective with integrity efficiency and economic through effective implementation of NCO’s policies.

## 1.5 Statement of the Problem

Most of the Nepalese Corporations are the victims of the unscientific inventory management system. It is one of the most important causes to impact adversely to the profit of this Corporation. In the context of inventory management Dr. Govinda Ram Agrawal opines “management expert claim that inventory management in Nepal is probably the weakest aspect of management. The tools and techniques for controlling their physical as well as financial dimension.”

Inventory management in Nepalese public and private enterprises is not considered as a vital aspect and no sufficient attention is paid towards the financial function and they made their scope very narrow. As a result the financial resources are squandered inefficiently with apparent wastage, which leads to high cost, lower quality and gross inefficiency. Less importance is given to financial matters such as management of working capital, preparation of financial plans, capital budgeting etc, in most of the public enterprises by the financial management body.

The basic problem of the study is to examine the inventory management system that is exercised by the Nepal Oil Corporation Ltd. Effective and efficient inventory management system can only yield expected profit of the corporation. The suitable adoption of inventory level is crucial for an organization. It should be balanced in such a way that it should neither be excessive nor be inadequate. The excessive inventory results the unnecessary tie up of the firms funds and loss of profit, excessive carrying cost and risk of liquidity whereas the inadequacy of inventory causes either production hold-up or failure to meet the demand of customer. Hence question of the study arises what should be the optimal level of inventory in NOC?

Inventory management system consists various tools and techniques for the effective management of inventory towards the profitability. Thus another problem of the study is concerned with tools and techniques of inventory management, which are applied by NOC.

Next problem is related to inventory turnover of NOC. The turnover is the conversion of assets into sales. Turnover indicates the relationship between sales and assets. High turnover rate of inventory shows speedy transaction that leads to the favorable financial position and low turnover rate means unnecessary blocking and unproductive investment of capital that leads the operational inefficiency of the corporation. On the basis of above- mentioned activities the following particular research questions are tried to be answered in this study.

- a. How much EOQ should be?
- b. How to reduce the inventory cost? (ordering and carrying cost)
- c. What impacts the inventory causes in profitability?
- d. What is the current situation and trend of sales and distribution of petroleum products?
- e. How the pricing mechanism of petroleum product is installed?

## **1.6 Objectives of the Study**

The basic objective of the study is to examine the inventory management status of Nepal Oil Corporation.

The specific objectives of this study are as follows:

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



## **1.7 Significance and Scope of the Study**

Inventory management is one of the important aspects in any manufacturing and non-manufacturing companies. Without effective and efficient inventory management system no organization can achieve the goal. Proper inventory management helps to maximize the profitability and does not block the inventories. Company should maintain adequate raw material, work-in progress, finished goods. Slight changes in the cost of materials affect in the profitability

There are lots of researchers on inventory management perspective in abroad but very few of them are concerned with Nepalese public and private companies. Some researcher are done in Nepalese field but they can't make proper recommendation for management and market scenario is being changed day by day with new challenges and opportunities.

The scope of this study is to make attention towards the inventory management in NOC which may be helpful to cope with the changed market scenario with new threats and opportunities.

A large amount of fund is invested by NOC in purchase; it cannot make a decision about when it has to place a new order what is the economic size of the inventory? So lack of these factors, NOC fails to achieve its goal that's why this study is focused on the inventory management aspect of NOC.

## **1.8 Limitation of the Study**

Due to time and budget constraints the study delimits a large comprehensive dimension through the attempts to enlarge its area are be made as possible and practicable.

No existence of limitation in research is exceptional case. So the following are the limitation of this study.

- a. The comprehensibility and the accuracy of the study is base on the data available from the management, various published documents and website of NOC.
- b. The study is based only on historical data of last five years for the Fiscal year. 2061/2062 to 2065/2066 B.S. due to resource and time constraints.
- c. The study is base on inventory management of NOC.
- d. Secondary data is the main source of information even in some cases primary data will be used.

## **CHAPTER- II**

### **REVIEW OF LITERATURE**

The previous studies cannot be ignored because they provide the foundation to the present study as any scientific research must be based on the past knowledge. Literature review is basically a 'stock taking' of available literature in one's field of research.

There are many researches made in the inventory management of Nepalese public enterprise and private enterprises. Most of them have been made on the manufacturing enterprises. The inventory management cannot be separated from the commercial enterprises.

Lots of studies have been made in the inventory management of NOC, a commercial public enterprise since its establishment. This study tries to review the relevant literatures in the topic of inventory management system.

#### **2.1 Theoretical Framework**

##### **2.1.1 Inventory Management**

The term inventory management is formed with two different words 'inventory' and 'management'. Inventory is the stock of materials held by a firm to meet its future requirement of production and sale. Management of material, parts, supplies, expenses tool work-in-progress, finished products and then record on the book and maintenance of store rooms, ware houses by an organization is known as inventory management. It is a system of ordering based on the maintenance of the stocking, a store following a recording proceed are based on the predetermined stock level (Goel, 1985). Management refers to an art, which is devoted for planning, directing, coordinating and controlling different activities to achieve the predetermined goal.

Inventory for any organization is necessary and requires careful planning and formulation of policies keeping in view the best interest of organization. The

main duty of top level management is formulating plans and policies that will be helpful to maintain optimum level of inventory investment for the achievement of desired goal. According to the nature of the industry and firm, inventories may be durable and non- durable.

### **2.1.2 Types of Inventory**

Manufacturing firms generally have four kinds of inventories which are given below:

#### **(i) Raw Material Inventory**

Raw material implies goods kept by manufacturing firm prior to their being utilized in the production process (Jain & Narang, 1984). Raw material are those inputs that are converted into finished goods through the different manufactures which have been purchased and stored for future production. A material used in factory is traditionally classified as direct and indirect material. Direct material generally includes all materials and parts that can be directly identified with the unit cost of the finished goods. The direct material is generally defined as the material used in the manufacturing process, which cannot be identified with the unit cost of finished goods. They are only the supporting materials of the products (Welsh, Hilton & Garden, 1991). The level of raw material inventories is influenced by anticipated production, reliability of sources of supply and the efficiency of scheduling, purchasing and production operation (Western & Copeland, 1982).

#### **(ii) Work- in Process Inventories**

Work- in process inventories are semi-manufactured products and represent the items that need more work before they are converted as finished product for sale. Sometimes difficulties may arise to determine which materials are work-in processes and which are not because the same material may be a raw material in one industry and the same material may be a work-in process

inventories in another. Work-in progress inventories are strongly influenced by the length of production period.

### **(iii) Finished Goods Inventories**

Finished goods inventories are those completely manufactured products, which are ready for sale. In a manufacturing firm, they are the final outputs of the production process. Stocks of finished goods are held by manufacturing and non-manufacturing company for market operation (Hampton, 1930).

Nepal Oil Corporation Limited is a non-manufacturing company; generally it holds different kinds of finished petroleum products, which are mentioned below:

- ) Motor Sprit (MS)
- ) High Speed Diesel (HSD)
- ) Super Kerosene Oil (SKO)
- ) Aviation Turbine Fuel (ATF)
- ) Light Diesel Oil (LDO)
- ) Furnace Oil (FO)
- ) Liquefied Petroleum Gas (LPG)
- ) Motor Turbine Oil (MTO)

### **(iv) Spare- parts and Supplies Inventories**

Spare- parts are those materials, which are used in maintenance and repairing functions, and supplies are those materials which are used in operating functions like soap, brooms, oil, fuel, light bulbs etc. These materials do not directly enter in the product, but are necessary for production process.

### **2.1.3 Need and Importance of Inventory Management**

Inventory in any organizations are of pivotal role. If the organization is not paying the attention to inventory management it will affect the efficiency and profitability of the organization. Buffa observes as: “Inventories serve the vital function of developing the various operations in sequence beginning raw material extending through all the manufacturing operations and into finished goods. Storage and continuing are to warehouse and retail stores” (Buffa, 1983)

A company holds inventories for three general motives:

- i) The transaction motive, which emphasizes the need to maintain inventories to facilitate smooth production and sales operation.
- ii) The precautionary motive, which necessitates holding of inventories to guard against the risk of unpredictable changes in demand and supply forces and others factors.
- iii) The speculative motive which influences the decision to increase or decrease inventory levels to take advantage of price fluctuation (Pandey, 1994).

A company should maintain adequate stock of material for continuous production. It is not possible for a company to procure raw material whenever it is needed. A time lag exists between demand for materials and its supply. There also exists uncertainty in procuring raw- materials in time at many occasions. The procurement of material may be delayed because of such factors as strikes transportation disruption should maintain sufficient stock of raw materials at given time to stream line production. Other factors, which may necessitate, purchasing and holding of raw materials inventories are quantity discount and anticipated price increase. The firm may purchase large quantity discount of bulk purchasing (Khan & Jain, 1992)

Work-in process build-up because of the production cycles, it is the time span between introduction and emergence of finished goods at the completion of production cycles. Till production cycle is completed, stock of work-in progress has to maintain. Efficient firms constantly try to make production cycle smaller by improving their production techniques.

Stock of finished goods has to be held because production and sales are not instantaneous. A firm cannot produce goods immediately when customers order these. Therefore, to supply finished goods on a regular basis, their stock has to be maintained for sudden demands from customers. In case the firm's sales are seasonal in nature, substantial finished goods inventory should be kept to meet the peak demand. Failure to supply products to the customer when demanded would mean loss of the firm's sale to competitors. The levels of finished goods inventories would depend upon the co-ordination between sales and production as well as on production time. If there is close relation between sales and production, a small finished goods inventory could be maintained and still customer needs would be met (Star, Martin and David, 1962).

#### **2.1.4 Objectives of the Inventory Management**

Main objectives of inventory management are:

- i. To maintain large size of inventory for efficient and smooth production and sales.
- ii. To maintain a minimum investment in inventories to maximize profitability

To achieve the above objectives inventory management should perform following function;

- a) Continuous supply of raw material without obstruction for smooth production operation.

- b) Provide enough raw materials in the condition of lack of raw material supply and price change in the future.
- c) Maintain enough finished goods inventory for effective market operation and customers' service.
- d) To minimize carrying cost and time.
- e) To control investment in inventories and maintain optimum level (Pandey, 1994).

### **2.1.5 Inventory Costs**

There are many costs associated with the size of inventory directly, either advocating decreasing the inventory size or suggesting to increase in the inventory size, for an effective analysis and control of the inventory system.

Inventory cost includes the cost of the invested money, insurances damage, second-keeping, space used, disseveration and spoilage, taxes, theft obsolescence labour. Different costs associated with inventory management are explained below:-

#### **A) Acquisition Costs or Order Cost**

The most obvious cost are those involved in the acquisition of the inventory, including the expense of such clerical operation as filling reviewing the requisition, processing the purchase order, checking the incoming vouchers and paying the bills. The important feature of these cost are "one time costs" and therefore may be treated like fixed costs. The larger the order quantity, the smaller these costs become on a per unit basis because the entire expenses of the order is spared over more items (Enra, 1984).

Moreover ordering cost which is also called procurement cost tend to have both fixed and variable elements they may vary considerably for different



commodity. Acquisition cost or ordering cost can be calculated with the help of following formula:

$$\text{Ordering cost} = \frac{\text{Annual Requirement}}{\text{Quantity order size}} \mid \text{Ordering cost per order}$$

$$\text{Symbolically, OC} = \frac{A}{Q} \mid O$$

## **B) Holding or Carrying Cost**

The next major categories of cost are those associated with carrying, the inventory itself such as capital cost, handling and storage costs, spoilage and shortage costs insurance payment and system cost. Carrying cost can be calculated from the following formula:

$$\text{Carrying Cost} = \text{Average Inventory} \mid \text{Carrying cost per unit}$$

Symbolically,

$$\text{Carrying Cost (C)} = \frac{Q}{2} \mid 2$$

### **i) Capital Cost**

As with any other assets, inventories require capital investment. Funds associated to inventories are not available for other uses. Therefore, the opportunity cost is determined by the alternative use to which the funds could be put. If the firm has alternative uses for the capital that would return 10% for example then the capital cost of the inventory is 10%.

### **ii) Handling and Storage Cost**

Facilities required to store an inventory generate costs such as rent, heat and light etc. Often storage facilities are available and have no alternative use, in that case the cost of storage are fixed and do not vary with inventory level.

Beyond a given level of inventory, however costs will begin to increase as more times are put in stock. Because of the inefficient stocking or because of less desirable warehouse space the storage cost begins to rise.

### **iii) Spoilage and Shortage Cost**

This is another type of inventory carrying cost. When goods are kept in warehouse or in storage they may be spoiled or deteriorated. Deterioration rate can be varied from product to product as per the nature. Whatever may be the reason of their deterioration it can be said that asset of the company or firm will be reduced and can be termed as cost of holding inventories.

Spoilage cost may occurs due to change in time or demand, deteriorate physically in storage, poor keeping, shrinkage and breakage and less cost also cause expensive shortage.

### **iv) Insurance and Taxes**

Many of the goods in inventory require insurance and it should be included in inventory holding cost. Insurance is carried out or inventory is itself insured. The cost of this insurance will vary according to the size and value of inventory. The same is true for taxes. Some countries levy inventory taxes, for example various data throughout the year, the inventory a firm has on hand those data the higher their tax bill will be where such taxes are in effect, product inventory management may dictate reduction in inventory to coincide with the data on which the assessments are made (Jone F.Meggee op.cit.44).

### **v) System Cost**

One final type of inventory holding cost remains to be discussed those associated with the administration of the inventory system is used such as information gathering cost, supervision cost, physical stock checking costs and record keeping equipment cost. It is difficult to determine whether these

expenses will be high or low except by making a comparison among actual inventory system.

### **C) Overstock and Stock out Cost**

Eventually every business organization is suffered from the problem of overstock and stock out of products. These problems ultimately involve the costs.

#### **i) Overstock Cost**

When the demand for the product is terminated however goods are still remained unsold, it is termed as overstock cost.

#### **ii) Stock out Cost**

It is the stock of goods go out of stock before the demand for the product is determined, the stock of used material go out of stock before the production process is stopped is called out the stock. Alternatively if the goods are not available at the time of receiving order, it loses the possible profit as well as good will from customers. In the stock out cost production process can be ceased with the insufficient supply of raw materials. Some firms feel so strongly about avoiding this type of cost that they after the customer substitutes of greater value than the item from a competition themselves and furnish it to the customer at a loss.

Stock out cost computed from following formula:

Stock out Cost = Inventory Cycle per year | Stock out units | Probability of a possible stock out | units stock out cost.

$$\text{Inventory Cycle per year} = \frac{\text{Annual usages}}{\text{Quantity order size}}$$

(Weston & Brigham, 1981)

When an item is not available to the production department, it may mean that an entire production line must be shut down. If this happens, idle labour and machine cost as well as start up and shut-down cost will be incurred. Both of these costs are generally easier to calculate than those of a state.

## **2.2 Technical Formulation**

### **2.2.1 Inventory Control**

Inventory control is a system, which ensures the provision of the required quantity of inventories of required quantity at the required time with the minimum amount of capital investment. Thus, the function of inventory control is to obtain the maximum inventory turnover with sufficient stock to meet all requirements.

There are basically two approaches to inventory control; unit control and value control. Unit control involves the control over inventories in terms of unit while value control entails the control over inventories in terms of value. These two approaches seem to be conflicting. Unit control of inventories ensures stocks for continuity of operations and sales and obviously the greatest insurance against running out of any items at a crucial movement is maintaining a huge supply of everything stored in the plant. It will increase the cost of handling the inventory and investment. If value control is imposed there is always a risk of running short of materials. Thus, an optimum control is achieved when the required materials can be obtained at a minimum cost through proper planning formulation of policies and procedures in order to maintain the inventory level at a desired point.

In the words of John L. Burbidge, “Inventory control is then, concerned with the control of the quantities and/or monetary values of these items at predetermined level or within safe limits.” Thus, the inventory control management includes the following aspects (Varma and Agrawal, 1997).

- i) Size of inventory determining maximum and minimum level establishing time schedules, procedures and lot of sizes for new orders, ascertaining minimum safety levels, coordinating sales, production and inventory policies.
- ii) Providing proper storage facilities arranging the receipts, disbursements and procurement of materials, development of the forms of recording these transactions.
- iii) Assigning responsibilities for carrying out inventory control functions.
- iv) Providing for the reports necessary of supervising the overall activities.

