A CASE STUDY ON

EFFECTIVE APPLICATION AND IMPLEMENTATION OF COST REDUCTION TOOLS IN NEPALESE MANUFACTURING ORGANIZATIONS

A THESIS

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RECOMMENDATION

This is to certify that the thesis:

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

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VIVA VOCE SHEET

We have conducted the viva-voce examination of the thesis presented

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and found the thesis to be the original work of the student written according to the prescribed format. We recommend the thesis to be accepted as partial fulfillment of the requirements for the degree of Masters of Business Studies (M.B.S.)

Viva-Voce Committee

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DECLARATION

I hereby declare that the work reported in this thesis entitled **A Case Study on Effective Application and Implementation of Cost Reduction Tools in Nepalese Manufacturing Organizations** submitted to Research Department of Nepal Commerce Campus, Faculty of Management, Tribhuvan University, is my original work. This research work is conducted in the form of partial fulfillment of the requirements for the master of Business studies (MBS) under the supervision and guidance of Prof. Dr. Bihari Binod Pokharel of Nepal Commerce Campus, New Baneshwor.

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Most of organizations are suffering organizational activities. So, cost reduction is one of the major issues today. We have been hearing news regarding winding up of a company due to high operating cost. In Nepal, high cost problem in manufacturing organization is major headache. Most of Japanese manufacturing organizations have succeeded due to applying right cost reduction tools. But in Nepal, most of organization do not have any idea about cost reduction tools some private organizations are sincere and positive to apply such tools. But other public and government base organization are failure to use these tools they even don't know why and how one organization can reduce costs. They are conducting their business on their luck. So, daily we are compelled to read news about bad days of our native industries, and other side good news about progress of manufacturing organizations in Japan, China a USA.

This study is an attempt to closely know about the application of modern cost reduction tools in Nepalese manufacturing organization widely being used by Japanese manufacturing organizations at present, which have led them to pick of success. Further this study tries to explore practical difficulties to use such tools.

I express my sincere thank to my thesis supervisor Prof. Dr. Bihari Binod Pokharel, Chairperson of Research Department for his valuable guidance, suggestions, support and supervision to complete this thesis and making this research productive.

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Keshar Chandra Bhandari

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ABBREVIATION

ABC	=	Activity Based Costing
ABCM	=	Activity Based Cost Management
ABM	=	Activity Based Management
B.S.	=	Bikram Sambat
BS	=	Balance Scorecard
CDM	=	Central Department of Management
CF	=	Correction factor
e.g.	=	For example
HRD	=	Human Resources Development
HRM	=	Human Resources Management
IMA	=	Institutions of Management Accountants
JIT	=	Just-in-Time
LCM	=	Least Common Multiplier
LCM	=	Least common multiplier
Ltd.	=	Limited
MACS	=	Management Accounting Costing System
No.	=	Number
SAARC	=	South Asian Association for Regional cooperation
SSE	=	Sum of squares due to Errors.
SSR	=	sum of squares between Rows
SSS	=	Sum of squares between columns
TOC	=	Theory of Constraints
TQC	=	Total Quality Control
TQM	=	Total Quality Management
TSS	=	Total sum of squares
TU	=	Tribhuvan University
USA	=	United States of America
VS	=	Versus
WTO	=	World Trade Organization

CHAPTER - I

INTRODUCTION

1.1 Background of the Study

Industrialization is the key factor in the process of economic development and its importance as a means of achieving economic growth and prosperity is immense. Industrialization offers the prospects for the exposition of employment and income. Further it generates innovations and technical changes that bring absent shifts in the production frontier, there by accelerating growth and factor productivities. Economic prosperity achieved by the so called developed countries of the world is largely by dint of rapid industrialization. This apparently reflects the tremendous significance of industrialization. Industrial development is more or less deeply associated with, and development on, other vital aspects such as agriculture, trade, transport, state policy and human attitude and efforts. Moreover industrialization in a long term affair and road to it's attainment is not as smooth as expected. Nepal is in the sphere of industrial development, is still in an infant stage and is just struggling to get matured. The contribution of manufacturing sector to GDP is estimated to be below 10 percent. Nepalese economies still depend mainly upon agriculture.

Long term sustainable development of any country directly and indirectly depends up on the promotion and growth of businesses and industries. Businesses and Industries are main key factors for development of a country. And the life of Businesses and Industries depends up on the efficient utilization of limited resources. The businesses and industrial enterprises are initiated by the entrepreneurs who start businesses with a vision and skills. For initiating the business and industrial enterprises, the cost plays a vital role. Every business firms or industries must bear cost to run day to day business activities. So, cost is unavoidable factor for business firms. Every business organization is worry about management of cost in its day to day operation. So it is very challenging job for every organizations. In developed countries, management of cost and application of cost reduction tools are also very challenging tasks. In the developing country Like Nepal, Business firms are said to be loosing their competitiveness due to higher cost. Most of the organizations are not using the cost

reduction tools in Nepal. So, they are suffering form loss every year. As Nepal has entered into WTO, Nepalese manufactures have to face high competition. Free enter of highly quality base cheap products are main headache for Nepalese entrepreneurs. Due to this, Nepalese products are less competitive with the products of other countries made of highly sophisticated technologies with lower price. This is the main challenging issues for Nepalese organizations. So, it has been a must for Nepalese manufacturing enterprises to apply the cost reduction tools effectively and efficiently.

To remain competitive in today's global markets, business must continuously improve. Moreover this continuous improvement needs to apply across the spectrum of business activity: from product design and quality through production operation and cost management, to customer service. Continuous improvement may be defined as the constant effort to eliminate the waste, reduce response time, simplify the design of both product and process and improve quality of customers' service. One compelling reason for the need for continual improvement is the price down cost concept. This refers to the tendency of price to fall over the life cycle of the newly introduced product. (Hilton, 1997: 264)

Application of cost reduction tools means managing of limited resource to produce high efficiency. It consists of those actions which are taken by manager to reduce costs. Cost reduction activities, taken by manager, are based on two criterions. One criterion of actions is prioritized on the basis of information extracted from the accounting system. Other actions however are under taken without the use of accounting information. They involve process involvements where an opportunity has been identified to perform process more effectively and efficiently and which have obvious cost reduction outcomes. Nowadays every organization is facing the challenges of competition. Success is not a matter of chance. In very comfortable and affordable price, production of qualitative product is very challenging job. It is not very hard, if organization use the cost reduction tools. So, management of cost by using cost reduction tools is necessary in every business organization.

The research work, 'Application of cost reduction tools in Nepalese manufacturing originations is not a case study. It is a survey study on many manufacturing industries situated in Kathmandu Valley. There are so many manufacturing industries in Kathmandu valley. Some of them are running successfully and some of them are in

critical condition. Those who are running successfully are called healthy industries. And those who are in the situation of do or die are called unhealthy organization. There are so many causes of success or failures. Among them, cost is main factor. Only qualitative goods can not be sold due to high cost. So, reduction of cost is very much essential. Most of the Nepalese organizations are facing such high cost problem. Now, this research work is going to explore and to examine whether or not the Nepalese organizations are using cost reduction tools? So, it mainly focuses on the manufacturing organization in term of application of cost reduction tools.

1.2 Relevance of the Study

Every day we hear news regarding the shut-down of many big corporations. Although the reason whatever, the cost can be sometimes explained reasonable. Every business organization wants its contribution in society. It wants to niche at least a sustainable margin for it. But it is not reachable when organizations fail to manage its cost. Then it becomes very miserable condition for organizations. Most of organizations think that to purchase at lower price from supplier is only the key factor to reduce the cost. But in fact, it is a little effort to reduce the cost not at all. There are so many other tools/mechanisms to reduce the cost. So, application of suitable cost reduction tools is important. This research work is significant in terms at exploring and examining the cost reduction tools applied by Nepalese manufacturing organization. So, the outcome of this research work is equally important to generate the knowledge to researcher as well as Nepalese organizations.

1.3 Objectives of the Study

The main objective of the study is to evaluate the application of the cost reduction tools in Nepalese manufacturing organizations. In order to meet the main objective of the study, the following sub objectives have been proposed.

1. To explore the current state for application of the cost reduction tools in Nepalese manufacturing organizations.
2. To identify the practical difficulties for applying cost reduction tools in Nepalese manufacturing organizations.
3. To know the view regarding application of cost reduction tools in organizations.

4. To provide suggestion and recommendation for the betterment of cost reduction.

1.4 Statement of the Problems

The main problem of Nepalese manufacturing organization is incurrence of high cost during the product production process. Due to this, many of the firms are being shut down. It is a very miserable condition for industry as well as nation also. Most of the organizations think that they have to buy raw materials in very low cost from their suppliers. The purchase manager only concerns with this topic. So, other manages show less responsibility toward cost minimization. This is why organizations have to face high cost problem. This is not only the one's responsibility. As we know, there are so many cost centers in one manufacturing organization. All cost centers should be responsible for managing the cost. So, management should know that using many cost reduction tools other than direct bargaining for costs with the suppliers can reduce cost of goods and services. Lack of well educated human resources and experienced management team are the problem in every business firms.

In the above context, the research work intends to explore the following questions.

1. Do knowledge of cost reduction tools affect in the application of the tools?
2. What is the manager's attitude to use such tools?
3. To what extent do organizations apply cost reduction tools?
4. Can competition among similar organizations help to use cost reduction tools?

1.5 Limitations of the Study

1. The study focuses only the manufacturing organizations based in Kathmandu valley.
2. The Study is based on the application of selected cost reduction tools only.
3. The research is mostly based upon primary data provided by the respondents. So, the reliability of the conclusion highly depends upon respondent's responses.
4. The status of the application of cost reduction tools analyzed in this research work is based on the data collected at the time of unit visit. Hence, this research work is not incurred the status before and after the visit.

