

CHAPTER I

INTRODUCTION

1.1 Background of the Study

Nepal is developing country with a very small number of industrial sectors. It's economy is based on agriculture. The industrialization process had started very late in the country. The actual process of industrialization began since 1936 only after the establishment of Council of Industry. The company Act was also passed in the same year.

Inventory is one of the most assets to many organizations. Large percentage of the total capital is invested in inventory. Inventory is vital element in the efforts of the firm to achieve desired of sales.

Inventory management involves planning of the optimal level of inventory and control of inventory cost supported by an appropriate organization structure, which is staffed by trained persons and directed by top management. It involves both financial and physical dimension and these dimensions are interrelated and can not be looked in isolation. Many business became failure due to not properly managing inventory. To produce any goods or service, it requires many types of material, direct or indirect. If the company did not get the required materials at needed time than production, system may be distributed and fails to produce and sale required quantity of products. Keeping more inventories will be expensive due to it needs large amount to invest in inventory, not only that keeping large amount of inventory will also increase cost associated with inventory where as keeping minimum amount will create the problem of shortage. Therefore inventory management plans for required amount of different types of inventory, required period and cost associated in it.

The private sector was reluctant to establish huge industries due to various constraints like requirement of substantial amount of fund, requirement of high-tech expertise, lack of attractive profit opportunities, limited size of the market and involvement of high risk. To accelerate the process of industrialization and to play catalytic role to promote economic growth, most of the public enterprises of Nepal were set up mainly through foreign assistance in the 1960s and 1970s.

Public enterprise, without doubt play a substantial and significant role to execute plans, programs, policies and strategies of national development.

Nepalese Public Enterprises are considered as the government tools for bearing socio-economic responsibility. For the purpose of modernizing the country's socio-economic system on the perceptual grounds for development economic and public enterprises bear the cost of development gestations. In this context PEs have been established to become the means of political relationship among the countries. Some are considered as the means of the revenue generation for the government, more over the generic significance of the establishment of PEs is to create the infrastructure for development and maintain public welfare and security where the private sector is not able to cover the areas of low profitability and heavy investment (Joshi, 2059:3).

The first formal government budget was introduced in 2008B.S. Business Budgeting in the complete and systematic manner was the rare case for Nepalese Commercial and industrial sectors.

Still public enterprises are the major business entity in the Nepalese economy. private sector is not completely developed. The existing private enterprises in business sector are not so much scientifically and systematically managed. Still, they are in small scale, the private enterprises they don't have adequate fund and technical knowledge to establish such large scale industries, most of the private sector business entities they are suffering from national and international cut- throughout competition. Consequently, comprehensive may not be feasible for those small business Enterprises.

Many public enterprises and private sector sell their production in same market. The products also are of same type. In the later quarter of twentieth century, the PEs was considered that they have to make profit by marketing their products and services. Public enterprises are unable to make adequate profits are considered unjust in the course of entrepreneurships development in a national periphery. Therefore the public enterprises should give market to their products and services as the private sector firms do in the competitive phenomena. This wick insures the utilization of natural scarce resources more efficiently and effectively. Consequently, PEs will be able to contribute in national exchequer adequately and will enhance the industrialization policy of the government. If such kind of circumstances help to minimize the unemployment rate by creating many and most employment opportunity

throughout the country. But the Nepalese public enterprises are the simply burden for the nation economy. This doesn't make a sense that PEs is worth privatization but are industry significant and are to be reformed more effectively and recently. By utilizing available resources efficiently public enterprises can contribute to the national growth and prosperity.

For the rapid development of developing nation like Nepal, development in agriculture sector is not sufficient. It is essential to develop to industrialization too. These industries have an important role to play in accelerating the rate of economic development. Much of the early literature treated industrialization as the key element of economics should have close association between development and industrial expansion. Industrialization has certainly been associated with growth but it is not only courses of growth. At certain stage of country's development the highest returns may come from manufactures, agriculture products or services. How to use resources at any time depends on market prospects and costs. So, the interesting question is not, how fast a country can be industrialized, but how incentive and policy can be designed so that few industries make the maximum contribution to the country's development, where must be applied suitable and effective and management system.

In Nepal, when first five year plan was launched in 1956, renewed efforts towards industrialization were made. Then provision was in those plans to set up public enterprise. In fact the growth of PEs during the successive National Plan Period is as follows:

Table-1.1
The Growth of PEs during the Successive National Plan

Period	PEs growth no. in each and Every plan	Total numbers
Period to the 1st 5 year plan	1	1
First five year plan(1956-1961)	7	8
Interim Period(1961-1962)	3	11
Third five year plan(1965-1970)	12	34
Fourth five year plan(1970-1975)	27	61
Fifth five year plan(1975-1980)	8	59
Sixth five year plan(1980-1985)	7	53
Seventh five year plan(1985-1990)	3	55
Eighth five year plan(1992-1997)	-	48
Ninth five year plan(1997-2002)	-	-
Tenth five year plan(2002-2007)	-	-

Sources: - Economic Survey, 2062/063

The public enterprises have therefore assumed special responsibility in our effort to translate the plan, objectives, and policies into specific operational programmes and implementation to achieve the twin objectives of economic development and social justice side by side, as laid down the constitution of Nepal.

In Nepal some authors have gone out to call PEs at the babies burned out of the unplanned parenthood. It is because they can't contribute to the country at satisfying way, but they invited the financial burden and difficulties to the government.

Nepal is one of the least developing countries in the world, which is still in its crawling stage of industrialization. The sound economic development of any nation depends upon the higher rate of growth of production activities in the different sectors of the country's economy. About four decade's age, when the country was under rana rule for more than a hundred years, no significant initiatives were taken to improve the economic condition. There are few rana Prime Ministers, who had shown interest in establishing some industries and Public utility Companies for the first time in the countries. During the rule of Ranas some industries were established. For the example, Chandra Shamsheer JBR had established means of communication and rope-way transport. Likewise, Judda Shamsheer JBR had established Biratnagar Jute Mills under the company act 1993 BS. Similarly, Judda Match factory and other limited companies were established during his ruling period. First financial institution of Nepal, Nepal Bank Limited was established in 1994 BS. Morang Sugar Mills Ltd. and Nepal Insurance and Transport Company Ltd. were established in 2003B.S and 2004B.S. respectively.

After the rana rule in 2007BS, And during the three decades panchayati system in Nepal, there can be seen a numbers of companies, industries and financial institutions established in the country. Democracy system restored in the country on 2046B.S. After that HMG/Nepal had adopted liberalization economic policy in the country. And many industries were established in form of public enterprises, private companies. And NG/Nepal gave more emphasis to privatization of the PEs.

Ten years armed janayudda conducted by Maoists certainly disrupted the soundness of industrialization in some cases and made hindrance for the genuine cause of nation building. But, the situation has been changed into peaceful approach, which is positive aspect for nation building. Timely amendments in industrial policy, industrial enterprises Act and

Economic policy have made over the period of the years with a view to industrialize the country. Inadequate industrial base of the country, negligence of inventory management make it imperative to identify new industrial sectors which are instrumental to attract and mobilize local manpower, materials, and scattered capital of the country.

1.1.1 General Background of Cement

Actually Cement plays vital role in construction business. Cement was named Portland because this material bears the color of the natural stone quarried from the isle of Portland, a peninsula on the south coast of Britain.

1.1.2 How Cement is made

Raw materials, Portland cement contains about 60% lime, 25% silica, and 5% alumina. Iron oxide and Gypsum make up the rest of the materials. The gypsum regulates the setting of cement. The lime comes from materials such as limestone, oyster shells, chalk and a type of clay that is called marlshale, clay, and silica sand and blast furnace slag provide the silica and alumina, and iron oxide is supplied by iron ore, pyrite, and other material.

Most cement plants are located near limestone quarries. They may also be near deposits of clay and other raw materials. Ships, trains, trucks and other conveyer belts haul the limestone and other raw materials to the plants. In the plants, the materials go through a chemical process that consists of three basic steps:

Crushing and Grinding: First the limestone is dumped into primary crushers which crushes the rock into pieces about size of a tennis ball then secondary crushers or hammer mill crushes the rock into pieces about 2cm wide.

Next the crushed rock and other raw materials are mixed in the right proportion to make cement. This mixture is then grinding in rotating ball mills and tube mills. The material can be grounded by either a wet or dry method. In the wet process, water is added during the grinding until a soup mixture called forms. In the dry process no water is added.

Burning: After the raw materials have been ground, they are fed into *klin*, a huge cylindrical furnace made of steel and lined with firebricks. It takes about four hours for the materials to

travel through the kiln. Oil, gas, or powdered coal is burned at the kiln. This produces a blast of flame that hits the materials to temperatures of between 1430 and 1600 degree Celsius. The heat changes the materials into a substance called clinker, in pieces about the size of marbles.

Finish grinding: Large fans cool the clinker after it leaves the kiln. The clinker may be stockpiled for future use, or it may be reground at once in ball or tube mills. A small amount of gypsum is added to the clinker before the regrinding. This final grinding produces powdery cement that is finer than flour. The cement is stored in silos until it is shipped. (Sources: Department of Industry)

1.1.3 Use of Cement in Nepal

Office building, factory and stand on cement are foundation. Cement is a basic construction material for strong and durable construction works. Since the construction works are growing rapidly, the consumption rate of cement is increasing day by day. The demand of cement in Nepal is begin met by two sources, i.e. internal and external.

The internal source of cement are Hetauda cement industry with an annual capacity of 260000MT, Udayapur cement industry with an annual capacity of 277200 MT, Annapurna cement Industry with an annual capacity 9000MT, Triveni cement industry with an annual capacity of 9000MT, Maruti cement factory with an annual capacity of 16500MT(Sources: Department of Industry)

Indian Cement Producers cover a wide range of cement to Nepal as an important external source. Korea is another external source cement of Nepali market.

1.1.4 Historical Background of Cement Industry in Nepal

After the democracy started in 2007 BS, many attempts have been made to develop the national economy in a planned way. During this period HMG Nepal (now Nepal Government) puts its emphasis on the establishment of industries which are designed to promote foreign export through utilization of locally available raw materials and domestic manpower. And these products can substitute the highly demanded commodities that used to

be imported such as cotton textiles and materials. Such industries in one hand increase the national production and on the other hand generate employment opportunities to people. In this way it helps to save the national funds from importing foreign goods.

Cement is an important material for any construction work. Cement and concrete similar to the kinds used today was developed by the ancient Roman by mixing slaked lime (lime to which water has been added) with a volcanic ash called *pozzuolana*. This became known as Roman cement. In 1811 James Frost patented hydraulic cement by calcining a mixture of limestone and clay. Joseph Aspden improved the process by raising temperature. In this way although the cement was introduced in 1824 i.e. 183 years ago by English gentlemen. In Nepal the development plan was started in 1950. The Cement was mostly imported from India before the establishment of Himal Cement Factory in Nepal. Since 1966 AD twenty-six licenses had been issued for cement manufacturing, among them three manufacturing are from public sectors and remaining is from private sectors.

The study attempts to focus its study on inventory management and its impact on profitability of Udayapur Cement Industry Limited (UCIL), one of the public enterprises. Inventory management is a challenging job in every organization engaged in holding inventory. It plays an important role for the success of the organization. Management always works against risks and uncertainties and faces various problems. Nepalese enterprises have also not escaped this reality and are facing uncountable problems, which have caught up its success. One of the major problems that they are facing is sound and proper management of inventory. Inventory management is one of the most important functions in any organization. Proper inventory mgmt. helps to maximize the profit of the firm. The slight change in the cost of material or work- in- process will bring a great change in the firm's profitability. Reduction in material cost may result in high profitability and vice-versa. The basic objective of this study is to evaluate the inventory and its impact on the profitability of UCIL. Most of the manufacturing companies have not given more attention in inventory management. More investment has been made on inventory Management, but they don't know when they place an order, what is economic size of the inventory. So lack of these, they fail to achieve their goals and objectives.

Inventory is the stock of materials held by a firm to meet its future requirement of production and sales. It is a significant part of current assets on which huge part of working capital is

invested, which refers a large portion of investment of the firm as well as of the country as a whole. It is less liquid asset, which affects on fund management. Small portion change in inventory level affects to the fund management with significant change in profit.

Therefore, management teams should give serious consideration towards inventory management. It helps management teams in avoiding over and under investment in inventory and helps to maintain adequate level of inventory required for production process and for sales. Various scientific tools and techniques are used to solve the inventory management problem. It facilitates in deciding order size and re-order level of inventory to minimize cost of ordering and holding it. As a result, the product cost will be controlled and minimized, which makes the firm competent to exist in the highly competitive market.

On the other hand, if there is lack of proper inventory management and investment on inventory is unproductive, it could block the capital unnecessarily. Hence, it is obvious that inventory management plays crucial role in the profitability of the organization.

1.1.5 Introduction of Udayapur Cement Industry Limited (UCIL)

Udayapur Cement Industry Limited (UCIL) is the largest cement factory in Nepal. It is located at Triuga Municipality, ward no.11 of Udayapur district which was established in jesh 31, 2044BS under company act 2021(now company act 2053).Production Capacity of this factory is 277,200 metric tones of cement per year. It started its commercial production since poush, 2049BS.Share investment of Nepal government and Overseas Economic Co-operation Fund (OECF)'s assistance to meet the foreign currency are the financial component of Udayapur Cement Industry Ltd. OECF has contributed Japanese yen 18770 million and has contributed Nepal Government Rs 450 million to it's total paid up equity shares. Annual requirement of raw materials are limestone 3,30,000mt, clay 57,000-87500mt, iron ore 4,000mt, Gypsum 10,500mt.Total estimated annual requirement of cement in the country is 6,00,000mt per year where as this factory produced 2,60,000mt per year. Thus this factory alone meets about 44% of the total demand of the nation. (Sources: Target and Performances of Public Enterprises, Government of Nepal, Ministry of Finance 2006)

1.2 Statement of Problems

Inventory is one of the most assets to many organizations. Large percentage of the total capital is invested in inventory. Inventory is vital element in the efforts of the firm to achieve desired of sales.

Public enterprises are accepted as a tool for economic development especially in developing countries like Nepal where capital structure is poor. The growth of organised industries in Nepal has a very recent origin. During a period of past six decade, a few industrial enterprises were incorporated under Nepal company act. But many of them went liquidated or stopped their production activities for various reasons. On the other hand, the need of private organization has been felt necessary for balanced economic development. However, because of dominant role of public enterprises; private enterprise is not performing well. Most importantly, all enterprises are confronting management problems.

The most neglected aspect of Nepalese enterprises is inventory management. Management experts claim inventory management in Nepal is probably the weakest aspect of the management. The tools and techniques for controlling inventory have not been applied in Nepalese public enterprises for controlling their physical as well as financial dimension (*Agrawal, 2006:239*). Least attention is given to the Important of inventory management in Nepal. Due to the lack of the study of inventory management, A huge amount of is being blocked in the inventory. The annual production capacity of UCIL is 277200 metric tones of cement. But, in practice the company is not producing at its full capacity at its Capacity. For optimal utilisation of resources, proper inventory management is essential for UCIL. Besides, various other problems, it is focused on general problems of inventory management of Udayapur Cement Industry Limited (UCIL) and its impact on profitability, which are as follows:

Inventory management of UCIL, which are as follows:

- The economic order size, price of the input handling charges, maintaining charges etc are fixed unscientifically and aren't based on mathematical model which are not helping to the Corporation to reduce unnecessary cost.

- Inputs are backbone of any enterprises. Both excessive & inadequate inventories aren't suitable. So optimum level of inventory management should be determined to reduce more investment in inventory.
- The lead time or gap between the placing & receiving a new order is not given proper attention.
- Inventory turnover measures relationship between goods sold & inventory level. But inventory Turnover ratio is not considered in UCIL.
- To know when the company has placed to next order is other problem faced by the company.

1.3 Significance of the Study

Inventory management is one of the important functions in any organization. Without an effective & efficient inventory management, no organization can achieve goals. Proper inventory management helps to maximize profit of the firm. A slight change on the cost of materials will bring about a great change in the company's profitability. So a company should maintain adequate stock of raw materials to fulfill market demand. Because of limited resources, industries in developing countries are still using traditional techniques in purchase of inventory. Most of Nepalese Manufacturing companies are the victims of poor inventory management. UCIL is also not free from this obstacle. This study is concentrated on the problems faced by company in the area of inventory management. It can be hoped that UCIL would be satisfied by eliminating the obstacles faced in future. UCIL spends huge amount of it's investment on inventories, but there is lack of proper inventory management system. Small portion reduce in material inventory cost will help a significant change on profitability of UCIL. It will also help to improve the quality of the product to increase its market. Considering the current situation of UCIL, it is felt necessary that their management and control system should find out the inventory management system they are applying currently and improve it.

1.4 Objectives of the Study

The objective of the study is to find the present position of inventory management and its impact on profitability of Udayapur Cement Industry Ltd. Other objectives are:

-) To identify the applied techniques used to acquire and to manage the inventories.
-) To examine the profitability & efficiency of Udayapur Cement Industry Ltd. due to inventory management.
-) To analyze the different aspects of inventory management in Udayapur Cement Industry Ltd. with the help of statistical & financial tools.
-) To provide logical suggestion for improvement on the basis of the study diagnosis.

1.5 Limitations of the Study

The study has certain limitations due to lack of sufficient time and resources. They are as follows:

-) The study has been carried out within a range of latest fiscal year data starting from 2055/56 to 2064/2065.
-) The study has been limited to the area of the inventory management system and its impact on profitability of UCIL and has not covered other areas.
-) The analysis is based on primary as well as secondary data. The primary data has been collected from questionnaire, field visit, personal interviews, whereas secondary data will have been collected from progress report, financial report, published and unpublished articles and so on.

1.6 Organization of the Study

The whole study has been divided into five chapters.

First is introduction chapter, which included general background, Statement of Problem, Objectives of Study, Scope of Study and Limitation of Study.

The second chapter has covered the fundamental concept and components of inventory management and review of previous research work.

The third chapter has described the methods followed to achieve the objectives of this study. Moreover, this chapter explains the research methodology employed to conduct the study and tools and techniques used in analysis of data. This chapter includes research design, sources of data, method of data analysis etc.

Fourth chapter explains to the data presentation and analysis, scoring the empirical findings out of the study through definite sources of research methodology.

Fifth and last chapter has provided summary and conclusions based on facts found so that the complete picture of the study can be understood in short form. Similarly, recommendations have also been provided.

Beside these Bibliography and Appendices will also present at the end of the thesis. Similarly, acknowledgement, table of contents, list of tables, list of diagrams, abbreviations are included in the front part of this thesis.

CHAPTER II

REVIEW OF LITERATURE

This chapter deals with the review of relating to “INVENTORY MANAGEMENT”. Various studies have been made on inventory management. Some of them are reviewed for this study. This chapter is devoted to present the co-erced literature of the research.

2.1 Theoretical Concept

Inventory is one of the most assets to many organizations. Large percentage of the total capital is invested in inventory. Inventory is vital element in the efforts of the firm to achieve desired of sales.

Inventory management involves planning of the optimal level of inventory and control of inventory cost supported by an appropriate organization structure, which is staffed by trained persons and directed by top management. It involves both financial and physical dimension and these dimensions are interrelated and can not be looked in isolation. Many business became failure due to not properly managing inventory. To produce any goods or service, it requires many types of material, direct or indirect. If the company did not get the required materials at needed time than production, system may be distributed and fails to produce and sale required quantity of products. Keeping more inventories will be expensive due to it needs large amount to invest in inventory, not only that keeping large amount of inventory will also increase cost associated with inventory where as keeping minimum amount will create the problem of shortage. Therefore inventory management plans for required amount of different types of inventory, required period and cost associated in it.

Any stock that a firm keeps to meet its future requirement for production and sales is called inventory. The basic reason for holding inventory is to keep up the production activities unhampered. Inventories are a part of current assets, which is, used within one year, in the normal course of business operation manufacturing organization’s inventory of raw materials, work-in-progress, finished goods, spare parts, supplies etc. Therefore combination of raw materials, work-in-progress, finished goods and supplies is called inventory. Managing the

stock at lowest cost is called inventory management. In other words, the planning, coordinating, and controlling activities related to the flow of inventory into, through, and out of an organization.