### **2.2.2 Techniques of Inventory Control**

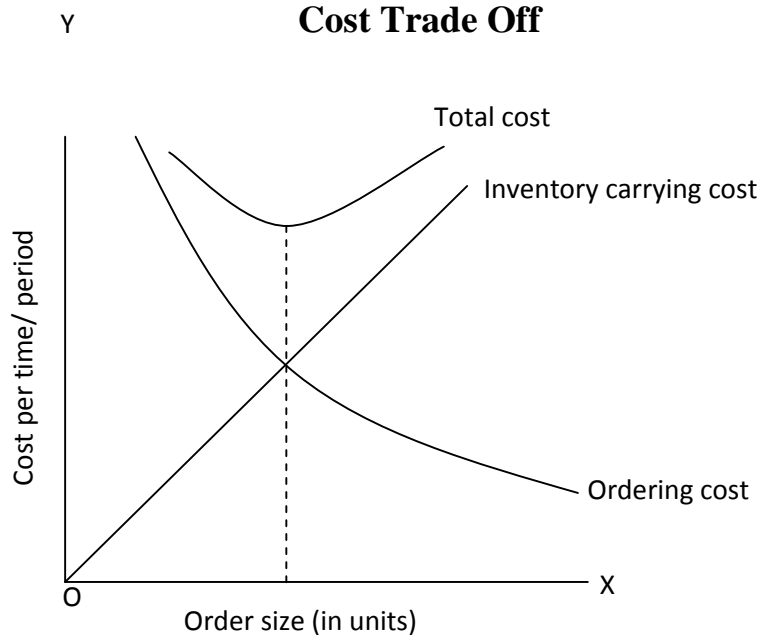
#### **a) Inventory Model**

Purchase of large quantity enables management reduce to the order placing costs incurred in a given period of time. Buying in bulk also makes it possible to take advantage of quantity discount and lower handling and shopping cost. As we know procurement cost decreases as carrying cost increases. There is a cost trade off between the two. And if we know add the cost graphically, we obtain the total cost curve. The optimum order quantity is the point at which annual total costs at a minimum.

On the other hand, the purchase of large amount of materials at one time raises the inventory carrying charge because of the increased size of the average inventory maintained (Megee, 1984).

**Figure No. 2.1**

**Cost Trade Off**



Since ordering costs are largely independent of the size of order, these costs go down as the order size is increased because fewer orders are placed. Mean while, however inventory costs increase as the order size is grown. To illustrate the relationship between these costs, let us consider the case of NOC those purchases 1000 kiloliters of petrol and if NOC makes an order with 100 KL at a time means that 10 orders must be placed whereas only five orders are needed for an order size of 500 KL. As a consequence inventory costs such as storage, insurance and interest, which vary with inventory level will be lower and are economy that pertain to large orders such as quantity discount, lower ordering cost and lower receiving cost, a balance must be struck between inventory carrying cost and ordering cost. In short, the most economical order size for a firm, which will result in a minimum total annual inventory cost, will reflect companies or accommodations, between the two cost patterns. This company occurs at the lower point on the total cost curve.

**b) Economic Order Quantity (EOQ/Q)**

One of the major inventory management problems to be resolved is how much inventory should be added when inventory is replenished. If the firm is buying raw-materials, it has to decide lots in which it has to be purchased in each

replenishment. If the firm is planning a production run, the issue is how much production to schedule (or how much to make). The problems are called order quantity problems, and task of the firm is to determine the optimum or economic order quantity (or economic lot size). Determining an optimum inventory level involves two types of costs : a) ordering cost and b) carrying cost. The economic order quantity is that inventory level, which minimizes the total of ordering and carrying costs (Pandey, 1998).

EOQ is the size of the lot to be purchased, which is economically viable. This is the quantity of material, which can be purchased at minimum costs. Generally, EOQ is the point which inventory - carrying costs are equal to order costs. In determining EOQ it is assumed that cost of managing inventory is made up solely of two parts i.e. ordering costs and carrying costs (Nair, Banjaree and Agrawal, year).

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

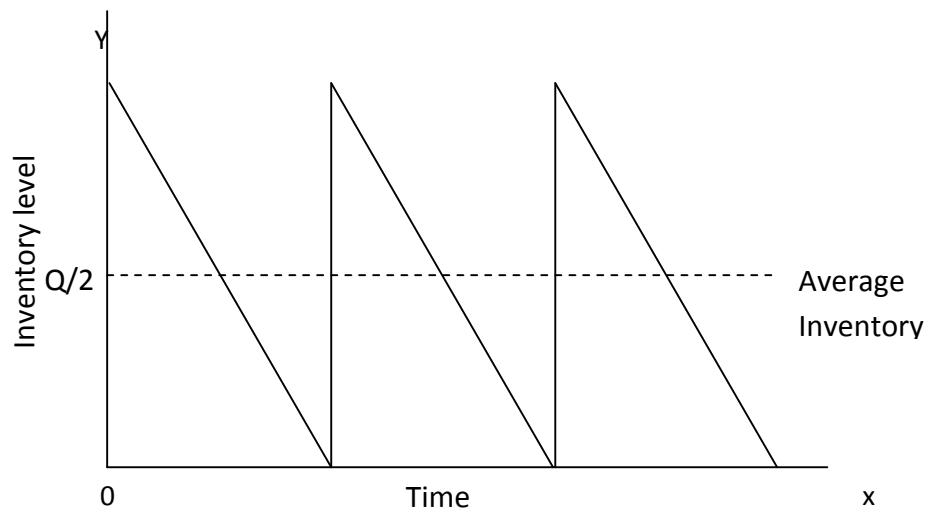
Mathematically, the economic order quantity (EOQ) model can be used to calculate the order size that minimizes total inventory costs. Simplicity of the EOQ model depends on four rather unrealistic assumptions.

- a) Constant and uniform demand over the planning period.
- b) Instantaneous delivery of orders.
- c) Constant cost per unit regards less of the number of units ordered.
- d) Constant carrying and ordering cost.

Under these assumptions, inventory size is shown below:

**Figure No. 2.2**

**Inventory level under EOQ Assumption Instantaneous Delivery**



The model is valid for any time period as long as all variables are defined for the time period considered. For simplicity assume the time horizon to be one year.

To determine the optimal order quantity (Q), the per unit carrying cost for one year (c), the cost of planning one order (o) and the yearly demand for the product (A). The economic order quantity is calculated with the following formula:

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

Where,

EOQ = Economic order quantity

A = Annual Requirement of product

O = Ordering cost per order

C = Carrying cost per unit



If the company orders EOQ unit each time, it will minimize total inventory costs. The following example proves this; The NOC purchases 100000kl (A) petroleum products annually. The ordering cost (o) is Rs.500 and carrying cost (c) is Rs.4. The economic order quantity will be,

$$\begin{aligned} \text{EOQ} &= \sqrt{\frac{2Ao}{c}} \\ &= \sqrt{\frac{2 \times 100000 \times 500}{4}} \\ &= 5000 \text{ KLS} \end{aligned}$$

Because NOC requires 5000 KL, it is necessary to place 20 orders per year to satisfy the demand (100000/5000=20) (c). To re-order Level the problem, how much to order is solved by determining the economic order quantity. The economic order quantity discussed above assumes that the organization knows with certainty the future demand or requirement of any item, and the supply of the items an instantaneous. Unfortunately, these assumptions are found to be unrealistic because in real world situation there should be gap between the planning order and the receipt of the delivery. This time gap can be due to delay in transportation, loading and many other factors which are beyond control.

### **c) Re-order Point**

To determine the appropriate time when the order should be placed in advance is difficult exercise. If an order is placed too early then it may result in piling up of inventory for larger period and if it is placed too late then this may result in shortages. Both these situation are not in the interest of the firm. The problem is known as ‘when to order’ and is very important for an organization. In other words the choice of appropriate point at which an order to replenish the inventory is of great significance. The level of inventory at which re-order

should place is known as re-order or re-order point (Goel, 1992). To determine the re-order under certainty, following factors should be taken into account;

- i) The time intervening between the date of order for goods and the arrival of supplies.
- ii) The average quantity consumed within stipulated time period.
- iii) The margin of safety.

The ordering level is revised from time to time on consideration of the exigencies relating to supplies of a demand for goods (Goyal and S.N., 1993).

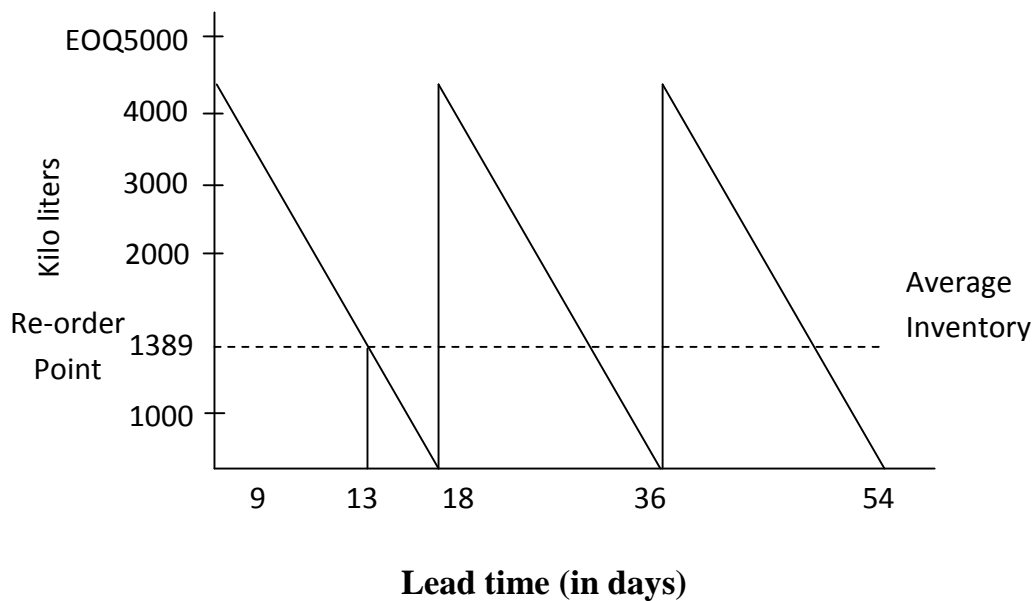
Under certainty situation, re-order point is simply that inventory level, which will be maintained for consumption during the lead- time. That is:

$$\text{Re-order point} = \text{Lead Time} \mid \text{Average Usage}$$

Suppose demand for inventory is known with certainty but that it takes 5 days before an order received. In the illustration shown above, the economic order quantity formula, the EOQ of NOC was 5000 KLS, resulting in an order being placed every 18 days.

If usage is steady, the NOC's average usage is 278 (approx) KL. If there is no lead time, that is delivery of inventory is instantaneous the new order will be placed at the end of 18 days as soon as the economic order quantity reaches zero level. But as the lead-time is 5 days the new order is placed at the end of 13 days. When there are 1389 (approx) units left on to consume during the lead-time. As soon as the lead-time ends and inventory reaches zero the new stock of 5000 KLS will arrive. Thus re-order point is 1389 KLS (approx) (5 | 277.77kl). This is illustrated in figure 3. It shows that the order should be placed at the end of 13 days, where 1389 KLS (approx) are left for consumption during the lead time. At the end of 18 days, the firm will get the supply of 5000 KLS. If the lead-time is till the re-order point will be in the level.

**Figure No. 2.3**  
**Instantaneous Delivery**



**d) Safety Stock**

Safety stock refers to extra inventory held as a hedge or protection against the possibility of stock out. Safety stock reduces or eliminates the costs incurred by a stock out, but it adds to carrying costs.

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

$$\text{Optimal order point} = \text{Transit stock} + \text{Safety stock}$$

If NOC Ltd. decides that a safety stock of 611 KLS petroleum product optimal, it will place a new order for the EOQ of 5000 KLS when inventory falls to 2000 KLS.

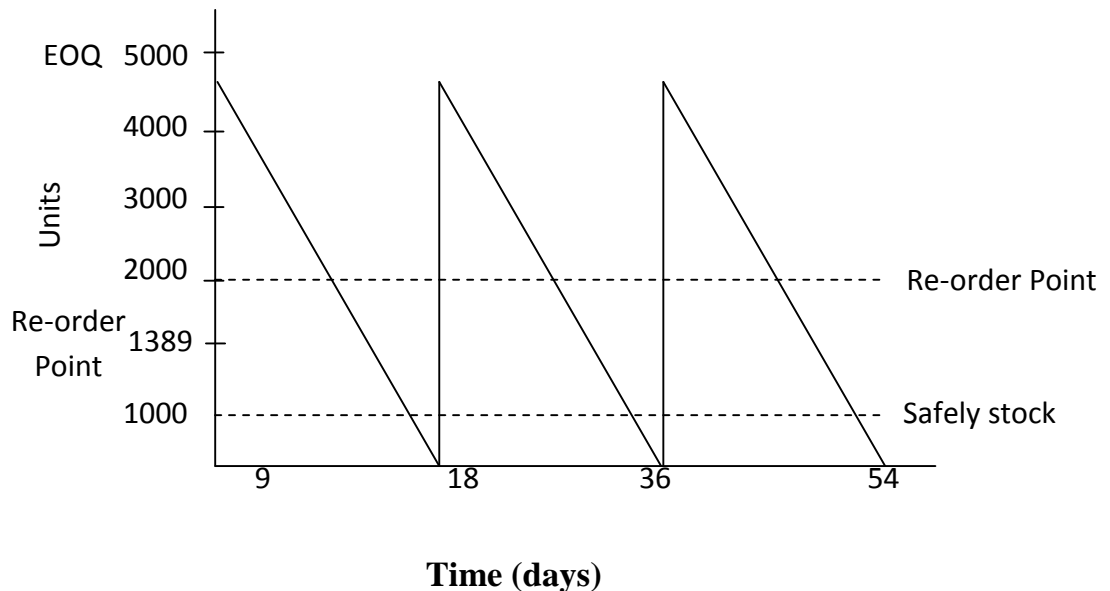
$$\text{Optimal re-order point} = 1389 + 611 = 2000$$

Thus, basically these items of information are needed as inputs to design the re-order point. The safety stock involves two types of costs i) sock out stock and ii) carrying cost. Safety stock is necessary under the condition of uncertainty.

The following figure shows the inventory levels overtime when transit and safety stock are taken into account:

**Figure No. 2.4**

**Inventory Level with Transit stock & Safety stock uncertainty**



**e) Stock Level Sub-System**

Carrying of too much and too little of inventories is detrimental to the firms. If the inventory is too little, the firm will face frequent stock out and when it is high, it will be unnecessary tie up of capital. Therefore, an efficient inventory management requires that a firm should maintain the optimum level of inventory, where inventory costs are the minimum and at the same time there is no stock out which may result in loss of sale or stoppage of production. Various stock levels are as follows (Nair, Banerjee and Agrawal, 1998).

**i) Minimum Stock Level**

This represents the minimum quantity of the material which must be maintained in hand all times. If stocks are less than the minimum level then the work will stop due to shortage of materials. Following factors are taken into account while fixing minimum stock level:

- Lead time
- Rate of Consumption
- Nature of Materials

Arithmetically minimum stock level is calculated by using the formula:-

Minimum stock level = Re-ordering level – (Normal Consumption \* Normal Re-order Period)

### **ii) Maximum Stock Level**

It is the quantity of material, which a firm should not exceed in its stock. If the quantity exceeds maximum level limit then it will cause the over stocking. A firm should avoid overstocking because it will result in high material costs. Overstocking will mean blocking of more working capital, more space for storing the materials, more wastages of materials and more chances of loss from obsolescence.

The following is the formula to calculate the maximum stock level.

Maximum stock level = (Re-ordering level + Re-ordering quantity) – (Minimum Consumption | Minimum Re-ordering period)

### **iii) Re-order Level**

This refers to the level which new orders are placed to replace low stock. New supplies will be received before the stock reaches at the minimum level. It is derived on the basis of:

- Rate of consumption
- Minimum level
- Delivery time

- Stock out cost

Formula to get Re-order level is:

Ordering level = Minimum Level + Consumption during the time required to get the fresh delivery (i.e. Daily requirement | Lead Time)

#### **iv) Average Stock Level**

Average stock level is calculated as:

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

#### **v) Danger Level**

It is the level beyond which materials should not fall in any case. If the danger level arises then immediate steps should be taken to replenish the stock even if the more cost is incurred in arranging the materials. If materials are not arranged immediately there is a possibility of stoppage in work process. Danger level is determined by the following formula:

Danger Level = Average Consumption | Maximum Re-order Period for emergency Purchase

### **2.2.3 Selected Inventory Control: ABC Analysis**

A firm has to maintain various items of inventories. All items in the inventory cannot be treated equally. They are different in value and can follow a selective control system. A selective control system: such as the ABC Analysis, classifies inventories into different three categories according to the value of the items. The first category 'A' consists of highest valued items, 'B' category consists of average valued items and 'C' category consists of lowest valued items. More categories of inventories can also be created according to the requirement and if possible, tight control may be applied for high valued items and relatively loose control for low valued item. The ABC analysis concentrates on important items and is known as control by importance and

exception (CIE). As the items are classified on the importance of their relative value, this approach is also known as proportional value analysis (PVA). ABC can be known as always better control.

ABC analysis has shown the following classification as being representation in many industries.

	Quantity of Items	Value of Items
A	10-15%	70-75%
B	15-20%	15-20%
C	60-70%	10-15%

(Pandey, 1998:844).