1.6 Organization of the Study

The research report has been divided into five different chapters.

Chapter I Introduction

The introduction chapter consists of the background of the study, relevance of the study, objective of the study, statements of the problems, limitations of the study, and organization of the study.

Chapter II Review of Literature

This chapter deals with conceptual review, review of previous related studies and research gap.

Chapter III Research Methodology

Research methodology chapter contains research design population and samples, sources of data, data collection techniques and data analysis tools.

Chapter IV Data Presentation and Analysis

This chapter deals with data presentation and analysis with the help of various tools, graphs and diagram. Major findings of the study are also presented in this section.

Chapter V Summary, Conclusion and Recommendations

The last chapter of research report contains summary, conclusion and recommendations of the study.

CHAPTER - II

REVIEW OF LITERATURE

This research work relates to the application of cost reduction tools in Nepalese manufacturing organizations. Accordingly, literature review relates to the following:

- Conceptual review
- Area of cost Reduction
- Tools and Techniques of Cost Reduction.
- Review of previous studies

2.1 Conceptual Review

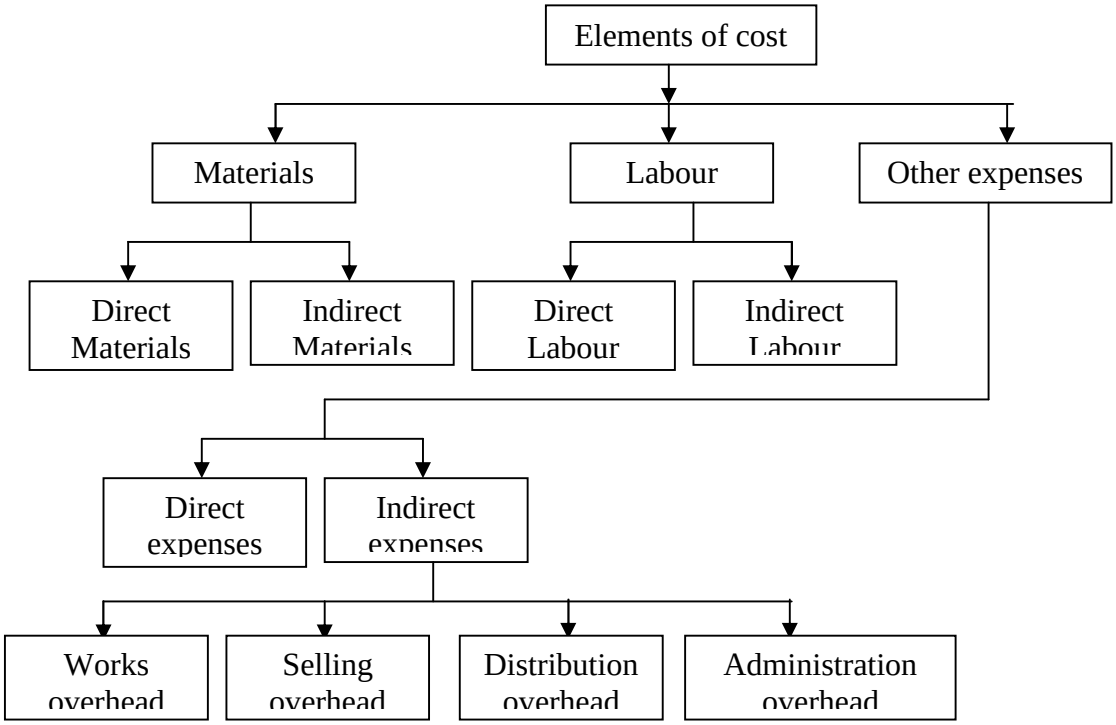
2.1.1 Concept of Cost

Cost is the amount of expenditure actual (incurred) or notional (attributable), relating to a specific thing or activity, may be a product, job service, process or any other activity. Cost is the amount of resources given up in exchange for some goods or services. The resources given up are generally in terms of money or if not in terms of money, they are always expressed in monitory terms. The terms 'Cost' itself is without any significant meaning and therefore, it is always advisable to use it with an adjective or phrase that will convey the meaning intended such as prime, direct, indirect, fixed, variable, controllable, opportunity, imputed, sunk, differential, marginal, replacement and the like (Lal, 1996: 23)

Accountants, economists, engineers and others facing cost problems have developed cost concepts and cost terminology according to their needs. Basically a concept should be stated in the terms in which it has become generally familiar. It is not easy to define or explain the term cost leaving no doubt concerning its meaning. The committee on cost concepts and standards of American Accounting Association wrote; "Cost is foregoing, measured in monitory terms, incurred or potentially to be incurred to achieve a specific objective. In a tentative set of Board Accounting principles for Business Enterprises "cost" is defined as an exchange price, a foregoing, a sacrifice to secure benefit. In financial accounting, the foregoing, or sacrifice at date of acquisition is represented by a current or future diminution in cash or other assets." (Matz/Cury, 1972: 39)

2.1.2 Elements of Cost

For the purpose the total cost is normally analyzed by the element of total cost i.e. by the nature of expenses. Broadly speaking the elements of cost are three in numbers, Viz, materials (stores), Labour (Wages), and overheads (other expenses). (Swaminathan, 1978:22)



The elements that enter into the cost of quantity are direct materials, direct labour, and manufacturing overhead. The elements that enter into the creation of a particular business or municipal service are essentially labor or payroll cost and variety of overhead or indirect costs (J.W. Neuner, 1957: 5)

2.1.3 Classification of Cost

Classification is the process of grouping cost according to their common characteristics. It is a systematic placement of like items together according to their common features (Dangol, 2062: 20)

There are many objectives of cost classifications depending on the requirements of management. However, the following objectives are considered very useful and significant.

i. Determining product cost for stock valuation and profit measurement.

ii. Planning

iii. Decision making

iv. Control (La, 1996: 20)

1. Natural Classification of Cost

a. Direct Materials

The direct material is all material that becomes a part of the product. The costs of which are directly charged as part of the prime cost. In other words, it is the material which can be measured and charged directly to the cost of product. (Owler and Brown, 1960:8)

b. Direct Labour

Direct Labour is all Labour expended in altering the construction, composition, conformation, or condition of the product. The wages paid to skilled and unskilled workers for this labour can be allocated specifically to the particular cost account concerned-hence the term "Direct wages", which may be defined as the measure of direct labor in terms of money. (Owler and Brown; 1960:8)

c. Direct Expenses

Direct expenses include any expenditure other than direct material or direct labour directly incurred on a specific cost unit. Such special necessary expense is charged directly to the particular cost account concerned, as a part of prime cost. (Owler and Brown, 1996:9)

d. Factory Overhead

Factory overhead also called manufacturing expenses or factory burden may be defined as the cost of indirect materials, indirect labour and indirect expenses. (Lal, 1996:27)

e. Selling, Distribution and Administrative Overhead

Selling and distribution overheads usually begin when the factory cost end. Such expenses are generally incurred when the product is in saleable condition. It covers the cost of making sales and delivering/dispatching products. (Lal, 1996:27)

2. Cost Behavior (In Relation to Changes in Output, Activity or Volume)

a. Fixed Cost

Fixed cost is a cost which does not change in total for a given time period despite wide fluctuations in output or volume of activity. These costs are also known as standby costs, capacity cost or period cost (Lal, 1996:28) Fixed costs can be classified in the following categories for the purpose of analysis.

i) Committed Cost/Capacity Cost

Fixed costs caused by purchase of capacity producing assets such as plant or equipment are called committed cost e.g. depreciation of plant equipment, insurance premium. (Khan and Jain, 1997:147)

ii) Discretionary Cost

They are also known as programmed costs. Discretionary cost resulted from special policy decision, management programs, new researches, R and D cost, new system development costs are example of discretionary cost. (Lal, 1996:29)

iii) Managed Cost

Managed costs are related to current operations which must continue to be paid to ensure the continued operating existence of the company eg. Management and staff salaries. (Lal, 1996:29)

iv) Step Cost

A step cost is constant for a given amount of output and then increase in a fixed amount of a higher output level. (Lal, 1996: 29)

b) Variable Cost

Cost that tend to vary total in direct proportion or in a one to one relationship to changes in production activity, sales activity or some other measure of volume are referred to as variable costs. (Khan and Jain, 1997:151)

In view of their behaviors, variable costs are some times called "engineered costs" An engineered cost is any cost that has an explicit specified, physical relationship with a selected measure of activities. (Horngren, 1978:206)

c) Mixed Cost

Mixed costs are costs made up from fixed and variable elements. They are a combination of semi variable costs and semi fixed costs. Because of the variable component they fluctuate with volume, because of the fixed component, they do not change in direct proportion to output. Semi fixed costs are those costs which remain constant upto a certain level of output after which they become variable. (Lal, 1996:30)

3. Degree of Traceability to the Product

a) Direct Cost

Costs which are easily traceable or identifiable with a product are called direct costs. If output units are the objects of costing, then direct costs represents costs and resources that can be traced to or identified with the finished product. Direct labour, direct materials and direct expenses are example of direct cost. (Lal, 1996:31)

b) Indirect Cost

Indirect costs are those costs which can not be identified with, or traced to a single product because they are incurred for several products. The examples are indirect materials, salary of factory supervisors etc. (Lal, 1996:31)

4. Degree with Association with the Product

a) Product Cost

Product costs are identified with goods produced or purchased for resale. Product costs are initially identified as a part of the inventory on hand. These product costs (Inventorial costs) become expenses (in the form of cost of goods sold) only when the inventory is sold. (Horngren, 1996:127)

b) Period Cost

Period costs are the expenses, which are recovered from the revenue of the period, normally. Expenses of general administration, selling and distribution cost and finance are treated as period cost. These costs are not necessary for production and hence, are called period cost. (Nigam and Sharma, 1992:26)