2.1.1 Types of Inventories

Manufacturing firms generally hold four types of inventories (*Saradhi, 1982: 31*)

Raw Materials

Material consists of items that firms purchase for use in its production process. It may consist of basic materials and/or manufactured goods. Maintaining adequate raw materials inventories provides a firm with advantages in both purchasing and production.

Knowing that there will be adequate stocks of raw materials available when needed permits the production development to meet production schedules. Thus, there are a number of valid reasons why a firm purchasing and production departments will want to maintain large inventories of raw materials. In manufacturing company raw materials involves those inputs/components, which are converted into final product through manufacturing process. For example Tobaccos industry, tobacco is the main and vital raw materials. Inventories sizes are large and small. It depends upon the nature of the company. Such as inventories in tobacco industry are larger because of the curing process. Inventories in gas and oil production are low, because raw materials and goods in process are small in relation to sales. In the canning industries average inventories are because the seasonally of the raw materials. Inventories are small in baking because of the perish ability of the final product. In the context of Udayapur Cement Industry Limited, it has used following raw materials: Lime Stone, Clay, Coal, Gypsum, Iron ore and Packing bags

Work-in-Progress

Goods partially worked on but not fully completed. Inventory consists of all items that are presently in the production cycle at some intermediate stage of completion. For example they may be in transit between operations or; they may be currently undergoing some type of operations; awaiting the next step in the production cycle, the large it's WIP inventories.

WIP inventories are a necessary part of modern industrial production systems, since they give each operation in the production cycle, a certain degree of independence, firm's production department will want to maintain reasonable WIP inventories to minimize cost delays and idle time. In general, larger the firm's production cycle, the larger it's WIP inventories.

WIP inventories is neither a final product nor a raw material. It is middle of raw materials and finished goods. WIP inventories are strongly influenced by the length of the production, which is the time between placing raw materials in production and completing finished products. One problem has to face to separate raw materials, WIP and finished goods. It depends on nature of production. For Cement Industry, Cement is the final product. But a bridge constructor Company uses this Cement as a raw material. Such an iron bar, electric wires are also raw materials for one company and finished products for another company.

Finished Goods

Finished goods inventory consists of those items that have completed the production cycle and are available for sale. Keeping enough finished goods inventories on hand provides significant benefits for both the marketing and the production departments. From marketing's perspective, large finished goods inventories enable them to fill orders promptly, minimize lost sales and avoid shipment delays due to stock outs. From production's point of view, maintaining a large finished goods inventory permits items to be manufactured in large production runs, which helps to keep unit production costs low by spreading fixed set-up expenses over large volume of output(*Moyer, McGuigan & Kretlow, 1999:517*).

Supplies, Stores and Spares

This type of inventory is also very important for the manufacturing enterprises as above included 3 types of inventory.

2.1.2 Objective of Inventory Management

According the Indian association of materials Management, 64 paisa on labor and the rest of one rupee of cost is spent on overheads (*Goal, 1997: A-69*). So the objective of inventory

management has to give more emphasis on the material management that reducing the cost of production and improving the profitability. Studies by experts in this field have brought out that if an organization can effect 5% savings in material cost, it would be as good as increasing the production or sales by about 36%.

On the other hand, the management should try paying adequate attention to the inventory management to reduce the cost of production and working capital requirements. In fact, an uncontrolled inventory can become industrial unit's cancer.

Two levels of inventory control exist: quantity or unit control and rupee or financial control. Production executive and storekeeper are primarily interested in quantity control. On the other hand, financial executives are interested that too much money should not be invested in inventory and every rupee spent in inventory should be efficiently and effectively utilized. Firm should always avoid over-investment or under-investment in the inventories. An optimum level of inventory should be determined on the basis of the trade-off between costs and benefits. The main objective of inventory management is to minimize the total cost and maximize the profit of the companies. It can be summarized up as follows:

- a) Availability of all items of inventory: There should be a continuous availability of all types of inventory in the factory. The main objective of inventory management is to maintain required inventory in needed time so that production process will take place smoothly.
- b) Minimization of risk of under and over stocking: If the factory keeps inventory without proper analysis, than there will be chances of over stocking, which will increase the cost of carrying inventories under stocking of inventories that create problem in smooth operation of business.
- c) Reasonable price: When we purchased the raw materials there should be strict on the pricing the raw materials. It should be reasonably low price. But we don't the quality by keeping lower prices materials. Firm should be adjusted between price of the raw materials and its quality.
- d) Minimum wastage: There should be minimum wastage of materials while storing in the warehouse by the workers. Wastage should be allowed up to a certain level known as normal level of wastage and it shouldn't exceed that level. Storekeeper and workers should be trained to handle the materials in a scientific way to avoid the wastage.

e) Risks of spoilage and obsolescence of inventory must be avoided. For this purpose, a maximum quantity of each item of inventory is determined and a proper method of issue of inventory is followed. LIFO and FIFO method is used to issue the inventory.

f) Information about availability of stock should be made continuously available to the management so that planning of production may be done. The storekeeper can supply this information because he keeps an up-to-date record of every item of stocks under a proper system of inventory control.

g) Internal checking of inventory of raw materials and finished goods which is a part of inventory control.

2.1.3 Aspect of Material Management

Material management is the most essential part of the manufacturing organization. In practice, executives don't pay attention the material management. Therefore many organizations have failed to achieve the objectives. Effective material management ensures optimizing materials productivity. There are eight primary and seven secondary objectives that can ensure the best performance and use of materials in an organization. 'Material management provides an integrated systems approach to the coordination of materials activities and the control of total materials costs (*Doubler and Burt, 1996:79*)

Overall objectives of materials management

1. To develop a system of supplies whereby there will be right quantity of stock of items properly stored, easily retrievable and distributed close to the points of usage, whenever required, at a given time. In case, there is not enough stock, the work the work in the organization may have to be stopped and the men and machines will remain idle. On the other hand, if there is overstocking of raw materials, it will unnecessarily block capital in inventories.
2. The reduction in inventory costs- both carrying costs and ordering costs.
3. To ensure that the resources available are used most effectively and the stores are purchased at most economical price consistent with the quality.

4. To bring about coordination among the various sections in the organization, i.e. in a company to bring coordination among the financial manager, production manager and marketing manager.
5. To ensure that the production doesn't suffer.
6. To ensure that the sale of finished goods is not effected.
7. To avoid wide fluctuations introduction.

Most of the manufacturing and government companies are not given more attention in material management that is most important task. Most of the organizations have found that they are either suffering because of heavy inventory or because of non-availability of certain materials in the inventory. Therefore more emphasis has to given to encourage the use of inventory management systematically to censure the best use of inventory.

2.1.4 Need/Importance/Benefits/ of Holding Inventories

There are many 'benefits of holding inventories. A firm has to keep enough inventories not least. Inventories are used to provide cushions so that the purchasing, production and sales functions can proceed at their own optimum paces. In achieving the separation of these functions, the firm realizes a number of specific benefits (*Hampton, 1986:271-273*).

I. Avoiding Losses of Sales

If the firm doesn't have finished goods available for sale, it will lose sales. There is much competition in the market. Customers will purchase from that firm who gives immediate delivery. The firms have to compete with another firm who transact the same goods. So, the ability of the firm to give quick service and to provide prompt delivery is closely tied to the proper management of inventory.

II. Gaining Quantity Discount

If a firm is willing to maintain large inventories, it may be able to make bulk purchase of goods at large discount. By obtaining large discount the firm's profit may increase as long as the costs of maintaining the inventories are less than the amount of discount. E.g. If cost of storing an item is estimated at \$1 and discount is \$3, the firm benefits by \$2 per unit from the quantity discount.

III. Reducing Ordering Costs

Every time, a firm places an order when it is necessary. It incurs certain costs such as transportation, insurance, inspection, stationary, bank expenses etc. The total ordering cost may reduce if the firm places an order at fewer times. It actually takes a lot of money. So a few orders must be placed, so that ordering cost may reduce.

IV. Achieving Efficient Production Runs

It is necessary to continue the production run; a firm must keep enough raw-materials. If the set-up cost is \$200 and run produces 200 units, the production run cost per unit is \$1. A longer run of 2000 units would reduce the set-up cost to \$0.10%. Inventories assist the firm in making sufficiently long runs to achieve efficient production.

A company should maintain adequate stock of materials so that it is possible for a company to procure raw-materials. Procurement of raw materials may be delayed because of strike, transport disruption or short supply. Therefore the firm should maintain sufficient stock of raw materials at a given time to continuous productions.

2.1.5 Structure of Materials Management Organization

In a manufacturing organizations i.e. Departments, Corporations and Companies engaged in manufacturing and sale of goods, there should be a full-fledged department dealing with materials management. Departments may be divided into the following sections (*Goel, 1999: 427*).

- i. Materials policy-making, planning and programming
- ii. Purchasing
- iii. Inventory Control
- iv. Receiving
- v. Warehousing
- vi. Store-keeping
- vii. Material handling and
- viii. Scrap and surplus disposal.

2.1.6 Purchase Management

In narrow sense, purchasing refers merely to the act of buying an item at a price and in broader sense purchasing makes it a managerial activity that goes beyond the simple act of buying and includes the planning and policy activities, research and development, service selection etc. Management suggests that purchasing decisions involve in the weighting of alternatives possibilities, and many of these alternatives involve the influence of other functions on the purchasing decisions. A good purchase management has played important role in the manufacturing companies. A good purchase management has played important role in the manufacturing companies. We may give more attention in the purchasing of raw materials, supplies and equipment. We should purchase raw materials, supplies in the right quantity, of the right quality, from the right origin, at the right time and cost. Purchase management should be effective, otherwise it hamper in the quality production. So, we give more attention on purchase management. The scarcity of raw materials hampers in the production on time. Purchasing department should take greater responsibilities and should analyze the existing procurement policy and should tune with the overall organizational objectives and polices. The efficiency of any business activity depends upon having materials, supplies and equipment available in proper quantity with proper utility at the proper place and time and the proper price. We can improve in purchase management by the help of standardization, value analysis, material substitution, transport saving, cost reduction by packing modification.

2.1.6.1 Importance of Purchasing

Purchasing management reflects the role of purchasing in corporate operation and organization. Purchasing is still a clearly identifiable function in most business organization. No organization can operate without materials supplies and equipment. The efficiency of any business activity is contingent upon having material, supplies and equipment available in proper quantity with proper quality, a proper place and time, and at the proper price.

2.1.6.2 Objectives of Purchasing

Providing the people to select of materials, supplies and services in an appropriate and fair price is the objectives of purchasing. Purchasing objectives is to buy materials and service of the right quantity, in the right quality at the right price from the right source at the time in the world of Doubler, Lee and Burt (*Doubler and Burt, 1999: 15*).

In general management terms, there are eight basic objectives of purchasing:

1. To support company operation with an uninterrupted flow of materials and service.
2. To develop reliable alternative sources of supply.
3. To develop good and vendor relationships and good continuing supplier relationships.
4. To buy competitively and wisely.
5. To keep inventory investment losses (due to deterioration obsolescence and theft) at a Practical minimum.
6. To achieve maximum intergration with other departments of the firms.
7. To train and develop highly competent personnel who are motivated to make the firm as well as their department succeed.
8. To develop polices and procedures, which permit accomplishment of the proceeding seven objectives at the lowest reasonable operating cost.

2.1.6.3 Purchasing Approach

Under the purchasing approaches there is various purchasing method, which are following (*Garrett and Silver, 1986: 374*):-

a. Hand to Mouth Buying

Under this approach, materials are purchased to meet immediate needs only. This approach is followed when the market price of the required materials is above average. Likely to fall or actual requirements of the company is uncertain the objectives of this approach is to minimize inventory less due to fall in prices.

b. Averaging Down

This approach of purchasing aims to obtain the benefit of price dips. In other words, purchasing is down in every price falls. If handled successfully, it is possible to keep the cost below the average market price.

c. Forward Buying

When the purchaser forecasts his future needs and purchases the required goods in economic quantities to meet those need, then this policy is forwarded. When price is relatively stable overtime or when only moderate price increases can be anticipated, then this approach is often used. This approach is used to take advantage of economical large volume purchases.

d. Speculative Buying

Under this method, purchase is made in excess of needs of the items when a market price is low. This purchasing helps the company to save the money in purchasing and to generate profit on sales. Hence speculative buying seeks to make a possible profit by purchasing materials in anticipation of price rises.

e. Reciprocal Buying

According to this approach, the firm agrees into a contrail to buy and supply materials from each other. It is difficult to set a hard and fast rule as the advisability of such agreement.

f. Local Buying

Sometimes through uneconomical materials are to be purchased from local supplier. Especially in the area where degree of industrialization is low, this is done to build good public image.

2.1.6.4 Purchasing Principle

Followings are some of the important principles of purchasing:

1. The acceptance of order is to specific and not implicit preferably ether side should acknowledge this before it is binding.
2. Ambiguity and misinterpretation should be avoided especially in respect of quality,

delivery, service, discount or any other such change.

3. The supplier takes warranty of goods as per specifications laid down in tender and not whether these are fit of intended use. It is so required the detailed information has to be stipulated well in advance or through negotiations has to be stipulated.
4. The other features are buyer's right to reject unwanted goods, liquidation for damages, passing of ownership etc, are covered in legal aspects.

2.1.7. Cost Basis for Inventory Valuation

The primary basis of accounting for inventory is cost, which has been defined generally as the price paid or consideration given to acquire an asset. As applied to inventories, cost means in principal the sum of applicable expenditures and charge directly or indirectly incurred in bringing an article to its existing condition and location (*AICPA, 1991:28*).

Conceptually, the process of value that multiplying physical quantity of goods by cost per unit. But in practice many organizations purchase different types of raw materials at different time price of materials remain change time to time. There are many types of raw materials remain the stock. It isn't always possible to identify the individual particular purchase group. At that situation, firms have faced difficulties in valuing the inventory. In this situation, there are many methods, which are based on historical cost, used in determining the values of inventory are:-

a) Specific Identification Method

The specific identification method requires that each unit in inventory be identified with the particular time it was purchased. In these methods, the items serial numbers or are distinguished by model, colors or size to identify the particular items but specific items separate at first and recorded in stock book. This method is more suitable to low volume, high cost item such as automobiles. It is not very practical when the firm purchase large quantities of identical units of various times and prices.

b) Weighted Average Cost/ End-of the Month Method

It assumes that goods are removed from the beginning inventory and purchase group in proportion to the number of units in these groups. Consequently, cost of the ending inventory also represents a proportional distribution from the beginning inventory and the various purchase groups. The weighted average cost computed by dividing the total cost of goods available for sale by the total no. of units available for sale for during period (*Eugene, 2003: 440-444*)

$$\text{Weighted average} = \frac{\text{Total cost of goods available for sale}}{\text{Total units available for sale}}$$

This method is widely used by organizations that hold items of inventory for long periods of time because it averages out of the effects of price increases and decreases. In addition, weighted averaging process is satisfactory when there are both increases and decreases in cost with in the accounting period. Some organization uses this method, which purchase the inventory items frequently interval because it doesn't require that the ending inventory cost be associated with any particular purchase group. A common criticism of the methods is that it attaches no more significance to current price than to price that prevailed several months earlier.

c) First- In- First Out (FIFO) Method

FIFO method assumes that the oldest items on hand are sold first. Each sale is made out of the oldest goods in stock; the ending inventory therefore consists of the most recently acquired goods. During the period of rising prices, these methods will result in a inventory then would be assigned under the average cost method. FIFO is the most commonly used method for valuing inventory. It is simple to use and appear to coincide with established merchandising principle of selling of selling the oldest items first.

d) Last-In- First out (LIFO) Method

This method assumes cost flow is exactly the opposite of FIFO method. The title of the method assumed that the recent items purchased. Consequently, the ending inventory consists of the oldest unit in hand cost of the latest purchased materials will be co-assigned to the first materials issued, until they are exhausted, then the price of the proceeding lot is used and so on. Materials are issued at cost approximating current market prices but inventories trend to be valued at the oldest lots on hand giving price, which is out of date with current invoice prices.

This method has become popular since the procedure became an acceptable method for determining the income taxes. Unlike weighted average in the inventory is less than the beginning inventory. In such a case, the firm must be able to identify the oldest remaining items for inventory valuation purposes.

e) Standard Cost Method

LIFO, FIFO and average cost method are often awkward to work within the subsidiary records for materials under a perpetual inventory system. For this, standard cost method may be used in accounting for individual items in materials inventory. This method charges materials unit into the factory at a pre-determined budgeted or estimated price reflecting a normal or expected future prices.

f) Base Stock Method

According to this method, a certain constant quantity or base stock of materials is assumed to be necessary to keep the concern going. The base is valued at the cost prevailing at the time from began or when the method was adopted. Any additional layers of materials in the inventory at close beyond the unit the base may be cost on the basic of FIFO, weighted average etc. method.

All the methods have their advantages and disadvantages. However, the method of chosen is significant for efficient inventory management especially in its financial dimensions.

2.2 Analytical Method

2.2.1. Inventory Management Techniques

In inventory management techniques, we seek how to minimize the inventory cost. Adequate inventory facilitate smooth production activities. On the other hands, excessive inventory is idle resources of the firm and the large amount of money is blocked unnecessarily. According to Atton N. Smith “Inventory is money on which a company pays interest rather than collects interests. It is money always in danger of devaluation. Every firm should have an optimum level of inventory or optimum balance level between too must inventory and too low inventory management techniques to solve inventory management problem faced by the most of the manufacturing firms.

2.2.1.1 Economic Order Quantity (EOQ)

One of the major inventory management problems to be re-solved 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 on each replenishment. If the firm is planning a production run, the issue is how much production to schedule. These problems are called order quantity problems, and the task of the firm is to determine the optimum or EOQ. Determining an optimum inventory level involves two types of costs (a) Ordering Cost and (b) Carrying costs. The economic order quantity is that inventory level, which minimizes the total of ordering and carrying costs. We can compute EOQ with the help of forecasting usage, ordering and carrying costs. In EOQ calculation, we must use marginal cost only and should not include fixed costs.

Assumption of EOQ: -

The EOQ model, as the techniques to determine the economic order quantity, explained by us, is based on three restrictive assumptions:

- (a) The firm knows with certainty the annual usage of a particular item of inventory.
- (b) The rate at which the firm uses inventory is steady overtime.

(d) The orders placed to replenish inventory stock are received at exactly than in time when inventory reach zero.

In addition, it may also be assumed that ordering and carrying cost is Constant over the range of possible inventory levels being considered.

Approaches: -

The EOQ model can be illustrated by I) the long analytical approach or Trial and Errors Approach ii) Formula Approach and iii) Graphic Approach

i) Trial and Error Approach

While determining the EOQ by trial and error technique, the following steps are to be taken to undertake

- a) Determining total costs for each lot size chosen
- b) Selecting the ordering quantity which minimizes total costs.

Example: -

Annual demand = 100 Units

Price per unit = Re. 10

Carrying cost = 20% of average inventory value

Cost per order = Rs. 10

Now, applying the techniques, optimum economic quantity can be determined for no. of orders 1,2,4,6 and 8 in this way:

Table No.: 2.1

Calculation of EOQ by using Tabular Method

(1) No. of Order(N) = A/Q	1	2	4	6	8
(2) Order Size(Q) = A/N	160	50	25	16.67	12.5
(3) Average Inventory = Q/2	50	25	12.5	8.34	6.25
(4) Total Carrying Cost =Q/2xC	10	5	2.5	1.67	1.25
(5) Total Ordering Cost = A/Q x O	10	20	40	60	80
(6) Total Cost = 4 + 5	20	25	42.5	61.67	81.25

ii) Formula approach

The economic order quantity can, using a short-cut method, be calculated by the

Following equation

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

Where,

A = Annual usages of inventory (units)

O = Ordering cost per order

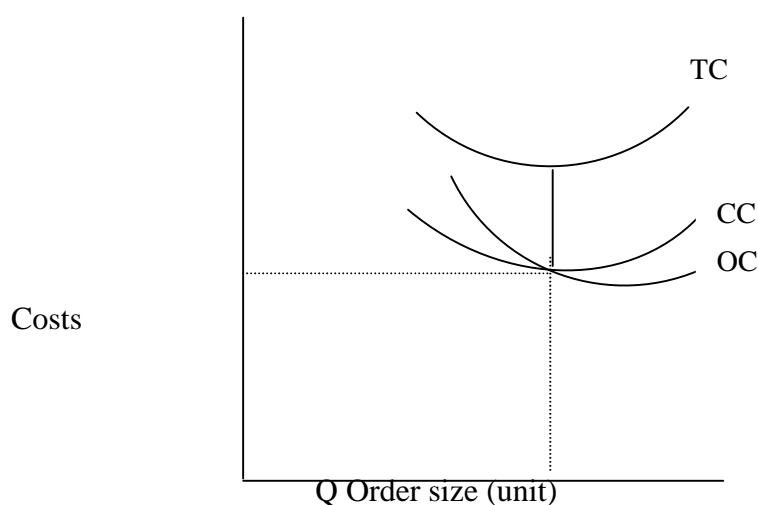
C = Carrying cost per order

iii) Graphic Approach

The economic order quantity can also be found out graphically. In the figure, cost- carrying, Ordering and total- are plotted on Vertical axis and horizontal axis is used to represent the order size. We note that total carrying cost increases as the order size increases, because, on a average, a large inventory level will be maintained and ordering costs decline with increase in order size because large orders size means less numbers of orders. The behavior of total cost line is noticeable since it is a sum of two types of costs, which behave differently with order size. The total cost decrease in average ordering cost is more than offset by the increase in carrying cost.