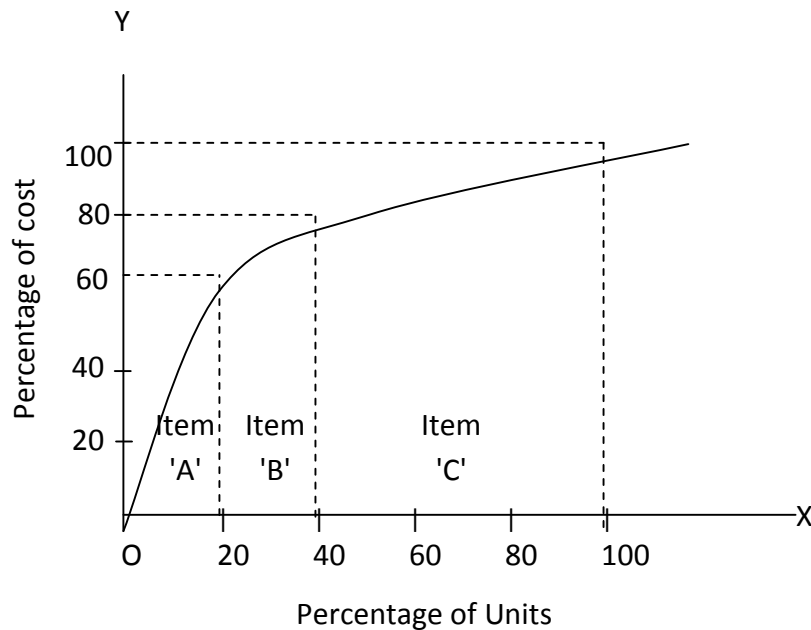
**Table No. 2.1**  
**ABC Analysis**

Classification	Items	Units	%of Total	Cumulative	Unit Price	Total Cost	% of Total	Cumulative
A	1	10000	10	15	30.4	304000	38	70
	2	5000	5		51.20	256000	32	
B	3	16000	16	45	5.50	88000	11	90
	4	14000	14		5.41	72000	9	
C	5	30000	30	100	1.7	51000	6.38	100
	6	15000	15		1.50	22500	2.81	
	7	10000	10		0.65	65000	0.81	
Total		100000	100	100		800000	100	100

The tabular and graphic presentation indicates that item 'A' forms a minimum proportion 15% of total unit of all items, but represents the highest value 70%. On the other hand, item 'C' represents 55% of the total unit and only 10% of the total value. Item 'B' occupies the middle place. Item 'A' and 'B' jointly represent 45% of the total unit and 90% of the investment. More than half of the total units are item 'C' representing merely 10% of the investment.

The significance of this analysis is that a very close control is exercised over the items of 'A' group which account for a high percentage i.e. 70% of cost while less control is adequate for category 'B' and very little control would be sufficient for 'C' items.

**Figure No. 2.5**  
**Graphical Presentation of ABC Analysis**



**Advantage of ABC Analysis**

- i) A strict control is exercised on the 'A' items, which represents a high percentage of the material costs. Managerial time is spent on 'A' item whereas 'C' items and some times 'B' item can be handled by



clerical staffs with least managerial supervision. Equal attention to all the items of stores is not desirable because it is expensive.

- ii) Investment on inventory is reduced to the minimum possible level because a reasonable quantity of 'A' items representing a significant portion of the material costs is purchased to reduce investment in materials. Close control of 'A' items contributes much more than close control of 'C' items.
- iii) Storage cost is reduced as a reasonable quantity of materials, which account for high percentage of value of consumption that will be maintained in the stores.

## **2.4 Two Bin/ FIFO and LIFO**

Material Handling: Organization should bear cost to hold the inventories. Costs of holding inventory directly affect the price of output. Minimization and control of holding the inventories is essential for sustainable growth and prosperity. While managing the inventories it's physical control and management should be emphasized. Physical control of materials means to protect the materials against theft, loss, damage, spoilage, deterioration etc. and to maintain the up-to-date record about the existing materials in the store. The place where materials are kept may be Cupboard, room, cabinet, box etc. Which are collectively known as bin and the statement in which the detail about the materials is recorded is called "Bin Card". Bin card is record of materials received and issued by the store which includes quality, type, date, responsible person handling materials and other associated information. It is prepared in store by the storekeeper. For the record of received materials and issued materials different bin cards are maintained. Bin card with the record about received materials is receiving bin card and with record about issued materials is issuing bin card. Bin card provides the up to date information about inventories to the management. It helps the controlling and managing process of inventories for there deduced cost incurred in inventory management.

As same with bin card next statement for materials is also maintained in manufacturing organization, which is called store ledger. Store ledger also contains the detail description about materials received and issued by the store in different date. It slightly differs from bin card. Store ledger is prepared in cost accounting section rather than store. To solve the problem of pricing the materials to be issued, different three methods can be applied while preparing store ledger .

#### **a. First In First Out (FIFO) Method**

In this method the earlier lots of materials or goods purchased or goods manufactured are exhausted first and closing received or goods manufactured are valued at cost of such goods. In other words cost of goods sold is calculated keeping in view the earliest lots exhausted on the presumption that units are sold in the order in which they were acquired (Jain & Narang, 1994).

#### **b. Last in First Out (LIFO) Method**

While issuing the materials to the production section from store section charging the price of materials of latest consignment happens at first until the finishing of the same lot. It means the materials of latest received are issued at first and the old one is issued only when the latest materials are finished.

#### **c. Simple Average Method (SAM)**

If the average price of all materials existing in the store is charged in every issue of materials the method is called simple average method.

### **Purchasing**

Purchasing of different transected product by the non manufacturing concern is for the supply of product as per demand to the customer to element the stock out position, which may cause the loss in opportunity gain, speculation gain, regular operating of the organization, over all efficiency of the organization in long-run is the related Purchasing is the task related to going

the open market finding the desired materials at the lowest possible price and selecting the supplier who offers it at that price having the quality of the materials in mind.

### **A. Objectives of Purchasing**

The major objectives of scientific purchasing may be stated as follows:

- J Procurement of required quality and quantity of materials at the best price not necessary the lowest price.
- J Procurement of materials, which best suits the product and the purpose for which they are intended.
- J Purchasing for time utility by a schedule, sufficiently in advance of the demands of the production department so that the production work shall not suffer due to lack of materials.
- J Buying the quantity, which is neither too much that involves blocking of the capital, or too little that holds up the regular supply for production.
- J Improvement of the product with reference to quality and the distribution by means of selection of adequate materials.
- J Maintaining continuity on supply to ensure production schedule at a minimum investment.
- J Avoidance of duplication of materials, leading to Waste of materials and equipment.
- J Maintenance of company competitive positions, i.e. market by having company's quality standards in accordance with the demands of the customers.
- J Creation of goodwill for the company through dealings with suppliers.

- J) Developing higher co-operation and co-ordination and maintain of internal relationship among various departments of the company.

## **B. Purchasing Producers**

The main steps in purchasing procedure may be listed as follows:

### **i. Purchase Requisition**

The initiation of purchase begins with the formal request from the various sections or department to the purchase department to order goods. The request is made in purchase requisition slips to the purchase department by the departments needing the goods authorizing the purchase department for procuring the goods as per as the specification given in the slip by the date mentioned on it.

### **ii. Decision for Purchase**

On receipt of the purchase requisition the purchase department decides what and how much to buy taking into consideration various limitations and constraints in purchasing the goods. As soon as possible the raw-materials should be purchased in sufficient quantity neither less nor more, to continue the flow of production. For purchasing other materials or plant and equipment the necessary permission should be obtained from the authority concerned and the finance department to release the finance.

### **iii. Study of Market Condition and Source of Supply**

Having the decision for the purchase of materials the purchasing agent should study the market condition on the basis of market reports as to when and what goods should be purchased. An intensive study of supply from where the goods can be procured with the helps of catalogues, directories, old records, price lists of vendor and purchase order etc.

#### **iv. Selection of Vendor**

On the basis of studies of market conditions and source of supplier the purchasing agent selects the vendor keeping in mind the reliability of his price movement history, his quired and his delivery record and other service required and his past co-operation. Sometimes supplier is selected out of the listed suppliers registered with the company for the supply of goods or sometimes quotations or price bids or tendering are invited from the prospective suppliers. After studying the details regarding the quality and quantity of goods vendor is selected out of the bidders or tenderizers.

#### **v. Purchase Order**

Having selected the vendor or supplier a purchase order is prepared in the prescribed form by the purchase department and sent to the vendor authorizing him to supply specified quality of materials at the stipulated terms at the time formal contract between there in. It forms formal contract between the purchaser and the vendor.

#### **vi. Receiving of Materials**

When goods arrive they are taken to delivery and the receving clerk checks materials with the order placed by the purchasing department to the vendor. After proper checking, goods should be delivered to the store department or to other department that requisitioned them. On checking, if any discrepancy is found as regards to quality or quantity it should immediately be refered to the purchasing department so that discrepancy may be adjusted.

### **2.5 Review of Articles and Journals**

Some studies have been made in the subject of inventory management but a few studies have been on this matter. Some studies will be reviewed in this chapter:

- i. Govind Ram Agrawal, Management expert that inventory management in nepal is probably the weakest aspect of management. The tools and techinques for controling inventory has not been applied in Nepalese enterprizes for controling their physical as well as financial dimation (Agrawal,1980).
- ii. Puskar Bajracharya has conducted a study on management problem in public sector manufacturing enterprizes in Nepal. One of the important findings was regarding the inventory. Their management suffers from lack of planning, high carrying cost, poor recording and stores management and virtual absences of controlling system (Bajracharya, 1983).
- iii. Rao and Jagmohan also observed that for the efficient management of inventory, there was the need of taking human element in third world country like Nepal. They have suggested to orienting the attitue of the staffs towards material cost because lack of knowledge and carelessness. Were the responsible of this management of inventory (Rao and Jagmohan, 1981).
- iv. A study related to Nepal Transport Corporation concerning with various aspects was made by CEDA. One of the major finding was that through inventory management of this factor was rather simple but due to management of stocking spare parts in hampered that smooth operation ot the enterprizes.(CEDA, 1973)
- v. Manohar Krishna Shrestha observed that Agriculture Input Corporation offer finding difficult to supply fertilizers and seeds to farmers due to lack of inventory policy to be followed by it. (Shrestha, 1980, CDC, TU)

## **2.6 Review of Related Studies on Inventory Management in Nepal**

- i. Mr. Amrit Kumar Sharma Gaire (1996 A.D.): Mr. Gaire has conducted a study on the topic of “Inventory Management: A case of Royal Drugs Ltd.”. He has stated some problems as quantity requirement of various inputs produced on the basis of estimation. The economic order size, price of the inputs, handling charge, maintaining ordering charge etc are determined unscientifically and do not use any analytical tools to reduce unnecessary cost. The concept of optimum level of inventory is totally ignored, i.e. re-order level, minimum stock, maximum stock, safety stock etc. are not taken into consideration. Another problem reflected by Mr. Gaire is lead-time, i.e. the gap between the placing and receiving a new order is not given proper attention.
- ii. Mr.Surendra Prasad Yadav (1999 A.D) has conducted a research work on the topic of “Inventory Management of manufacturing public enterprises: A case study of Janakpur cigraette factory Ltd.”. He has also extracted the similar problems as by the previous researchers. All the required inputs are just estimated. The concept of economic order size, price of input, handling charge and maintaining charges etc. are determined unscientifically and do not use any tools and techniques or models to control inventory so that unnecessary cost can't be reduced. The concept of optimum level of inventories is not allowed. As a result fixing of re-order level, minimum stock level, safety stock level and danger level etc. are not determined. Lead time ordering cost and carring cost are totally out of consideration.
- iii. Ms. Indira Shrestha (2000 A.D.): Study was made by Ms. Indira Shrestha on the topic of “Inventory management of manufacturing industries of Nepal (with special reference to quick foods).” She has depicted the same types of problems as the previous related studies. Inputs necessary to

produce noodles and cheese ball are found to be estimated by the company. Economic order size, handling charge, maintaining ordering and carrying charge etc. are predetermined unscientifically and do not use any type of analytical tools. The concept of optimum level of inventory is not used. Re-order level, minimum stock level, safety stock level, maximum stock level and danger stock level help to maintain optimum level of inventory which are not given serious consideration while deciding the size and level of various raw materials in the factory. Lead time is also not considered.

- iv. Bhattraï (2002): A Case study was conducted by Krishna Kumar Bhattraï on the topic of “Inventory management system: A case study of Gorkhapatra corporation.” He has found that the corporation is not following any systematic tool and techniques to control and manage inventory systematically even the corporation is running in profit although the amount of profit is in decreasing trend. The Corporation is importing lower and lower quantity of newsprints year after year. It seems that demand of newspaper is decreasing due to severe competition.

Due to lack of sufficient data various models, examples formulate etc. couldnot be used fully to ascertain the necessary operation of the corporation. No techniques for inventory management are used to reach the major decpsion when to buy because of the lack of planning and unsystematic method of recording cost.

- v. Niroula (2003) has conducted a research work on the topic “Study of inventory in Dairy Development Corporation (With special Reference to Biratnagar Milk supply scheme).” The major finding of his study was that the corporation management was not conscious aboinventu the application of inventory management is not conscious and reduce the cost of inventories. The corporation is earning minimum profit but is in decreaning trend. While purchasing milk no techninqe of inventory



management used and no exercises are made by corporation about different stock levels re-order quantity etc. Due to the lack of proper inventory management, the potentiality of earning is losing by the corporation. The pre-caution and preventive efforts are not made to produce the destroyable dairy products and it is the main cause which impact to the earning of Corporation.

- vi. Adhikari (2004) had concluded that Nepal Ltd. was subsidiary company of Hindustan Lever Ltd. having 80 percent share of it, makes centralized purchase procedure for raw-materials from HLL of india. It uses Bin card technique to control the inventory cost. Pricing of material was based on the weighted average of market or cost rather conclude price. He further concluded that NLL is following the ABC analysis and physical checking for the purpose of inventory management no systematic procedure is followed to determine ordering cost and carrying cost. In case of threats faced by NLL concluded by the researchers are; political crisis like a Banda, strikes, lockout geographical barriers and transporation problems. EOQ (order size) of inventory is not properly followed by the company to reduce total cost of inventory, i.e ordering cost and carrying cost.
- vii. K.C. (2005) concluded that Royal Drugs Limited classifies its inventories into five groups viz; raw materials, packing materials and accessories, work-in-process, finished products and office supplies and stationery. Most of the purchase are made from abroad without proper plan. Separate stores are maintained and physical safety provision is followed by using Bin card and store ledger following FIFO method. Components of inventory management, i.e. ordering cost and carrying cost was not determining lead time, consumption level and stock level. Further, no scientific inventory management is used by RODL with no planning of comprehensive profit, cost and revenue. Planning of production and sales is found in RDL by the researcher and both components are in decreasing trend within the study period.

- viii. Khanal (2005) concluded that the corporation imports almost all the required equipments and materials like chemicals, stationery, inks, newsprints, aluminum sheets, film sheets etc. from various countries without using sufficient data, models, tools and techniques of inventory management. No planning and predictions of ordering cost, carrying cost, safety stock, different stock level, reorder quantity, cost of materials, is used by the corporation to minimize and control the cost of inventory although it has to keep many components as inventory. Cost of carrying inventory is incurred unnecessary due to indiscriminate storing system in the corporation.
- ix. Bhandari (2005) has conducted a research work on the topic of “Inventory management in production companies, (with special reference to Agriculture Lime Industry, Kathmandu.)” and found that the management is not applying adequate inventory management techniques to control and reduce the inventory related cost. Due to the lack of prior planning about inventory and its different aspects, no effectiveness and efficiency is achieved according to its objectives.
- x. Khatiwada (2007), has conducted a research work on the topic of “Inventory management in Nepal.” A case study of salt trading corporation Limited.” The major finding of his study are that the STCL is more careful about re-order point and buffer stock because lead time is long which may create shortage of salt and sugar. But according to the re-order point it is not calculated properly in STCL rather order was placed when needed or before pick demand. The purchase of salt and sugar was fluctuating year after year which shows that the inventory level will decrease or increase in high volume, which makes inventory handling more difficult. Out of total sales major part of sales was covered by sales of salt. Salt covered more than 60% of total sales of STCL.

He has suggested that government should open itself to inspire private to import salt in Nepal. Government should concentrate on development of infrastructure, research and extension marketing advertisement should be intense to grow the use of salt in remote area of the country.

## **2.7 Research Gap**

From the review of above mentioned literature it has been observed that many theses and dissertations have been written on the topic of Inventory management. But an effective inventory management system couldnot be found. Which system is suitable for what types of inventories is not mentioned. Inventory management status is not clarified and mentioned for the betterment of NOC and other public enterprises as well. 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 make study about the pricing mechanism of NOC ltd, which is not studied in previous researches and provides necessary suggestion and recommendation for the betterment of NOC ltd. For that purpose, this study will try to study various system and their applications according to ABC classification of inventories including EOQ calculation and pricing mechanism of petroleum product as well.

The purpose of research work is quite different from the studies made by the above persons. This study is little bit different than previous studies. This study will be fruitful to those interested persons, scholar, researcher, students, teachers, businessmen and government academically as well as from policy perspective.

## **CHAPTER - III**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

Research methodology is the way to solve systematically about the research problems (Kothari, 1998). It is the process of arriving at the solution of problems through the planned and systematic dealing with collection, analysis and interpretation of facts and figures. The major objective of this study is to analyse the inventory management of NOC ltd.

For the purpose of achieving the objectives the following methodology has been proposed which includes the research design, population and sample size, nature and source of data and presentation and analysis techniques.

#### **3.2 Research Design**

“The formidable problem that follows in the task of defining the research is the preparation of the research project, Popularly known as research design” (pathak, 1982). The research design refers to the systematic framework under which the research is conducted. It is the planned structure and is the strategy for investigation. Research design involves selection of the most appropriate method or technique to solve the particular problem under investigation. As this study entitled “Inventory management in Nepal. A case study on Nepal oil corporation ltd.” deals with procurement, sales and distribution procedure, trends of sales and purchase and present practice of inventory management of Nepal Oil Corporation. The descriptive as well as analytical research design has been used.