5. Functional Classification of Costs

a) Manufacturing Cost

Manufacturing cost are all product costs incurred to manufacture the products and to bring them to a saleable condition, including direct materials, direct labour and indirect manufacturing (or factory overhead) costs. (Lal, 1996:33)

b) Selling and Distribution Cost

Selling cost is the cost of seeking to create and stimulating demand and of securing orders. Distribution cost is the cost of sequences of operations which begins with making the packed product available for dispatch and ends with making the reconditioned returned empty package for reuse, it includes advertising, samples, warehousing cost, upkeep and running cost of delivery van. (Dangol, 2062:21)

C) Administration Cost

This is general administration cost and includes all expenditures incurred in formulating the policy directing the organization and controlling the operations of an undertaking, which is not directly related to production, selling, distribution and research and development activity of functions. It includes account office expenses, audit fees, bank charges, legal expenses, office rent, postage, telephone, rates and directors remuneration, etc (Dangol, 2062:20)

6. Relationship with Accounting Period

a) Capital Cost and Revenue Cost

Cost can be divided into two broad classes on the basis of accounting period to which they relate: i) capital expenditures and ii) revenue expenditures. A capital expenditure provides benefit to future periods and is classified as expenses. A capital expenditure will flow into the cost stream as an expense, when the asset is used up or written off. (Lal, 1996:3)

7. Cost for Decision Making and Planning

a) Opportunity Cost

An opportunity cost can be defined as the potential benefit that is sacrificed when the choice of one course of action requires the giving up of an alternative course of action. Opportunity cost is not usually entered on the books of organization but it is a

cost that must be expertly considered in every decision that a manager makes. (Garrison, 1985:44)

b) Sunk Cost

A sunk cost is the cost that has already been incurred. Generally known as unavoidable cost, it refers to all past cost since these amounts cannot be changed once the cost is incurred. They are the costs which have been created by a decision in the past and cannot be changed or avoided by any decision that is made in future. (Lal, 1996:34)

c. Relevant Cost

A cost which is influenced by a decision is relevant cost and hence is important for decision makers. Relevant cost in true sense is an incremental cost. (Khan and Jain, 1993: 162)

d. Differential Cost

Any cost that is present under one alternative but is absent in whole or in part under another alternative is known as differential cost. (Garrison, 1985:45)

e. Imputed Cost/Implicit Cost

Implicit costs are those expenses, which can not be proved for external reporting. These are not allowable for tax purpose. Implicit costs are implied in nature, which can just be understood, but may not need to be paid in cash at present or in future, for example, interest on owners, capital. (Bajracharya and Ojha, 2005:51)

f. Out of Pocket Cost

While imputed costs do not involve cash outlays, out of pocket costs signify the cash incurred on an activity. Non cash costs such as depreciation are not included in out of pocket costs. This cost concept is significant for management in deciding whether or not a particular project will a least return the cash expenditure associated with the project selected by management. (Lal, 1996:36)

g. Shutdown Cost

Shutdown costs are those costs which have to be incurred under all situations in the case of stopping manufacture of a product or closing down a department or a division. Shutdown costs are always fixed costs. (Lal, 1996:36)

8. Cost for Control

a. Controllable Cost

An item of cost is controllable if the amount of cost incurred in a responsibility center is significantly influenced by the actions of the manager of the responsibility center, otherwise it is non controllable. (Anthony and Welsh, 1977:28)

b. Non Controllable Cost

Any cost that is not subject to change within the related responsibility center (lower level of management) and within the short time span is called a non controllable cost. (Bajracharya and Ojha, 2005:53)

c. Standard Cost

Standard costs are those costs which are planned or predetermined cost estimates for a unit of output in order to provide a basis for comparison with actual costs. Standard costs are used to prepare budgets. (Lal, 1996:37)

9. Cost Reduction Point of View

a. Costs that Add Value or Value Added Cost

A value added activity is an activity that customers perceive as adding usefulness to the product or service they purchase. For example painting a car would be value added activity in an organization that manufactures cars. (Drury, 2000:8-9)

b. Costs that do not add Value or Non Value Added Costs

Non value added activities are operations that are either (i) unnecessary and dispensable or (ii) necessary but inefficient and immovable. Non value added costs, which result from such activities, are the costs of activities that can be eliminated without determination of product quality, performance or perceived value. (Hilton, 1997:261-262)

10. Other Costs

a) Joint Cost

Joint costs arise where the processing of a single raw material or production resources results in two or more different products simultaneously. Joint cost relate to two or more products produced from a common production process or element material,

labor or overhead or any combination there of so locked together that one can not be produced without producing the others. (Lal, 1996:37)

b) Common Cost

Common costs are those which are incurred for more than one product, job, territory or any other specific costing object. Common costs are not easily identifiable with individual products and, therefore, are generally apportioned. (Lal, 1996:37)

2.1.4 Cost Reduction

Cost Reduction may be defined as an attempt to bring costs down. Cost reduction implies real and permanent reduction in the unit cost of goods manufactured or services rendered without impairing their product or goods) suitability for the use intended. The goal of cost reduction is achieved in two ways: (i) by reducing the cost per unit and (ii) by increasing productivity. The steps for cost reduction include elimination of waste, improving operations increasing productivity; search for cheaper materials, improved standards of quality, findings other means to reduce unit costs. (Lal, 1996:1077)

Profit is the difference between the sale value and the cost of sales. Thus profit can be improved either by increasing the sale or reducing the cost or both. In most of the situations, sale value depends on market forces which can seldom be substantially influenced by managers. Usually, even a real increase in cost can not be passed on fully to the customers and a potion of the cost is burned by the manufacture. Therefore, it is not and always possible to improve profit by increasing sales value. Cost reduction is generally the only alternative for improving the profitability of a product. With allround increase in the cost of inputs and increase in completions, cost reduction has assumed great importance in most of the organizations. (Bhattracharya, 1992:825)

Whilst cost control aims at reducing the actual to the target, cost reduction aims at reducing the target themselves. Viewed from this point, it can be said that cost reduction begins where control ends cost. The necessary for cost reduction arises when the profit margin has to be increased without an increase in the sales turnover, ie. For the same volume of sales the cost of sales should be reduced. If costs are already under control and represent more or less the targets set up, the problem arises as to how best the profit margin could be increased ie. What is the further step to be

taken to reduce the target step to be taken to reduce the target cost of production. This necessary leads us to cost reduction programmes. Cost reduction is a dynamic function, a function which can see no end, inasmuch as no result can ever be taken as ultimate goal. The working of cost reduction programme has rightly been compared by one author to a tiger hunt. (Swaminathan, 1978:349)

Every organization has an objective to attain public undertaking strive for maximization of public welfare. However, maximization of profit is the overriding aim of enterprises in the private sector. (Agrawal, 2026:9)

Cost reduction, in fact, is profit earning. It is essential for the survival of business. In a competitive economy increase of price may not be a sound policy. Consumers may stop buying product. It may even lead to increase in raw materials wages, and other costs. The result may be a vicious spiral where product price increases are followed by wage and other increased costs which in turn are followed by price increases. The solution lies in cost reduction. (Agrawal, 2026: 9)

Cost reduction, therefore focuses on the following:

I. Real reduction in cost

II. The reduction should be of a permanent nature.

III. It should not impair the quality.

IV. It should not impair the suitability for intended use.

2.1.5 Cost Reduction and Cost Control

Cost reduction and cost control is not the same thing. In cost control, actual costs are compared with planned cost and necessary corrective actions are taken where there are variations. It is mainly concerned with adhering to the set standards which are assumed to be the desired state of efficiency in a given set of circumstances. (Agrawal, 2026:9)

Cost reduction, however, is concerned with genuine savings existing costs or standard are regarded as merely yardsticks and efforts are made to improve and change them in all sets of circumstances. The presumption is that genuine changes in costs are always possible. (Agrawal, 2026:9)

Thus, cost reduction is different from cost control. Cost control refers to the mechanism to keep the cost within the established standard, whereas cost reduction challenges the established standard by focusing on the concealed potential saving in the standard. Cost reduction is not cost saving because cost saving may result from a short term decision and under a bad business situations the cost savings decision may even result in the temporary reduction in quality, where as cost reduction is always permanent in nature and never ignores the principle that the quality of product and its suitability for the intended use cannot be reduced in the process of cost reduction. (Bhattacharya, 1992:826)

2.1.6 Organization of Cost Reduction

The cost reduction programmes should be initiated and followed up by a cost reduction committee, which should preferably be under the chairmanship of an industrial engineer. This committee will also include the cost accountant of the organization who, as its financial adviser, will render advice on the various programmes that are considered from time to time. This committee should meet at regular intervals to discuss the new programes to be taken up the progress made on the programes computes. In this connection it should be noted that the research and development projects are slightly different from cost reduction programmes. Research and development concentrate more on new products and improved methods, with the emphasis on increasing the utility of the product and its potentiality marketability. Cost reduction on the other hand aims at reducing the cost of production of the present manufacture and to increase the profit margin. (Swaminathan, 1996:350-351)

2.2 Areas of Cost Reduction

A cost reduction programme should be all pervasive because cost reduction is attainable in almost all the areas of business activities. There can hardly be any area of operation, which can not be improved. (Bhattacharya, 1992:286)

Some of the important cost reduction areas are as follows:

1. Product Design

Product design offers the greatest scope for cost reduction of a permanent nature. Designing being the first step in manufacturing a product, the impact of a decision at

this stage is felt throughout the manufacturing or processing of the product in the factory. The possibility of cost reduction should be investigated at the time of introducing a new design, as well as at the time of introducing any modification in an existing design. (Bhattacharya, 1992:286)

2. Production Planning and Control

Production planning and control (including materials planning and control) endeavors to achieve the best co-ordination among material, manpower and manufacturing facilities. So that delivery commitments are met without causing waste of resources. (Bhattacharya, 1992:287)

3. Plant Layout and Equipment

Plant layout is the floor 'plan' with involves analysis and arrangement of equipments, work station, and floor area to ensure most efficient utilization of equipments, plant facilities and plant services. A good plant lay out aims at reducing the wasteful movements of men, materials and the optimum utilization of the area covered by production facilities. (Bhattacharya, 1992:827)

4. Factory Organization

A considerable cost reducing can be effected by improving the factory organization. Though cost reduction resulting from an improvement in the organization can not be measured, yet it has been undoubtedly established that economies can be achieved through improvements in the following areas. (Bhattacharya, 1992:827)

- Improvement in the organization structure by defining functions and responsibility in clear terms.
- Improvement in communication among various management levels and between managers and workmen.
- Delegation of authority should be encouraged because it helps to achieve better supervision.
- The participation of employees in cost reduction programmes.