Figure No: 2.1

Showing Order size & Costs through Graphic Approach



2.2.1.2 Re-Order Point/ Re-Order Level

The EOQ technique determines the size of an order to acquire inventory so as to minimize the carrying costs as well as the ordering cost. In other words the EOQ provides an answer to the question how much inventory should be ordered in one lot? Another important question is when should the order to procure inventory be placed? The aspect of inventory management is covered under the re-order point problem. The re-order point of is stated in terms of the level of inventory at which an order should be placed for replenishing the current stock of inventory. In the other words, re-order point may be procuring additional inventory equal to the economic order quantity. We used a formula to calculate the re-order point. It is based on the following assumptions:

Constant daily usages of inventory and Fixed lead-time.

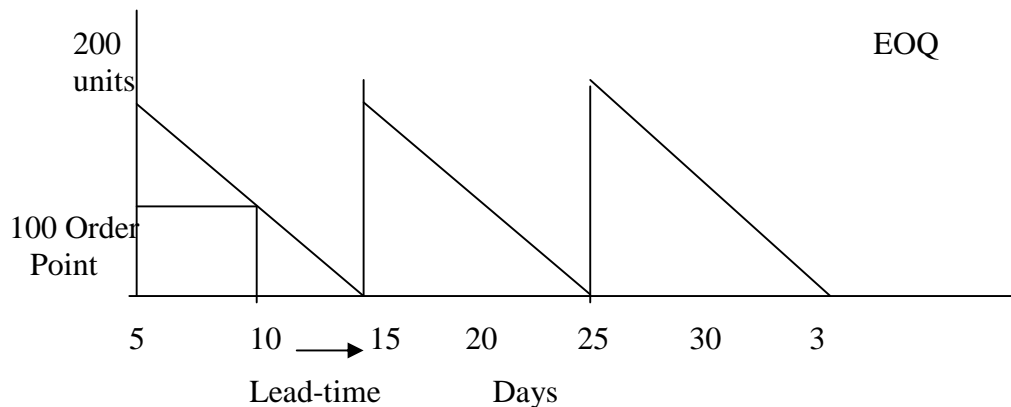
In other words the formula assumes conditions of certainty the re-order point = Lead time in day X Averages Daily usages of inventory

The term lead-time refers to the time normally taken in receiving the delivery after placing orders with the suppliers. It covers the time span form the point when the decision to place the orders for the procurement of inventory is made to the actual receipt of the inventory by the firm.

The average usages means the quantity of inventory-consumed daily, we can define re-order point as the inventory level, which should be equal to the consumption during the lead-time.

Suppose demand for inventory is known with certain but that it takes 5 days before an order is received. The EOQ of the firm is 200 units resulting in orders being placed every 10 days. If the usages were steady the firm now would need to orders 5 day before it run out of stock or at 100 units of stock on hand. Thus, the re-order point is 100 units when the new order is received 5 days later the firm will just have exhausted its existing stock.

Figure No. 2.2
Showing Re-Order Point when lead time is certain



The Re-order Point = Lead Time x Average Usage of Inventory

2.2.1.3 Goods in Transit

If a new order must be placed before the previous order is received, a good in transit inventory will build up. Goods in transit are goods that have been ordered but have not been received (*Weston, Bisley & Brigham; 1996:434*).

A good in transit inventory will exist if the normal delivery leads than the time between orders. Re-orders point is calculated as follows:

Re-Orders Point = Lead Time x Average Usages – Goods in Transit

2.2.1.4 Maximum Stock Level

Maximum level represents the maximum quantity of an item of inventory that can be held in stock at any time that stock shouldn't exceed this quantity. The quantity is fixed so that there may be no over stocking. The maximum stock level is fixed by taking into account the following factors: -

- a. Amount of capital available for maintaining stock
- b. Golden space available
- c. Maximum requirement of the stock for production purpose at any point of time.

- d. Rate of consumption of the materials during the lead time.
- e. The time lag between indenting and receiving of the inventory.
- f. Possibility of loss in stores by deterioration, evaporation etc.
- g. Fluctuation in price: - for instance, if there is the coming period a comparatively large maximum stock level will be fixed. On the other hand, if there is the possibility of kept decrease in price in the near future stocks are kept at a much reduced level.
- h. The seasonal nature of supply of some items of inventory goods are available only during specific periods of the year,so these have to be stocked heavily during those periods.
- i. Restrictions imposed by Government or local authority in regard to material in which there are inherent risks e.g. fire and explosion.
- j. Possibility of change in fashion and habit, which will necessitate change in requirement of materials.

The formula of maximum stock level: ***Re-Ordering Level + Re-ordering Quantity - (Minimum Consumption x Minimum Re-Ordering Period)***

2.2.1.5 Minimum Stock Level

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

- a. Lead-time i.e. time lag between indenting and receiving of the inventory. It is the time required replenishing the supply.
- b. Rate of consumption of the inventory during the lead-time.
- c. Nature of inventory, minimum level isn't required against customer's specific orders.

The formula for the calculation of minimum level: ***Minimum Stock Level=Re-ordering Level -Normal Consumption x Normal Re-Order Period)***

2.2.1.6 Danger Level

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

Danger Level = Average Consumption x Maximum Re-Order Period

2.2.1.7 Perpetual Inventory System

The chartered institute of management account, London defines the perpetual inventory as an “A system of record maintained by the controlling department, which reflects the physical movement of stock and there current balance. Thus this is a method of ascertaining balance after every receipt and issue of materials. It means the system of record. Continuous stock – taking is a physical checking to ensure the accuracy of perpetual inventory system. It is based on record. It requires a lot of recording thus it is expensive also. This system is adopted as shorter interval.

The perpetual inventory system is intended as an aid to inventory control because the balance of stock shown by bin cards or stock ledger should agree with the balance ascertained by physical checking.

The operation of the perpetual inventory system may be outlined as follows: -

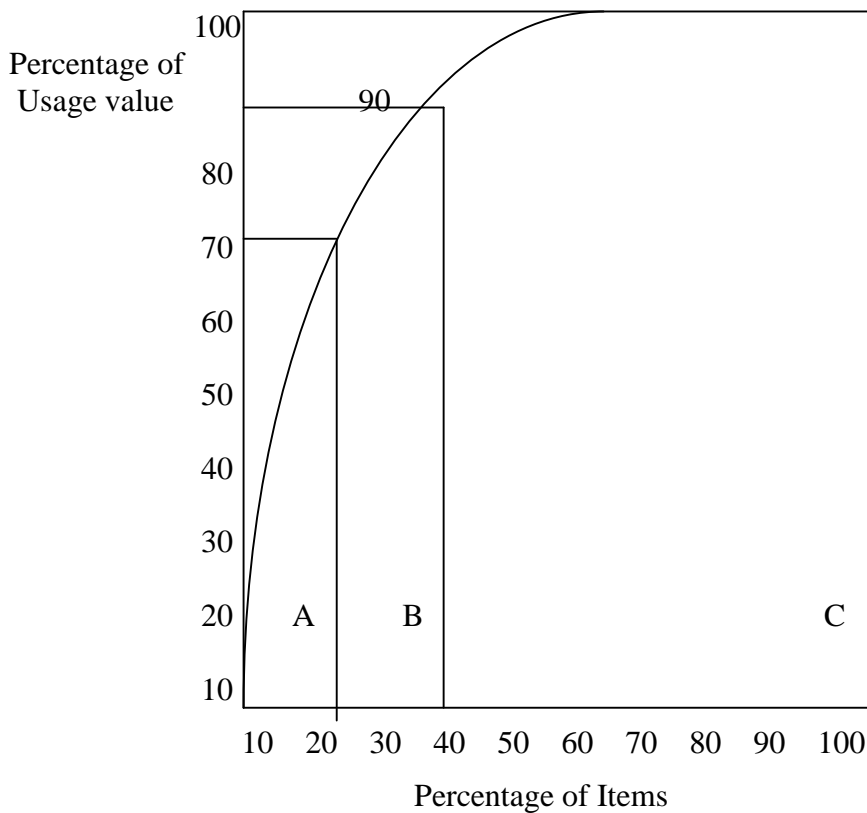
- a. The stock records are maintained and up-to-date posting of transactions is made there in so that current balance may be known at any time.
- b. Different sections of the stores are taken up by rotation for physical checking.
- c. Stores received but awaiting inspection aren't mixed up with regular stores at the time of physical verification because entries relating to such stores have not yet been made in the stock records.
- d. Notice of the particular items to be verified each day.
- e. The physical stock available in the store after counting weighting measuring or listing as the case may be is properly recorded by any of the following three methods. They are:
 - (a) Record in Bin Cards
 - (b) Inventory tags
 - (c) Stock Verification sheets.

2.2.1.8 ABC Analysis

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

Graphic Presentation of ABC Analysis

Figure No: 3



In above map, a level of material store low quantity but its value is higher than B level material store high-level quantity but lower value and C level material store the highest level of quantity but its value is lowest. It means store maintain at category wise and store maintain at different levels. In ABC analysis firstly we have to plan properly of all inventories items into 3 categories.

The items in A, B& C classes can be compared in the following tabular form (*Goel, 1999: 307-308*)

Table No: 2.2

Showing the items on the basis of ‘Always Better Control’

A	B	C
Maintains close control	Maintains moderate control	Maintains less control
Size of order based on calculated required	Size of order based on usage	Size of order based on the level of inventory
Procured from many sources	Procures from two or three source	Procured from two sources
Keeps records of receipt	Keeps records of receipt And usage	No records are kept
More effort to reduce lead time	Moderate effort	Minimum effort
Close checks on schedule revision	Some check on changes in need	No checks against on need
Frequent ordering	Less frequent ordering	Bulk ordering
Continual expediting	Expediting for prospective shortages	No expediting
Accurate forecasts	Less accurate forecasts	Approximate forecasts
Low safety stock for less than 2 weeks	Large safety stoke up to 2 to 3 month	Large safety stock for more Than 3 month
High consumption value	Average consumption value	Low consumption value

The following points should be kept be in mind for ABC analysis (*Goel, 1999:308*):

- Where items can be substituted for each other, they should be preferably treated as one item.
- More emphasis should be given ton the value of consumption and not to price per unit of the item.

- The entire item consumed by an organization should be considered together for classifying as A, B, or C instead of taking them as spares raw-materials, semi-finished and finished items and then classifying as A, B, or C.
- There can be more than three classes and period of consumption needn't necessarily be one year.

The following are the step for classes of items as A, B or C.

1. Take a representative sample of stocks items.
2. The annual usage value is calculated for each item to be classified by multiplying the quantity used with the unit price of the item.
3. The usage values in the step (2) are arranged in descending order.
4. Calculate the cumulative total of the number of items and the usage value obtained in step(3)
5. Find the percentage of the value obtained in step (4) the grand total of the corresponding columns.
6. Percentage of items are taken on x axis and the corresponding usage value percentage on y arises to plot various point on graph paper and to draw a smooth curve.
7. Mark the points x and y where the slop of the curve change sharply. The usage value and the percentage of items corresponding to these points will determine the items to be classified as A, B, or C.

2.3 Different Cost Concepts

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

2.3.1 Carrying/Holding Cost

Total carrying cost generally increases in direct proportion to the average amount of inventory carried. Inventory carried in turn depend upon the frequency with which orders are placed (*Weston, Bisley & Brigham, 1996:428*)

The cost associated with having inventories, which includes storage cost & so on. These costs generally increases in proportion to the average amount of inventory held.

To illustrate if a firm sales(S) unit per year if it places equal order 'N' times per year then $Q = A/N$ unit will be purchased with each order. If the inventory is used evenly over the year & if no safety stocks are carried then the average inventory 'A' will be,

$$\begin{aligned}\text{Average inventory (A)} &= \text{Units per order}/2 \\ &= S/N = Q/2\end{aligned}$$

Defining the annual percentage carrying cost as C, annual total cost (Tcc) as the percentage carrying cost 'c' times, price per unit PP times the average inventory in units 'A'

$$\begin{aligned}\text{Total Carrying Cost (TCC)} &= C \times PP \times A \\ &= C \times PP \times Q/2\end{aligned}$$

The inventory carrying costs are further explained as below: -

2.3.1.1 Capital/ Opportunity Cost

This consist of expenses raising funds (interest on capital) to finance the acquisition of inventory if funds weren't locked up in inventory, they would have earned a returns. This is opportunity cost fund or financial cost components of the cost (*Weston, Bisley & Brigham; 1996: 428*)

Funds associated with inventories aren't available for other uses; therefore an opportunity cost is determined by the alternative use to which the funds could be put.

For example: From the alternative uses if firm can earn 10% return then the capital cost of inventory is 10%.

2.3.1.2 Handling Cost

This size of consignments and the material handling facilities in the store determines these cost up to a certain level of inventory size the per unit handling beyond that the level the per unit handling cost starts increasing.

2.3.1.3 Storage Cost

The Cost associated with maintenance of inventory is storage cost. These include expenditure made on inventory staff, expenditure on providing various facilities like heating, lighting, floor space, shelves and racks, bins and containers material handling equipment's and other provisions for safe and proper storage of items. These costs generally depend upon the volume to value ratio of an item.

2.3.1.4 Depreciation cost

In every organization, the value of capital investment decreases with time. Thus, there is a tendency among organization to reduce its capital investments on machines and other equipment. The depreciation cost is thus reduced. Naturally the desired amount of production with reduced number of machines can be obtained by running the machines in slack period increasing the size of inventory.

2.3.1.5 Spoilage and Shortage Cost

Many products deteriorate overtime in storage. The precise nature of the deterioration varies from product to product but whatever the causes, it represents reduction in company's assets and such in a cost of holding inventories. This is termed as spoilage cost (*Ezra 1995: 34*).

2.3.1.6 Insurance and Taxes

Many of the goods in inventory requires insurance and it should be included in inventory holding costs whether outside, insurance is carried or inventory is self 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 on various data's through the year. The inventory a firm has one hand those data's the higher their tax bill will be. Where such tax and effect prudent inventory management may dictate period reduction in inventory to coincide with the data's on which the assessment are made (*Megee, 1990: 44*).

2.3.1.7 System Cost

Another type of inventory carrying cost, which is associated with the administration of inventory system, is known as system cost. These cost incurred for gathering information, supervision, physical stock checking and maintaining the record keeping equipment cost. It is difficult to determine whether these expenses will be high or low except by making a comparison amount actual inventory system (*Handling and Whitin, 2004:17*).

2.3.2 Ordering Cost

It is assumed that carrying cost are entirely variable & increases in direct proportion to the average size of inventory, ordering cost usually are fixed regardless of average size of inventory. For example, the cost of pacing and increasing in an order generally inter office memos, using fax transmission or long distance telephone call and taking delivery-essential are fixed regardless of average size of inventory (*Weston, Bisley & Brigham, 1996:429*).

In practice, the cost per order generally contains both fixed and variable components, since a portion of the cost such as that of receiving and inspecting the order normally varies with the quantity ordered. Ordering cost may differ in the sense of inventories nature. In case of raw material, ordering cost involves the clerical cost in placing and order as well as certain cost of receiving and checking the goods once they arrive. For finished goods, ordering cost involves scheduling a production run and for work-in-progress ordering cost is likely to involve nothing more than record keeping.

Furthermore, ordering cost is the cost involved in placing & receiving an order or purchased items. The expenses involved in this cost are: -

- a) Cost of placing an order
- b) Requisitioning cost

- c) Transportation/ Shipping cost
- d) Receiving, inspecting and storage cost
- e) Sales tax, customs etc
- f) Clearing and forwarding cost
- g) Insurance of raw-material
- h) Stationary cost
- i) Bank commission/LC charges etc.
- j) Telephone/Fax/Postage expenses to follow up
- k) Cost incurred when raw materials are in transit

Ordering cost increases with the number of orders, thus more frequency in Inventory acquired, higher the firms ordering cost. On the other hands, if the firm maintains large inventories level, there will be a few orders placed and ordering cost will be relatively small. Thus ordering costs decreases with the increasing size of inventory. The fixed costs associated with ordering inventories as 'o' and we placed 'n'

Ordering per year, the total ordering cost is given as: -

$$\begin{aligned} \text{Total Ordering cost (TOC)} &= O \times N \\ &= O(S/Q) \end{aligned}$$

Where,

TOC = Total Ordering cost

O = Fixed cost per order

Q = Inventory quantity for each order

2.3.3 Stock out Costs

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

money paid to re-order goods and notification to customers when goods arrive (*Everett, Adams & Jebert, 2000: 462*).

2.4 Inventory Model

2.4.1 Periodic Re-view System

The system is sometimes called the constant cycle system. The system has the following characteristics (*Lucey T., 2004: 183*).

Stock levels for all parts reviewed at fixed intervals e.g. every fortnight where necessary a replenishment order issued. The quantity of the replenishment order is not a previously calculated EOQ, but is based upon; the likely demands until the next re-view, the present stock level and lead-time.

The replenishment order quantity seeks to bring stocks up to a pre-determined level. The effect of the system is to order variable quantities at fixed intervals as compared with the re-order level system.

2.4.2 Replenishment Model

Replenishment models of base stock models are effective in many real inventory situations, particularly when delivery lead times are long and shortage cost are extremely high or when stock counts are infrequent (*Joseph and Ernest, 1970: 362-363*).

This model is also called maximum liability model. Inventory costs are not considered explicitly in the replenishment system and there is no fixed re-order quantity instead, inventory is reviewed at periodic intervals, and if there have been any sales since the last re-view, an order is placed. In this model, there is only one number to be determined: M, The base stock or maximum inventory level, SW is mean weekly demand, L is the mean lead time in weeks, R is the Inventory review time in weeks, and B is the buffer stock in units. M must certainly be larger than LSW, which is just sufficient to meet average demands until the ordered goods arrived. We therefore see the replenishment level is determined by the following formula:

$$M = SW (L + R) + B$$

Depending on whether lead time is greater than or less than the review time, one of the following two rules is used for determining the re-order quantity (q) under the replenishment Model: -

$$Q = M - I \text{ if } L < R$$

$$Q = M - I - T \text{ if } L > R$$

Where,

I = Inventory at a review time (in units)

T = Number of unit in transit (previous orders which haven't yet arrived)

The buffer stock B must be sufficient to guarantee an adequate service level in the face of variations in both demands and lead-times. If we take the replenishment times as being the total of lead-time and review time and have a measure of the distribution in demand over.

When lead times are long compared to review times, larger buffer stocks are required than in the case where the reverse is true. For long times (and particularly for items which have a large shortage costs), one finds replenishment models in which orders are placed when an items (or a number of items) is sold.

2.4.3. Inventory Models with Uncertainty

In simple inventory models, we assume that demand and supply, lead times are constant, in many real world applications, demand can not be predicted with certainty and lead times often vary from one order to another. A consequence of this variation is that stocks outs may occur if future demand exceeds our estimate of if an order arrives later than expected. It is possible to reduce the risk of stock-outs by carrying larger inventories called safety stock or buffer stocks; however additional costs are incurred by trying up additional funds in inventories and risking the possibility of obsolescence. The objective then, is to develop a model for determining inventory policy that balances these risks and minimizes expected total incremental costs.