#### **3.3 Population and Sample**

Public enterprises in Nepal had been established in various sectors like manufacturing sector, trade sector, public utility & social sector, finance/ insurance sectors, etc. for the overall development of the country. 64 public

enterprises have been established during the period of B.S. 2013 to B.S. 2047. But after the restoration of democracy, more than 15 public enterprises have been privatized for achieving the all round economic development of the private sector through the operation of such enterprises. All public enterprises, which belongs to public utility and social sector has been selected as population. As the study of each and every enterprises is not possible so, Nepal oil corporation Ltd., which belongs to public utility and social sector and was established in 2027 B.S. under company act is taken as sample. The name of privatised public enterprises are presented in appendix –II.

### **3.4 Nature and Source of Data**

Both primary and secondary data have been used in this study. Primary data are based on interviews as well as unstructured dialogues and discussion with staff of Nepal Oil Corporation. While secondary data have been collected from the following sources:

- Published and unpublished documents related NOC.
- Books, articles, magazines and official records of NOC.
- Website of NOC.

### **3.5 Data Gathering Procedure**

Data gathering procedure, which is most important part of the research, consists of obtaining information from somebody's hand. It is therefore very difficult activity of the whole research process. For this study, a frequent visit to central office of NOC in order to collect the required data from officials has been made by the researcher. Published and unpublished documents, books, articles, magazine, website and the official's records are the main sources of secondary information while the primary sources consisted were interviews, dialogues and informal discussion with the concerned parties.

### **3.6 Presentation and Analysis Techniques**

In this study, the collected data from various sources are managed, analyzed and presented in proper tabular formats and the diagrams are interpreted and explained wherever necessary. The statistical techniques included in this study are:- graph, time series analysis, Karl Pearson's coefficient of correlation. And the inventory management techniques applied in this study are: Economic order quantity, Re-order level, Inventory turnover ratio and ABC analysis.

## **CHAPTER - IV**

### **PRESENTATION AND ANALYSIS OF DATA**

#### **4.1 Introduction**

According to the basic objectives of this dissertation as stated in the first chapter, the various aspects of inventory management have been discussed in the review of literature. Necessary analytical tools and techniques have been employed for the accomplishment of prescribed objectives discussed in the research methodology.

In this chapter, efforts have been made to process the obtained data analysis and interpret them. The available data are presented in table and graph and they are analyzed with the help of statistical, mathematical and inventory management tools and are finally interpreted to explore the facts. In this study, the items of petroleum products which are transacted by NOC right now are: High-Speed Diesel (HSD), Super Kerosene Oil (SKO), Motor Spirit (MS) and Aviation Turbine Fuel (ATF). They are explained to achieve the objectives of this study. But the other products i.e. MTO (Motor Turbine Oil), FO (Furnace Oil), and LDO (Light Diesel Oil) are not included in the analysis because NOC doesn't keep stock of those products; it purchases these products as per demand of customers and directly supplies to them. For the product LPG (Liquefied Petroleum Gas) NOC doesn't keep stock, it is maintained by private dealers.

#### **4.2 Procurement procedure of NOC**

During Indo-Nepal impasses in 1989/90, Nepal Oil Corporation (NOC) had very hard time. It had to meet the national requirements of various petroleum products as India discontinued the supply to Nepal. NOC imported small cargoes of kerosene, petrol, aviation fuel and diesel mostly in term contracts from third country suppliers and stored them in some store tanks at badge near Calcutta. The products were then taken to Nepal by tank, lorry shipment under NOC's own arrangement and risks.

Latter on when the trade and transit issue between Nepal and India was normalized; NOC and IOC (India Oil Corporation) reached an agreement on 30<sup>th</sup> June 1990 for the supply of various petroleum products to Nepal. This agreement is reviewed in each 5 years interval.

On the basis of agreement, Nepal Oil Corporation imports Kerosene and Diesel cargoes of 30000 MT (1/10%) as per IOC's demand and fulfills the national requirements of different petroleum products from the various IOC's depots across Indo-Nepal boarder. Incorporating the changes for some matters, following to the development of Indian and Nepalese government's policies during the period NOC reviewed this agreement on 27<sup>th</sup> June 1995, NOC had to import different petroleum products against bulk import from IOC under the agreement, which was made on 25<sup>th</sup> March 2002, and it lasted on 31<sup>st</sup> March 2007 A.D. But right now due to the poor economic condition of NOC, it is not able to give crude oil cargoes by purchasing from international market and aiming to do according to the agreement of March 2007 A.D. as soon as possible.

The agreement signed in 1995 allowed NOC to discharge the cargo at Paradip as a first discharge port to vessel suitable for discharge at Joldina. Earlier to 1996 both HSD (High Speed Diesel) and SKO (Super Kerosene Oil) cargoes used to get discharged at Madras and Haldia. Initially in 1996, only the diesel cargoes used to go to Paradip and SKO cargoes had go to Madras for the partial discharge. Latter on, when the Paradip post was upgraded for SKO in the beginning of 1997, the detention charge of four cargoes had considerably reduced vis-à-vis the long queue which normally would prevail at Madras.

Recently, NOC is purchasing the refined petroleum products directly from IOC instead of doing according to the agreement of 2007 between NOC and IOC. Even purchase or import procedure according to the agreement is profitable for NOC. Due to poor economic status of NOC, it exercised the easy but expensive way. IOC determines the adjusted selling price of petroleum products by



including refinery cost, transportation cost and other costs in a six months intervals. (April and October in each year) But, if the agreement of 2007 is implemented, NOC purchases 24 cargoes and provides to IOC. One cargo means 30,000 metric tons (+/- 10%), Out of 24 cargoes 12 are SKO and 12 are HSD.

Petrol and aviation turbine fuel come under kerosene cargoes and price determined on the basis of average weight with refinery differential (+/-) of imported kerosene. Furnace Oil (FO) and Light Diesel Oil (LDO) come under diesel cargoes and prices is determined on the basis of average pricing of furnace oil in Singapore and aviation Gulf plant on the data of purchased. On the other hand, since India also purchases furnace oil from APM (Administered price mechanism), IOC adds profit margin in that price while determining the rate of APM. In case of LPG the price is determined on the basis of CIF (Cost, Insurance and freight charge). Price in average cost of LPG and then railway freight (nationally) wharf age, and landing cost in transporting the Barauni and per metric ton rate of Barauni refinery is determined on the basis of purposed marketing and profit margin. Finally such rate is equated with net cost of imported kerosene and diesel cargoes.

### **4.3 Process of Procuring Cargo**

NOC procures diesel and kerosene cargoes under the direction of Governing board of NOC. IOC suggests buying cargoes for every three months to NOC and NOC announces tender as per suggestion. While announcing tender, NOC announces Global tender and asks offer from importer of mailing list in telex. Now there are 26 companies in mailing list. A definite period is provided to accept telex offers and offers received earlier or later than the given period are not valid. Such period is of 24 hours and the telex room is sealed for that period. In the eve of that period representative of ministry of supply and commerce representative of NOC sign in two-telex roll and next signature is taken at the bottom of the telex roll after opening of the seal. The original copy

of the telex roll is preserved safely. The Governing board decides about procuring in the date offer received and the committee must decide immediately as the validity is very short in the offer. But right now the above mentioned process is not being followed to procure the petroleum products, the direct import of refined oil from IOC is in practice however it is costly method but less lengthy. The existing practice of import of petroleum products is against the agreement between IOC and NOC.

Payment for cargo to IOC is done as follows: payment is made in four installment of 4,11,19 and 25 English month.

Note: Payment is made on Indian Currency at exchange rate of state bank of India on the data of cargo unloads.

#### 4.4 Trend Analysis of Purchase

Purchasing is the procurement of goods and services from external agencies, which plays significant role on earning of profit of an organization. The following table shows the comparative statement of annual purchase of petroleum products from F/Y 2061/62 to 2065/66 B.S.

**Table No. 4.1**  
**Comparative Statement of Annual Purchase of Petroleum Product.**

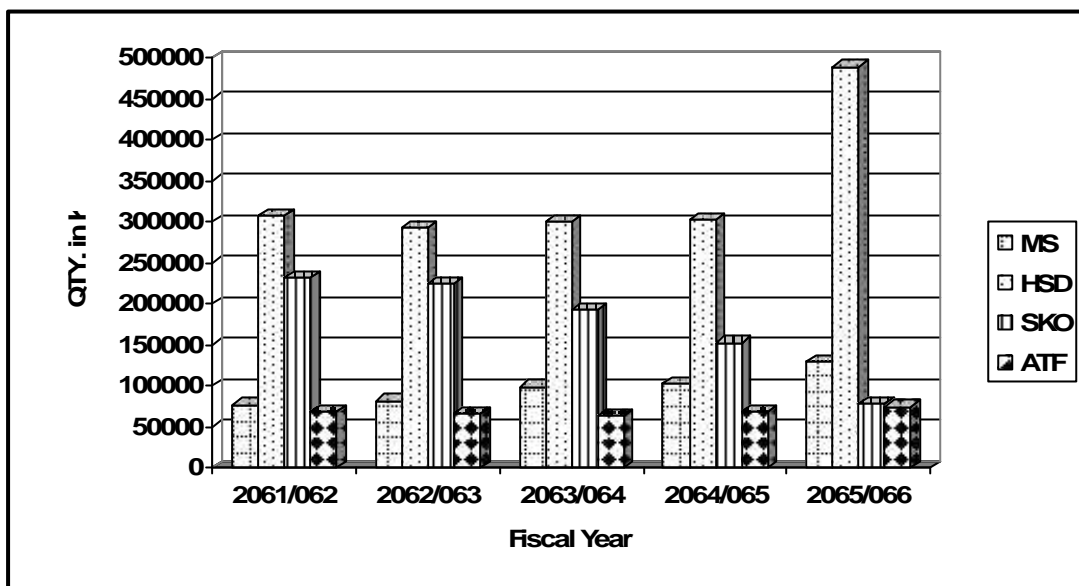
FY	2061/62		2062/63		2063/64		2064/65		2065/66	
	Kiloliter	%	Kiloliter	%	Kiloliter	%	Kiloliter	%	Kiloliter	%
MS	76097	9	81817	12	98435	15	101624	16	128372	17
HSD	308076	38	292381	44	299419	46	303212	49	489219	64
SKO	231463	45	225007	34	192576	29	152168	24	77799	10
ATF	68340	7	66100	10	63650	10	68534	11	74306	9
Total	674976	100	665305	100	654080	100	625538	100	769696	100

Source: Prabhat, 2066

The above table shows total purchase of petroleum product with in the period of FY 2061/062 to FY 2065/066 in total 3389595 kiloliters and 677919 kiloliters in average in the study period. In FY 2061/062 purchase of MS was 76097 kiloliters, 308076 kiloliters, 231463 kiloliters, 68340 kiloliters of HSD, SKO, ATF respectively. In the FY 2062/063 81817 KLS of MS, 292381 KLS of HSD, 225007KLS of SKO, 66100 KLS of ATF was purchased, which represents 9 percent, 40 percent, 42 percent, 9 percent of total purchased by each components. Bear the 15 percent, 46 percent, 29 percent and 10 percent weight up total purchase where as quantity of MS 101624 KLS, HSD was 303212 KLS, SKO was 152168 KLS, ATF was 68534 KLS. Similarly, in FY 2064/065 MS of 101624 KLS with 16 percent of total, HSD of 303212 KLS with 49 percent, SKO of 152168 KLS with 24 percent of total, ATF of 68534 KLS with 11 percent of total. Finally, in FY 2065/066 purchase proportion of MS, HSD, SKO and ATF was 17 percent, 64 percent, 10 percent, 9 percent with their respective purchase in KLS was 128372, 489219, 77799 and 74306 KLS.

The purchase trend in figure of these items can be present as follows:

**Figure No. 4.1**  
**Purchase Statistics of Petroleum Products**



Above figure of purchase of petroleum products shows the decreased value of SKO and Fluctuation in HSD with increasing last three years and decreasing in the last two year. For the individual products MS, it was in increasing trends up to study period. The individual HSD was in fluctuation figure where it was increasing last three years of the study and decreasing year two. It was due to instability in political condition and regular show called Banda and agitation of different groups in Terai Region. The individual product ATF was in fluctuation in first three years decreasing trends then increase up to study period.

On the other hand the purchase of MS and ATF was comparatively low because it was limited demand for specific purpose.

#### **4.5 Storage Facility**

Inventory management is the management of goods and products stored in the warehouse so storing is the back bone of inventory management of course, no storage no inventory management. Good storage helps to maintain the quality of the goods, smoothness in sales, facilitation in production process similarly, it provides well service to customers, regular flow of materials and grasp of the opportunity.

In the process of decision making about location, size etc. of the store a numbers of factors are to be taken into consideration as follows:

- ) Value of stock transaction.
- ) Type of stock.
- ) Volume of stock to be held at a time.
- ) Amount of handling, re- handling and extent of transport involved.
- ) Security.
- ) Safety requirements.

In order to distribute petroleum products throughout the kingdom, NOC has built many storage tanks in different areas. Few years ago there were storages

tanks with capacity up to 31 thousand kiloliter with NOC, which was only equal to the demand of around 15 days. For not to depend upon such minimum capacity of storage facility, particularly for the landlocked country like Nepal. NOC received loan for ADB to construct the extra storage capacity. NOC took almost 300 million NRs. Loan for capital expenditure, NOC has now expanded its storage capacity to 71558 kiloliters. This can fulfill the demand of petroleum products at least for 35 days. Recently, demand of petroleum product is decreased for last two years and the present capacity may fulfill the demand of other more days.

**Table No. 4.2**  
**Description of NOC's Storage Capacity & Spots**

<b>Place</b>	<b>Petrol</b>	<b>Diesel</b>	<b>C.Kerosene</b>	<b>Aviation Fuel</b>	<b>Total</b>
Kathmandu	1870	8400	4960	7710	22940
Amlekhgunj	1960	16100	5880	-	26570
Biratnagar	560	8510	2180	280	11530
Bhairahawa	140	3055	994	60	4249
Nepaljung	140	1520	1520	280	3460
Dhangadi	85	1590	760	45	2480
Pokhara	350	2280	760	64	3454
Surkhet	-	-	45	60	105
Dipayal	-	15	45	-	60
janakpur	30	140	70	-	240
<b>Total</b>	<b>5135</b>	<b>41610</b>	<b>16314</b>	<b>8499</b>	<b>71558</b>

*Source: NOC Ltd; Central Office Kathmandu, 2066*

The above figure shows the total storage capacity of NOC was 71528 kiloliters. The total capacity of Petrol, Diesel, Kerosene and Aviation Fuel was 5135, 41610, 6314, 8499 KLS respectively.

#### **4.6 Selective Inventory Control: ABC Analysis**

It is understandable that all the items in the inventory are not of equal importance in terms of investment of money, profit potential, sales volume or usage volume and stock out penalties. Therefore it is unrealistic to devote equal attention to each of these items. Rather, it is more reasonable to pay attention to the items according to their relative importance in the total inventory system. The system of giving priority to the items is called priority system or ABC system. “ABC system classifies all the items in the inventory system” (Shrestha & Silwal, 2001)

The ABC system classifies all the items in the inventory into A, B, C criteria according to their relative importance or priority. The items included in groups. A involve in the largest value. Therefore, the most rigorous, intensive and sophisticated inventory control techniques should be applied to these items. C items represent relatively least investment and would be under simple control. B items fall in between these two categories and required reasonable attention of management. The ABC analysis concentrates on high valued items and also known as control by importance and exception (CIE) (Richmond, 1969).

As the items are classified according to the importance of the relative value, better control is possible. This approach is also known as proportional value analysis (PVA) or stock control according to value method.

Most of the Nepalese organization does not apply the scientific tools and techniques. NOC has inventories of various kinds of products, which differ in value and can follow a selective control system for the appropriate preservation

of different products. However, researcher has classified the items according to the consumption value in the following way.

**Table No. 4.3**  
**Selective Inventory Control: ABC Analysis**

Fiscal year	MS		HSD		SKO		ATF		Total	
	Sales	%	Sales	%	Sales	%	Sales	%	Sales	%
2061/62	75989	11	315368	45	239328	34	66825	10	697510	100
2062/63	80989	12	294329	44	226637	34	64335	10	666290	100
2063/64	101912	15	306687	46	197850	30	63778	9	670227	100
2064/65	100842	16	302706	48	155216	25	68938	11	627702	100
2065/66	124169	17	466468	64	70089	10	68935	9	729661	100

*Source: NOC Limited, Central Office, Kathmandu, 2066*

The above table shows that the item of HSD was the highest consumption with 45 percent, 44 percent, 46 percent, 48 percent and 64 percent. The second position with consumption was occupied by SKO ranging from 34 percent, 10 percent of total. The third position of consumption was occupied by the MS ranging from 11 percent, 17 percent of total consumption in the study. Comparatively, the share of ATF was lowest ranging 10 percent to 9 percent from FY 2061/062 to 2065/066.

Above analysis provides guidelines for corporation to categorize the HSD as A group and to maintain strict control in order to minimize inventory cost and to maximize profitability on its investment. This item should be treated first and more carefully. The moderate control mechanism should apply for SKO item that falls under B group minimize attention can be made for MS and ATF laying under C group.