5. Purchasing and Material Control

Purchasing and materials control functions should be systematically investigated and the following important question should be asked and answered. (Bhattacharya, 1992: 827)

- Are purchases being made at the right price?
- Is the material inspected as soon as it is received?
- Is there a proper system for the collection and dissemination of market (of raw materials and other inputs) information?
- Is there any scope of improving material handling? etc.

6. Marketing

In marketing, the following are the cost reduction areas: channels of distribution, sales promotion schemes, marketing research plan, territorial responsibilities, methods of remunerating sales men, advertising methods, after sales service costs, packaging methods, material handling, transport arrangement, etc. (Lal, 1996: 1078)

7. Finance

The financial function aims at arranging fund most economically and ensuring the optional utilization of funds so arranged. Working capital provides sample scope for reducing cost because in most of the organizations the scope exists for reducing working capital cycle. Working capital can be reduced by identifying parallel operations, realizing debt without delay, by reducing inventory level through effective inventory control and by reducing for liberal credit from suppliers of materials and services. (Bhattacharya, 1992: 829)

8. Administrative Function

Administrative functions include personnel purchase and general administration. The goal of cost reduction requires efficient administration, effective purchasing procedure and a fair personnel policy and schemes. Some of the important areas are: investment planning, cash discount policy, mechanized system of accounting, labor relations, labour welfare measure, availability of servicing facilities. (Lal, 1996:1078-1079)

9. Direct Labour

Some aspects that need systematic investigation to reduce the cost related to direct labour are:

- Scope for improving the time keeping system
- Scope for improving labour productivity through work study.
- Proper maintenance of equipment and tools.
- Need for supervision of standards so that they continue to be representative of the current conditions.

Scope for providing labour productivity through rationalization, training and use of other human resources development techniques etc. (Lal, 1996:1079)

2.2.1 Cost Reduction Programme

Cost control involves the comparison of actual results with pre-determined standards. It is clear that for the control to be really effective, standards should be reviewed and revised periodically. An old standard might fail to represent the current conditions and a comparison of actual results with these would lead to misleading conclusions. (Bhattacharya, 1992: 827)

The revision of standard requires implementation of a system, which in the light of intervening changes, would continually question the existing standard. This system covers short and routine cost reduction programs. Thus, short term and routine cost reduction programe should form a part of the budgetary control/standard costing system. (Bhattacharya, 1992: 830)

Long-term cost reduction schemes involve plans to deal with improving the efficiency in a particular field. The steps involved include the identification of an area with the highest potential for cost reduction, a comprehensive survey to narrow down the area of investigation, application of cost reduction techniques and implementation of the accepted suggestions which might involve capital expenditure. For achieving expected results it is essential that the objective of a particular cost reduction programme, the scope of investigation and responsibilities of the individuals involves on the programme are clearly defined. (Bhattacharya, 1992: 830)

2.2.2 Cost Reduction Committee

There should be team work approach to cost reduction. In small concerns, cost reduction is the concern of all members of the staff and the initiative is generally taken by the higher levels management. (Agrawal, 2026:9)

However, in large scale concerns, a cost reduction committee should be set up to effect permanent savings. Its members should be drawn from research and development, productions and marketing departments with the cost accountant being the secretary and co-ordinator of the committee. The committee must have the necessary booking of the highest levels of management; get full cooperation from all the employees, personnel should know what products are being produced along with a clear understanding of their cost structure. Cost centers with clear demarcation of responsibilities for the cost reduction should establish and the areas for cost reduction should be properly selected. The continuous appraisal of the cost reduction programme is essential to measure its effectiveness. (Agrawal, 2026:10)

Effective management and cost savings are interrelated. The survival of our industries very much depends on their "cost reduction" consciousness. In fact, it is essence of individual survival. (Agrawal, 2026:10)

2.3 Cost Management and Cost Reduction Tools

Cost management focuses on cost reduction and continuous improvement and change rather than cost containment. Traditional cost control systems tend to be based on the preservation of the status quo and the ways of performing existing activities are not reviewed. The emphasis is on cost containment rather than cost reduction. Indeed, the term cost reduction could be used instead of cost management but the former is an emotive term. Therefore, cost management is preferred. Whereas traditional cost control systems are routinely applied on a continuous basis, cost management tends to be applied on an adhoc basic when an opportunity for cost reduction is identified. Also many of the approaches that are incorporated with the area of cost management do not necessary involve the use of accounting techniques. In contrasts, cost control relies heavily on accounting techniques. (Drury, 2004:943-944)

Cost management consists of those actions that are taken by managers to reduce cost some of which are prioritized on the basis of information extracted from the accounting system. Other actions, however, are undertaken without the use of

accounting information. They involve process involvements, where opportunity has been identified to perform process more effectively, and efficiently, and which have obvious cost reduction outcomes. It is important that organizations are aware of all approaches that can be used to reduce costs even if these methods do not really based on accounting information. Organizations should also note that although cost management seeks to reduce costs, it should not be at expense of customer satisfaction. Ideally, the aim is to take actions that will both reduce costs and enhance customer satisfaction. (Drury, 2004: 945)

Manager commonly use the following tools to implement the firms broad strategy and to facilitate the achievement of success on critical success factors-Benchmarking, Total Quality Management, Continuous Improvement (Kaizen), Activity Based Costing, Reengineering, Theory of Constraints, Mass Customization, Target Costing, Life Cycle Costing and the Balance Scorecard. (Blocher, 1999:16)

2.3.1 Benchmarking

In order to identify the best way of performing activities and business processes organizations are turning their attention to benchmarking, which involves comparing key activities with world class best activities with world class best practices. Benchmarking attempts to identify an activity, such as customer order processing, that needs to be improved and finding a non-rival organization that is considered to represent world class best practice for the activity and studying how it performs the activity. The objectives are to find out how the activity can be improved and ensure that the improvements are implemented. Benchmarking is cost beneficial since an organization can save time and money avoiding mistakes that other companies have made and/or the organization can avoid duplicating the efforts of other companies. The overall aim should be to find and implement best practice. (Drury, 2004: 9650

Benchmarking is a process by which a firm identifies its critical success factors, studies the best practices of other firms (or other units within a firm) for these critical factors, and then implements improvements in the firm's process to match or beat the performance of those competitors. Benchmarking was first implemented by Xerox Corporation in the late 1970s. Today many firms use benchmarking, and some of these firms are recognized as leader, and therefore, benchmarks, in selected areas. (Blocher, 1999:12)

Benchmarking efforts are facilitated today by cooperative networks of non competing firms that exchange benchmarking information, for example, the institute of management accounting (IMA) has a continuous improvement center to help organizations benchmark and there by improve their financial processes. The IMA program includes accesses to a benchmark database, assistance in assessing CSFS, programs to assist firms in implementing improvement opportunities, and a recognition program that honors firms that achieve outstanding levels of continuous improvement. The Houston International Benchmarking clearinghouse also assists firms in strategic benchmarking. (Blocher, 1999:13)

2.3.1.1 Process of Benchmarking

The benchmarking process typically consists of five stages that include several organizational/diagnostic, operational, and informational factors. (Kaplan, 2004:299)

Stage-1 Internal Study and Preliminary Competitive Analysis

In this stage, the organization decides which key areas to benchmark for study for example, the company's activities, products methods. Then the company determines how it currently performs on these dimensions by initiating both preliminary internal competitive analysis using internal company data and preliminary external competitive analysis using for example industry comparisons of quality from publications such as consumer reports or T.D. powers and associates reports. (Kaplan, 2004:299)

Stage-2 Developing Long Term Commitment to the Benchmarking Project and Coalescing, the Benchmarking Team

In this stage, the organization must develop its commitment to the benchmarking project and coalesce a benchmarking team. Because significant organizational change, such as adopting a total-life-cycle costing approach can take several years, the level of commitment to benchmarking has to be long term rather than short term. (Kaplan, 2004: 300)

Stage 3- Identifying Benchmarking Partners

The third stage of benchmarking includes identification of partners-willing participants who know the process. Some critical factors are as follows: (Kaplan, 2004:30)

1. Size of the partners
2. Number of partners
3. Relative positive of the partner within and across industries.
4. Degree of trust among partners.