2.5 Review of Previous Studies

Inventory Management is a wide subject but no-one pay attention in this field. Many modern techniques to control inventory management have been realized. In Nepal, Many public & private enterprises have been established as well as analysis has been made but only the aspect of financial performance. A few researchers made the researchers made the research in inventory management of manufacturing company. An attempt is made to review some of the researches which have been submitted in inventory management in the context of Nepal.

Ms. Pathak (2007) carried out a research study on “**Inventory Management of Hetauda Cement Industries Limited**” to examine the profitability and efficiency of HCIL regarding inventory management. To find out the efficiency level, she has investigated various inventory related factor such as raw-materials consumption and collection procedure, store and warehousing techniques, production and supply techniques and its schedules etc.

Ms. Pathak has used both secondary and primary data for analysis of the inventory management system of HCIL. She has applied all accounting, financial and statistical tools to evaluate and analyze the gathered data. Some of her remarkable findings were:

-) HCIL is not running even in its average capacity due to lack of raw-materials.
-) The company could not keep proper balance between yearly demand and supply trend so the inventory stock is fluctuating every year.
-) The company could not apply even basic inventory management system, so it needs to apply the inventory control system to strengthen the organization.

Mr. Dahal (2006) has carried out a research study on “**A Comparative Study on Inventory Management of Dabur Nepal Pvt. Ltd. and Nepal lever Ltd**”. His aim of study was to examine and find out the present position of inventory management of both the companies.

Mr. Dahal has used both primary and secondary sources of data along with previous studies, articles and published/unpublished official records of both organization for the sake of

examination and analysis. He used various accounting, financial and statistical tool to analyze the data. His findings were:

-) Both the organizations use raw materials from local, India and third countries where they are unable to practice inventory management.
-) Purchasing of raw materials in NLL is fluctuated whereas DNPL has increasing trend of raw materials procurements because of sound management of demand and supply.
-) They both have invested huge amount in inventories but do not apply dynamic inventory management system.
-) The researcher has suggested that the both companies should apply the control of stock level to get better performance.

Mr. Upadhy (2005) has been conducted “**A Study on Inventory Management in Janakpur Cigarette factory Limited**”. The study was to analyse the performance of JCF on the basis of demand and supply trend regarding inventory management. He has tried to identify the present practice of procurement of raw materials, maintenance of work in process stock and finished stock etc.

The researcher has collected related data from the factory using published and unpublished official records. He also used journals, magazines, government and universities publications as a source of secondary data. Mr. Upadhy used both qualitative and quantitative tools of various aspects to present and analyze the data. Some of his important findings are:

-) The factory is highly dependent upon raw material suppliers, it means that the company is unable to find competitive source of raw materials.
-) The company is always facing stock out, overstock and understock problems, it is all due to lack of appropriate application of inventory management.
-) The factory is running under traditional productions system, which has arisen problems in implementation of scientific inventory system.

-) The top level management should pay attention in budgetary and financial analysis along with purchasing, production and financial aspects of inventory management to boost up the organization.

Mr. Niraula (2004) has conducted “**A Study of Inventory Management in Dairy Development Corporation, with special reference to Biratnagar Milk Supply Scheme**” to determine the organizational efficiency in terms of Inventory Management. His main objective of the study is was to identify the organizational efficiency in terms of Inventory Management. His main objective of the study was to identify the inventory quality maintenance process of BMSS.

Mr. Niraula has collected both primary and secondary data for the sake of examination and interpretation. Primary data has been obtained through inquiries, informal talks and interviews with officers whereas secondary data were collected from periodic bulletins, journal reports, and published/unpublished records. He used various analytical tools to make the research findings. Some of his remarkable findings are:

-) BMSS was unable to practice optimum order quantity in material procurements.
-) The project is running without practice of any scientific inventory management system which has burden loss in profitability of the company.
-) Top level management should pay due attention to improve efficient application of inventory management to reduce procurement costs, carrying costs and production costs.

2.6 Research Gap

These days, the new inventory management tools and techniques have been increased dramatically. Progress in computer application and software development has made to the point that powerful and advanced computer software available in the market to control the inventories. Besides it, there are many inventory control tools and techniques that have been developed to optimize the inventories reduce inventory costs.

Many studies have reported that, implementation of scientific inventory management is essential in Nepalese business organizations. However, there has been very little research reported on the effectiveness of scientific inventory management and its impact on profitability. The purpose of the present study is therefore to ascertain the effective use of scientific inventory management tools to reduce costs and increase profitability of Organization.

CHAPTER III

RESEARCH METHODOLOGY

We need appropriate research methodology to achieve the objective of the study. The study on the inventory management of UCIL concentrates in the issues of efficiency to maintain inventory management systematically. So that inventory can be controlled in right way and inventory cost can be minimized. The research methodology comprises introduction, research design, population and sample, nature and sources of data, data collection procedures, analytical tools and methods of analysis and presentation.

3.1 Introduction

Research methodology is the first steps to be taken for the study of the problem by a researcher. This is full path of the study which leads to the findings and fulfills the objective of the research study. Followings are steps of research methodology used in this study.

-) Research design
-) Nature and Sources of Data
-) Population and Sample
-) Data collection Procedures
-) Analytical Tools
-) Methods of Analysis and Presentation

3.2 Research Design

The research design is a plan and strategy to obtain the answer of research question through analysis of collected data and information. Only a suitable research design can produce effective answer to the related research questions.

The study is mainly concentrated on case study of inventory management and its impact of profitability on UCIL and data are mostly secondary. Therefore as per the nature of the study, analytical and descriptive research design has been followed.

3.3 Nature and Sources of Data

The study is basically conducted on secondary data but primary sources have been used as per the requirements of the study. Depending on the nature of data and information, following sources have been used for research purpose:

i) Primary Sources:

- Direct interview and Supplementary questionnaires have been conducted.

ii) Secondary Sources:

- Official records and publications of UCIL.
- Published and Unpublished records
- Government and non-government publications
- Previous Studies etc.

3.4 Population and Samples

All the manufacturing Public enterprises according to the book “Targets and Performances of Public Enterprises – Government of Nepal, Ministry of Finance 2007” were considered as the total Population for the study.

Out of 7 manufacturing PEs listed in the country, only one PE was adopted to select. The table 3.1 clearly describes head office of total PEs, total population, sample drawn and sample percentage. The research has been conducted to identify the applied techniques used to acquire and to manage the inventories, to examine the profitability & efficiency, and to analyze the different aspects of inventory management in Udayapur Cement Industry Ltd

Table No: - 3.1

Total Population, Sample and Sample Average

S.N.	Mfg. PEs(Industries)	Head Office	Selected PEs	%
1	Dairy Development Corporation	Lainchor,Kathmandu		
2	Herbs Production and Processing Ltd.	Koteshwor,Kathmandu		
3	Hetauda Cement Industry Ltd.	Hetauda,Makwanpur		
4	Janakpur Cigarette Factory Ltd.	Janakpurdham,Dhanusa		
5	Nepal Drugs Ltd.	Babarmahal,Kathmandu		
6	Udayapur Cement Industry Ltd	Jaljale,Udayapur	1	
7	Nepal Orind Magnesite Pvt. Ltd	Lamosangu, Dolakha		
Total Population 7			1	14.28%

Sources: - "Targets and Performances of PEs- Government of Nepal, Ministry of Finance 2006"

3.5 Data Collection Procedure

Secondary data are collected from published/unpublished materials and records of UCIL whereas primary data are collected through questionnaire, interview and discussion with the responsible head as well as managerial person of the company. Collected data has been gathered and tabulated in order to make analysis.

3.6 Analytical Tools Applied

Secondary data collected in raw form are classified and tabulated in the required form. The following accounting/financial tools and statistical tools have been used for analysis and interpretation of data.

3.6.1 Accounting/Financial tools

There are different types of financial tools that are applied in order to evaluate and examine inventory management in the research process are given below.

a. ABC Analysis

This technique is used to identify various items of inventory for the purpose of inventory control. In this analysis, we divide the inventory items into three groups A, B and C. According to investment and valuable, inventories are classified A, B and C groups.

b. EOQ Model

This model is used to find the economic quantity that we order to purchase inventory once. It can be computed by using following formula:

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

Where A = Annual Consumption/Demand

O = Ordering cost per order

C = Carrying cost per order

c. No. of Order Size

This formula is used to find out how many times we order with EOQ annually. This can be computed as under:

$$\text{No. of order size} = \frac{\text{Annual Consumption/demand}}{\text{EOQ}}$$

d. Order Size

It is calculated by using following formulae:

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

e. Average Inventory

It is calculated by using following formulae:

$$\text{Average Inventory} = \frac{(\text{Opening Inventory} + \text{Closing Inventory})}{2} \quad \text{OR} \quad \frac{\text{Order Size}}{2}$$

f. Total Cost

It refers total inventory cost. It can be computed as under:

Total Cost = Total carrying cost + Total ordering cost

Where,

Total Carrying Cost = Average Inventory x Carrying Cost per Unit

Total Ordering Cost = Ordering Cost per Order x No. of Order

g. Re-Order Point

It is that point at which the firm places an order with suppliers for procuring an additional inventory equal to EOQ. This model is calculated to find out at which point firm re-order. It can be computed by using following formulae:

ROP = Usage rate x Lead time [When safety stock is not mentioned]

ROP = (Usage rate x Lead time) + Safety stock [When safety stock is mentioned]

h. Ratio Analysis

i. Inventory Turnover Ratio

It measures the efficiency on inventory management and how quickly inventory is sold. It indicates the relationship between cost of goods sold & inventory level. The formula is: -

$$\text{Inventory Turnover Ratio} = \frac{\text{Cost of Goods Sold}}{\text{Average Inventory}} \quad \text{OR} \quad \frac{\text{Sales}}{\text{Closing Stock}}$$

ii. Inventory Holding Days (DIH)

It measures how many days the firm holds the inventory. The formula is: -

$$\text{Inventory holding days} = \frac{\text{Average Inventory}}{\text{Cost of Goods Sold}}$$

iii. Raw Material Turnover Ratio

This ratio is examining with the firm converts raw materials into WIP and WIP into finished goods. The formula is: -

$$\text{Raw Materials Turnover Ratio} = \frac{\text{Material Consumed}}{\text{Average Raw Material Inventory}}$$

iv. Inventory to Total Assets Ratio

It measures the relationship between inventory and total assets. This ratio can be computed for what percentage of inventory holds as a assets. The formula is: -

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

v. Inventory to Net Working Capital Ratio

It measures the relationship of closing stock of finished goods and working capital. This ratio explains that percentage of working capital is represented through closing stock of finished goods and is this closing stock excessive so that liquidity resources of the business enterprises get reduced. The formula is: -

$$\text{Inventory to Net Working Capital Ratio} = \frac{\text{Closing Stock}}{\text{Net working capital}}$$

vi. Inventory to Current Assets Ratio

It measures how much inventory firms should keep as current assets. It shows the relationship between inventories to current assets. The formula is: -

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

vii. Inventory to Profit Ratio

This ratio tells how much inventory is needed to generate a unit of profit. The formula is:

$$\text{Inventory to Profit Ratio} = \frac{\text{Material Consumed}}{\text{Gross Profit}}$$

3.6.2 Statistical Tools

Many kinds of statistical tools can be applied to examine the relationship between financial data of a company. In this study the following statistical tools have been taken into consideration.

a. Mean

It is calculated by dividing the no. of variables to no. items, symbolically,

$$\bar{X} = \frac{\sum x}{N}$$

Where \bar{X} denotes mean/average.

$\sum x$ denotes the sum of all variables and N denotes no. of items observed.

b. Standard Deviation (SD)

It is a measure of the deviation of each individual firm the mean it express mathematically how far the individual values deviated or differ from the mean. It is calculated using the following formula:

$$SD = \sqrt{\frac{\sum (d)^2}{n}}$$

Where SD , N and d denotes standard deviation, no. of observations and deviation from assumed mean respectively.

c. Coefficient of Variance (CV)

It measures corresponding relative of variation. CV is computed as under:

$$CV = \frac{SD}{\bar{X}} \times 100$$

d. Coefficient of Determination

It measures the degree of correlation between two variables, one dependent and another independent variable. Symbolically,

$$r^2 = \frac{a^2 \sum y^2 - (\sum y)^2}{\sum y^2 \sum ny^2}$$

Where,

$$a = \frac{\sum y \sum x}{\sum x^2}$$

$$b = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}}$$

e. Regression Analysis

Using the relationship between a known variable and unknown variable to estimate the unknown one is called as regression analysis. It is an extremely useful tool specially in problems of business and industry involving predictions. It is used to determine the statistical relationship between (or more) variable on the basis of others.

a) $Y_1 = a + b X_1$

Where Y_1 = Production, X_1 = Selling price per unit, a & b = regression coefficients

b) $Y_2 = a + b X_2$

Where Y_2 = Closing stock of finished goods, X_2 = Sales, a & b = regression coefficients.

c) $Y_3 = a + b X_3$

Where, Y_3 = purchase of Raw-materials, X_3 = Sales, a & b = regression coefficients.

d) $Y_4 = a + b X_4$

Where Y_4 = Operating profit, X_4 = Closing stock of Raw-materials, a & b = regression coefficients.

f. Correlation Analysis

The term Correlation indicates the relationships between two such variables in which with changes in the values of one variable, the values of the other variable also change.

If two or more quantities vary in sympathy so that movements in the one tend to be accompanied by corresponding movements in the other(s) then they are said to be correlated.

Karl Pearson, the greatest biologist and statistician, has given a formula for the calculation of coefficient of correlation. According to it the coefficient of correlation of two variables is obtained by dividing the sum of the products of corresponding deviations of the various items of the series from their respective means by the product of their standard deviations and the number of pairs of observations.

The formula of Karl Pearson's coefficient of correlation is: -

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

Probable error of coefficient of correlation

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

The value of r in the universe would be:

$$r \pm P.E.$$

CHEPTER IV

DATA PRESENTATION AND ANALYSIS

Introduction

Inventory management is a part of overall management process of an organization. It is the formal management of the organization in terms of minimizing investment on inventories and maximizing the organization's overall earnings. Profit is major element of each and every business endeavor for its existence. Survival and further development to fulfill social and organizational for expectations. To achieve the profit, one of the major tasks of an organization is to control over it's investment on inventories

The basic objective of this chapter is to present and analyze the collected information for reasonable recommendations. In this section, gathered data has been examined and analyzed using various accounting and statistical tools in order to find out the organizational effectiveness in terms of inventory management.

In this section, first part is analysis of inventory management and second part is analysis of its effect on the present position of inventory management by using different accounting financial tools.

4.1 Analysis of Inventory Management of UCIL

Inventory management is the planning directing. Controlling and coordination of those activities which are concerned with inventory requirement. The major functions of inventory management are planning and programming for material purchase. Store and stock control. Receiving and issue of the material, transportation and material handling of the material and value analysis etc.

Especially the procedure of inventory management covers the activities such a purchasing, receiving, store keeping, issuing and pricing.

4.1.1 Purchasing

The purchasing is scheduled according to requirements of various departments of the organizations. UCIL has an installed capacity of producing 275, 000 metric tons of cement per year. The basic raw materials required for the cement industry are (i) lime stone (ii) Gypsum (iv) coal (v) Clay (vi) bags, water and electricity etc. all these raw materials are must locally available.

The factory has regular supply of raw materials like like lime stone, clay & water from their own natural stones. But raw materials like gypsum, iron core, coal and bags are imported from outside the country. The later raw materials are purchased through agents under tender agreement. Therefore UICL is in difficulty to computing the re-order level of raw materials according to its consumption.

4.2.1 Collection of Raw Materials by UCIL

The level shows yearly collection trend of raw materials by UCIL in different years.

4.2.1.1 Collection of Raw Materials in Quantity (in MT)

Table No: 4.1

Collection of raw materials in quantity (in MT)

F. Y.	Lime stone	Iron ore	Gypsum	Coal	Polly bag	Total	Change %
2055/056	156546.430	2239.040	3968.12	17779.77	490.98	181025.14	
2056/057	82428.473	1796.860	2193.12	14978.88	261.40	101658.73	43.84
2057/058	190000.000	3849.100	4579.05	21340.32	459.28	220227.75	21.66
2058/059	150221.727	1876.10	3489.92	23308.34	497.51	179393.60	0.90
2059/060	156463.570	1814.280	4772.26	24035.98	433.71	187519.80	3.58
2060/061	194656.280	3780.460	7711.24	24627.36	506.96	231282.30	27.76
2061/062	18812.03	1713.58	5893.24	33507.29	514.48	230440.62	27.30
2062/063	187252.000	4356.660	10833.50	29116.90	571.90	232130.96	28.23
2063/064	178464.690	1589.570	8438.52	31986.12	494.20	220973.10	22.07
2064/065	207335.850	1727.84	3543.61	33293.05	477.10	246377.45	36.10

Source: unpublished official record

Form the table it is observed that purchasing quantity of lime stone occupies highest significant among all raw materials which is followed by coal. Gypsum, iron ore and Polly bag in all the years of the study period. It is also found that the total quantity procured for each type of raw materials were neither constant in quantity nor had a constant trend during the study period. It is also reflected by compared to the base year 2055/2056 as base year. As compared to the base year 2055/056 the annual change percentage increased in fiscal year 2057/058, 2059/060, 2060/061 2061/062, 2062/063, 2063/064 & 2064/065 by 20.66%, 3.58%, 27.76%, 28.23%, 22.07% & 36.10% respectively. However it is decreased by 43.84% in fiscal year 2056/057 and by 0.90% in the fiscal year 2058/059.

From the above analysis it is found that procurement of raw materials in UCIL showed fluctuating trend. It indicates that there is lack of appropriate purchasing policy in organization. UCIL has not given proper attention to this problem which ultimately has impact on the production.

4.2.1.2 Collection of Raw Materials in Terms of Values

Table No. 4.2

Collection of raw materials in terms of values (Rs)

Fiscal year	Lime stone	Iron core	Gypsum	Coal	Polly bag	Total	Change%
2055/056	12530915.94	2229191.89	6071524.29	52360838.71	20463239.6	93655710.00	
2056/057	19975304.01	6485314.86	7842864.19	9479184.66	32902042.0	69626709.71	25.65
2057/058	29602000.00	5103030.16	7924012.78	70054383.55	24196353.6	166879780.7	78.1
2058/059	21692017.38	2586376.6	6622601.59	72869129.21	24014182.1	127784306.4	36.4
2059/060	38986340.60	2661794.41	12126571.65	82636997.99	2007104.2	138418808.8	47.8
2060/061	23025891.36	5578158.31	17063354.75	88413306.63	28309017.4	162389725.4	73.3
2061/062	25305532.32	2565197.19	13829326.93	142497453.9	26702665.9	210900176.3	125
2062/063	34032382.29	6735162.92	25644690.64	114066620.4	27597408.7	208076264.9	122
2063/064	18717537.32	2512124.80	19198983.17	126708091.2	19837673.5	186974410.1	99
2064/065	15345962.94	2852687.70	7997935.87	131433687.6	2093069.34	159723343.4	70

Source:-Unpublished official record

The above table shows the purchase of the different raw materials in term of their value over the ten years period from 2055/056 to 2064/065. It reveal that UCIL purchased different raw materials costing Rs.93655710.00 in fiscal years 2055/056. It is reflected by annual change percentage taking F/Y 2055/056 as base year. It is Rs. 6962709.71 in the F/Y 2056/057 which is decreased by 25.66% then the base year 2055/056. However it increased by 78.18%, 36.44%, 47.80%, 73.39%, 125.19%, 122.17%, 99.66% & 70.54% in the FY 2056/057, 2057/058, 2058/059, 2059/060, 2060/061, 2061/062, 2062/063, 2063/064, 2064/065 respectively.