## 4.7 Distribution System of Petroleum Products

To meet national requirement in an easier and fastest way following Indo Nepal boarder areas have been used for distribution of petroleum product for different regions:

For Eastern Region	Barauni Refinery
For Central Region	Raxual Depot
For Western Region	Betalpur Depot, Mugalsari Terminal
For Mid Western Region	Allahabad Ternimal, Gonda Depot
For Far Western Region	Banthara Depot

In order to transport the petroleum products from the above mentioned places of India and internally from one storage area to next storage area inside the country, involvement of transporters is shown in the following table.

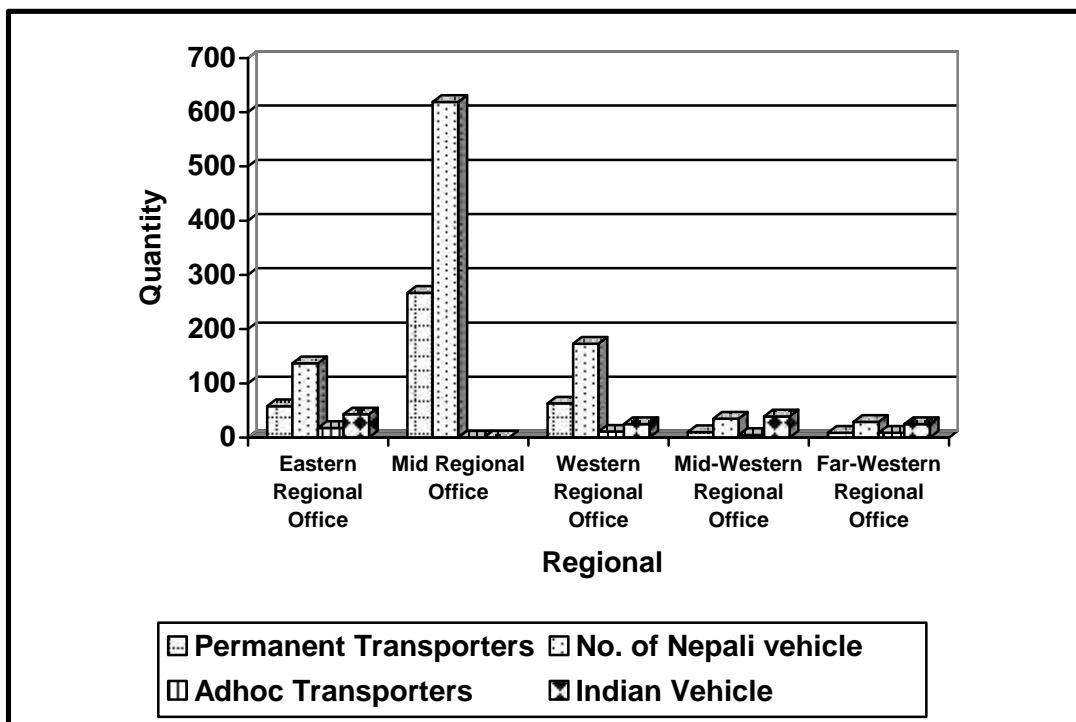
**Table No. 4.4**  
**Region Wise Data of Petroleum Transporters**

<b>Type of Transporter</b>	<b>Eastern Regional Office</b>	<b>Mid-Regional Office</b>	<b>Western Regional Office</b>	<b>Mid-Western Regional Office</b>	<b>Far-Western Regional Office</b>
Permanent Transporters	58	267	63	10	9
No. of Nepali vehicle	137	619	173	35	29
Adhoc Transporters	18	0	11	5	9
Indian Vehicle	43	0	25	39	25

*Source: Prabhat, 2066*



**Figure No. 4.2**  
**Statistics of Region Wise Transporters**



For the regular sales and distribution of petroleum products throughout the kingdom of Nepal, five regional branches have been established in Biratnagar, Birgunj, Siddharthanagar, Nepalgunj and Dhangadi representing eastern, central, Western, mid- western and far- western region respectively. There are central fuel depots in Kathmandu and Amlekhgunj and branch depots in Biratamod, Surkhet, Dang and Dipayal where as aviation fuel is distributed by NOC itself. NOC provides aviation fuel for national and international flights from Kathmandu and aviation fuel for internal flights is provided from Biratnagar, Pokhara, Bhairahawa, Nepalgunj, Surkhet and Dhangadi as well.

In order to check the possible shortage of petroleum product throughout the kingdom, NOC has managed to provide necessary fuel through their distributors on the basis of demand and necessity of petroleum product in different regions. NOC has managed its distributors according to the table below:

**Table No. 4.5**  
**Region Wise Data of Dealers**

<b>Region</b>	<b>General Distributors</b>	<b>Packed Dealers</b>	<b>Kerosene Dealers</b>	<b>Kerosene Dealers (Bisthapit)</b>	<b>Total</b>
Eastern	94	75	282	150	601
Central	460	85	754	138	1437
Western	188	28	261	84	561
Mid- Western	70	7	104	32	213
Far-Western	27	42	58	43	170
<b>Total</b>	<b>839</b>	<b>237</b>	<b>1459</b>	<b>447</b>	<b>2982</b>

*Source: Central Office of NOC, Kathmandu, 2065*

For the easy and regular supply of petroleum products, NOC has managed different types of dealers according to the authority provided for the transactions of petroleum products they are;

- i. General dealers refer to those who have authority to sell petrol, diesel, kerosene, light diesel oil and furnace oil from one sales depot with installation of dispensing pumps.
- ii. Packed dealers are those who have authority to sell all types of petroleum products except petrol.
- iii. Kerosene dealers are only authorized to sell kerosene.
- iv. Bisthapit dealers are those who were together with petrol and diesel but now segregated to transact kerosene separately.

In this way petroleum products have been distributed in five development regions. Especially hilly districts and inaccessible districts are beyond the access of dealers. Tanker is the only way to provide petroleum products throughout the kingdom. Especially there is urgent need of alternative means for transportation of petroleum products from India because Nepal often suffers oil crisis.

On the other hand the development of LPG (Liquefied petroleum Gas) used for household purpose, commercial and industrial purpose is increasing day by day. In this context NOC has been providing LPG through different gas authorities throughout the kingdom. LPG is currently imported from Barauni refinery of IOC and given to the Nepalese authorities for the distribution to the public. But in case of technical break down, Nepal suffers LPG crisis. There has not been conducted any so as to assess the quantity of demand for LPG in order to enable oil authorities to supply required products. At present vehicles running from LPG are increasing day by day and their consumption is more than 115813 m.tones. Due to unavailability of auto gas (Virtually same as LPG but with some specification), some vehicles are running on fuel quotas of cooking gas. There is not clear demarcation of the purpose. This is essential because the subsidy in LPG basically meant to support households.

#### **4.8 Trend Analysis of Sales**

Exchange behavior of goods and service by receiving money is called sales. Nepal Oil Corporation sales its different products to its customers. The following table shows the comparative statement of annual sales of NOC from FY 2061/62 to 2065/66.

**Table No. 4.6**  
**Comparative Statement of Annual sales of Petroleum Products.**

(In Kiloliter)

S.N.	Types of fuel	Year and Respective Percentage										
		2061/62	%	2062/63	%	2063/64	%	2064/65	%	2065/66	%	Total
1	MS	75989	11	80989	12	101912	15	100842	16	124169	17	483901
2	HSD	315368	45	294329	44	306687.2	45	302706	48	466468	64	1685558
3	SKO	239318	34	226637	34	19784905	30	155216	25	70089	10	889120
4	ATF	66825	10	34335	10	63777.8	10	68938	11	68935	9	332811
Total		697510	100	666290	100	670227	100	627702	100	729661	100	3391390
% of Total of Total		20		18		19		19		21		100

*Source: NOC Limited, Central Office, Kathmandu, 2065*

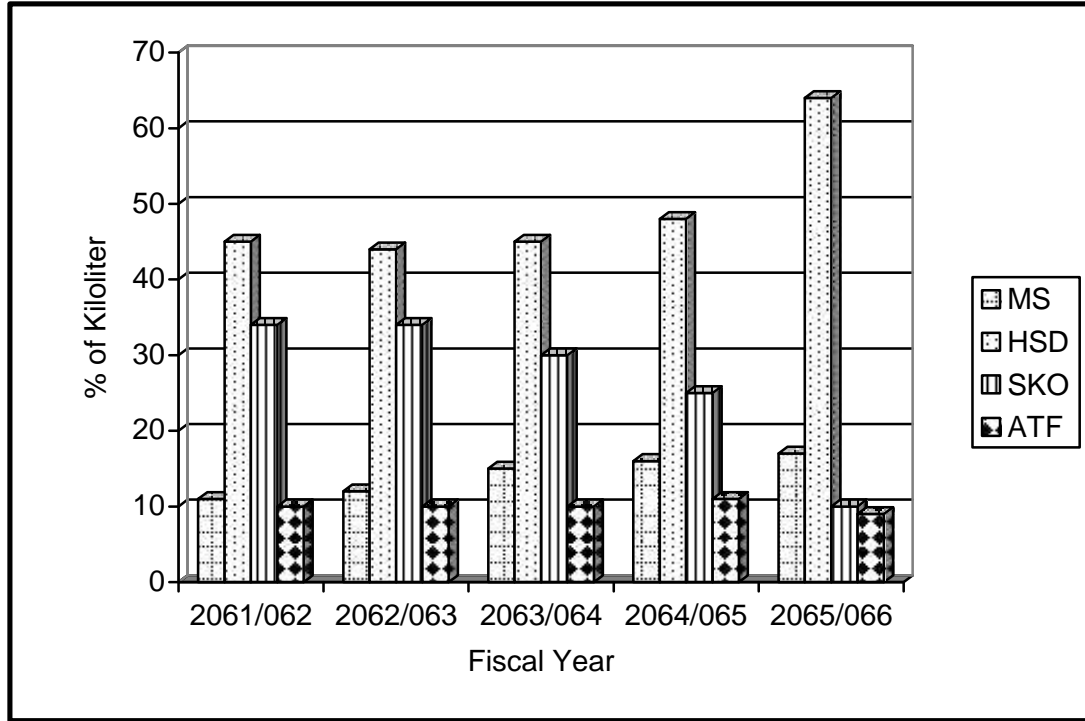
The above table shows that the sales trend of petroleum product during the past five years from FY 2061/62 to FY 2065/66. That was 697510, 666290, 670227, 627702, 729661 KLS in respective years with total of 3391390 KLS with in the study period.

In FY 2061/62 sales were: MS 75989 KLS, HSD 315368, SKO 239328 and 66825 KLS of ATF with the proportion of 11 percent, 45 percent, 34 percent and 10 percent respectively. Similarly, they were 80989 KLS 294329 KLS, 226637 KLS 64335 KLS in FY 2062/63 with proportion of 12 percent, 44 percent, 34 percent, and 10 percent of each component. In FY 2063/64 respective proportion of 15 percent, 46 percent, 29 percent, and 10 percent with relative sales 101912, 306687 197850 and 63778 KLS. MS, HSD, SKO, and ATF representing 16 percent, 48 percent, 25 percent and 11 percent with 100842, 302706, 155216, and 68938 KLS in quantity respectively by each in FY 2064/65. Finally, in FY 2065/66, they were in the proportion of 17 percent, 64 percent, 10 percent and 9 percent with their relative sales quantity of 124169 KLS, 466468 KLS, 70089 KLS and 68935 KLS.

The above table shows that sales proportion of MS has increased every year. In FY 2061/62 it was 11 percent of total sales and 17 percent in FY 2065/66 of total sales. The sales proportion of HSD was increased in study last three years with comparison of FY 2061/62 but decreased in FY 2062/63. Sales of SKO was decreasing trend in every year. FY 2061/62 to 2063/64 sales of ATF was stable then increased in FY 2064/65, again decrease sales FY 2065/66.

Total consumption of petroleum products within the study period varies from 19 percent to 21 percent. The highest sale was in the FY 2065/66. It was decreased figure of FY 2061/62 and FY 2062/63, then increased FY 2063/64 again it was in decreasing FY 2064/65, then increasing trend. The graphical figure illustrates the sales trend in detail.

**Figure No. 4.3**  
**Sales Statistics of Petroleum Products**



From the above graphical figure, it is found that the sales of HSD was higher for the five study period. HSD was increasing trends and SKO was decreasing trends. Similarly, the sales of MS was increasing trends with in study period. ATF was increasing trends up to FY 2064/65 and decreasing FY 2065/66. Due to subsidization in kerosene by the government, it is cheaper and affordable for the poor people. So it is used as the cooking fuel in replacement of forest based fuel, Lightening purpose and also used in vehicles by the people. Similarly, the demand of the HSD is higher because it is used in public means of transport and number of vehicles is increasing every year. The other reason being the cheaper price than petrol and highly efficient for engine fits very demand.

The sale of SKO was higher in the FY 2061/62 in comparison of later years. The reasons may be the comparatively cheaper price than the diesel and being used in

many vehicles, government subsidy on it and subsidized kerosene was used by the non- targeted customers for their personal benefit and leakage of subsidized kerosene in India on the very year.

On the other hand, the sale of MS and ATF seems comparatively low because these are used for specific purpose and with limited demand. The ATF is used for air services and it is in fluctuating within the period of study.

#### **4.9 Relationship between Total sales and Total Purchase.**

The following table shows the comparative figure of corporation's operation relating to total sales and total purchase of FY 2059/60 to 2063/64.

**Table No. 4.7**  
**Annual Total Sales and Purchase**

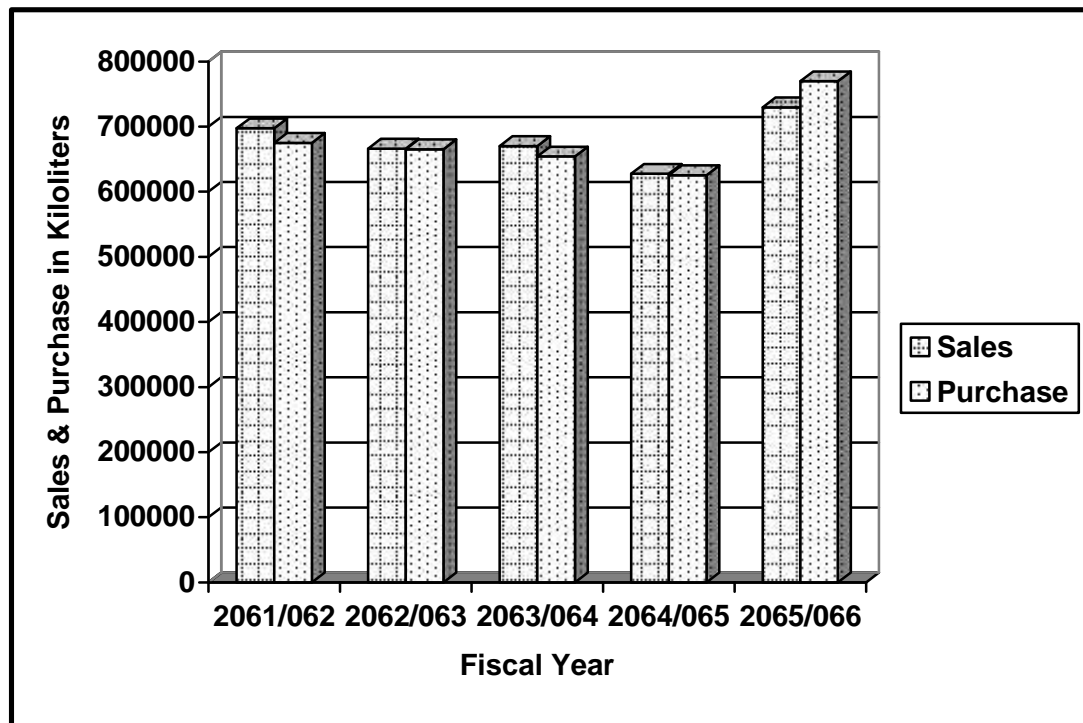
(In Kiloliters)

<b>Fiscal Year</b>	<b>Sales</b>	<b>Purchase</b>
2061/62	697510	674976
2062/63	666290	665305
2063/64	670227	654080
2064/65	627702	625538
2065/66	729661	769696
<b>Total</b>	<b>3391390</b>	<b>3389595</b>

*Source: Prabhat, 2066*

The above table shows the comparison between sales and purchase of petroleum products. The difference was not so measurable except in FY 2063/64 when the difference is slightly higher than other year and sales was greater than purchase in the following year except FY 2065/66 which has affected the total purchase than total sales with decreased quantity of closing stock. FY 2065/66 has higher purchase than sales. The above table of purchase and sales trend can be presented in graphical form as follows:

**Figure No. 4.4**  
**Relationship between Total Sales and Total Purchase**



The graphical presentation shows that the gap between total purchase and sales is not large. Difference between the commodities has appeared with deviations where sales are less than purchase in the last years of study period. And sales were higher than purchase in FY 2061/62, FY 2063/64. Similarly, in FY 2062/63 and FY 2064/65 purchase and sales seem as equal to each other.



In order to calculate variability, correlation and other statistical measures are required to be calculated. These are the mean, standard deviation, coefficient of variation and correlation coefficient.