Stage 4- Information Gathering and Sharing Methods

Two dimensions relating to information gathering and sharing emerge from the literature. (Kaplan, 2004:3020)

i. Type of information that benchmarking organizations collect

Firms interested in benchmarking can focus on three broad classes of information. Product benchmarking is the long standing practice of carefully examining other organizations' product. Functional (process) benchmarking is the study of other organizations' practice and costs with respect to functions or processes such as assembly of distribution. Strategic benchmarking is the study of other organizations' strategies and strategic decisions, such as why organizations choose one particular strategy over another. (Kaplan, 2004:302)

ii. Methods of information collection

Management accountants play a key role in gathering and summarizing information used for benchmarking. These are two major methods of information collection for benchmarking. The most common can be described as unilateral (covert) benchmarking in which companies independently gather information about one or several other companies that excel in the area of interest. A second method is cooperative benchmarking, which is the voluntary sharing of information through mutual agreements. The major advantage of cooperative benchmarking is that information sharing occurs both within and across industries. Cooperative benchmarking has three subcategories: data base, indirect/third party, and group. (Kaplan, 2004:302-303)

Stage -5 Taking Actions to Meet or Exceed the Benchmark

In the final stage, the organization takes action and beings to change as a result of the benchmarking initiative. After implementing the change, the organization makes comparisons to the specific performance measures selected. In many cases, the

decisions may be to perform better than the benchmark to be more competitive. The implementation stage, in particular the change process, is perhaps the most difficult stage of the benchmarking process, as the buy in of organizational members vs critical for success. (Kaplan, 2004:303)

2.3.2 Total Quality Management (TQM)

To survive and be successful in today's global competitive environment, firms must manufacture quality products and provide quality services. Quality products and services also enhance any competitive advantages a firm may have. (Blocher, 1999:166)

The ultimate test of quality product or service is whether the product or service meets or exceeds customers' expectations. The requirements to meet or exceed customers' expectations then service as specifications for operations throughout an organization needs to strive for conformity to specifications that meet and improve upon customer satisfaction. (Blocher, 1999:166)

Total quality management starts with identifying the firm's customers and their requirements. At some stage, everyone in a process or organization is a customer or supplier to someone else, either inside or outside the organization. The TQM process begins by identifying the requirements and expectations of external customers. These requirements and expectations are the bases for specifying requirements for each in succession of internal customer/supplier, including design requirements, part characteristics, manufacturing operations, production and external vendor requirements, and selling requirements. A firm can serve its ultimate, external customer better if the firm meets fully all the requirements of each internal customer. (Blocher, 1999:167/168)

2.3.2.1 Cost of Quality

Cost of quality are costs associated with the prevention, identification, repair, and rectification of poor quality, and with opportunity costs from lost production time and sales as a result of poor quality. Traditionally, quality costs had been limited to the cost of finished units. Other cost of poor quality were included as overheads and not identified as quality costs. (Blocher, 1999:175)

Firms have discovered that in addition to manufacturing costs quality costs include costs associated with supporting functions such as product design, purchasing, public

relations and customer services. Joseph Juran classified cost of quality into four categories: prevention, appraisal, internal failure, and external failure. A main criterion in Jurans classification of quality costs is the time when quality costs are incurred. (Blocher, 1999:175)

i) Prevention costs

Cost of preventing defective work is usually expanded before the product is made or the service is rendered. (Dilworth, 1993:465). They include the cost of preventive maintenance, quality planning and training and the extra cots of acquiring higher quality raw materials. (Colin, 2000:901)

ii) Appraisal costs

The cost of appraisal is incurred for auditing service procedure to make sure they conform to prescribed work practices. (Dilworth, 1993:466)

iii) Internal failure costs

An internal failure cost includes collecting or repeating any service activities before a service customer leaves an establishment. (Dilworth, 1993:466) They include costs incurred before the product is dispatched to the customer, such as the costs of scrap, repair, down time and work stoppages caused by the defects. (Colin, 2000:902)

iv) External failure costs

External failure costs are associated with defects found after items are shipped to the customer. (Dilworth, 1993:466) They include cost of handling customer complaints warranty, replacement, repairs of returning product and the cost arising from a damaged company reputation. (Colin, 2000:992)

2.3.2.2 Total Quality and Productivity

A common misconception is that improvements in quality decrease productivity. The reasoning behind quality improvement required additional input efforts. Because productivity measures the relationship between output and input resources, an effort that requires additional input resources with no increase in output may believe that materials, labour hours, and other resources spent on rework, repair or other activities to improve quality consume additional resources with no increase in output. (Bloche, 1999:185-186)

Studies have shown, however, that improvements in quality led to increases in productivity. The belief that quality improvement and productivity have an inverse relationship may have grown out of the misperception that all units, once manufactured are good outputs, what ever the quality or required subsequent spending to specify poor quality products. A firms accounting system may not include resources on rework or repair in the manufacturing cost of unit. Rather, repair or rework costs are treated as manufacturing overheads to be shared by all products and units. The term hidden factory sometimes refers to the use of facilitates and recourse for repairs, rework, retests, and other remedial work for poor quality products. They are hidden because these accounts often are included as part of the total manufacturing overhead shared by all. (Blocher, 1999:186)

2.3.3. KAIZEN (Continuous Improvement)

Kaizen costing is similar to target costing in its cost reduction mission, except that it focuses on reducing cost during the manufacturing stage of the total life cycle of a product. Kaizen is the Japanese term for making improvements to a process through large innovation. Kaizen's goals are responsible because when the product is already in the manufacturing process, it is difficult and costly to make large change to reduce costs. Kaizen costing contrasts with target costing, which allows many more opportunities to effect change because it occurs much earlier in the product's life cycle. (Blocher, 1999:13)

Henry ford realized that the right attitude is important to success. That belief is what continuous improvement (the Japanese word is Kaizen) is a management technique in which managers and workers commit to a program of continuous improvement in quality and other critical success factors. It's origin is attributed to Japanese manufactures, with their tireless pursuit of quality. Continuous improvement is very often associated with benchmarking and total quality management, as firms seek to identify other firms as models to learn how to improve their critical success factors. (Blocher, 1999:13)

Kaizen is the Japanese term for making improvements to a process through small incremental amounts rather than through large innovations. The major differences between target costing and Kaizen costing is that target costing is applied during the design stage whereas Kaizen costing the focus is on the product, and cost reductions

are achieved primarily through product design. In contrast, Kaizen costing focuses on the production processes and cost reductions are derived primarily through the increased efficiency of the production process. Therefore the potential cost reductions are smaller with Kaizen costing because, the products are already in the manufacturing stage of their life cycles and a significant proportion of the costs will have become locked in. (Drury, 2004:950-951)

The aim of Kaizen costing is to reduce the cost of components and products by a pre-specified amount. Monden Hamada (1991) describes the application of kaizen costing in Japanese automobile plant. Each plant is assigned a target cost reduction ratio and this is applied to the previous year's actual costs to determine the target cost reduction. Kaizen costing relies heavily on employee empowerment. They are assumed to have superior knowledge about how to improve processes because they are closest to the manufacturing processes and customers and are likely to have greater insights into how costs can be reduced. Thus, a major feature of Kaizen costing is that workers are given the responsibility to improve processes and reduce costs. Unlike target costing it is not accompanied by a set of technique or procedures that are atomically applied to achieve the cost reductions. (Drury, 2004: 951)

2.3.3.1 Elements of KAIZEN System

There are basically four elements applied for Kaizen System. They are: (Paudel, 2005:42-44)

PDCA Cycle and Progress: the world PDCA goes for

P for "plan"

a) Theme selection
b) Reasons for theme selection
c) Analysis of current situation
d) KAIZEN goal setting and action plan

D for "do"

e) Execution

C for "check"

f) confirmation of the results

A for "act"

g) Standardization

h) Remaining problems and future plans

PDCA cycle is used to identify the problem and the portion of original goals which has not been received. So Kaizen can be generated to situation. Using PDCA model the Kaizen is generated as follows:

Step 1: Find a problem and select themes (policy)

Step 2: Find the cause for the problem and consider the reasons why the theme was selected.

Step 3: Study what is the most influential factor and analyze the present situation.

Step 4 : Consider remedial measure using 5W 1 H, principle as follows:

5 Ws: Why (concerning with necessity)

What (concerning with objective)

Where (concerning with place)

When (concerning with time and limits)

Who (concerning with person)

1H:

How (concerning with method)

Step 5: Implement remedial measure.

- Integration of TQM function and professional Function:

TQM function and professional function both should be integrated to Kaizen. Kaizen will be effective only if both functions are cooperating.

- Top down and Bottom-up management:

There should not be restriction for upward messaging if Kaizen system has to be implemented effectively. Two way traffic should be entertained for communication. Similarly, employees need to be motivated to participate in 5s activity, suggestion program (idea box) and quality circle. The 5s activities are as follows:

5s	Original Japanese	English Meaning
1s	Seiri or Clear cut	Sort out unnecessary item in the workplace and discard them.
2s	Section or configure	Arrange all necessary item in good order so that they can be picked for use: a. A place for everything b. Everything in its place.
3s	Seiso or clean check	Clean your workplace completely so that there is nod dust on the floor, machines or equipment
4s	Sei Ketsu or conform	Maintain a high standard of housekeeping and a work place organization at all times.
5s	Sbitsuke or custom and practice	Train people to follow good housekeeping disciplines autonomously.