From the above analysis it is observed that the materials consumption in the factory is erratic, as the raw materials has a direct relation with production as well as sales also were fluctuating over the study period. This indicates that there is no sound purchasing policy in the organization. The procurement of raw materials is increasing except in the fiscal year 2056/057, but it is not as much satisfactory. The increasing rate is also in fluctuating trend in some year it is over then hundred percentages like 125% & 122% in F/Y 2061/062 & 2062/063. This situation may be due to lack of proper planning for purchasing of materials. On an inquiry whether the company is using the modern procurement technique like properly maintained stock level, fixing level as well as economic order quantity the authority didn't provide satisfactory answer. From this it is cleared that the company has neither maintained the maximum and minimum stock level nor fixed the EOQ level.

To solve this problem to some extent there should maintain maximum stock level. Minimum stock level and reorder level as well as economic lot size. This helps the management to strike balance between liquidity and profitability of UCIL.

4.2.2 Consumption of Raw Materials and Production of UCIL

4.2.2.1 Consumption of Raw Materials in Terms of Quantity

Table No: 4.3

Consumption of raw materials in terms of quantity (MT)

Fiscal year	Lime stone	Iron core	Gypsum	Coal	Polly bag	Total	Change%
2055/056	168323.61	2760.27	4702.41	22273.43	488.87	198548.69	
2056/057	105281.10	1085.71	2457.53	14822.86	260.15	123880.35	37.61%
2057/058	181276.12	2752.53	4413.54	20165.87	418.82	209026.88	5.28%
2058/059	180688.01	2261.92	4811.85	23879.11	497.63	212138.53	6.84%
2059/060	161777.46	2125.45	4239.71	23608.13	425.71	215358.87	8.47%
2060/061	197507.30	2990.54	5346.80	28615.83	505.07	234965.55	18.34%
2061/062	195306.20	2892.38	7469.64	28938.11	500.72	235107.05	18.41%
2062/063	177466.16	2394.89	10586.19	30676.54	546.23	221370.02	11.64%
2063/064	181733.31	2711.95	5194.17	31139.92	515.67	221295.03	11.45%
2064/065	183132.59	3023.79	3130.93	34719.74	476.09	224483.14	13.06%

Source: - unpublished official record

Form the above tabulation we know the trend of consumption of different raw materials like lime stone. Iron core, coal and Polly bag in different fiscal year in terms of their quantity. The consumption of total quantity of raw materials showed erratic trend. The consumption showed 198548.56 MT in F/Y 2055/056 whereas it decreased by 37.60 i.e. 123880.35 MT. in F/Y 2056/057. But in remaining fiscal year from 2057/058 to 2064/065.it increased by 5.28%, 6.84%, 8.47%, 18.34%, 18.41%, 11.64%, 11.45%, &13.065 respectively.

From the above analysis it is obvious that raw materials consumption pattern in factory was fluctuating from year to year like raw materials purchasing pattern. This shows that the company is not able to utilize its existing capacity in the production of cement. As consequence the company is not only unable to meet the market demand of cement but also increase the cost of production of cement. But utilization ratio of installed capacity does not have any impact on fixed cost of company. Even though UCIL is running on low production capacity but the fixed cost of company had not decreased. Therefore both the cases proved that poor inventory management always have negative impact on production cost. So the company should bear loss instead of profit and fades the glory of company.

4.2.2.2 Consumption of Raw Materials in Terms of Values

Table No:-4.4

Consumption of raw materials in terms of values (Rs)

Fiscal year	Lime stone	Iron core	Gypsum	Coal	Polly bag	Total	Change %
2053/054	13473676.07	2748132.33	7193180.32	65594522.77	20375298.26	109384809.75	-
2056/057	25576568.42	3821133.40	8788433.51	93804488.49	30635333.87	162625957	48.67%
2057/058	28242094.39	3649228.03	7637609.31	66198991.47	22064804.12	127792727	16.83%
2058/059	26092357.22	3118267.11	9131150.66	74653521.08	24000716.26	136996012	25.24%
2059/060	40310542.64	3118317.06	10773319.65	81166019.70	19700611.47	155068810	41.67%
2060/061	23363739.91	4412611.16	11831354.42	102732100.39	28203433.75	170543239	55.91%
2061/062	26175824.22	4329835.73	17519653.16	123065963.83	25988106.98	197079383	80.17%
2062/063	28842065.98	3702380.89	25059569.23	120176572.51	26358734.31	204139322	86.62%
2063/064	19060353.13	4285919.72	11817567.82	123356012.60	20700206.95	179220060	63.84%
2064/065	13554584.37	4992319.05	7065967.72	137065931.99	20886509.18	183565312	67.81%

Source: - Unpublished official record

The above table depicts the lively picture of consumption trend of various types of materials in terms of monetary value over the study period from 2055/056 to 2064/065. The consumption trend is not regular. Various basic raw materials consumed by the factory come to total of rs 109384809.75 in fiscal year 2055/056. from fiscal year 2055/056 to 2064/065, the consumption values of raw materials

increased by 48.67%, 16.83%,25.24%, 41.67%, 55.91%, 80.17%, 86.62%, 63.84% &67.81% in fiscal year 2055/056, 2056/057, 2057/058, 2058/059, 2059/060, 2060/061, 2061/062, 2062/063, 2063/064 & 2064/065 respectively. In fiscal year 2057/058 there is lowest increase in consumption values of different raw materials i.e.16.83% than the base year whereas there is highest increase in consumption values of different raw materials i.e. 86.62% then the base year in fiscal year 2062/063.

From the above analysis the consumption of different raw materials shows increasing trend as compared the base fiscal year 2055/056.

4.2.3 Consumption of Raw Materials & Production of Cement

Table No. 4.5

Consumption of raw materials & productions of cement in terms of quantity in (MT)

Fiscal year	Consumption of raw material		Production		Ratio of production & consumption
	Total Qty	% change	Total Qty	% change	
2055/056	19858.60	-	118394.13	-	1:0.596
2056/057	123880.35	-37.61	77052.08	-34.92	1:0.622
2057/058	209026.88	5.27	97432.00	-17.71	1:0.466
2058/059	212138.53	6.48	118039.72	-0.30	1:0.557
2059/060	215358.87	8.46	106966.75	-9.65	1:0.497
2060/061	234965.55	18.34	124985.30	+5.57	1:0.532
2061/062	235107.05	18.41	125899.31	+6.34	1:0.536
2062/063	221670.02	11.64	136988.05	+15.71	1:0.618
2063/064	221295.03	11.45	128734.73	+8.73	1:0.582
2064/065	221295.03	13.06	118666.18	+0.23	1:0.529
Main					1:0.554

The above table shows the consumption of raw materials and its respective production of cement over the period of ten years from 2055/056 to 2064/065 in fiscal year 2055/056 factory consumed 198548.60 MT of raw materials to produce 118394.13 MT of cement. In F/Y 2056/057 factory consumed 123880.35 MT of raw materials to produce 77052.08 MT of cement. The total consumption was declined by 37.61% and production quantity of cement was also declined by 34.92% in comparison to 2055/056, which is supposed as a base year for the calculation. In fiscal year 2056/057, 2058/059 & 2059/060 the total consumption of raw materials were increased by 5.27%, 6.48% & 8.46% i.e. 209026.88 MT, 212138.53 MT & 215358.76 MT. but the production quantity of cement was decreased by 17.71%, 0.30% & 9.65% i.e. 97432.00 MT, 118039.72 MT & 106966.75 MT than the base year respectively. In case of other fiscal year 2060/061, 2061/062, 2062/063, 2063/064 & 2064/065 124985.30 MT, 125899.31 MT, 136988.05 MT, 128734.73 MT & 118666.18 MT of cement were produced by consuming 234965.55 MT, 235107.05 MT, 221670.02 MT & 224483.13 MT of materials respectively.

4.2.4 Trend of Material Cost and Cost Price of Cement

The material cost and cost price of cement per ton the last ten fiscal year is presented below.

Table No. 4.6
Material cost of cost price of cement per ton in (Rs)

Fiscal year	Material cost		Cost price per ton of cement		Difference
	price per ton	%change	Price per ton	%change	
2055/056	923.90	-	2664.37	-	1740.47
2056/57	1721.25	83.30	4619.18	73.37	2897.93
2057/058	1311.61	41.96	3208.58	20.43	1896.97
2058/059	1160.59	25.62	3300.09	23.86	2139.50
2059/060	1449.69	56.91	3638.60	36.57	2188.91
2060/061	1364.51	47.69	3651.87	37.06	2287.36
2061/062	1565.35	69.43	3875.30	45.45	2309.93
2062/063	1490.20	61.29	4079.30	53.11	2589.10
2063/064	1392.17	50.68	4111.30	54.31	2719.13
2064/065	1546.90	67.43	4515.77	69.49	2968.87

Source: - unpublished official record

The table shows the trend of materials cost and cost price of cement of UCIL. Materials cost include the cost of lime stone, coal, gypsum, iron ore and Polly bags and cost price of cement include cost of production and the selling and distribution overhead. In the fiscal year 2055/056 the materials cost per ton was 923.90 and the cost price of cement was Rs. 2664.37. There is different of Rs 1740.47 between materials cost and cost price cement. In fiscal year 2056/057 materials cost and cost price of cement was increased by 83.30% and 73.37% than the base fiscal year 2055/056 respectively. In fiscal year 2057/058 materials cost increased by 41.96% and cost price of cement was increased 20.43% in comparison to base year. During the fiscal year 2058/059, 2059/060 & 2060/061 material cost and cost price of cement was increased by 25.62%, 56.91% & 47.69% and 23.86%, 36.57% & 37.06% than the base year respectively. Again in fiscal year 2061/062 & 2062/063 materials cost was increased by 69.43% & 61.29% and cost price of cement was also increased by 45.45% & 53.11% in the comparison to base fiscal year 2055/056 respectively. In the fiscal year 2063/064 & 2064/065 the materials cost were Rs 1392.17 & 1546.90 the cost price of cement were Rs 4111.30 & 4515.77 respectively. The different between two costs were Rs 2719.13 & 2968.87 respectively.

From the above analysis it shows that the trend of material cost and cost price of cement are in increasing trend. From the above analysis it shows that the trend of material cost and cost price of cement are in increasing trend. From the above analysis it can be concluded that there is a high deviation in the amount of annual needs, collection and consumption. The annual production capacity is very far from the existing production volume. Due to this production cost per ton of cement is very high than the materials cost per ton.

Since Karl Pearson's correlation has been calculated for material cost per ton and cost price of cement the relationship is highly significant. The consumption is depicted in ANNEX no.6.

4.2.5 Trend of Consumption of Raw Materials and Sales of Cement

Table No. 4.7

Consumption of raw materials and sales of cement In terms of value (Rs)

Fiscal year	Consumption of raw material	Change %	Sales	Change %
2055/056	109384809.75	-	309788761.68	-
2056/057	162625957.69	48.67%	445084060.54	43.67%
2057/058	127792727.32	16.83%	327847367.14	5.83%
2058/059	136996012.33	25.24%	415197505.48	34.03%
2059/060	155068810.52	41.76%	366416871.15	27.74%
2060/061	170543239.63	55.91%	515452623.77	66.39%
2061/062	197079383.92	80.17%	539860115.50	74.27%
2062/063	20413932.92	86.62%	600095539.50	93.21%
2063/064	179220060.22	63.84%	586041884.00	89.17%
2064/065	183565312.31	67.81%	542170326.50	75.01%

Source: - unpublished official record

Above table shows the trend of consumption of raw materials and sales of cement in terms of value for different years from 2055/056 to 2064/065. The consumption of raw materials and sales trend is not stable. From 2055/056 to 2064/065 the consumption values of raw materials were increasing than base year. In fiscal year 2057/058 the lowest increase in consumption values of different materials that is 16.83% than the base year. In the fiscal year 2062/063 the highest increase in consumption values of different raw materials i.e. 86.62% than the base year. In fiscal year 2056/057, 2057/058, 2058/059, 2059/060, 2060/061, 2061/062, 2062/063,

2063/064, 2064/065 it increase by 48.67%, 25.24%, 41.76%, 55.91%, 80.17%, 63.84% & 67.81 than the base year respectively.

In the fiscal year 2055/056 the total sales of cement was Rs. 309788761.68, which is supposed as a base year for calculation. Sales of UCIL between the period of 2057 & 2064 were increased than the base year. In the fiscal year 2057/058 the lowest increase in consumption values of different raw materials that is 5.83% more than the base year. In fiscal year 2062/063 the highest increase in consumption values of raw materials, 93.21% than the base year.

The Karl Pearson's coefficient has been calculated for consumption of raw materials and sales of cement in terms of values. The relationship is highly significant. The computation is depicted in ANNEX no.5.

4.3 Analysis of Inventory of UCIL

4.3.1 ABC Analysis

ABC analysis is a widely used classification techniques to identify various items of inventory for the purpose of inventory control. This analysis is important that a firm should not exercise the same degree of control on all types of inventory. The researcher has to classify all types of raw materials on the basis of nature, the investment and importance of it. In this analysis they are categorized A, B and C classes. Generally group A involve the largest investment. Therefore we have to apply most rigorous and sophisticated inventory control. Group C involves relatively small investment although the items of inventory may be large. So, we give less attention to control the inventory management is paid. The group B stands midway. It deserves less attention than A but more than C.

Table No: 4.8

ABC categorization in terms of value (Rs)

Fiscal Year	A Category	B Category	C Category
2055/056	98151118.55	52612606.89	4851538.02
2056/057	106189196.96	45004329.31	18336333.74
2057/058	1175297807.9	49224913.58	24697915.28
2058/059	131070406.38	41903896.62	20742027.60
2059/060	132367688.69	36500488.17	18138598.19
2060/061	145261759.68	47458263.23	22569812.85
2061/062	152648849.23	49990280.56	33743020.11
2062/063	146966648.69	53117664.73	26225981.14
2063/064	145174865.11	55660704.07	33480905.59
2064/065	152981617.01	77734018.76	26737907.60

Source: - unpublished official record

The ABC analysis is a very useful technique to classify various items of inventory to determine degree of importance for inventory control. It should however an item of inventory may be very cheap. Under ABC analysis cheapest item have given less attention. But it is very critical in the production process to give importance on and kind of inventories we should give more attention. But in ABC analysis, we have to give least attention in such inventories. This is a limitation of ABC analysis.

Such division reflects we should not given same types to efforts to control the inventory management. First priority we have given such items of inventory in which we have invested more money and the main inventory for the purpose of production, which materials don't available easily and no enough sources of it is difficult to supply. In this regard, there categories of raw materials have been used by Udayapur cement industry limited.

The steps computing ABC analysis are: -

First we calculate annual usage, multiplying the quantity (number of units) if the items consumable in one year by its unit price.

1. Arranging all inventory items, first item will show maximum annual usage in rupees, the second item the second maximum, the third item usage the third maximum and so on. After having done this total of annual usage in rupees in put at the bottom of the list.
2. Inventory items are categorized on the basis of annual usage and its price. Which item has more annual usage and higher its price, these items is categorized as a item, the item which contribute lesser than categories A should be kept in categories B and rest contribution of the total percentage of annual usage are called C categories.
3. Placing of the orders on the basis of this classification.

4.3.2 VED Analysis

VED analysis is used for spare parts of inventory. Absence of that item work/production will not stop some days. This type of analysis helps in deciding on the confidence level.

Vital item must be available in stock demanded. Essential items should be available in stock. Desirable may or not be stocked. UCIL has not used this type of analysis method.

4.3.3 EOQ Model

This model is used to find the economic quantity that we order purchase inventory once. It can be computed by using following formula.

Due to write here some formula:

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

Where,

A = Annual consumption /demand

B = Ordering cost per order

C = Carrying cost per unit

But Udayapur cement limited is not applying this method because of direct supply of raw materials. So they just call tender and give the tender and give the order to the supplier who supplies in low cost. And in the whole fiscal year the supplier supplies the raw materials when UCIL demands. In the case of lime stone, it is collected from their one mine, it is supplied regularly when factory runs continuously. And the other things that are very difficult to calculate is ordering and carrying cost of individual raw materials. Since it is hard to calculate the accurate EOQ, UCIL has not applied the EOQ method.

4.3.4 Just –in –time (JIT)

Just in time (JIT) is a significant approach of production management after post world war-11. JIT is the both a philosophy and set of method for manufacturing. Its an integrated set of activities designed to achieve high volume production using minimum inventories of raw materials. Work in process, and finished goods. JIT means producing what is needed when it is needed and no more. JIT is based on logic that nothing will be produced until it is needed because anything over the minimum need is viewed as waste. JIT requires high level of quantity at each stage of production process, strong vendor relations, and fairly predictable demand for the end product for smooth flow of work.

Therefore, JIT emphasizes waste reduction, and total quality control, and devotion to the customer (Regme, Joshi, Chaudhari, & Fago, 2004: 187). Therefore it can be seen that this philosophy applies equally to running a chemical plant, a management consultancy. It has been equated with an inventory control system, which requires an organization's suppliers to provide raw material in small quantities, very frequently. JIT concept shares a great deal with total quality management (TQM). But UCIL has not applied this concept.

4.3.5 Production and Sales of Cement in Terms of Quantity (in MT)

The production and sales of cement in terms of quantity of last ten years is presented below.

Table No. 4.9

Production and sales of cement in terms of quantity (in MT)

Fiscal year	Production			Sales	
	Total Quantity	% change	Total Quantity	% change	
2055/056	118394.130	-	122117.500	-	
2050/057	77052.082	-34.92	151520.100	+24.08	
2057/058	97432.00	-17.71	103776.800	-15.02	
2058/059	118039.720	-0.30	123557.200	+1.18	
2059/060	106966.750	-9.65	106252.750	-12.99	
2060/061	124985.300	+5.57	126267.300	+3.40	
2061/062	125899.315	+6.34	124385.650	+1.86	
20602/063	136988.055	+15.71	136557.750	+11.82	
2063/064	128734.730	+8.73	128921.900	+5.57	
2064/065	118666.185	+0.23	119023.350	-2.35	

Source: unpublished official record

Above table shows the production trend and sales in terms of their quantity for different years from 2055/056 to 2064/065. In the fiscal year 2055/056 the company had produced 118394.13 MT of cement and sales 12217.500 MT of cement. In fiscal year 2058/059, 2060/061 production of cement was decreased by 34.92% & 0.30% but sales of cement were increased by 24.08% & 1.18% respectively. In F/Y 2057/058 and 2059/060 production and sales of cement were decreased by 17.71% & 9.65 % and 15.02% & 12.99% respectively. In fiscal year 2060/061, 2061/062, 2062/063, 2063/064 both the production of cement and sales were increased by 5.57%, 6.34%,

15.71%, &8.73% and 3.40%, 1.86%, 11.82%, &5.57% respectively. In the fiscal year 2064/065 the production of cement was increased by 0.23% but sales were decreased by 2.53%. In this year production was 118666.185 MT and sales of cement were 119023.35 MT.

It indicates that factory is running with lower efficiency as consequences they can not meet market demand as well as fixed cost per unit increased by production under capacity. This is not only reason for variation in production there may be different reasons for increase or decrease in production sales like unavailability of raw material, for example, limestone in time, power interruption and managerial negligence. From this one can surely say that the overall performance of company may have negative impact.

4.3.6 Production, Sales and Profit (gross margin) in Terms of Values

Gross margin profit is the different between sales value and production cost. For conducting organization smoothly, profit is essential factor. If deviation between sales value and production cost is high, profit may also be high. Usually profits do not just happen. Profits are managed. The sole objective of any manufacturing organization is to maximize profit for its own existence. For increasing profit it is essential for any organization to be able to increase sales value in the comparison of production cost. If production cost of organization increases, the organization must succeed to maintain similar increase in sales. The production, sales and profit (gross margin) in UCIL are presented below:

Table no. 4.10**Production, sales and profit (gross margin) in terms of values (Rs)**

Fiscal year	Production cost		Sales		Profit
	Amount (Rs)	Change %	Amount (Rs)	Change %	Amount (Rs)
2055/056	315445251.70	-	309788761.68	-	5656490.62
2056/057	355917522.47	12.83%	445084060.54	43.67%	89166538.07
2057/058	312326239.83	-0.99%	327847367.14	5083%	15521127.31
2058/059	389541668.40	23.46%	415197505.48	34.03%	25655837..8
2059/060	389208837.58	23.38%	386416871.15	24.74%	2791966.43
2060/061	456430003.16	44.69%	5154522623.77	66.39%	59022620.61
2061/062	487897481.86	54.67%	539860115.50	74.27%	51962633.64
2062/063	558815676.13	77.15%	600095539.50	93.71%	41279863.37
2063/064	529267292.63	67.78%	586041884.00	89.17%	56774591.37
2064/065	535869455.14	69.88%	542170326.50	75.01%	6300871.36

Source: - unpublished official record

The above table compares production cost, sales amount and profit of UCIL from fiscal year 2055/056 to 2064/065. The production cost was Rs. 315445251.70 and sales was Rs. 309788761.68 which implies a loss Rs. 5656490.62 in fiscal year 2055/056. for the fiscal year 2056/057 the production cost increased by 12.83% compared to production cost of 2055/056, which is taken as a base year for the calculation, but the sales was increased by 43.67% compared to its relevant base year and resulted a profit of Rs. 89166538.07. The situation was different for fiscal year 2057/058, in this year although the production decreased by 0.99% compared with its base year but the sales amount increased by 5.83% compared to its relevant base year. After then the production cost and sales amount increased simultaneously but there was work a loss of Rs. 2791966.43 in fiscal year 2057/058. The percentage change was peaked in fiscal year 2062/063; the production cost was increased with 77.15% while the sales amount was increased with 93.71% and then after the trend was little slow.