**Table No. 4.8**  
**Relationship between Total sales and Total purchase**

<b>Statistical Tools</b>	<b>Sales</b>	<b>Purchase</b>
Mean ( $\bar{X}$ )	678278	677919
Standard deviation( $\dagger$ )	33990	48791
Coefficient of variation(C.V)	5%	7%
Correlation(r)	+0.92	

From the above table, it can be analyzed that total purchase of NOC is less stable than total sales. It means, there is more fluctuation in the figure of purchase than the sales. Hence the coefficient of variation (C.V) of total purchase is higher than that of total sales. A distribution with higher C.V is said to be less homogeneous or more variable than the other and with similar C.V is said to be less heterogeneous or less variable than the other but the difference between the C.V. of purchases and sales is not measurable/remarkable.

Another statistical tool, correlation coefficient can be used to analyze the relationship between actual sales and actual purchase. Actual sales and actual purchase should be positively correlated. If the sales are high the purchase should be high to meet the increasing demand. Therefore purchase must be increased as sales increases. To find out such relation correlation of coefficient is calculated coefficient denoted by 'r' we can examine whether there is positive correlation

between actual sales and actual purchase or not. For this purpose actual sales is denoted by X and assumed to be independent variable and actual purchase is denoted by Y and assumed to be dependent variable. The detail calculation of correlation coefficient is show in appendix- III from of the calculation of the value of 'r' is found +0.92.

The figure of the value of 'r' shows that there is positive correlation between actual sales and actual purchase. The value of 'r' +0.92, which represents that there is perfect correlation between sales and purchase.

The calculation of probable error of 'r' is also shown in appendix- III. The value of probable error i.e. 0.0463. It verifies the significance of 'r'.

$$\text{i.e. } r > 6 \times \text{P.E.}$$

$$\text{Or, } 0.92 > 6 \times 0.0463$$

It proves that the sales and purchase are nearly perfectly correlated and it is significantly proportionate to the increase in purchase.

#### **4.10 Inventory Turnover Ratio**

Finished goods inventory is the cushion between sales and purchase for non-manufacturing enterprises. When sale exceeds purchases, the inventory is used for sales and level of inventory goes on decreasing and on the other hand. When purchase exceeds sales then the excess purchase is kept into store and the level of inventory goes on increasing. A certain level of inventory is needed for smooth sales activities of enterprises.

Inventory turnover ratio is also called stock velocity turnover ratio. The inventory turnover ratio measures how quickly the inventory is converted into sales. It is a

test of efficient inventory management. The inventory turnover ratio is calculated by using the following formula:

$$\text{a. Inventory Turnover Ratio} = \frac{\text{Cost of Goods sold}}{\text{Average Inventory}}$$

$$\text{b. Inventory Turnover Ratio} = \frac{\text{Sales}}{\text{Closing stock}}$$

**Table No. 4.9****Inventory Turnover Ratios of Individual Items of Petroleum Products**

(In Kiloliters)

Years	Motor sprit (MS)			High Speed (HSD) Diesel			Super Kerosene Oil(SKO)			Aviation Turbine Fuel (ATF)		
	Salas	Closing Stock	ITR	Sales	Closing Stock	ITR	Sales	Closing Stock	ITR	Sales	Closing Stock	ITR
2061/62	75989	4802	15.82	315368	26712	11.8	239328	32994	7.25	66825	7620	8.77
2062/63	80989	5630	14.39	294329	24764	11.88	226637	31364	7.23	64335	9385	6.86
2063/64	101912	2153	47.33	306687	17496	17.53	197850	26090	7.58	63778	9257	6.89
2064/65	10082	4115	24.5	302706	27090	11.17	155216	36495	4.25	368938	3751	18.74
2065/66	124169	4894	25.37	466468	39004	11.96	70089	43796	1.60	68935	7104	9.70

*Source: Nepal Oil Corporation Central Office, 2066*

The above table shows the inventory turnover ratios of different items from FY 2061/62 to FY 2065/66. From the table it was observed that inventory turnover ratios of all other products are fluctuating. That of MS was 15.82, 14.39, 74.33, 24.5 and 25.37 times from the FY 2061/62 to FY 2065/66 respectively, which shows it had decreased in FY 2062/63 and increased in FY 2063/64 and in FY 2063/64.

Inventory turnover ratio of HSD increased except FY 2064/65. The value of 11.8, 11.88, 17.53, 11.17 and 11.96 from FY 2061/62 to FY 2065/66 respectively. For individual product SKO was increasing trend upto study three period then decreasing i.e. 7.25, 7.23, 7.58. 4.25 and 1.60 times respectively. ITR of ATF was observed within the study period in a yearly basis i.e. 8.77,6.86, 6.89, 18.74 and 9.70 times with fluctuation nature.

If the above figure is analyzed in an aggregate manner, it is observed that in the initial two year it is decreased due to increase of the closing stock of products .For last three years,it is in heterogeneous result due to decreased purchase, sales and inventory as well except of HSD.

The accumulated turnover ratios of these four products can be presented the following table:

**Table No. 4.10**  
**Total Inventory Turnover Ratio of Petroleum Products**

(In kiloliter)

<b>Year</b>	<b>Sales</b>	<b>Closing Stock</b>	<b>ITR</b>
2061/62	697510	72128	9.67
2062/63	666290	71143	9.37
2063/64	670227	54996	12.19
2064/65	627702	70451	8.91
2065/66	729661	94798	7.7

*Source: NOC Limited, Central Office, 2066*

From the table it is clear that the maximum inventory turnover ratio is 12.19 and is observed in FY 2063/64 and minimum is in FY 2065/66 i.e. 7.7 times. Average inventory turnover ratio is 9.6 times. It means that NOC Ltd. Holds 38 days in average ( $365 \div 9.6$ ) inventory of petroleum products.

Higher ITR is caused by increased sales or decreased closing stock or both. In general the higher ITR is better than the low ratio. It is indicator of under inventory. A very low level of inventory has serious implications that it will adversely affect the ability of firm to meet customer's demand and it may not cope with its requirements. That is there is a danger of the firm being stock out condition and suffering high stock out cost.

The main reason to have lower inventory ratio of NOC limited due to the policy of corporation to maintain higher closing stock. Keeping excessive inventory

involves cost items of interest on funds lacked up, rental of space, possible deterioration and so on.

#### **4.11 Economic Order Quantity (EOQ)**

The economic order quantity is that size of the order which minimized the cost of ordering and carrying the stock. In other words, the quantity of material to be ordered at one time is known as economic order quantity. However, in NOC limited, they total ignore the concept of economic order quantity. There is no proper segregation of carrying and ordering costs and it does not practice to determine EOQ level.

#### **4.12 Re- Order level (ROL)**

Re- Order level may be defined as that level of inventory when fresh (new) order should be placed for replenishing the current stock of inventory. Under perfect certainty, Re- order level can be determined on the basis of lead time, average usage and economic order quantity but safety stock is also taken into consideration under uncertainty to calculated ROL. In NOC limited, lead- time, average usage as well as safety stock are not fixed so, there is difficult to determine ROL. However now NOC keep safety stock to meet the demand for 35 days sales.

#### **4.13 Variance Analysis between Estimated Closing Stock and Actual Closing Stock**

Estimation of closing stock is made by the NOC limited to find variance by using the quantity of purchase, and sales with the consideration of opening stock. The estimated closing stock can be determined by following ways:

Estimated Closing Stock = Opening Stock + Purchase – Sales

The table shows the variance between estimated and actual closing stock from FY 2061/62 to 2065/66 in total.

**Table No. 4.11**  
**Annual Estimated Closing Stock and Actual Closing Stock**

(In Kiloliter)

<b>Years</b>	<b>Estimated Closing Stock</b>	<b>Actual Closing Stock</b>	<b>Variance(Loss)</b>	<b>Percentage</b>
2061/62	77953	72128	(5825)	7.47
2062/63	75642	71143	(4499)	5.95
2063/64	59575	54996	(4579)	7.69
2064/65	52832	70451	16619	31.45
2065/66	110486	94798	(15688)	14.20

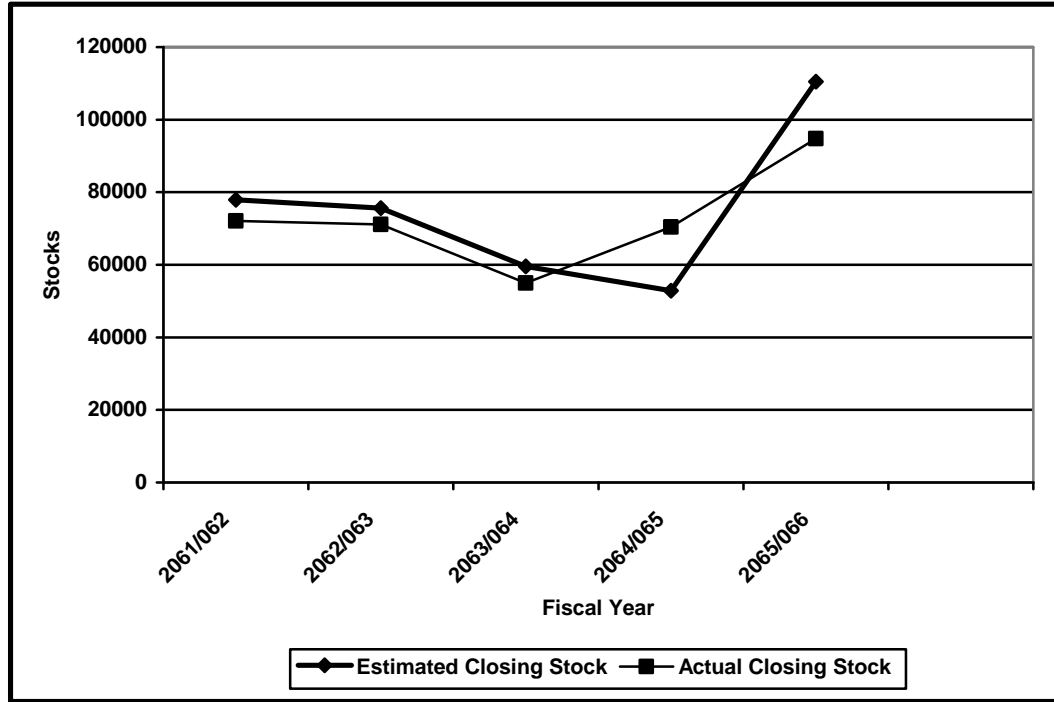
*Source: NOC Limited, Central Office, Kathmandu, 2066*

Analyzing the above table it is found that there is large variance between estimated closing stock and actual closing stock. In FY 2061/62, it was 5825 kls of negative variance and 7.47 percent. FY 2062/63 reflects the lowest variance i.e. proportion 5.95 percent as compared to other year is proportion (i.e. variance). This variance can also be shown through graphical presentation.



**Figure No. 4.5**

**Annual Estimated Closing Stock and Actual Closing Stock**



The above graph shows the variance between estimated closing stock and actual closing stock. The gap between two stocks is very high in FY 2065/66, i.e. gap is more than other study period. This variance may occur due to normal and abnormal losses. Normal losses include shrinkage, normal leakage, working loss etc. where as abnormal losses occur due to mishandling, carelessness, audient, improper management etc.

**4.14 Relationship between Actual Purchase and Closing stock**

Procurement of goods or services from supplies with cash or on credit as raw material or finished product is termed as purchase. Closing stock means the inventory at the end of given period of time with the organization in its store. NOC doesn't have its own sources of petroleum products, all products have been

imported from other countries. The following table shows 5 years data regarding purchase and closing stock of petroleum products of Nepal Oil Corporation.

**Table No. 4.12**  
**Total Actual Purchase and Total Closing stock**

(In Kiloliters)

<b>Years</b>	<b>Actual Purchase</b>	<b>Actual Closing Stock</b>
2061/62	674976	72128
2062/63	665305	71143
2063/64	654080	54996
2064/65	625538	70451
2065/66	769696	94798

*Source: NOC Limited, Central Office, 2066*

In an aggregate, the above figure of purchase shows that it is in decreasing trend from FY 2061/62 to FY 2065/66. And about closing stock, it is in derivative figure where it is increased for two years and then decreased for last three years.

In order to find out the nature of variability of actual purchase and closing stock of different years mean, standard deviation, coefficient of variation and correlation coefficient has been calculated. The calculation is given in appendix- IV

**Table No. 4.13**  
**Relation between Actual Purchase and Closing Stock**

<b>Statistical Tools</b>	<b>Actual Purchase</b>	<b>Closing Stock</b>
Mean ( $\bar{X}$ )	677919	72707
Standard Deviation ( $\dagger$ )	48791	12724
Coefficient of Variation(C.V)	7.2%	17.5%
Correlation (r)	+0.83	

From the above table it is analyzed that closing is less stable than actual purchase. Actual purchase is less variable than closing stock. The series with higher C.V. is less homogenous or more heterogeneous which represents the more fluctuation in the series. The C.V of actual purchase is less than that of closing stock means the series of actual purchase is more homogeneous than series of closing stock.

Another statistical tool, correlation coefficient is used to analyze the relationship between actual purchase and actual closing stock. Whether correlation is positive or negative depends upon the direction of change occurred in the variable. If both the variables are ranging in the same direction i.e. if one variable is increasing, the other one on an average is also increasing or if one variable is decreasing, the other one on an average is also decreasing, correlation is said to be positive. On the other hand, if the variables are varying in opposite direction i.e. as one variable is increasing and the other is decreasing or vice-versa then correlation is said to be negative.

To find out such relation the Karl Pearson's coefficient of correlation is calculated denoted by 'r' taking the purchase as an independent variable and the closing stock as dependent variable and are assumed as X and Y respectively. To examine whether there is positive correlation between actual purchase and closing stock or not, for the same correlation coefficient is calculated and found the value of 'r' is +0.83.

The value of  $r = + 0.83$  shows that there is the positive correlation between actual purchase and closing stock. The relation between actual purchase and closing stock are in same direction means the decrease in closing stock. For such result there is a vital role of sales, which determines the level of closing stock.

The calculation of probable error of 'r' shown in appendix – IV shows the probable error of 'r' = 0.0938 and correlation coefficient appeared greater than six times of probable error i.e.  $0.83 > 6 | 0.0938$ . It indicates that the value of 'r' is

definitely significant. It means that actual purchase and closing stock vary on positive directions with the same proportion that is decrease in purchase makes closing stock increase due to decreasing sales more than the purchase.

#### **4.15 Relationship between Actual Sales and Closing stock**

Petroleum products sold and closing stocks maintained by Nepal Oil Corporation through FY 2061/62 to 2065/66 is presented in the table given below:

**Table No. 4.14**  
**Total Actual Sales and Total Actual Closing Stock**

(In Kiloliter)

<b>Years</b>	<b>Actual Sales</b>	<b>Actual Closing Stock</b>
2061/62	697510	72128
2062/63	666290	71143
2063/64	670227	54996
2064/65	627702	70471
2065/66	729661	94798

*Source: NOC Ltd, Central Office, Kathmandu, 2066*

The figure of sales on above table was fluctuating trend upto five study period year two and four decreased sales and increased year three and five. Trend of closing stock was decreasing upto three study period then increased last two study period. The highest point i.e. 94798 KLs.

In order to find out the nature of variability of actual sales and closing stock of different years, the mean, standard deviation, coefficient of variation and

correlation of coefficient are calculated. The detail calculation of these variables is presented in appendix- V.

**Table No. 4.15**  
**Relationship between Actual Sales and Actual Closing Stock**

<b>Statistical Tools</b>	<b>Actual Sales</b>	<b>Closing Stock</b>
Mean ( $\bar{X}$ )	678278	72707
Standard deviation ( $\dagger$ )	33980	12724
Coefficient of variation (C.V)	5.01%	17.5%
Correlation 'r'	+0.65	

The result calculated above shows that the closing stock is less stable than actual sales or actual sales are less variable than the closing stock. The coefficient of variation (C.V) of closing stock is higher than the actual sales. Distribution with higher C.V. represents the less homogeneous and with smaller C.V. represents the less heterogeneous than the other.

To analyze the relationship between actual sales and closing stock correlation coefficient is used. Generally, an increase in sales causes the decrease of closing stock and decrease in sales increases the volume of closing stock. To find out the correlation between actual sales and closing stock the Karl Pearson's coefficient of correlation is used as measure of intensity or degree of linear relationship between two variables.

In the calculation procedure of correlation between actual sales is actual closing stock, the sales is assumed as an independent variable and denoted by 'X' and the closing stock is assumed as a dependent variable with 'Y' notification. The Karl Pearson's coefficient of correlation of actual sales and closing stock is denoted by 'r'. The detail calculation is shown in appendix – V. In the calculation 'r' is found + 0.65 between actual sales and closing stock. The result i.e.  $r = +0.65$  represents

that there is a moderate degree of positive correlation between actual sales and closing stock. In other words the change pattern of sales positively appears in the change pattern of closing stock with moderate degree.

Appendix- V shows that coefficient of correlation between actual sales and closing stock is + 0.65 and probable error of 'r' is 0.1742 respectively. Correlation coefficient comes less than 6 times of probable error that is  $+ 0.65 < (6 \times 0.1742)$ . It signifies that actual sales and closing stock are positively related however the correlation is not much significant, i.e. increase in actual sales will not be proportionate to the increase in closing stock. Degree of fluctuation in sales doesn't affect to the closing stock in the same proportion.