Three Dimensional Management:

For effective application of KAIZEN the management should be three dimensional. The three dimensions are:

a) Policy management

b) Department management

c) Inter departmental management

2.3.4. Activity Based Costing and Management

A new method of cost accounting developed in the past 10 years called "activity-based" accounting -records all costs. And it relates them, as traditional cost accounting can not, to value added. Within the next 10 years it should be in general use. And them we will have operational control manufacturing. (Peter F. Drucker The wall street Journal, April 13, 1993:14)

Many firms have found, they can improve planning, product costing, operational control, and management control by using activity analysis to develop detailed description of the specific activities performed in the operation of the firm. The activities analysis provides the basis for activities based costing and activity based management. Activity based costing (ABC) is used to improve the accuracy of cost

analysis to improving the tracing of costs to cost objects. ABC is used to cost objects. ABC is used for different cost objects including individual products. And related groups of products, and individual customers. Activity based management (ABM) uses activity analysis to improve operational control and management control. Although ABC and ABM have been in practice for some time, only in recent year have they become widely used. These techniques are especially useful when operations are complex, with the large number of products and manufacturing process or steps in providing the services to customers. When operations are complex, the identification of and cost tracing for activities can provide a good understanding of cost drivers and cost behavior that is difficult to obtain without detailed activity analysis. ABC and ABM are key strategic tools for firms with complex operations. (Blocher, 1999:13-14)

ABC helps firms reduce distortions caused by the traditional costing system and obtains more accurate product costs. It provides a clear view of how a firm's diverse products, services, and activities contribute in the long run to the bottom line. ABM focuses on managing activities to promote business efficiency and effectiveness, and to increase not only the value received by customers but also the firm's profit. (Blocher, 1999:89)

ABC and ABM are closely tied to strategic cost management. Managers receive more meaningful information to answer strategic questions such as these: (Blocher, 1999:89)

- What are the potential impacts on pricing and product line decisions if a firm switches from the traditional costing system to an activity based costing system?
- What are potential cost savings if a firm uses ABM to identify and eliminate non value added activities to achieve its low cost strategy?
- How can ABC/ABM help to firm achieve its competitive strategy of high performance and short lead time in delivering its product?
- How can ABC/ABM help a firm analyze its major customer’s profitability and develop a customer-focused strategy?

2.3.5 Reengineering

Reengineering is a process for creating competitive advantage in which a firm recognizes its operating and management functions, often with the result that jobs are modified, combined, or eliminated. It has been defined as the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed. Under the pressure of global competition, many firms look a reengineering as a way to reduce the cost of management and operations, and as a basis for careful reanalysis of the firm's strategic competitive advantage, cost management supports the reengineering effort by providing the relevant information. (Blocher, 1999:140)

Reengineering is the complete redesign of a process. Wish an emphasis on findings, create new ways to accomplish an objectives reengineering has sometimes been desired as taking blank piece of paper and starting from scratch to redesign a business process. Rather than searching continually for minute improvements, reengineering in value a radical shift in thinking about new objectives should be met. (Hilton, 1997:268)

Reengineering is the fundamental rethinking and radical redesign of business process to achieve contemporary measures of performance, such as cost, quality, service and speed. (Hammer, 1993:2)

2.3.5.1 Reengineering Process

Richard B. chase, Nicholas J. Aquilono and Jacobs F. Robert (1999) have presented the following six steps to be taken into consideration for reengineering any product manufacturing:

Step 1 State a Case for Action

The need for change should be effectively communicated to company employees through educational and communication campaigns. Two key messages should be articulated:

i. A need for action: Here is where as a company, and this is why we can't stay here.

ii. A vision statement: This is what we as a company needs to become.

iii. The objective for reengineering must be in the form of a qualitative and quantitative vision statement. These objectives can include goals for cost reduction, time to time market quality and customer satisfaction level and financial indicators.

Step 2 Identify the Process

All major processes in organization should be initially identified. However, not all major processes should be reengineered at the same time. The following questions define the criteria for selecting processes for reengineering:

i. Which processes are currently most problematic?

ii. Which processes are critical to accomplishing company strategy and have the greatest impact on the company's customer?

iii. Which processes are most likely to be successfully redesigned?

iv. What is the project scope and what are the costs involved?

Step 3 Evaluation Enablers

Information technology and human/organizational issues act as enablers of the reengineering process. Technology evaluation has now become a core competency required of all companies-companies should develop the ability to evaluate current and emerging technology and identify creative application to redesign their existing processes.

Step 4 Understanding the Current Process

The current process must be studied to understand the activities which are essential to completion. We need to introduce some terminology to describe component activities to add our analysis. All work activities can be classified into three types:

i. Value-adding work: It consists of all the activities that create the goods and services that customers want. Value adding work can rarely be eliminated from a process, although it can be improved.

ii. Non value-adding work: It is mainly administrative overhead-the reporting, checking, supervising, controlling, reviewing and coordinating.

iii. Waste work: It is pointless work whose absence would, by definition, not be noticed by the customers, producing reports that no one read, doing erroneously, so that it needs to be done and redundant checking activities are waste work. Waste works are needed to be eliminated.

Step 5 Create a New Process Design

Process design requires beginning with a clean sheet of paper. Reengineers should suspend current rules, procedures, and values so as to create new process designs. They also need to utilize the principles of reengineering that have been discerned. The first emphasis in reengineering process is to eliminate all waste work. Waste work can often be eliminated immediately during the reengineering effort. Next, focus is on elimination of non value-adding work. The consequences of redesigning process, to reduce non-value adding work, are significant.

Step 6 Implement the Reengineered Process

Leadership is critical, not just to the implementation process but to entire reengineering effort. Process engineering teams are typically responsible for implementing the new designs. However, support and buy in from line managers are crucial to success because implementation changes accountabilities of line managers while expecting them to delivers on the improvements.

2.3.6 Theory of Constrains (TOC)

In contrast to target costing, which focuses on the early phases of the cost life cycle, the theory of constraints focuses on manufacturing activity. The theory of constraints (TOC) was developed by Goldratt and Cox to help managers improve the overall profitability of the firm. This theory focuses the manager's attention on the constraints, or bottlenecks, that slow the production process. The main idea is that a firm succeeds by maximizing the overall rate of manufacturing output, which is called the throughput of the firm. Throughput is defined as sales less direct costs, including purchased components and material handling costs. (Blocher, 1999:140)

TOC directs managers' attention to the speed with which the product's raw materials and purchased components are passed into final products and delivered to the customer. TOC emphasized the improvement of throughput by removing or reducing the bottlenecks in the production process that slow the rate of output, manufacturing

and distribution process that do not affect throughput are nonbinding constraints that receive less attention than bottlenecks or binding constraints. (Blocher, 1999:140)

2.3.6.1 Steps in Theory of Constraints Analysis

Blocher (1999) has indicated five steps in TOC analysis

Step 1 Identify the binding constraints

In the first step the management accountant works with manufacturing managers and engineers to identify binding constraints by developing a network diagram of the flow of production. A network diagram is a flow-chart of work done that shows the sequence of processes and the amount of time required for each. The purpose of the network diagram is to help the management bottleneck. A bottleneck often is indicated by a process with relatively large amount of inventory accumulating or where there are lead times. Task analysis, which describes the each process in detail, also could be used to identify binding constraints.

Step-2 Determine the most efficient utilization for each binding constraint

In this step, the management accountant determines how to most efficiently utilize the firm's resources. The approach differs somewhat depending on whether there is one product, or two or more. If there is one product, the management accountant looks for ways to maximize the flow of production through the constraint. For two or more products, however, the determination of which product or product mix to product becomes important, as does maximizing the glow through the constraint. Different products are likely to require different times on the binding constraint. Thus, managers must determine the most profitable mix of the products. Determining the most profitable product mix involves careful analysis of the profitability of each product as well as the time required for each product on the binding constraint.

Step-3 Mange the flows through binding constraint

In step 3 the objective is to mange the flow of production in and out of the binding constraint to smooth the flow of production through out the plant. The orderly scheduling of production prevents the building up of materials or work-in-process inventory at various processes. An important tool for managing product flow in this context is the drum-buffer-rope (DBR) system which is a system for balancing the flow of production through a binding constraint.

Step 4 Add capacities to the binding constraint

As a longer-term measure to relieve the bottleneck and improve throughout, management should consider adding capacity to binding constraints, by adding new or improved machines/and/or additional labour.

Step 5 Redesign the manufacturing process for flexibility and fast throughput

The most complete strategic response to the bottleneck situation is to redesign the manufacturing process, including the introduction of new manufacturing technology, deletion of some hard to manufacture products, and redesign of some products for greater case to manufacturing simply removing one or more minor features on a given product might speed up the production process significantly. The use of value engineering as described earlier might help at this point.

2.3.6.2 ABC and Theory of Constraints

Activity based costing (ABC) is employed commonly by firms using such cost management methods as target costing and the theory of constraints. The difference is that TOC take a short term approach to profitability analysis, whereas ABC costing develops a long term analysis. The TOC analysis has a short term focus because of its emphasis only on materials related costs, while ABC includes all products costs. (Blocher, 1999:145)

On the other hand, unlike TOC, ABC does not explicitly include the resource constraints and capacities of production activities. Thus, ABC can not be used to determine the short term best product mix, as for the auto window manufacturer. ABC and TOC are thus complementary methods; ABC provides a comprehensive analysis of cost drivers and accurate unit costs, as a basis for strategic decision about along term pricing and product mix. In contrast, TOC provides a useful method for improving the short term profitability of the manufacturing plant through short term product mix adjustments and through attention to production bottleneck. (Blocher, 1999:145)

2.3.7 Just in Time (JIT)

Think of a situation where we produce the required goods only at the time when they are needed and in the quality that is needed; and where this holds goods for finished products and semi finished products, both. If such a situation materializes, the

inventories of the finished goods and work in progress would be almost nil or low, if we make our raw materials supplier agree that they should deliver their goods only at the time and in the quantities we need them to, then we are almost eliminating raw materials inventories as well. We shall then have virtually zero inventories (or near about zero). This is called the just in time (Z-I-T) production system founded by Tailichi Ohno (a vice-president at Toyota) and first successfully implemented at the Toyota motor company's plants in Japan and now being tried at various manufacturing industries all over the world. (Bhattacharya, 2004:36.1)

The competitiveness of Japanese manufactured products has focused attention on their manufacturing systems since the basis of their success has been high quality, competitively priced products. Indeed, the Japanese market strategy seems to be rooted in their production systems and the literature is filled with reports of remarkable quality levels, achieved along with lower costs through higher productivity and very low in process inventories. (Buffa, 1987:436)

Sepehri (1986) reports on a sample of five Japanese companies that employ JIT methods producing the necessary parts in the quantities needed at the time they are needed-as a basis for comparing the results of 13 U.S. companies that have installed JIT concepts. The summary results of five Japanese companies in providing productivity, reducing set up time, reducing inventory improving quality, saving space, and improving quality, saving space and reducing lead times. (Buffa, 1987:436)

JIT manufacturing requires making a product or service only when the customer, internal or external, requires it. It usages a product layout with a continuous flow-one with no delays once production starts. This means a substantial reduction in setup costs. Is necessary to eliminate the need to produce in batches, therefore processing systems must be reliable. (Anthony, 2004:203).