From the table it can be seen clearly that production and sales were not synchronized properly as a result although there was an increase in total sales amount but no regular increase of gross margin. The production system was not regular in UCIL, in fiscal year 2056/057 the sales figure increased tremendously but they failed to increase the production which resulted a very low profit in that fiscal year. Similarly they maintained an increase of 23.38% for production in fiscal year 2059/060 but they failed to maintain similar increase in sales as a result there was a loss in that fiscal year. UCIL should control good production system and also should maintain regular sales system so that UCIL will get a better gross profit rather than a loss.

The Karl Pearson's coefficient of correlation has been calculated to examine the relationship between production and sales. From the computation the relationship between the above variables is highly significant. The computation is depicted in ANNEX no.4.

4.3.7 Demand and Supply of Raw Materials

To have smooth operation of the industry it is perquisite that the demand of raw materials must be satisfied through its regular supply. Under and over supply of materials than the required quantity adversely affect the economic condition of the factory. Under supply of materials curtails production and ultimately affects it's profit due to decrease in sales volume and the company has not issued it's share in the market. On the other hand over supply of raw materials also result in excessive inventory carrying cost and finally affect the working capital of the industry. So the supply of materials should be matched with the demand of raw materials. Matching between supply and demand of materials may protect the industry against the fluctuations of production. So it is essential for industry that the demand of raw materials must be satisfied through it's regular supply. The demand and supply of raw materials in UCIL are presented below:

Table no. 4.11**Demand and supply of raw materials**

Fiscal year	Demand for raw material		Supply of raw materials		Differences
	Amount (Rs)	% Change	Amount (Rs)	% Change	
2055/056	109384809.75	-	133212918.5	-	23823108.75
2056/057	16265957.69	48.67%	1713880088.1	28.86%	8762050.41
2057/058	127792727.32	16.83%	125542524.2	5.76%	2250203.12
2058/059	136996012.33	25.24%	164382704.9	23.40%	27386692.57
2059/060	155068810.52	41.76%	171988073.3	29.11%	16919262.78
2060/061	170543239.63	55.91%	192325968.2	44.37%	21782728.28
2061/062	197079383.92	80.17%	222162019.5	66.77%	25082635.58
2062/063	204139322.92	86.62%	243424473.0	82.73%	22010550.08
2063/064	179220060.22	63.48%	207223820.1	55.56%	28003759.88
2064/065	1835653112.31	67.81%	230231295.9	72.83%	46665983.59

Source: - unpublished officer record

Note: - (1) Demand of raw materials means consumption of raw materials

(2) Supply of raw materials means purchase + opening stock of raw materials

The above table shows the position of demand and supply of raw materials in terms of rupees speed over the last ten fiscal year from 2055/056 to 2064/065. In fiscal year 2055/056 the supply was higher than the demand by 23823108.75 Rupees. In the fiscal year 2056/057 demand and supply both was increased by 48.67% & 28.66% than the base year 2055/056. In the fiscal year 2057/058 there was increase by 16.83% but supply of raw materials was decreased by 5.76% than base year. In this fiscal year the demand is more than supply by Rs. 2250203.12. in fiscal year 2058/059 the demand and supply both were increased by 25.24% and 23.40% respectively than the base year. In this year the supply is more than demand by Rs. 27386692.57. in fiscal year 2059/060 the demand and supply of raw materials both were increased by 41.76% and 29.11% respectively than the base year. In this year the supply is more

than demand by Rs. 16919262.78. In fiscal year 2060/061 the demand and supply of raw materials both were increased by 55.91% and 44.37% respectively than the base year. In this year the supply is more than demand of Rs. 21782728.28. In fiscal year 2061/062 the demand and supply of raw materials both were increased by 80.17% and 66.77% respectively than the base year. In this year the supply is more than demand by Rs. 25082635.58. In fiscal year 2062/063 the demand and supply of raw materials both were increased by 86.62% and 82.73% respectively than the base year. In this year the supply is more than demand by Rs. 22010550.08. In fiscal year 2063/064 the demand and supply of raw materials both were increased by 63.84% and 55.56% respectively than the base year. In this year the supply is more than demand by Rs. 28003759.88. In fiscal year 2064/065 the demand and supply of raw materials both were increased by 67.81% and 72.83% respectively than the base year. In this year the supply is more than demand by Rs. 25082635.58.

From the above analysis it is that the trend of demand and supply were increasing except in fiscal year 2057/058. In this fiscal year the demand of raw materials were increased but supply was decreased. From this it indicates that the company has increased its demand of raw materials but ratio of supply of raw materials is high. UCIL doesn't meet its capacity. It may be the causes of transportation problem, management negligence, restriction in electricity etc.

4.3.8 Inventory Position of Udayapur Cement Industry (Ltd.)

Every business organization whether big or small has to maintain some inventory. Inventory serves as cushions for smooth production. Therefore the management tries to strike between demand and supply of raw materials as well as demand and supply of cement produced. So holding of inventory involves not only in acquiring cost but also involve carrying cost for holding it. Inventory for any organization is supposed to be necessary evil and it requires careful planning and formulation of policies. Keeping in view the best interest of the organization. Therefore it should neither excess nor shortage than what its requirements. It consists the stock of purchases, semi-processed materials and finished products. The difference types of inventory position of UCIL are given below over the past ten years from 2055/056 to 2064/065.

4.3.8.1 Inventory Stock of Raw Materials, Semi-Finished Goods and Finished Production (in Terms of Quantity i.e. in MT)

Table no: 4.12

Inventory stock of raw materials, semi- finished good and finished production (in MT)

Fiscal year	Raw materials	Semi-finished	Finished goods	Total quantity	Change %
2055/056	171083.883	150910.705	118394.13	440388.72	-
2056/057	233694.00	152406.43	155503.91	541604.34	22.98
2057/058	136419.31	87861.552	97431.84	321712.70	(6.95)
2058/059	182955.089	115474.728	118039.72	416470.35	(5.43)
2059/060	164656.88	106568.625	106192.174	377429.68	(4.30)
2060/061	200836.327	120029.111	124985.300	445850.74	1.24
2061/062	198415.88	118400.079	125899.315	442216.00	0.41
2062/063	181872.096	118660.777	136988.055	437520.94	(0.65)
2063/064	184567.945	20351.534	128734.73	333654.21	(24.24)
2064/065	186179.255	118492.168	118666.185	423337.62	(3.87)

Source: - unpublished official records

The above table presents the fluctuating inventory position in UCIL from fiscal year 2055/056 to 2064/065. The inventory consists of stock of raw materials. Semi-finished goods and finished products. Cement is given in terms of quantity. In fiscal year 2055/056 the industry held inventory stock 440388.72 MT. In fiscal year 2056/057, 2060/061, 2061/062 The Company's holding inventory was increased by 22.98%, 1.24% & 0.41% respectively than the base year. In fiscal year 2057/058, 2058/059, 2059/060, 2062/063, 2063/064 & 2064/065 the industry's holding inventory stock was decreased by 6.95%, 5.43%, 0.65%, 24.24%, and 3.87% than the base year respectively. From the above analysis we know that UCIL is not entirely using its installed capacity.

4.3.8.2 Inventory Stock of Raw Materials, Semi-finished Goods and Finished Production in Terms of Amount

Table No: 4.12

Inventory stock of raw materials, semi-finished goods and finished production (in Rs)

Fiscal year	Raw materials	Semi-finished goods	Finished goods	Total amount	Change %
2055/056	22653301.66	9192732.07	20766573.16	52612606.89	-
2056/057	19330377.00	12446617.95	25673952.31	57450947.26	9.20
2057/058	29694864.1	3712410.85	15817638.63	49224913.58	6044
2058/059	26901065.56	10347093.62	4655737.44	41903896.62	2035
2059/060	16521560.95	12302365.88	7676561.34	36500488.17	30.62
2060/061	19572252.72	12933247.82	3617007.20	36122507.74	31.34
2061/062	17906569.55	23483490.38	8600520.63	49990580.56	4.98
2062/063	24011972.02	18848578.25	10237114.46	53097664.73	0.92
2063/064	15972158.77	15167690.39	10059424.82	41199273.98	21.69
2064/065	4246132.04	25752756.16	9555130.56	77734018.76	47.45

Source: unpublished official record

The above table presents the fluctuating inventory position of UCIL from fiscal year 2055/056 to 2064/065. The inventory consists of stock of raw materials, semi-finished goods and finished goods (cement) and are given in terms of amount. In fiscal year 2055/056 the factory held inventory stock costing Rs. 52612606.89. The inventory stock for the fiscal year 2056/057, 2062/2063 & 2064/065 was increased by 9020%, 0.92% & 47.75% i.e. amounted to Rs. 57450947.26, 53097664.73 & 77734018.76 respectively than the base year. In fiscal year 2057/058, 2059/060, 2060/061, 2061/062 & 2063/064 was decreased by 6.44%, 20.35%, 30.62%, 31.34%, 4.98% & 21.69% i.e. amounted to Rs. 49224913.58, 41903896.62, 36500488.17, 36122506.74, 49990580.56 & 41199273.98 respectively than base year.

From the above analysis it is known that the investment in inventory stock of UCIL is in large amount. And it is also known that the value of inventory stock in every year is changing. A huge investment on the inventory stock in fiscal year 2064/065 may be the outline of inefficient management of inventory. So it can be concluded that the production and sales plan of the factory is not practicable and realistic. There is no proper coordination between the production and sales of cement and procurement planning.

4.4 Ratios Relating to Inventory Management

4.4.1 Inventory Turnover Ratio

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

In general, high turnover ratio is better than low ratio. High turnover ratio indicates good inventory management, finished goods are quickly selling over period of time and firm able earn profit by it, similarly, a very low inventory turnover ratio is dangers. It signifies excessive inventory or over- investment in inventory. Low inventory level shows firm has more stock of finished goods for sales. Due to this, inventory involves cost in term of interest of blocked amount, rent of ware house, damage/ deterioration and so on. A low ration may be result of obsolete goods, over valuation of closing stock, reduce demand in market, more purchase of raw-materials in anticipation of future increase in their process and so on.

Therefore, the company has to keep optimum level of inventory. Through the study of inventory turnover Ratio it helps to detect the imbalance investment in the various inventory components. Inventory turnover Ratio can be calculated by using formula.

$$\text{Inventory turnover Ratio} = \frac{\text{Cost of Goods Sold}}{\text{Average Inventory}}$$

Here of cost goods sold computed adding opening stock to purchase (includes limestone purchase) transportation of by road. Lime stone received from local place. Other materials and debuts closing inventory. Average inventory is computed by adding opening inventory and closing inventory and dividing by two.

Table No. 4.13
Inventory turnover ratio in terms of value (Rs)

Fiscal year	Cost of goods sold	Average inventory	Turnover Ratio (times)
2055/056	171082940.86	63786724.065	2.6821
2056/057	118070029.09	48808468.065	2.4190
2057/058	114438180.97	47114621.445	2.4289
2058/059	142098857.81	45564405.10	3.1186
2059/060	150190416.27	39202192.395	3.8312
2060/061	175687387.69	36311497.955	4.8383
2061/062	188721993.99	43056394.15	4.3831
2062/063	172400538.67	51553972.654	3.3441
2063/064	126705246.76	54389184.40	2.3296
2064/065	177724392.38	66697361.415	2.6646
MEAN			3.2040
SD			0.8836
CV			27.58%

Source: - unpublished officer record

In another way, we can compute the inventory turnover Ratio by dividing closing stock sales.

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

In this formula sales in valued at market price and closing stock is valued at cost price. So it is not comparable. Appropriated formula to calculate inventory is described earlier.

From the above tabulation it is known that inventory turnover ratio of UCIL is very low it means more inventories are kept on ware house, due to more inventories are kept in stock. Unnecessary investment tied-up on it. It directly affects on the profitability of the firm.

At last we can say that efficiency in inventory of UCIL is poor. UCIL is not able to change its inventory into cash through sales. So it is essential for company to give more attention in inventory management.

4.4.2 Inventory Holding Days (DIH)

Inventory holding Days represent how much day's company holds average inventory.

The formula to calculate DIH is as follows:

$$\text{DIH} = \frac{\text{Average inventory}}{\text{Cost of goods sold}} \times 360 \text{ or } \frac{\text{closing inventory}}{\text{sales}} \times 360$$

Table No: - 4.14

Inventory holding days (DIH) in terms of values

Fiscal year	Average inventory	Cost of goods sold	DIH(days)
2055/056	63786724.065	171082940.86	134
2056/057	48808468.065	118070029.09	149
2057/058	47114621.445	114438180.97	148
2058/059	45564405.10	142098857.81	115
2059/060	39202192.395	150190416.27	94
2060/061	36211497.955	175687387.69	74
2061/062	43056394.15	188721993.99	82
2062/063	51553972.645	172400538.67	107
2063/064	54389194.40	126705246.76	155
2064/065	66697361.415	177724392.38	135
MEAN			119.3
SD			29.24
CV			24.511%

Source: - unpublished official record

In above tabulation we represent the inventory holding period of UCIL throughout the study period from 2055/056 to 2062/063. The company holds average inventory of

119 days in regards of mean. In fiscal year 2055/056, 2056/057, 2057/058, 2058/059, 2062/063, 2063/064 and 2064/065 DIH has crossed the mean whereas in rest of the years. DIH has remained below the mean. The SD and CV of DIH were 29.24 and 24.511% respectively.

4.4.3 Raw Materials Turnover Ratio

Raw materials turnover ratio examines the efficiency with the firm which converts raw materials into work-in-progress and work-in-progress into finished goods. The formula is:

$$\text{Raw materials turnover ratio} = \frac{\text{Materials consumed}}{\text{Average inventory of raw materials}}$$

Table No: - 4.15

Raw materials turnover ratio in terms of value (Rs)

Fiscal year	132809985.93	227002234.33	5.85
2056/057	156342984.02	14768530.36	10.59
2057/058	114438180.97	18289311.58	6.26
2058/059	142008857.81	28297973.83	5.02
2059/060	150490416.27	21711313.26	6.93
2060/061	176182387.69	18046906.92	9.76
2061/062	188721993.99	18729261.14	10.08
2062/063	222390819.23	20959120.79	10.61
2063/064	189395160.76	27222780.44	6.96
2064/065	177724392.38	36429860.45	4.89
MEAN			7.70
SD			2.439
CV			31.67%

Source: - unpublished officer record

The table shows the raw materials turnover ratio from fiscal year 2055/056 to 2064/065. The maximum ratio was 10.61 in fiscal year 2062/063. The mean of the raw material turnover ratio is 7.70. in fiscal year 2056/057, 2060/061, 2061/062 &

2062/063, raw material turnover ratio has crossed the mean and in the remaining fiscal year below the mean. SD and CV ratio were 2.439 and 31.67% respectively.

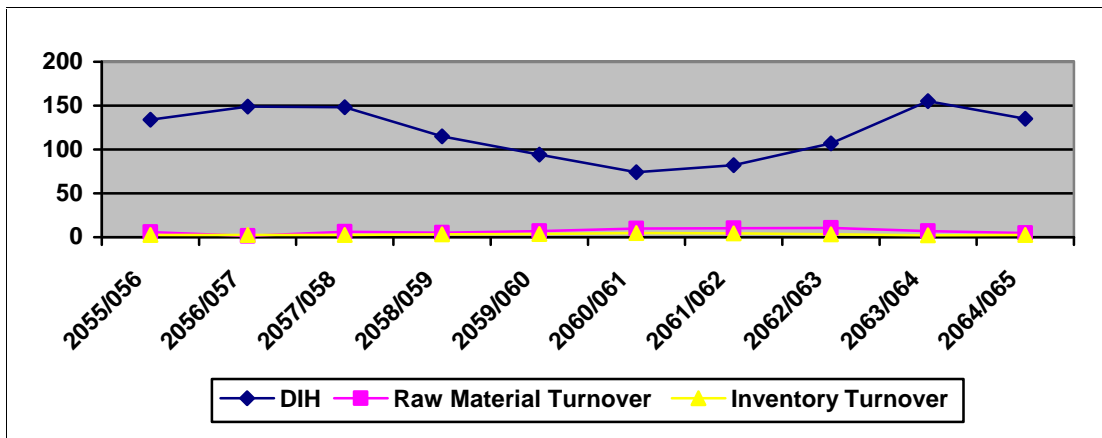
Table No: - 4.16

Summary chart of turnover ratio of UCIL

Particulars	Mean	S.D	C.V
Inventory turnover	3.2040	0.8836	27.58%
DIH	119.3	29.24	24.511%
Raw material turnover	7.70	2.439	31.67%

Figure No: - 4.1

IT Ratio, DIH and RT Ratio of UCIL



4.4.4 Inventory to Current Assets Ratio

In inventory to current Assets ratio, inventory constitute 60% of the current assets of public limited companies in India and about 45% to 50% in manufacturing public enterprises in Nepal.

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

Here, inventory includes closing stock of raw materials, work-in-progress, finished goods, other stocks, spare parts, tools and consumable. Current assets include debtors, inventories, prepaid expenses, advance, deposits, cash balance and bank balance.

Table No. 4.17
Inventory to current assets ratio in terms of value (Rs)

Fiscal year	Inventory	Current assets	Inventory to current Ratio in percentage
2055/056	155615263.46	202602538.82	76.81
2056/057	169529860.01	201094975.98	84.30
2057/058	191452609.65	229464056.00	83.43
2058/059	193716330.60	234428546.76	82.63
2059/060	201780946.52	263523830.53	76.57
2060/061	182716005.36	289402340.11	63.14
2061/062	236990452.21	337197706.48	70.30
2062/063	230855886.57	319493229.08	72.26
2063/064	24356885.23	363459587.65	66.13
2064/065	261695711.32	391757760.82	65.50
MEAN			74.237
SD			7.69
CV			10.36%

Source: - unpublished officer record

According to above table of inventory to current assets it is clear that the highest ratio 84.30 in F/Y 2056/057. The mean is 74.237 and inventory to current asset ratio has remained below the mean in fiscal year 2060/061, 2061/062, 2062/063, 2063/064 & 2064/065 and in remaining years it crosses the mean. SD and CV are 7.69 and 10.36%. In the context of manufacturing companies in Nepal, UCIL has not satisfactory level.

From the above calculation, it is clear that the company has not any satisfactory situation about inventory to current assets ratio throughout the study period. Many companies hold more inventory as current assets. Whenever more inventories kept by

company, it can not mobilize the amount, which has blocked in inventory and the company can not sell it immediately. So it directly affects the profitability of the firm. Due to blocked amount in inventory, the companies can not re-investment in other areas. So, the company loses the return of that blocked amount in inventory.

4.4.5 Inventory to Total Assets Ratio

Inventory to total assets ratio is calculated by using following formula:

$$\text{Inventory to total assets ratio} = \frac{\text{Inventory}}{\text{Total assets}}$$

Here, inventory means closing stock of raw materials, work-in-progress, finished goods, other materials, spare, tools, consumable and goods in transit. Total assets mean fixed assets and current assets.