#### **4.16 Pricing Mechanism of Petroleum Product in NOC Ltd.**

NOC Ltd is a trading concern that purchases petroleum products from supplier i.e. IOC and sale to the customer without making any change on it. It doesn't have its own production of the petroleum product. So it fully depends upon the import of such products of meet the energy requirement within the nation.

A group of petroleum products producers' nation (OPEC) is authorized to fix the price of petroleum products with consideration of international economy and its effect. The Indian Oil Corporation imports petroleum product from of crude Oil and refines it into the different from like, MS, HSD, SKO, ATF, LPG, FO, LDO etc. and exports it to NOC Ltd by adjusting the cost of refinement, profit and other charges. An agreement was made between IOC and NOC in 1974 A.D. to make the transaction of petroleum products. According to the agreement the crude Oil is purchased from international market and handed over to the IOC for refinement process and required form of petroleum products are received from IOC equal to the value of crude Oil delivered to IOC due to not having of refinement plant of NOC.

The transaction between IOC and NOC was performed according to the agreement to 2007 A.D. and after that the agreement became inactive due to poor economic condition of NOC being unable to purchase the crude Oil from international market by paying foreign currency. Right now NOC directly imports the petroleum products from IOC' according to the requirement of fuel energy.

Having a direct transaction of petroleum product with IOC, the pricing mechanism of such product in Nepal is directly affected by the pricing mechanism of IOC. Other factors like the economy of Nepal, economic condition of Nepalese people, political interests of concerned Government to some extent are also affecting the price of petroleum products.

Being a public utility concern, NOC is not fully authorized to fix the price of petroleum product; it should make co- ordination with Nepalese Government for an adjustment of IOC price with its own economic condition as well. In the study period NOC is selling its products at a loss except of ATF. Some portion of cost is provided by Nepal Government as subsidy on which product there is loss, although the subsidy is not sufficient to adjust the total loss.

Many attempts are made by NOC to adjust the price of petroleum products according to the international price but some of those are enacted by the movement and agitation of public and other interest group due to their poor economic condition and so on. Next reason of loss suffering by NOC i.e. open border of Nepal and India and unauthorized sales of subsidized petroleum products to the people of India political instability and its effect on economy and NOC is also affecting the pricing of petroleum products.

The following table shows the price adjustment of petroleum products in different data within the study period.

**Table No. 4.16**  
**Detail of Retail Selling Price (RSP) of Petroleum Products on**  
**Different Dates**

(In Kiloliters)

Date	RSP NRs./Ltr.							
	Petrol	Inc./Dec. %	Diesel	Inc./Dec. %	Kerosene	Inc./Dec. %	Kerosene Quota	Inc./Dec. %
2061/04/28	56	3.70	31.00	0.00	24	0.00	24	20.00
2061/06/01	56	0.00	35.00	12.90	28	16.67	24	0.00
2061/09/26	62	10.71	41.00	17.14	36	28.57	30	25.00
2061/11/02	62	0.00	41.00	0.00	34	-5.56	34	13.33
2062/05/02	67	8.06	46.00	12.20	39	14.71	39	14.71
2062/11/05	67	0.00	52.50	14.13	47.65	22.18	N/A	N/A
2062/11/09	67.25	0.37	53.15	1.24	47.65	0.00	N/A	N/A
2064/07/8	73.50	9.29	56.25	5.83	51.20	7.03	N/A	N/A
2064/09/11	80	8.84	56.25	0.00	51.20	0.00	N/A	N/A
2065/02/27	100	25	70	24.44	65	26.95	N/A	N/A
2065/07/09	95	-5.00	70	0.00	65	0.00	N/A	N/A
2065/07/16	90	-5.26	65	-7.15	65	0.00	N/A	N/A
2065/08/18	85.50	-5.00	60.50	-6.92	60.50	-6.92	N/A	N/A
2065/09/11	80.50	-5.85	59.50	-1.65	59.50	-1.65	N/A	N/A
2065/10/20	77.50	-3.73	57.50	-3.36	57.50	-3.36	N/A	N/A
2065/11/20	77.50	0.00	55	-4.35	55	-4.35	N/A	N/A

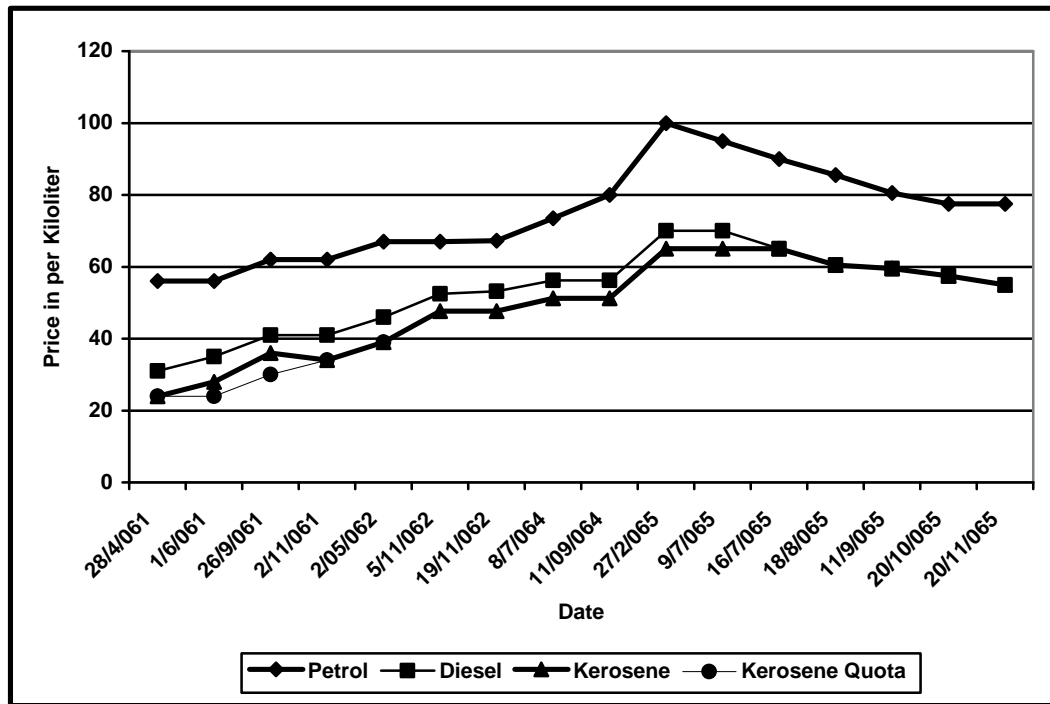
*Source: NOC Limited, Central Office, 2066*

In aggregate figure, the price of petroleum product is in increasing trend due to the increased price in the international market. IOC, increased transportation cost and



increased demand of petroleum products all over the world. Effect of world economy is seen in the price of petroleum product in Nepal. Instability in political condition and frequent change in the government having different policy regarding the petroleum products has made declined price of such product on the date 2065/02/27 to 2065/11/20 and other adjustment are made to increase the price of product in this study period. The adjusted price in the recent years is not appropriate to include in the study, so the available data are shown in appendix-VI.

**Figure No. 4.6**  
**Details of Retail Selling price of Petroleum products.**



From the above figure, the individual product MS it was increased up to 27/02/2065 then decrease up to study period. Similarly, next component HSD was increasing up to 27/02/2065. From the year 07/09/2065 the price of HSD was in decreasing trend up to study period. The same pattern of change in the price of

SKO as well. A provision of kerosene quota was made available to the year 2062 with subsidized price but it was discontinued from the year 2062.

**Table No. : 4.17**

**Details of Retail Selling price of Aviation Turbine Fuel on Different Date**

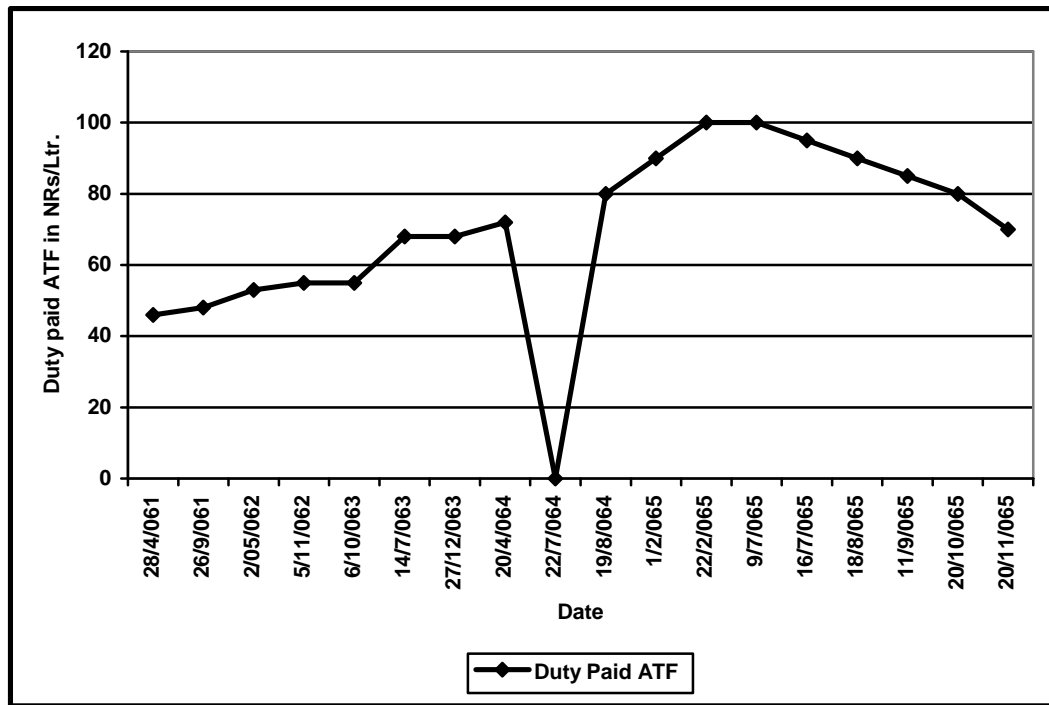
<b>Date</b>	<b>Duty paid ATF (NRS./Ltr.)</b>	<b>Inc./Dec. %</b>	<b>Bonded ATF USD/KI</b>	<b>Inc./Dec. %</b>
2061/4/28	46	39.39	609.27	69.24
2061/9/26	48	4.35	660.12	8.35
2062/5/2	53	10.42	660.12	0
2062/11/5	55	3.77	660.12	0
2063/6/10	55	0	931.83	41.16
2063/07/14	68	23.64	931.83	6.94
2063/12/27	68	0.00	996.49	6.93
2064/04/20	72	5.88	996.49	0.00
2064/07/22	-	-	1100	10.39
2064/08/19	80	-	1180	7.27
2065/02/01	90	12.5	1330	12.71
2065/02/22	100	11.11	1500	12.78
2065/07/09	100	0.00	1400	-6.67
2065/07/16	95	-5.00	1300	-7.14
2065/08/18	90	-5.26	1200	-7.69
2065/09/11	85	-5.56	1000	-16.67
2065/10/20	80	-5.90	900	-10.00
2065/11/20	70	-12.5	805	-10.56

*Source: NOC Central Office, Kathmandu, 2065*

Same trend of other petroleum products described ahead is followed by the product; ATF with the increased trend up to 22/02/2065 then decrease price up to period of study. Maximum increase appeared 14/072063 with 23.64 percent of previous one.

**Figure No. 4.7**

**Details of Retail Selling Price of Aviation Turbine Fuel on Different Date**



The price of ATF was adjusted on 28/04/2061 and it was adjusted recently due to change in government policy and it was stable to 26/09/2061 to 05/11/2062 and adjusted with the increased price. Maximum increased appeared 22/02/2065 then decrease the period of study was shown by the above figure.

**a. Working Loss of Petroleum Products**

NOC, which purchase petroleum products from IOC and carries it through the road transportation, which occurs normal and abnormal loss in quantity.

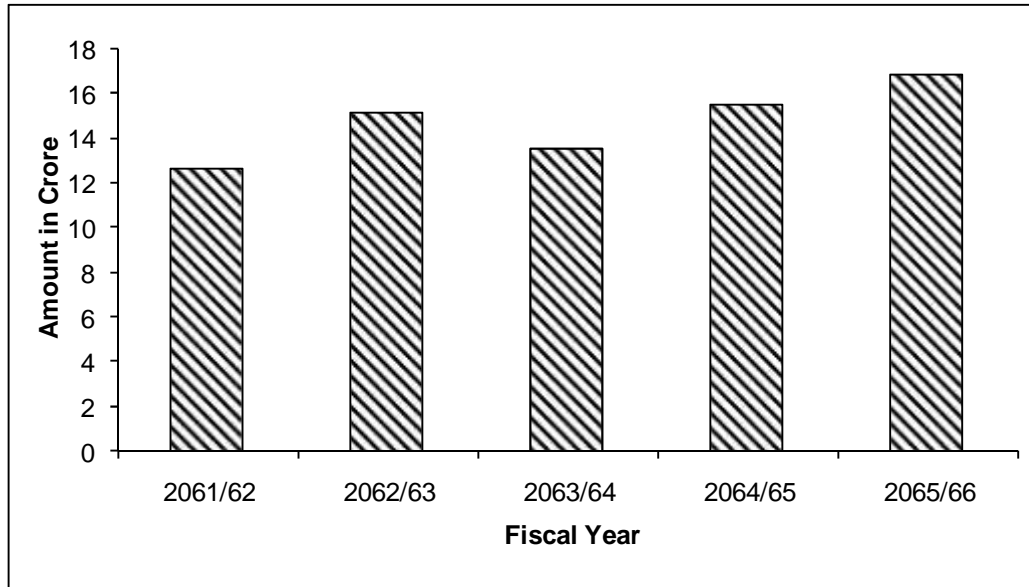
**Table No. 4.18**  
**Details of Working Loss of Petroleum Products**

<b>Fiscal Year</b>	<b>Quantity in Ltr.</b>	<b>Percentage</b>	<b>Amount in Crore</b>
2061/62	4777722	0.58	12.64
2062/63	4756906	0.56	15.16
2063/64	4187719	0.53	13.59
2064/65	3525247	0.43	15.54
2065/66	3118741	0.43	16.88

*Source: NOC Central Office, Kathmandu, 2065*

The above table shows the quantity of working loss in decreasing trend, which is decreased from 4777722 Ltr. to 3118741 Ltr. within the study period with relative percentage of total purchase from 0.58 to 0.43 percentages. Although the percentage and quantity are decreased but amount of working loss is in increasing trend due to increased price of petroleum product in international market and its effect in Indian market as well. The amount of working loss in 2061/62 was 12.64 Crore is increases in the following year and decreased in the year 2063/64. And it is increased for the last two years of study period.

**Figure No. 4.8**  
**Details of Working Loss of Petroleum Products**



The above figure shows the fluctuated trend of working loss, which took place, due to differential temperature in Indian depot and Nepalese depot at Thankot and Amlekhgunj volume of petroleum product is increased in high temperature and decreased in low temperature. Loss on the transportation process, loss on loading and unloading, absorbed by the storage tank, pipeline, Loss due to the minimum stock in the storage tank with high temperature etc. are the major reasons for the working loss of petroleum products.

#### **4.17 Estimation of Purchase, Sales and Closing Stock through Time Series Analysis**

For the future estimation, management can use the information which is gathered from the past behavior data. Such data are collected, observed or recorded at successive intervals of time.

A time series is a sequence of observation of a variable made in regular points or intervals of time and arranged in chronological order. Time series analysis is one of the quantitative methods used to determine patterns in data collection belonging to different time periods of some economic variable or composite of variables. A time series depicts the relationship between two variables, one of them being time.

For the estimation of purchase, sales and closing stock of petroleum products in the FY 2071/72 and 2073 B.S., the time series techniques is applied with the help of least square method and it is most popular and widely used in practice. It provides basis for obtaining the line of best fit in the series.

Let the straight line of trend be

$$y = a + bx$$

Where as,

y = Dependent variable

x= Deviation from some convenient time periods.

b= Slope of trend line or annual rate of growth

Estimation of purchase in the fiscal year 2071/72

The line of best fit is:

$y = a + bx$ , putting the value of  $a$  and  $b$  calculated in appendix- VII in the equation  $y = a + bx$ , we get fitted trend line.

$$Y_c = 677919 + 17821 | x$$

The purchase of petroleum products in fiscal year

$$2071/72 = 856134 \text{ KLS}$$

The above calculation shows that the purchase of petroleum products in fiscal year 2071/72 will be 856134 Kls if the same trend of decreased purchase will exist as the previous years but the calculated figure seems as unrealistic.

Estimation of sales in the fiscal year 2071/72.

The line of best fit is:

$y = a + bx$ , putting the value of  $a$  and  $b$  calculated in appendix – VIII in the equation  $y = a + bx$ , we get the fitted trend line.

$$Y_c = 678278 + 5271.4 | x$$

The sales of petroleum products in fiscal years:

$$2071/72 = 703992 \text{ KLS.}$$

The above figure of estimation shows that if the same trend i.e.  $Y_c = 678278 + 5271.4 | x$  is remains the same then the sales in 2071/72 will be 703992 KLS. But the calculated figure seems as unrealistic which may not occur in the future.