2.3.7.1 Single Unit Production and Conveyance

The JIT concept may have been borrowed from the inventory systems of American supermarkets, i.e. only the units that are sold are replaced. It is actually a production and materials planning system where the production and procurement closely flow the actual demand. And this system is carried down the line from final product to the basic component. It can be perceived as a job order production carried to the extreme

of single unit job ordering yet retaining the convey or line system and its advantages. There are no lot size productions anywhere (If inevitable, they are minimized). As and when the item is produced it is conveyed to the next process so that there is no "waiting" involved at any place. Of course, the operation time at each work place are also equalized. In short, JIT we have : (i) no delay either due to lot size production or due to unequal production time of different work places and (ii) conveyance times are also balanced JIT is a combination of single unity production and the conveyance or system and is called 'IKKO Nagare' in Japanese meaning single unit production and conveyance (Chary, 2004:36.1)

2.3.7.2 Eliminating Waste and Adding Unable

Just in time requires a great deal of organizational discipline. As in the case of material requirements planning (MRP), JIT requires not only changes in the way a company handles its inventory but also changes in its culture. JIT also encompasses the Japanese managerial characteristics. (Adam, 2005:567-568)

The seven wastes-Shigeo Shingo, as recognized JIT authority and engineer at the Toyota motor company identifies seven wastes as being the targets of continuous improvement in production processes. By attending to these wastes, improvement is achieved. (Adam, 2005:568)

1. Waste of overproduction- Eliminate by reducing setup times, synchronizing quantities and timing between processes, compacting layout visibility, and so forth make only what is needed.
2. Waste of waiting- Eliminate through synchronizing work flow as much as possible, and balance uneven loads by flexible workers and equipment.
3. Waste of transportation- Establish lay outs and locations to make transport and holding unnecessary if possible. Then rationalized transport and material handling that can not be eliminated.
4. Waste of processing itself-first question why this part or product should be made at all, then why each process is necessary. Extend thinking beyond economy of scale or speed.
5. Waste of stocks- Reduce by shorting setup times and reducing lead times, by synchronizing work flows and improving work skills, and even by smoothing

fluctuations in demand for the product. Reducing all the other wastes reduces the waste of stocks.

6. Waste of Motion- Study motion for economy and consistency. Economy improves productivity. First improve the motions, then mechanize or automate. Otherwise there is danger of automating waste.
7. Waste of making defective products -Develop the production process to prevent defects from being made so as to eliminate inspection. At each process accept no defects and make defects. Make processes failsafe to do this. From a quality process comes quality product automatically.

2.3.7.3 Value Added Manufacturing

JIT'S seven wastes are at the root of what U.S. companies term value added manufacturing: Any step in the manufacturing process that does not add value to the product for the customer is wasteful. Examples of wasteful steps included process delays, (WIP) process inventories, finished goods inventories, excessive paper processing, and many other activities that do not add value to the product. Wasteful tasks increase costs and reduce competitiveness. To identify and delete wastes, each aspect of manufacturing is analyzed to confirm or refute its value. (Adam, 2005:568)

2.3.7.4 KANBAN Production Information System

A JIT production system uses a particular material withdrawal and work ordering system. This is called the Kanban (or maker) system. As we have so far noted, the JIT system works, based on the requirement at the final product level. Basically it believes in producing at a time only that many items as have been withdrawn. This Chain of withdrawal-and-production is continuous from the end product to the beginning process. This is the way the work in process inventory is kept very low. (In the JIT system, in fact, the inventories are not kept in the store but on the shop floor, right in between to proceeding and succeeding processes.) The withdrawal of material forms the proceeding process and the production of items to replace this is ordered through a withdrawal and production Kanban (or maker card). It is physical control system, and is visual in nature which is an advantage over the conventional production control paper work which could be quite confusing at times (Chary, 2004:36.4)

2.3.7.5 JIT as a Business Philosophy

JIT should not be viewed as a mere production system. It expresses, in fact, an organization's philosophy of customer orientation. Service to the customer is the focus of JIT. The production system is a consequence of this business philosophy. Service includes providing to customer the product (necessary service) in time, providing him variety of products, allowing him to choose as per his performances, providing him with quality products, providing him service/product close to him (space utility), and communicating with him more intensely than before almost including him in your own facility or vice versa and above all providing product/service at a price affordable and perceived as reasonable by the customer. Such service-orientation generates the need for an appropriately responsive production system such as a JIT system. (Chary, 2004:36.8)

As the customers are to be provided a variety of products and in time, the production of the finished goods should be in very small lots. For the same reason, the upstream production processes should also produce equally small lots just to meet the down stream needs. Going upstream in this manner, it is obvious that the vendors too have to supply items in small numbers and just in time. (Chary, 2004:36.8)

2.3.7.6 Implication of Just in Time Manufacturing

Just in time manufacturing is a simple theory but hard to achieve in practice. Some organizations hesitate to implement JIT because with no work in process inventory a problem anywhere in the system can stop all production. For this reason, organizations that use just in time manufacturing must eliminate all sources of failure in the system. The production process must be redesigned so that if is not prohibitively expensive to process one or small number of items at a time. This usually means reducing the distance over which very adaptable people and equipment that can handle all types of job. (Anthony, 2001:204)

As the core of the JIT process is a highly trained workforce whose task is to carry out activities using the highest standards of quality. When the employee discovers a problem with a component he or she has received, it is the responsibility of that employee to call immediate attention to the problem so that it can be corrected. Suppliers must be able to produce and deliver defect free materials and components just when they are required. In many instances, companies compete with the

suppliers of the same components to see who can deliver the best quality. At the end of a performance period, the supplier who performs the best will obtain a long term contract. Preventative maintenance is also employed so that equipment failure is a rare event (Anthony, 2004:204)

Consider how just in time manufacturing can be used at a fast food restaurant. Some use a just in time, continuous flow product layout, while others use batch production in a production layout process. In fact, some fast food restaurants combine both approaches into hybrid systems that use a batch approach to production and keep inventories at predefined levels. For example, the restaurant may use racks or bins to hold food ready to be sold to the customer and have employees start another batch of production when the existing inventory falls below a line drawn on the bin or rack. At off-peak times the restaurant may produce to order (Anthony, 2004:204-206)

The motivation to use the JIT approach is to improve the quality of the food and to reduce waste by eliminating the need to discard food that has been held in the bin too long. The motivation to use batch production is to sustain a certain level of inventory to reduce the time the customer has to wait for an order. As processing time and set up costs drop, the organization can move closer to just in time manufacturing and reduce the wastes and quality problems that arise with batch production. (Anthony, 2004:206)

2.3.8 Target Costing

Target costing is a customer oriented technique that is widely used by Japanese companies and which has recently been adopted by compares in Europe and the USA. The major advantage of adopting target costing is that it is deployed during a product's design and planning stage so that it can have a maximum impact in determining the level of the locked-in costs. (Drury, 2004:946)

Target costing is the design of a product, and the processes used to produce it, so that ultimately the product can be manufactured at a cost that will enable a firm to make a profit when a product is sold at a estimated market driven price. Target costing can be critical tool for management as it seeks to strategically manage the company's cost and profits. By ensuring that products are designed so that they can be produced at a low enough cost to be priced competitively, management can achieve or maintain a sustainable competitive position in the market. (Hilton, 2002:670)

Target costing is a tool that has arisen directly from the intensely competitive markets in many industries. Target costing determines the desired cost for a product on the babes of given competitive price, such that the product will earn a desired profit. Cost is thus determined by price. The firm using target costing must often adopt strict cost reduction measures or redesign the product or manufacturing process by order to meet the market price and remain profitable. (Blocher, 1999:16)

Target costing is a method of profit planning and cost management that focuses on products with discrete manufacturing processes. The goal of target costing is to design costs of products in the RD and stage of a product is life cycle, rather than trying to reduce costs during the manufacturing stage. Target costing is a relevant example of how a well designed MACS can be use for strategic purposes and how critical it is for organizations to have a system in place that considers performance measurement across the value chain (Kaplan, 2004:290)

A major feature of target costing is that a team approach is adopted to achieve the target cost. The team members included designers, engineers, purchasing, manufacturing, marketing, and management accounting personnel. Their aim is to achieve the target cost specified for the product at the prescribed level of functionality and quality. The discipline of a team approach ensures that no particular group is able to impose their functional preferences. (Drury, 2004:946)

According to Drury, (2004) target costing can be used as a cost management tool, which involves the following stages:-

Stage 1- Determine the target price which customers will be prepared to pay for the product.

Stage 2- Deduct a target profit margin from the target price to determine the target cost.

Stage 3- Estimate the actual cost of product.

Stage 4- If estimated actual cost exceeds the target costs investigate ways of driving down the actual cost to target cost.