Table No: - 4.18

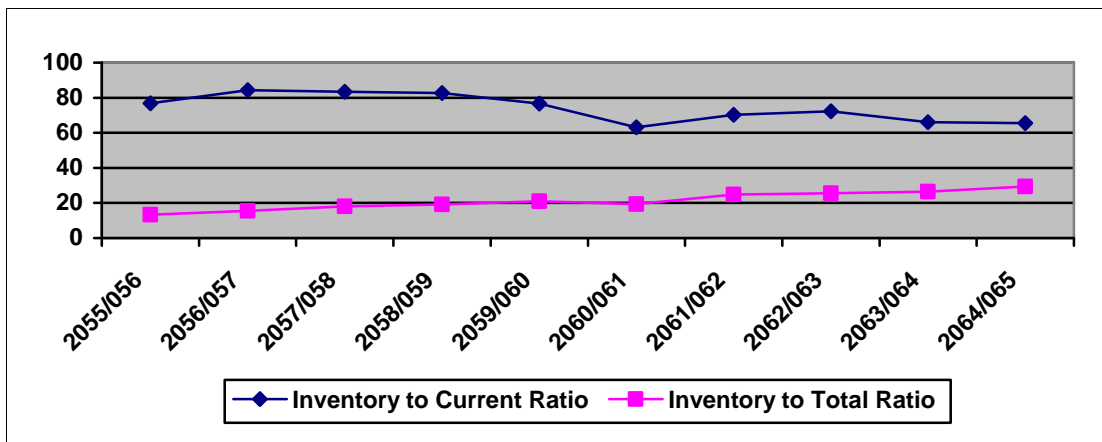
Inventory to total assets ratio in terms of value (Rs)

Fiscal year	Inventory	Total assets	Inventory to total ratio in percentage
2055/056	155615263.46	1153521550.46	13.39
2056/057	169529860.01	1086759682.04	15.60
2057/058	191452609.65	1060384585.17	18.06
2058/059	193716330.60	10065771796.33	19.25
2059/060	201780946.52	965502267.07	20.90
2060/061	182716005.36	941029668.17	19.42
2061/062	236990452.21	951817533.84	24.90
2062/063	230855886.57	906252611.95	25.47
2063/064	240356885.23	906068309.01	26.53
2064/065	261695711.32	888775878.46	29.44
MEAN			21.31
SD			5.12
CV			24.022%

Source: - unpublished officer record

From the above tabulation of UCIL, we have known that minimum inventory to total assets ratio is 13.49% in fiscal year 2055/056 and maximum inventory to total assets ratio is 29.44% in fiscal year in 2064/065. According to Weston brigham inventory to total assets are concentrated in the 16% to 30% are optimum ratio. So we can say that the UCIL is kept good ratio of inventory to total assets.

Figure No. 4.2
Inventory to total assets ratio and current assets ratio



4.4.6 Inventory to Net Working Capital Ratio

Inventory to Net Working capital ratio explains the relationship of closing stock of finished goods and working capital. This ratio measures how much closing stock of finished goods should kept by the company as a working capital. If the closing stock of finished goods is high the liquid resource of the company may get reduced. Generally 85% of working capital in the form of closing stock of finished goods is considered as an ideal ratio.

$$\text{Inventory to Net working capital ratio} = \frac{\text{Closing stock}}{\text{Working capital}}$$

Here, closing stock includes closing stock of finished goods. Working capital = current assets – current liabilities

Where, current assets mean those assets which we can convert into cash within a year. These assets are receivable, inventory, cash in hand, cash at bank, current liabilities mean those liabilities which we have to pay within a year. These liabilities are short term maturities and over dues loan, interest accrued and outstanding and other liabilities and provision.

Table No. 4.19
Inventory to net working capital ratio in terms of value (Rs)

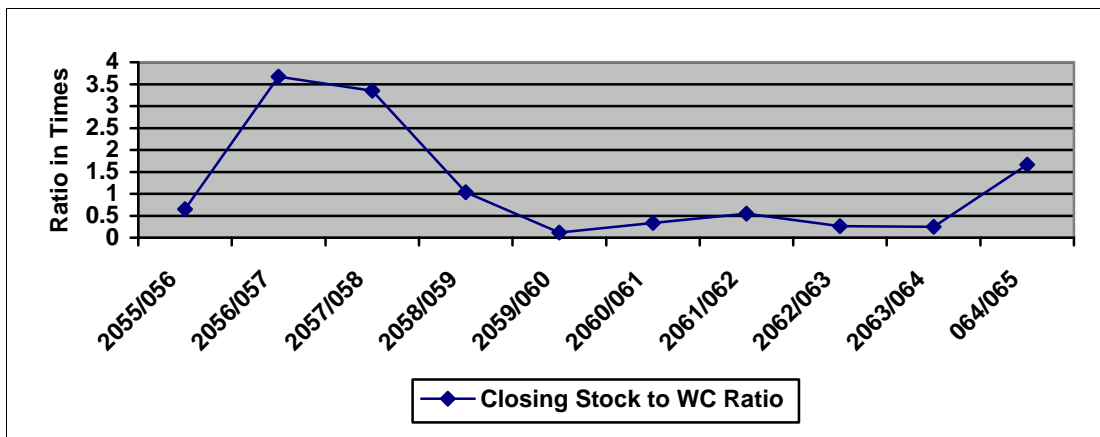
Fiscal year	Closing stock	Working capital	Closing stock to working capital ratio (times)
2055/056	52612606.89	81429001.27	0.6461
2056/057	45004329.31	12268163.06	3.6684
2057/058	49224913.58	14692693.97	3.3503
2058/059	4193896.62	40426500.56	1.0365
2059/060	36500488.17	313713305.22	0.1163
2060/061	36122507.74	107683170.37	0.3355
2061/062	49990280.56	91055843.92	0.5490
2062/063	53117664.73	199758517.02	0.2659
2063/064	55660704.07	225505808.53	0.2468
2064/065	77734018.76	46808679.55	1.6607
MEAN			1.18755
SD			1.3076
CV			110.10

Source: - unpublished officer record

Note: - the figures in brackets are negative

The above table shows the ratio of the inventory and working capital of the company. From the above tabulation, we have known that the ratio is negative in every fiscal year. It indicates the poor situation of working capital. The ratios are not satisfactory. The mean is (1.118755). The company holds highest negative ratio in year 2056/057 and lowest negative ratio in year 2059/060. SD and CV are 1.3076 and (110.10) respectively.

Figure No. 4.3
Closing Stock to WC Ratio



4.4.7 Inventory to Profit Ratio

This ratio tells how much inventory is needed to generate a unit of profit. Actually proper inventory affects profitability of industry. So for generating profit in proper way, firm must pay attention for managing inventory properly.

$$\text{Inventory to profit Ratio} = \frac{\text{Opening profit}}{\text{Material consumed}}$$

Table No. 4.20
Inventory to profit ratio in terms of value (Rs)

Fiscal year	Opening profit	Material consumed	Inventory to profit ratio
2055/056	5656490.02	122809985.93	0.0425
2056/057	89166538.07	156342984.02	0.570
2057/058	15521127.31	114438180.97	0.136
2058/059	25655837.08	142008857.81	0.181
2059/060	2791966.43	15049.416.27	0.0186
2060/061	59022620.61	176782387.69	0.335
2061/062	51962633.64	188721993.99	0.275
2062/063	41279863.37	22390819.23	0.186
2063/064	56774591.37	189395160.76	0.300
2064/065	6300871.36	177724392.38	0.0355
MEAN			1.9574
SD			0.1853
CV			9.4643

Source: - unpublished officer record

From above table it's clear that the ratios are very low. In F/Y 2055/056 & 2059/060 the ratios were in negative value. It means company does not generate a unit of profit in regards of material consumed. The mean was 1.9575. SD and CV were 0.1853 and 9.4643% respectively.

Figure No. 4.4
Inventory to Profit Ratio

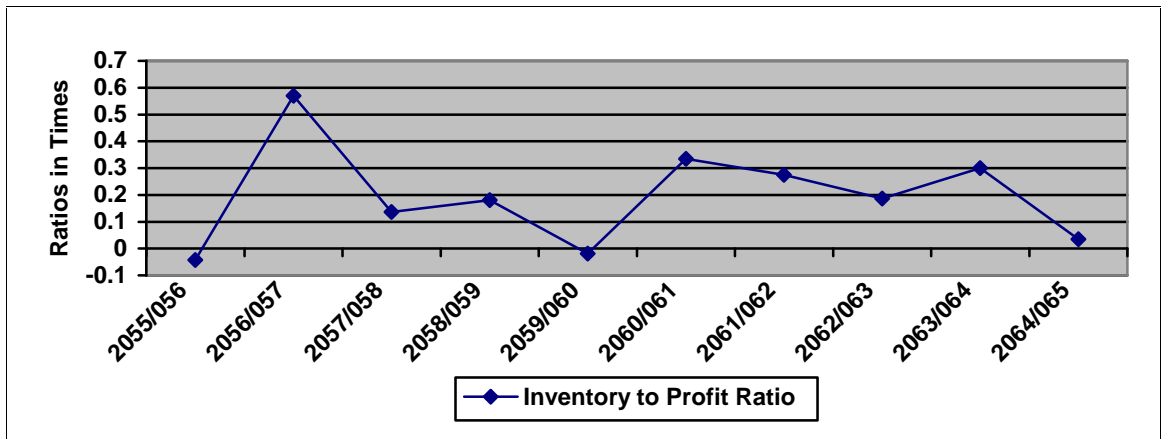


Table No. 4.21
Summary Chart of Ratio Analysis of UCIL

Particulars	Mean	S.D	C.V
Inventory to total assets	21.31	5.12	24.022%
Inventory to current assets	74.237	7.69	10.36%
Inventory to Net WC	1.18755	1.3076	110.10
Inventory to Op	1.9574	0.1853	9.4643

Source: - unpublished officer record

Table No: - 4.22

Regression (Coefficient of Determination) Results

S.N.	Models	d.f.	a	b	SE	t	r ²
1	$Y_1=a+bx_1$	8	7.645026	0.08646	0.2233	0.38719	0.293831
2	$Y_2=a+bx_2$	8	24.979472	-0.2788	0.25926	1.07568	0.180148
3	$Y_3=a+bx_3$	8	-7.048249	0.53621	0.1300	4.1247	0.58888
4	$Y_4=a+bx_4$	8	74.076923	-1.692308	0.29475	-5.741	0.260593

Note: Y_1 represents finished goods, Y_2 and Y_3 represent sales, and Y_4 represent operating profit. Similarly x_1 , x_2 , x_3 and x_4 represent production in quality. Closing stock of finished goods, purchase of raw materials and closing stock of raw materials respectively.

4.5 Analysis of Primary Information Collected Through Questionnaire

In course of analyzing the data, I have not only analyzed the secondary data. To make my research work more effective and accurate, I have also collected some primary data through the means of questionnaire by the help of company's employee having different post i.e. production manager, purchase manager, sales assistant, store keeper.

There are 4 respectively in total who have helped me for filling up questionnaire because of the belongings of the information I had not consult the lower level employees of the company. On the bases of answers given by them, I am going to analyze the answers. For this purpose, I arrange the information in a tabular form which is in below and questionnaire given with options of answers are kept in last at annex.

Question No. 1

According to respondents answers from question no, 1 "what are the basic motives for holding inventory management In your organization " it can be said that these

- Alternatives:
- (I) Transaction Motives,
 - (II) Precautionary Motives
 - (III) Speculative Motives
 - (IV) Others

Question No. 2

"Does your organization use inventory management", three respondents say "yes" and one respondent says "no".

Question No. 3

"Which method does organization use for collection of raw materials", all four respondents say that the factory uses both direct collection method & collection through agent by global tender.

Question No. 4

"Is there proper target for materials purchase in your factory" three respondents say that there is no proper target for material purchase in factory and one respondent say that there is proper target management.

Question No. 5

"Is the factory following EOQ model in purchasing decision" all respondents say that the factory is not using EOQ model in purchasing decisions.

Question No. 6

"Is there deviation in the amount of annual needs and annual collection and annual consumption", two respondents say "yes" and two "no".

Question No. 7

"What are the trend of demand and supply of raw materials "two respondents say that the trend of material cost and cost price of the cement are increasing, two respondents say that the trend of material cost and cost price of the cement are decreasing.

Question No. 8

"Is factory is able to utilize its existing capacity", all four respondents say "no".

Thus by analyzing this primary information it is found that the result of secondary data analysis and results of primary data analysis are matches in various major aspects.

Table No. 4.23
Analysis of Respondent Answers

Q. No.	Answers						
	Yes	No	a	b	c	d	e
	1			2	1		1
2	3	1				-	-
3					4	-	-
4	1	3				-	-
5		4				-	-
6	2	2				-	-
7			2	2		-	-
8		4				-	-

Hence, finally the major and important part of this thesis i.e. presentation and analysis of data comes to an end. Overall, inventory management in UCIL has been analyzed to be not proper. However, the analysis presented here couldn't be considered complete and final. In subsequent chapter, major findings of the analysis and recommendations to remedy the situation have been presented systematically. In the like manner summary and conclusion have been drawn at the end of this thesis.

4.6 Major Findings of the Study

The inventory management of UCIL and its impact on profitability has been analyzed by using various financial and analytical tools. The various ratio and financial have noticed amicable performance of the factory. However, data analysis and interpretation of UCIL reveals the major findings as follows:

From Secondary Data

1. Analysis of its effect on the inventory management

-) The consumption and production trend of the factory is decreasing. And the ratio between consumption and of cement indicates a fluctuating trend. It was highest in the FY 2056/057 whereas the lowest in the fiscal year 2057/058.
-) The production of cement in UCIL is decreasing in FY 2056/057, 2057/058, 2058/059 & 2059/060 and sales of cement in UCIL are also decreasing in 2057/058, 2064/065. But production cost and cost of sales of cement increasing every year expect in FY 2057/058. The highest gross margins in fiscal year 2056/057 and lowest in 2059/060.
-) The consumption pattern of the industry is also fluctuating from year to year like purchasing pattern. This shows that the company is unable to utilize its existing capacity in the production of cement.
-) The trend of demand and supply of raw materials is increasing except in fiscal year 2057/058.
-) The investment in inventory stock of UCIL is in large amount, the value of inventory stock is in fluctuating trend.

2. Efficiency on inventory management of UCIL limited (turnover Ratio)

- The average inventory turnover ratio, inventory holding day and raw material turnover Ratio UCIL of ten years study period (fiscal year 2055/056 to 2064/065) were 302040%, 119.30 days and 7.70 times respectively. Whereas variability of those ratios was 27076%, 27.511 days and 31.57% respectively and standard deviation were 0.8836, 29.24 and 2.433 respectively. The highest IT ratio is 4.8383 times in F/Y 2058/059 because average inventory of finished goods is very low. It means company is able to change its inventory (finished goods) into receivable/cash through sales. The lowest IT ratio is 2.3296 times only in FY 2058/059.
- Similarly, the lowest DIH is 74 days in FY 2060/061 because of lowest average inventory of finished goods. It means company holds 74 days average

inventory. The highest DIH was 155 days in FY 2063/064. It means company holds approximately 2 month average inventory which is good performance.

- In FY 2062/063, company was able to convert raw materials into work-in-progress/finished goods successfully by 10.61 times. It is because in that year raw materials consumption volume is very high, i.e. more and more raw materials consumed and changed into finished goods. The latest ratio was 4.89 times in FY 2064/065. In this year company was not able to convert raw materials into finished goods frequently. It is due to high volume of raw materials kept by the company and unnecessary investment tied up in raw materials.

3. Other ratio analysis

- The average of total assets, inventory to current assets ratio throughout the study period was 20.31 and 74.237 percentage respectively. The variability of those ratio was 24.022 and 10.36 percentage. The highest ratio for inventory to total assets percentage was 29.44 in FY 2064/065 and lowest ratio in percentage was 13.49 in FY 2055/056. According to western and brighan, company should be hold inventory to total assets are concentrated 16.30%. Such ratio has been applied by UCIL on the study period except in FY 2055/056 and 2064/065, it means that more money has not locked as inventory.
- The highest inventory to current ratio in percentage was 84.30% in FY 2056/057 and lowest ration in percentage was 63.14% in FY 2060/061. According to rising Nepal, 2063, Jestha, in manufacturing public enterprises in Nepal inventory to current assets ratio should concentrate in 45 to 50. Such ratio has not exit throughout by UCIL in the study period so we can say that holds more inventory as current assets, due to keeping more inventory as current assets the amount blocked in inventory cannot be applied in other beneficial areas. In other words investment in inventories was worthless. So it directly affects on the profitability of the company.
- The average of inventory to Net working capital nation was 1.18755. The variability of this ratio was 110.10. There was negative ratio in all over the study period. Generally 855 of working capital in the form of closing stock of

finished goods is considered as an ideal ratio. The highest ratio was 0.1163 in FY 2059/060 and lowest ratio was 3.6684 in FY 2056/057. In the study period there are no good ratios of the company. The average of inventory to profit was 1.9574 and variability was 9.4646%. The highest ratio was 0.570 in FY 2056/057 and lowest ratio was 0.0186 in FY 2059/060. It means no more gross profit earned by the company. On the basis of material consumed. Company did not earn high unit of profit.

4 Simple regression analyses

-) The regression equation 1 shows the positive relationship between production in Qty and its average price during the ten years of periods. The marginal propensity to spend on production of cement is 8.646 paisa and intercept (a) was 7.645026. The coefficient of determination (r square) was 0.293831; SE was 0.2233 means 22.33% is incorrect and 77.67% is correct. The calculated 't' value is 0.38719 is less than tabulated value. So the estimated slope coefficient is statistically significant at 5 D.F. (degree of freedom).
-) The regression equation 2 shows a negative relationship between closing stock of finished goods and sales. The marginal propensity to earn sales revenue is -27.888 paisa and intercept (a) was 24.979472. The coefficient of determination (r square) was 0.180148. SE was 0.25926 means 25.926% is incorrect and 74.074 are correct. The calculated 't' value is 1.07568 which is less than the tabulated value. So the estimated slope coefficient is statistically significant at 5 D.F.
-) The regression equation 3 shows a positive relationship between purchase of raw materials and sales during the 10 years of period. The marginal propensity to raw materials purchase is 53.621 paisa and intercept (a) was -7.048249. The coefficient of determination (r square) was 0.5888, SE was 0.1300 means 87% is correct. The calculated 't' value is 4.1247 which is higher than tabulated value. So the estimated slope coefficient is statistically significant at 5 D.F.

The regression equation 4 shows a negative relationship between closing stock of raw materials and operating profit during the ten year of period. The marginal propensity to earn sales revenue -16.92307692 paisa and intercept (a) was 74.076923. The coefficient of determination (r square) was 0.260593. SE was 0.29475 means 76.618% is correct. The calculated 't' value is -7.2377 is less than the tabulated value. So the estimated slop coefficient is not statistically significant at 5 D.F.

From Primary Data

For the purchase or collection of raw materials in UCIL uses two methods i.e. direct collection and collection through agent by global tender method. Mainly, UCIL purchases its raw materials in Nepal and from India and Bhutan.

-) The basic motive for holding inventory management in organization is transaction motives and precautionary motives.
-) The factory is not following EOQ model in purchasing decisions.
-) There is no proper target for materials purchases in industry and the prices and quantity of collection of materials are fluctuating from year to year.
-) The consumption pattern of industry is also fluctuating from year to year like purchasing pattern. This shows that the company is unable to utilize its exiting capacity in the production of cement.
-) The consumption and production trend of the factory is decreasing. And the ratio between consumption and cement indicates a fluctuating trend. The trend of material cost and cost price of the cement are in increasing trend. And there is high deviation in the amount of annual needs and annual collection and consumption. The annual production volume has not been able to meet its production capacity.
-) The trend of demand and supply of raw materials is increasing.

CHAPTER V

SUMMARY, CONCLUSION & RECOMMENDATIONS

5.1 Summary

In our country Nepal. Public enterprises were established for the purpose of preparing infrastructure services to produce goods in the country, to increase export items, to help in controlling price situation, to create opportunities for employment and increase government revenues and to contribute significant in the national development as well as to assist in the country's economic advancement.