Estimation of closing stock in 2071/72, the line of best fit is  $Y = a + bx$  putting the value of  $a$  and  $b$  calculated in appendix- IX in the equation.

$Y = a + bx$ , we get the fitted trend line:

$$Y_c = 72707 + 4565.3 | x$$

The closing stock of petroleum products in fiscal years:

$$2071/72 = 118360 \text{ KLS.}$$

The closing stock in 2071/72 will be 118360 KLS if the existing trend of increasing the quantity of closing stock will remain the same in coming year.

#### **4.18 Quality Control**

Quality control refers to the systematic control of those variables encountered in a manufacture process, which affects the excellence of the end product. Such variables result from the application of material, men, machines and manufacturing conditions. It is a process of establishing acceptable limits of variation in size, weight and so forth for product of services and maintaining the resulting goods or services within the limit (Goal, 1992).

In these days of radically changing circumstances, quality has become an overriding factor in corporate success. In order to maintain improved corporate image. Responsibility in giving quality assurance has become the most important factor. The attainment of quality reputation calls for careful development and effective implementation of quality system. Quality philosophy is gradually changing from inspection to quality control and from quality control to quality assurance, here by shifting the focus from product to process and from process to system. In this context traditional quality control system is no longer sufficient to ensure future success of one's business.

As the NOC limited is having the slogan "Our Commitment, Purity on Petroleum Products" Which is relevant. According to the nature of product, NOC is focusing its efforts to maintain quality on the petroleum products by implementing different techniques such as elimination of SKO, regular inspection etc.



NOC is having a monopolistic type of business of direct public concern. Tomorrow the situation may not remain as of today, with the present government policy on parallel marketing through privatization and liberalization. With the competitive marketing of future and unionization, those who can't deliver good services and quality will have to struggle very hard even for mere survival. Taking into consideration of these bitter facts, NOC has already started gearing an important and delivering update a quality product to meet consumer satisfaction.

To keep the quality of the petroleum products in predetermined specification, the quality control department has been formed by NOC. Until 2050 B.S., quality specifications for petroleum product imported to Nepal and distributed to different parts of Kingdom was not determined.

In 2050 Magh 7<sup>th</sup>, a committee including the authorized representative of quality control department of NOC determined the quality specification as per Nepal Quality Control Act. In accordance to the process, different methods to check the quality of petroleum product have also been applied.

The quality of petroleum products is directly concerned to air pollution. The pollution is one of the major issues and considerably reported to the urban areas of Nepal. The task of quality control has become more radical to NOC as one of the reasons pointed out for the pollution is the quality of the fuels. For the better performance and long lasting of engine, better fuel whether gasoline diesel or any other fuel is needed. In recent days, better performance not only relates to better mileage, less repair and maintenances costs but also a better combustion. So quality of fuel is directly or indirectly related to environment.

#### **4.18.1 Quality Control Procedure**

##### **a. Quality Assurance Provision at QCR 2064:**

An appropriate rule and regulation is needed for quality control and assurance of petroleum products. The regulation should declare a responsible department with full power and right to test all fuel parameters and to impose penal for non-compliances. NOC has formulated the Quality control Regulation 2064 (QCR-2064) in 2007. The purpose of the regulation is to ensure the quality of petroleum products and verifying the products with Nepal Standard (NS) especially, for marketing and distribution. According to the regulation, Quality control and research control department newly named as quality control and research department of NOC is a responsible department for fuel quality control. It has quality control responsibilities and obligation to enforce the QCR-2064 as well. It has set the MS and HSD products specifications, which are as follows:

**MS:** Final Boiling Point (FBP) and density are major parameters to test for quality assurance for petroleum products according to the QCR. 200 c FBP is allowable for receiving products in the depots of NOC. If depots of NOC have got the product with the FBP more than 200 c, then they should get permission to unload from the quality and pollution control dept. The difference of temperature is 4 c from benchmark for NOC and dealers.

**HSD:** The specifications for density for diesel and petrol are 820-870 and 710-770 respectively and +/- 0.0025 differences from benchmarks at 15 c is tolerable and kinematics viscosity range is 2-5 cst.

**Penal:** The regulation has a provision of penal for fuel adulteration from the both NOC and its dealers. If the dealer's fuel have not been found within the NS, stopped supply for three months or Rs 300,000 if it occur second time stop supply for 6 months or 500,000, again the third time fuel not have been found with in the NS canceled the dealership of HSD and MS. But, the FPB of MS dealer has

crossed the 4 c up 8 c from received temperature, and then stopped supply for 1 month, 2 months, 3 months and dealership cancelled if occurred first, second, third and fourth time respectively with penal charge Rs.100,000, Rs.300,000, Rs.500,000 by NOC.

Likewise, petroleum transporters are also penalized if their fuels are not in compliance with QCR 2064. If FBP of MS ranges 4 c- 8 c then the transporter is penalized by stoppage of in supply for three months, six months and one year in first, second and third time. Again the transporter wanted to start transport to the petroleum product after 1 year, they can pay penal Rs.100,000 to receive the authority of supply petroleum product by NOC.

#### **4.18.2 Quality Control Approach**

NOC has obligation to be more responsible for public use about adulteration. It does various activities regarding this, for examples sample collection, laboratory testing, producing reports, and compliance with NS.

The lottery system is practiced to control the fuel quality of dealers. Coded dealers name are selected by lottery in front of representatives of Nepal petroleum dealers association, Nepal consumer forum, and forum for protection consumer right Nepal. Then the teams go to the selected dealers for checking the petroleum products.

#### **4.18.3 Fuel Quality at NOC Depots**

The fuel qualities of all regional depots are within the NS/IS where as Bhairahawa and Pokhara depots have contained the FBP of MS that are the same such as 1990c maximum. Likewise, Nepalgunj depot has hold 1950c maximum FBP of MS. Similarly, Thankot, Amlekhgunj and Biratnagar depots have contained 1910c, 1900c and 1800c maximum FBP of MS respectively. The density for MS

from Nepalgunj is very closer to the NS/IS than other depots of NOC. Moreover, the density from Amlekhgunj for HSD is also very nearer to NS/IS, and kinetic viscosity for HSD from Biratnagar is very closer to NS/ IS resulting better effort on quality control.

#### **4.18.4 Fuel Quality at NOC’s Dealers**

NOC has obligation to be more responsible for public use about adulteration. It does various activities regarding this, for example sample collection, laboratory testing, producing reports and compliance with NS. Lottery system is practiced to check the fuel quality of dealers. It is teamwork and it consists NOC quality control officer, representatives of Nepal Petroleum Dealer Association, Nepal consumer forum, forum for protection consumer right Nepal and pro public. About 95 percent of market fuel has been resulted within the specification for the period is shown in the table below:

**Table No. 4.19**  
**Enforcement Result of QCR 2048 for Dealers**

(2061 Baisakh-2063 Baisakh)

S.N.	Dealers	EDR	CDR	WDR	MWDR	FWDR	Total	%
1	Non Compliance Dealers	4	18	13	7	1	43	5
2	Compliance Dealers	144	379	232	48	57	860	95
Total		148	397	245	55	58	903	100

Where as:

EDR = Eastern Development Region

CDR = Central Development Region

WDR = Western Development Region

MWDR = Mid-western Development Region

FWDR = Far-western Development Region

#### **4.19 Major Findings**

On the basis of data presentation and their analysis, the most remarkable findings related to this study have been presented below:

- i. The annual sales and purchase trends of the corporation differ from year to year and it is decreasing of all the years except FY 2063/64 and 2065/66 sales of study period due to fluctuating demand and corporation store keeping policy.
- ii. The calculated Karl Pearson's coefficient of correlation between actual sales and purchase is 0.92 which is more than 6 times of probable error that is  $0.92 > (6 \times 0.0463)$ . It signifies that actual purchase and sales are positively related and the correlation is significant i.e. increase in actual sales is proportionate to the increase in purchase.
- iii. Variance between estimated closing stock and actual closing stock varies largely in every year. This is due to normal and abnormal losses.
- iv. Closing stock of any firm directly affects the amount of capital tied up. If closing stock is huge, more capital is locked unnecessary, which could have been used productively somewhere else. There is not uniformity in closing stock of NOC, which is more of the reasons for cost increment.
- v. In the NOC the economic order quantity model is not applied in the study period. The corporation has maintained the safety stock for 35 day. The safety stock is estimated roughly. Therefore it is found fluctuating.
- vi. Problem of storage capacity also exists. Although storage capacity has been increased, it is not adequate in emergency period.

- vii. The company has not categorized its inventories for the purpose of control and paid equal attention for all inventories held by corporation.
- viii. The NOC has established higher level separate quality and pollution control department in order to ensure quality of petroleum products. This separate unit is not completely successful to control the quality of petroleum product.
- ix. There is no cost classification system. So there is difficulty to determine the ordering and carrying cost.
- x. Scientific tools and techniques are not used by NOC in order to forecast purchase and sales, it is prepared on adhoc basis.
- xi. Inventory turnover ratio is an indicator of the efficiency of management. Inventory turnover ratio of NOC is in decreasing trend from FY 2061/62 and 9.37 times in FY 2062/63 and it is a sign of inefficient inventory management system.
- xii. NOC is not applying scientific techniques of inventory management, which is most crucial point in NOC. There are several internal and external causes for not using scientific techniques, but NOC is neglecting the inventory management completely. This is a matter of misfortune to the consumer as well as the nation as a whole.
- xiii. Pricing mechanism of petroleum products largely depends upon the price of crude oil in international market, pricing policy of IOC, policy of Nepal Government and policy of NOC as well.
- xiv. Due to poor economic status, NOC is purchasing the refined petroleum products directly from IOC instead of doing to the agreement of 2007 AD. Between NOC and IOC.

## **CHAPTER - V**

### **SUMMARY, CONCLUSION AND RECOMMENDATIONS**

All the related information and introduction of inventory management of this study have already been presented in the first chapter. In the second chapter the available literature on inventory management is reviewed. Moreover, research methodology is described in the third chapter. All the available data are presented and analyzed in the fourth chapter relating to inventory decision by sorting out issues of inventory management of the corporation.

This concluding chapter attempts to include and present summary, conclusions and suggestions.

#### **5.1 Summary and Conclusions**

Nepal Oil Corporation is one of the largest public enterprises in Nepal. It was established in 2077/09/26 under the Company Act 2071, as a state owned trading enterprise to fulfill the fourth five years national periodic plan objectives. It has been supplying continuously a vital commodity to the general public, industries, aviation field and development projects of the nation and this has been making significant contribution to the economic development of the country.

Since Nepal has no sources of petroleum production of its own, all products have to be imported for domestic use, industries and transportation. Among them the cheap fuel like kerosene, diesel, petrol and aviation fuel, cooking gas (LPG) come to the front beside light diesel oil, furnace oil have also been supplied by the corporation.

At the beginning, it acted only as a dealer of foreign countries but in 1972 (2029) it entered the business of importing petroleum oil and lubricant products on its own and right now it is running in fourth decades. NOC is only one supplier of

petroleum products in the country. Supply and distribution of lubricant is handed over to private sector organization to enter this business. NOC, however, still remains the only importer of major petroleum products in the country.

Most of the manufacturing and trading companies invest a huge amount of capital in the form of inventory. NOC also invests a huge amount of capital in the form of inventory, the concept of inventory management is almost void in NOC, they are not applying the scientific techniques of inventory management, which is the short sight, unskilled, inexperience, inability and unknown manner of management aspect.

The basic problem of this study is to examine the inventory management system exercised by the Nepal Oil Corporation. The main objective of the study is to know the present situation and to identify the problem of inventory management faced by Nepal Oil Corporation and to provide suggestions on the basis of study. For this purpose this study is conducted on the basis of direct interview with officials and observation of the inventory system personally.

All the collected data and facts are analyzed on the basis of inventory management theory, with the help of Karl Pearson's correlation coefficient, probable error, ABC analysis, and inventory turnover ratio and variance analysis. Based on the above, the following conclusion is drawn:

- i. The purchase plan depends upon the sales plan but the plans are made on adhoc basis.
- ii. To maintain the regular supply, demand and purchase of inventory components the most important aspect of management should match with each other. If actual supply does not match with each other, there would be either stock out position or overstock position. In NOC target supply and actual supply varies each year.



- iii. Inventory turnover ratio in total study period reveals a maximum turnover ratio was 12.19 times in fiscal year 2063/64 and minimum turnover ratio is 7.7 times in fiscal year 2065/66. It is due to decrease in total supply and increase in closing stock.
- iv. The difference between estimated closing stocks varies largely in every year. The maximum variance between two stocks is 31.45 percent in financial year 2064/65 and minimum variance is 5.95 percent in FY 2060/61.
- v. The correlation coefficient between actual sales and purchase is 0.92, which represents perfect relationship between them. Similarly correlation coefficient between closing stock and actual purchase is 0.83 and that actual sales and closing stock is +0.65
- vi. Storage capacity of NOC is sufficient to meet the demand for 35 days.
- vii. Distribution of petroleum products throughout the nation is made by corporation itself or by agent. It has five-area office, six sub branches and so many other sales depots all over the country.
- viii. NOC is not independent to fix the price of petroleum product. So it is not able to have a sustainable market and that of IOC.
- ix. The decreased /increased trend of purchase and sales of petroleum products is caused by the unavailability of such products in a regular basis, in fact demand is not decreased, it is increased but NOC is not able to fulfill the demand. Due to the same reasons sales and purchases are decreased.
- x. NOC is purchasing the refined petroleum product directly from IOC instead of doing according to the agreement of 2007 AD. Between IOC and NOC. It is not able to give crude oil cargoes because of poor economic condition of NOC. Even purchase or import procedure according to the agreement is profitable for NOC.
- xi. NOC has formulated the quality control regulation 2064 (QCR-2064). It ensure the quality of petroleum products and verifying the products with

Nepal standard. It is not completely successful to control the quality of petroleum product.

## **5.2 Recommendations**

This study is a small part to fulfill the partial requirement of master of business study. Analyzing available data, some findings were extracted. Based on the major findings of the study, it may be appropriate to make some suggestions. Although these suggestions may not be adequate and could very easily give negative reflection but it is hoped that these suggestions will help to improve the corporation and acquaint the other concerned.

- i The objective of inventory management system is to control the inventory and to minimize the stock out and overstocking condition which helps to increase profitability. NOC, should make an effort to minimize such conditions to overcome the over stock position or stock out position of inventory. For this purpose NOC should use scientific tools and techniques like Trend Analysis, Regression Analysis, Time Series etc. to forecast purchase and sales.
- ii To reduce the cost price of petroleum products NOC should follow according to the agreement between IOC and NOC i.e. purchase of crude oil from IOC is cheaper than the existing practice on which NOC is purchasing refined oil.
- iii For the same purpose, i.e. cost reduction NOC should focus its consideration to have a pipe line transportation system from Raxual to Amlekhgunj, which is in process as the agreement between NOC and IOC and it should be completed as soon as possible to solve the problem of narrow road, traffic, strikes, geographic terrain and high transportation cost.
- iv The open boarder line between Nepal-India and the difference in price of petroleum products between two countries has increased the unauthorized

infiltration of petroleum products. So, the determination of price should be done according to petroleum price in India.

- v The variation between estimated closing stock and actual closing stock is very large. The reason may be due to normal loss like: shrinkage, normal leakage, unfavorable temperature, working loss management etc. NOC should effort to analyze and diagnose the abnormal losses for place the proper management.
- vi Although demand of petroleum products is not increasing the storage capacity is not sufficient to make a regular flow of petroleum products in some difficult situation like disturbance on receiving from IOC. So called 'Band' & are increasing due to political instability. The current storage capacity is just enough to adequate attention for expansion of storage capacity, also existing capacity should be repaired and fully utilized.
- vii NOC should attempt to use scientific models like economic order quantity (EOQ), ABC analysis, Re-order level etc. So, this will help solving the inventory problem such as over stock, under stock or stock out. As a result NOC can deliver the regular supply of petroleum products to the consumer at a right quantity at reasonable price and at a right time.
- viii With the rising concern to the environment pollution, Nepal Oil Corporation should tighten up its quality control system and should be more concerned with the fuel qualities. The inspection of the corporation should be active more than ever and all over the country. Quality monitoring of the petroleum fuels should be performed.
- ix The kerosene elimination prices of NOC to ensure the quality of petroleum products and to avoid fuel adulteration need to be more responsible. Serious and effective implementation of such policy is required.
- x Every organization/public enterprise should be allowed to function according to its own mechanism. The undue influence and direct instructions from

ministers and top-level offices offsets to achieve the organizational goals. These kinds of involvement should strictly be avoided in the pricing process.

- xi Preparation of a quality control manual for maintaining quality of petroleum products both aviation and non-aviation products need immediate circulation of very old storage fuel of depots on petroleum products.
- xii Cost should be classified as fixed, variable, semi-variable, controllable etc. For the same, the methods used may be: least square method, high low method etc. It helps to minimize the cost of inventory and the accounting section seems responsible for the same.
- xiii An adjustment of petroleum price should be done in a span of 15 days including the increase and decrease price of petroleum product in international market.
- xiv Government of Nepal and NOC should have coordination to maintain an automatic price mechanism principle to avoid the loss in transaction and dependency over the government for the payment of trade amount to IOC.

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