The establishment of import substituting industry in Nepal has a great importance. It is one of the means among other to achieve the goal of the economic development in our country. Such industry minimizes the import of goods on one hand and it employs local resources such as labor and materials with in the country on the other hand. Further these industries tend to create employment opportunities and generate revenues in the government exchequer and then it helps to make the balance of payment favorable.

UCIL is established in 2044 B.S. Jestha 31 under company act 2021 (now company act 2053). Share investment of Nepal government and Overseas Co-operation Fund (OECF)'s assistance to meet the foreign currency are the financial component of Udayapur Cement Industry ltd. OECF has contributed Japanese Yen 18770 million and has contributed Nepal Government Rs 450 million to it's total paid up equity shares. Production Capacity of this factory is 275,000 metric tones f cement per year. It started its commercial production since Poush, 2049 B.S.

The Gainda Chhap product of the UCIL is found very qualitative. It is said that the raw materials of the industry are very pure. The limestone is supposed to be pure more than 90%. The red clay is in the industry site is to be perfect. The silica stand is still dirt free. The other materials such as iron ore, which need in small quantity, are imported from India. It may be due to the location of the industry in the mountain

range where pure materials are available that the industry is getting pure raw material and producing qualitative cement.

The cement (Gainda Chhap) produced by the industry meets the standard as well as the Nepali standard. UCIL has early capacity of 2,77,2000 MT cement production but it has not utilized the total capacity due to lack of raw materials and liberalization policy of Nepal government.

The basic objectives of this study is to examine the inventory management system as practical by the UCIL. The present study basically aimed at variables of the inventory management.

Research methodology is a tool for scientific study which is supported by collection, analysis and interpretation of data, information, facts and figures, financial and statistical tools are used to analyze the data collected during study.

The analysis of this study includes analysis of inventory management in UCIL, analysis of present its effect on the present position of inventory management, Ratio analysis, Regression analysis and correlation analysis. For this purpose the data covering a decade 2056 to 2065 were picked up.

So, far the study has a broad scope academic as well as practical. As a Master's Degree thesis this thesis has limitations. Which the nature of the purpose study is concerned with Inventory management system of UCIL and its impact on profitability, the scope of the study is will be limited to this very aspect only.

5.2 Conclusion

In conclusion, it can be said that Inventory Management is an important part of any manufacturing organization. Many firm become failure due to not properly managing inventory. To produce any goods or services, it requires many types of material, direct or indirect. If the firm does not get any required materials at needed time, production system may be disturbed and fail to produce and sale required quantity of products. Keeping more inventory will be expensive due to it needs large amount to invest in

inventory, not only that keeping large amount of inventory will also increase cost associated with inventory where as keeping minimum amount will create the problem of shortage. Therefore, inventory management plans for required amount of different types of inventory, required period and cost associated in it.

Any stock that a firm keeps to meet its future requirement for production and sales is called inventory. The basic reason for holding inventory is to keep up the production activities unhampered. Inventories are a part of assets, which is, used within one year, in the normal course of business operation manufacturing organization's inventory of raw materials, work-in-progress, finished goods, spare parts, suppliers etc. Therefore, combination of raw materials, work-in-progress, finished goods and suppliers is called inventory. Managing the stock at lowest cost is called inventory management. In other words, the planning, coordinating and controlling activities related to the flow of inventory into, through, and out of an organization.

Therefore, the main objective of inventory management is to minimize the total cost and maximize profit of firm.

5.3 Recommendations

The study stresses the need for a good inventory management system to the better performance of the company. If UCIL initiates steps to the appropriate management of inventory, certainly it will cope its set objectives successfully. On the basis of the study, the following suggestions are recommended for consideration.

-) There is lack of proper planning of purchasing raw materials because the procurements of different raw materials is fluctuating from year. UCIL has not given proper attention to this important segment. So it is suggested that the procurement department with the cooperation of production and marketing department should analyze the annual required materials following a appropriate purchasing policies. For this, if possible maximum stock level and re-order level a well as economic lot size should be fixed. This helps the management to strike balance between liquidity and profitability in the company.

-) There is high deviation in the amount of annual collection and consumption. The annual production capacity is very far from the existing production volume. Due to this the production cost per ton cement is very high than the material cost per ton. therefore the production of installed capacity of this industry they should purpose production plan on the basis of market demand and try to utilize it's means of production effectively.
-) UCIL is running in loss except the FY2056/057, 2062/063, 2063/064 when the production is 155503 MT, 124985 MT, 136988 MT, & 128696MT. If the company is not using its full capacity, the production cost would naturally be high. Other thing remaining same if the production increased the company could make a profit. \so UCIL should utilize its production capacity in full as well as co- ordinate between factors of production.
-) The company has lack of study on effective and efficient inventory management system for controlling inventory. Due to this, the huge money to be blocked in the inventory. How much money should be company invests in the inventory? How much inventories should be stocked? How can we minimize the inventory cost?, What is the optimum EOQ, and what is optimum ROP are the questions which the company pays more attention for the better performance.
-) In the aspect of Inventory to Current Assets Ratio, UCIL's situation is very poor. During the 10 years study period, the company's inventory turnover ratio is very poor. It indicates excessive inventory kept by the firm. In other words, the company has more stock, of finished goods for sale. Due to more investors are kept in the stock, unnecessary investment tied up on it. UCIL is not able to change its inventory into receivable/cash through sales. So UCIL has to give more attention in regards of inventory turnover.
-) UCIL has not exercised how much working capital should keep in form of closing stock of finished goods. Generally 85% of working capital, in the form of closing stock of finished goods is considered as an ideal ratio. But unfortunately, during the study period we do not find such optimum ratio. So it should be better to improve the relationship of closing stock of finished goods and working capital.

) Material is an important item of inventory in production in a manufacturing organization. Proper material management is not found in UCIL. Studies by experts in this field have brought out it, if an organization can affect 5% saving in material cost, it would be as increasing the production or sales by about 36%. Hence the company is advised to enhance the materials control mechanism.

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ANNEX - 1

Dear Sir/ Madam,

I would like to request you kindly fill up the following questionnaire prepared for collection of your views as valuable resources for my research work.

This research is concluded for partial fulfillment of requirements of Masters of Business Studies (MBS) Degree. I am concluding a research work "*Inventory Management and its Impact on profitability, a case study of Udayapur Cement Industry Limited*".

I would be very much appreciating if you kindly spare few of your busy and valuable time for my research work. Your views are purely used in my academic purpose only and would not be public.

Thanking you for the anticipation.

Sincerely Yours

Mahendra Pradhan

(Researcher)

Nepal Commerce Campus, T.U

ANNEX - 2

List of the Respondent for the Questionnaire

PEs	Department	Post	Address	Phone No.
UCIL	Production	Production Manager	Jaljale	035-521043
	Sales	Sales Assistant		
	Purchase	Purchase Assistant		
	Storekeeping	Storekeeper		

ANNEX -3

<p>1. Name of PE: Udayapur Cement Industry Ltd. Address: Central Office, Jaljale, Udayapur Fax no.: 035-5214032 Telephone No: 035-521403, 511230, 521105</p>
<p>2. Enterprises Establishment of Order Date: 31.2.2044 B.S Date of Incorporation: 31/2/2044 B.S At under which PE was incorporated: Company Act, 1964</p>
<p>3. Objectives on Incorporation: Production, Selling and Distribution of Cement</p>
<p>4. Capital at the time of Incorporation: Rs. 4000 Million (Authorized), 300 Million (Issued Capital)</p>
<p>5. Present Governing Act: Company Law</p>
<p>6. Present Objective: Production, Selling and Distribution of Cement</p>
<p>7. Line ministry: Industry, Commerce and Supply</p>
<p>8. <u>Financial Updated Status:</u> A. Final Audit Completed Upto: FY 2004/2005 B. Provisional Financial Statement Prepared Upto: C. If Provisional Financial Statement up to Previous FY is not prepared when it can be completed:</p>
<p>9. <u>Financial Status:</u> A. Net Profit/Loss for FY 2004/2005: Rs. 83700000 B. Cumulative Profit/Loss up to FY 2004/2005: Rs. 104070000</p>

ANNEX -4

Calculation of Karl Pearson's Correlation

1) Production and Sales in amount (0000000)

F.Y.	Prod ⁿ . (X)	Sales (Y)	x= (X-Mean)	x ²	y = (Y- mean)	y ²	xy
2055/056	32	31	-11.5	132.25	-15.9	252.51	182.29
2056/057	36	45	-7.5	56.25	-1.9	3.61	14.25
2057/058	31	33	-12.5	156.25	-13.9	193.21	173.75
2058/059	39	42	-4.5	20.25	-4.9	24.01	22.05
2059/060	39	39	-4.5	20.25	-7.9	62.41	35.55
2060/061	46	52	2.5	6.25	5.1	26.01	12.75
2061/062	49	54	5.5	30.25	7.12	50.41	39.05
2062/063	56	60	12.5	156.25	13.1	171.41	163.75
2063/064	53	59	9.5	90.25	12.1	146.41	114.95
2064/065	54	54	10.5	110.25	7.1	50.41	74.55
Total	x X435	y X469	x X0	x ² X778.5	y X0	y ² X980.	xy X 833.54
Mean	43.5	46.9					

According to Karl Pearson's formula,

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

$$r = \frac{833.54}{10 \sqrt{\frac{778.54}{10} \cdot \frac{980.9}{10}}}$$

$$= \frac{833}{10 \sqrt{8.8233 \cdot 9.9040}}$$

r = 0.9538

Probable Error of coefficient of correlation

$$P.E. = m \cdot 0.6745 \frac{1 - Zr^2}{\sqrt{n}}$$

$$= 0.6745 \frac{1 - Z(0.9538)^2}{\sqrt{10}}$$

$$= 0.0193$$

The value of r in the universe would

r ± P.E.

= 0.9538 ± 0.0193

= 0.9791 or 0.9345

Highly Significant

ANNEX-5

(2) Consumption of Raw Material and Sales in Amount (Rs 0000000)

Fiscal Year	Material (X)	Sales (Y)	x= (X-mean)	x ²	y = (Y-mean)	y ²	xy
2055/056	11	31	-5.3	28.09	-15.9	252.81	84.27
2056/057	16	45	-0.3	0.09	-1.9	3.61	0.57
2057/058	13	33	-3.3	10.89	-13.9	193.21	45.87
2058/059	14	42	-2.3	5.29	-4.9	24.01	11.27
2059/060	16	39	-0.3	0.09	-7.9	62.41	2.27
2060/061	17	52	0.7	0.49	5.1	26.01	3.57
2061/062	20	54	3.7	13.69	7.1	50.41	26.27
2062/063	20	60	3.7	13.69	13.1	171.41	48.47
2063/064	18	59	1.7	2.89	12.1	146.41	20.57
2064/065	18	54	1.7	2.89	7.1	50.41	12.07
Total	x X163	y X469	x X0	x ² X78.1	y X0	y ² X980.9	xy X255.2.
Mean							

According to Karl Pearson's formula,

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

$$r = \frac{255.2}{10 \sqrt{\frac{78.1}{10} \frac{980.9}{10}}}$$

$$= \frac{255.2}{10 | 2.7946 | 9.9040}$$

r = 0.9220

Probable Error of coefficient of correlation

Probable Error of coefficient of correlation

$$P.E. = m \cdot 0.6745 \frac{1 - Zr^2}{\sqrt{n}}$$

$$= 0.6745 \frac{1 - Z(0.9220)^2}{\sqrt{10}}$$

$$= 0.010112$$

The value of r in the universe would

r > P.E.

= 0.9538 > 0.010112

= 0.84612 or 0.664388

Highly Significant

ANNEX-6

(3) Material Cost Per ton and Cost Price of cement in amount (Rs 00)

F.Y.	Material (X)	Cost (Y)	x=(X-mean)	x ²	y = (Y-mean)	y ²	xy
2055/056	9	27	-5.1	26.1	-11.7	136.89	59.67
2056/057	17	46	2.9	8.41	7.3	53.29	21.17
2057/058	13	32	-1.1	1.21	-6.7	44.89	7.37
2058/059	12	33	-2.1	4.41	-5.7	32.49	11.97
2059/060	15	36	0.9	0.81	-2.7	7.29	-2.43
2060/061	14	37	-0.1	0.01	-1.7	2.89	0.17
2061/062	16	39	1.9	3.61	0.3	0.09	0.57
2062/063	15	41	0.9	0.81	2.3	5.29	2.07
2063/064	14	41	-0.1	0.01	2.3	5.29	-0.23
2064/065	16	45	1.9	3.61	6.3	39.69	11.97
Total	x X141	y X387	x X0	x ² X48.9	y X0	y ² X328.1	xy X112.3
Mean							

According to Karl Pearson's formula,

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

$$r = \frac{112.3}{10 \sqrt{\frac{48.9}{10} \frac{328.1}{10}}}$$

$$= \frac{112.3}{10 \sqrt{2.2113 \times 5.728}}$$

r = 0.8866

Probable Error of coefficient of correlation

Probable Error of coefficient of correlation

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

$$= 0.6745 \frac{1 - Z(0.8866)^2}{\sqrt{10}}$$

= 0.0456

The value of r in the universe would

r ± P.E.

= 0.9538 ± 0.0456

= 0.9322 or 0.841

Highly Significant.

ANNEX-7

(1) Regression of Production in Quantity on Sales

Fiscal Year	Production(Y)	Sales(X)	y ²	x ²	xy
2055/056	12	31	144	961	372
2056/057	8	45	64	2025	360
2057/058	10	33	100	1089	330
2058/059	12	42	144	1764	504
2059/060	11	39	121	1521	429
2060/061	12	52	144	2704	624
2061/062	13	54	169	2916	702
2062/063	14	60	196	3600	840
2063/064	13	59	169	3481	767
2064/065	12	54	144	2961	648
Total	y X117	x X469	y ² X1395	x ² X23022	xy X5576

Simple regression equation is $Y = a + bx$

Where,

$$b = \frac{\sum xy}{\sum x^2} - \frac{\sum y}{\sum x} \cdot \frac{\sum x}{\sum x^2}$$

$$= \frac{5576}{23022} - \frac{117}{469} \cdot \frac{469}{23022}$$

b = 0.08646

a = y - bx

a = 11.7 - (0.08646) | 46.9

a = 7.645026

Equation y = 7.645026 + (0.08646)x

Simple coefficient of determination (r^2)

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

$$= \frac{5576 - \frac{117}{469} \cdot 23022}{1395 - \frac{(117)^2}{469}}$$

$r^2 = 0.293831$

r = 0.54206

Standard Error (SE) = $\frac{1 - r^2}{\sqrt{n}}$

$$= \frac{1 - (0.54206)^2}{\sqrt{10}}$$

= 0.2233

T-test,

$$t = \frac{b}{S.E}$$

t = 0.08646/0.2233

t = 0.38719

ANNEX - 8

(2) Regression on Closing Stock of Finished Goods (y) and Sales(X)

Fiscal Year	Finished Goods(Y)	Sales(X)	y ²	x ²	xy
2055/056	21	31	441	961	651
2056/057	26	45	676	2025	1170
2057/058	16	33	256	1089	528
2058/059	5	42	25	1764	210
2059/060	8	39	64	1521	312
2060/061	4	52	16	2704	208
2061/062	9	54	81	2916	486
2062/063	10	60	100	3600	600
2063/064	10	59	100	3481	590
2064/065	10	54	100	2961	540
Total	y X119	x X469	y ² X1859	x ² X1859	xy X5259

Simple regression equation is $Y = a + bx$

Where,

$$b = \frac{\sum xy}{\sum x^2} - \frac{\sum y \sum x}{n \sum x^2}$$

$$b = \frac{5295 - \frac{119 \times 469}{10}}{23022 - \frac{10 \times (46.9)^2}{10}}$$

$$b = -0.27888$$

$$a = y - bx$$

$$= 11.9 - (-0.27888) \times 46.9$$

$$a = 24.979472$$

$$\text{Equation } y = 24.979472 + (-0.27888)x$$

Simple coefficient of determination (r^2)

$$r^2 = \frac{a \sum y + b \sum xy - \frac{(\sum y)^2}{n}}{\sum y^2 - \frac{(\sum y)^2}{n}}$$

$$= \frac{24.9794 \times 119 + (-0.27888) \times 5295 - \frac{(119)^2}{10}}{1859 - \frac{(119)^2}{10}}$$

$$r^2 = 0.180148$$

$$r = 0.424438$$

$$\text{Standard Error (SE)} = \frac{1 - r^2}{\sqrt{n}}$$

$$= \frac{1 - (0.424438)^2}{\sqrt{10}}$$

$$= 0.25926$$

T-test,

$$t = \frac{b}{S.E}$$

$$t = -0.27888 / 0.2596$$

$$t = -1.07568$$

ANNEX -9

(3) Regression on Purchase of raw materials (Y) on Sales(X)

F.Y.	Raw Material (Y)	Sales(X)	y ²	x ²	xy
2055/056	11	31	121	961	341
2056/057	15	45	225	2025	675
2057/058	12	33	144	1089	396
2058/059	13	42	169	1764	546
2059/060	15	39	225	1521	585
2060/061	18	52	324	2704	936
2061/062	20	54	400	2916	1080
2062/063	37	60	1369	3600	2220
2063/064	20	59	400	3481	1180
2064/065	20	54	400	2961	1180
Total	y X181	x X469	y ² X3777	x ² X23022	xy X9039

Simple regression equation is $Y = a + bx$

Where,

$$b = \frac{xy \sum n \cdot x \cdot y}{x^2 \sum n (x)^2}$$

$$b = \frac{9039 \sum 10 \mid 18.1 \mid 46.9}{23022 \sum 10 (46.9)^2}$$

$$b = 0.53621$$

$$a = y - bx$$

$$= 11.9 - (0.53621) \mid 46.9$$

$$a = -7.048249$$

$$\text{Equation } y = -7.048249 + 0.53621x$$

Simple coefficient of determination (r^2)

$$r^2 = \frac{a \sum y \Gamma b \quad xy \sum n (y)^2}{y^2 \sum n (y)^2}$$

$$= \frac{7.048249 \mid 181 \Gamma 0.53621 \mid 9039 \sum 10 \mid (18.1)^2}{3777 \sum 10 \mid (18.1)^2}$$

$$r^2 = 0.58888$$

$$r = 0.76739$$

$$\text{Standard Error (SE)} = \frac{1 \sum r^2}{\sqrt{n}}$$

$$= \frac{1 \sum (0.076739)^2}{\sqrt{10}}$$

$$= 0.13000$$

T-test,

$$t = \frac{b}{S.E}$$

$$t = 0.53621 / 0.13$$

$$t = 4.1247$$

ANNEX-10

(4) Regression Closing Stock of Raw Materials (x) on Gross Profit(y)

Fiscal Year	Raw Material (Y)	Operating Profit (X)	y^2	x^2	xy
2055/056	23	(6)	529	36	(138)
2056/057	7	89	49	7921	623
2057/058	30	16	900	256	480
2058/059	27	26	729	676	702
2059/060	17	(3)	289	9	(51)
2060/061	20	60	400	3600	1200
2061/062	18	52	324	2704	936
2062/063	24	41	576	1681	984
2063/064	30	57	900	3249	1710
2064/065	42	6	1764	36	252
Total	y X238	x X338	y^2 X6460	x^2 X20168	xy X6698

Simple regression equation is $Y = a + bx$

Where,

$$b = \frac{\sum xy}{\sum x^2} - \frac{\sum y \sum x}{n \sum x^2}$$

$$b = \frac{6698 - \frac{238 \times 338}{10}}{6460 - \frac{(23.8)^2}{10}}$$

$$b = -1.692307692$$

$$a = y - bx$$

$$= 33.8 - (-1.692307692) \times 23.8$$

$$a = 74.0769230696$$

$$\text{Equation } y = 74.0769230696 + (-1.692307692)x$$

Simple coefficient of determination (r^2)

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

$$= \frac{6698 - \frac{238 \times 338}{10}}{6460 - \frac{(23.8)^2}{10}}$$

$$r^2 = 0.51048$$

$$r = 0.51048$$

$$\text{Standard Error (SE)} = \frac{1 - r^2}{\sqrt{n}}$$

$$= \frac{1 - (0.51048)^2}{\sqrt{10}}$$

$$= 0.23382$$

T-test,

$$t = \frac{b}{S.E}$$

$$t = -1.692307692/0.23382$$

$$t = -7.2377$$