2.3.8.1 Target Costing and Value Engineering

Target costing is an outgrowth of the concept of value engineering, which is a cost reduction and process involvement technique that utilized information collected about

produce is design and production processes and then examines various attributes of then design and processes to identify candidates for improvement efforts (Hilton, 2002:673-674)

Much of the historical development of the target costing approach has where now "more than 80 percent of all assembly industries in Japanese companies". In recent years, however, many other companies have made significant contributions to target costing theory and practice. Among them are Caterpillars, Daimler Chrysler, Boeing, and Kodak. (Hilton, 2002: 674)

2.3.8.2 Target Costing and Kaizen Costing

Target costing is to use Kaizen costing and operational control to further reduce costs. Kaizen costing occurs at the manufacturing stage, so that the effects of value engineering and improved design are already in place, the role for cost reduction at this phase is to develop new manufacturing methods and to use new management techniques such as operational control, total quality management and theory of constraints to further reduce costs. Kaizen means "continual improvement", that is, the forgoing search for new ways to reduce costs in the manufacturing process of product with a given design and functionality. (Blocher, 1999: 138)

2.3.9 Life Cycle Costing

Life cycle costing is a management technique used to identify and monitor the costs of a product throughout its life cycle. The life cycle consists of all the steps from product design and purchase of raw materials to delivery and service of the finished product. The steps include i) research and development ii) product design including protyping target costing and testing, iii) manufacturing, inspection, packaging and warehousing, iv) marketing, promotion, and distribution, and v) sales and service. Cost management has traditionally focused only on costs incurred at the third step, manufacturing. Thinking strategically, management accountants now manage the full life cycle of costs for the product, including upstream costs as well as manufacturing costs. This expanded focus means that careful attention is paid especially to product design, since design decisions lock in most subsequent life cycle costs. (Blocher, 1999:16)

Life cycle costing estimates and accumulates costs over a products entire life cycle in order to determine whether the profits earned during the manufacturing phase will

cover the costs incurred during the pre-add post manufacturing stages. Identifying the costs incurred during the different stage of product's life cycle provides an insight into understanding and managing the total costs incurred throughout its life cycle. Life cycle costing help management to understand the cost consequences of developing and making a product and to of identify areas in which cost reduction efforts are likely to be most effective. (Drury, 2000:844)

Products today are said to be profitable only when it yields profits over their whole life cycle periods. To know the life cycle profits the costs to be incurred during various periods over the life cycle of the products should be known. Mainly these costs are of two-types by nature cost committed and costs incurred. Cost commitment is also called licked in costs. These cost those costs, which have not been incurred but will be incurred in the future on the basis of decision that has already been taken. The product design specifications in the planning phase determine a product's material and labour inputs and production process. At this stage, costs become committed and broadly determine the future costs that will be incurred during the manufacturing stage. Incurred costs are those costs, which are already been expanded. These occur when a resource is used or scarified. In the manufacturing stage, the majority of costs are incurred. Costs are incurred only after they are committed. Committed costs can not be altered. So, before making any cost committed, proper decision should be taken prior in planning phase. Understanding of life cycle costs helps to take right decision in the very beginning. (Dahal, 2005:58)

A typical product's life cycle has five distinct stages. Obviously, not all products will flow this pattern. Some products will fail early and have a truncated life cycle. (Kalapn, 2004:60)

1. The product development and planning phase –In this phase, the organization incurs significant research and development costs and product testing costs. Traditional costing often treats these costs as general overhead with two consequences: they are not associated with the product that creates the cost, and the total amount of these costs is often either unknown or only vaguely known.

2. **Introduction Phase-** In this phase, the organization incurs significant promotional costs as the new product is introduced to the market place. At this stage, the product's

revenue will often not cover the flexible and capacity-related costs that it has inflicted on the organization.

3. **Growth Phase-** During this phase, the product's revenues finally begin to cover the flexible and capacity-related costs incurred to produce, market, and distribute the product. There is often little or no price competition. The focus of attention is on developing systems o deliver the product to the customer in the most effective way.

4. Product maturity Phase- In this phase, price competition becomes intense and product margins (the difference between the product's revenue and flexible costs) begin to decline. While the product is still profitable, profitability is declining relative to the growth phase; organizations undertake intense efforts to reduce costs of remain competitive and profitable.

5. Product decline and abandonment phase- During this phase, the product begins to become unprofitable. Competitors begin to drop out-the least efficient first. The remaining competitors find themselves competition for a share or a smaller and declining market. As organizations abandon the product, they incur abandonment costs such as selling off equipment no longer required or restoring an asset prior to abandoning it (e.g.) land reclamation in the case of a mine that has been worked out and is being abandoned.

Form this life cycle; it is apparent that product-related costs occur unevenly over the product's life time. This uneven pattern has prompted some people to argue particularly costs other than those associated with making the product and delivering it to the customer, should be considered systematically both before and during the product's lifetime (Kaplan, 2004:61)

2.3.9.1 Purposes of Life Cycle Costing

There are three broad purposes of life cycle costing. First life cycle costing helps to develop a sense of the total costs associated with a product in order to identify whether the profits earned during the active manufacturing phase will cover the costs in the development and decommission phase. Life cycle costing often will identify products that are no longer profitable when their decommissioning costs are factored into the product evaluation process. Second, because of its comprehensive consideration of costs, life cycle costing will identify a product's environmental cost

consequences and spur action to reduce or eliminate those costs. Third, life cycle costing helps to identify the planning and decommissioning costs during the product and process design phase in order to control and manage cost in that phase. In general, life cycle costing provides a comprehensive accounting of a product costs. Both manufacturing and environmental, from cradle to grave to help decision makers understand the cost consequences making that product and to identify areas in which cost reduction, efforts are both desirable and effective. (Kaplan,1998:236)

2.3.10 The Balanced Scorecard

With the emergence of the information era, however, companies needed more than prudent investment in physical assets and excellent management of financial assets and liabilities to achieve success. Today, companies mobilize and create value from their intangible assets as well as their physical and financial assets. An organization's intangible assets include the following: (Kaplan, 2004:355)

- Loyal and profitable customer relationships
- High-quality processes
- Innovative products and services.
- Employee skill and motivation
- Databases and information systems.

Given the importance of intangible assets, some academic scholars and practioners have tried to expand the financial model to incorporate the valuation of intangible assets and a company's balance sheet. Realistically, however, difficulties in placing a reliable financial value on intangible assets will likely prevent them form ever being recognized on a company's balance sheet. Yet these assets are critical for success, and managers understand that "If you can't measure it, you can't manage it". Many managers searched for a system that would help them measure and manage the performance of their intangible, Knowledge-based, assets. (Kaplan, 2004:355)

Strategic information using critical success factors provides a roadmap for the firm to use to chart its competitive course, and serves as a benchmark for competitive success. Financial measures such as profitability reflect only a partial and frequently only short term, measure of the firm's progress without strategic information, the firm is likely to stray from its competitive course, to make strategically wrong product

designs-for example, choosing the wrong marketing and distribution methods. (Blocher, 1999:1617)

The Balanced scorecard (BSC) provides a system for measuring and managing all aspects of a company's performance. The scorecard balances traditional financial measures of success- such as profits and return on capital-with non financial measures of the drivers of future financial performance. The balance scorecard measures organizational performance across four different but linked perspectives that are derived form the organization's vision, strategy, and objectives: (Kaplan, 2004: 356)

- Financial: How is success measured by our shareholders?
- Customer: How do we create value for our customers?
- Internal: At what, internal processes we excel to satisfy our customers and shareholders?
- Learning and growth: What employee capabilities, information systems, and organizational climate do we need to continually improve our internal processes and customer relationships?

To emphasize the importance of using strategic information, both financial and non financial, accounting reports of a firm's performance are how often based on critical success factors in four different dimensions. One dimension is financial, the other three dimensions are non financial. (Blocher, 1999:17)

i) Financial Perspective

The balanced scorecard retains the financial perspective as the ultimate objective for profit-maximizing companies. Financial performance measures indicate whether the company's strategy, implementation, and execution are contributing to bottom-line improvement. Financial objectives typically relate to profitability-measured, for example, by operating income and return-on-investment-the company's financial performance can be improve through two basic approaches-revenue growth and productivity. Profitable revenue growth can be achieved by depending relationships with existing customers, such as selling them additional products and services beyond the first product or service they purchase. For examples, banks can attempt to get their checking account customers to also use the bank for mortgages and car loans. (Kaplan, 2004:360)

ii) Customer Perspective

In the customer perspective of the balanced scorecard, manager identify the targeted customer segments in which the business unit competes and the measures of the business units performance in these targeted segments. The customer perspective typically includes several common measures of the successful outcomes form a well-formulated and implemented strategy: (Kaplan, 2004:362)

- Customer satisfaction
- Customer retention
- Customer acquisition
- Customer profitability
- Market share
- Account share

iii) Internal Perspective

Once an organization has a clear picture of its financial objectives and customer objectives, it can determine the means by which it will.

- Produce and deliver the value proposition for customer and
- Achieve the productivity improvements for the financial objectives.

The internal perspective of a balanced scorecard indentures the critical progresses in which the organization must excel to achieve its customer, revenue growth, and profitability objectives. (Kaplan, 2004:365)

Organizations perform many different processes. It is useful to think of processes within four groupings. (Kaplan, 2004:365)

1. Operating processes
2. Customer management process
3. Innovation process
4. Regulatory and social process.

iv) Learning and Growth Perspective

The fourth perspective of the balanced scorecard, learning and growth, identifies the objectives for the people, systems, and organizational alignment that create-long term growth and improvement. For the learning and growth perspective, managers define the employee capabilities and skills, technology, and organizational alignment that will contribute to improving performance in the measures selected in the first three perspectives. They learn where they must invest to improve the skills of their employees, enhance information technology and systems, and align people to the company's objectives. (Kaplan, 2004:373)

The learning and growth perspective of the scorecard identifies how executives mobilized their intangible assets-human, informational, and organizational-to drive improvement in the internal processes most important for implementing their strategy. The following describes some typical objectives for these three components of the learning and growth, perspective: (Kaplan, 2004:374)

- Employee capabilities
- Information capabilities
- Organization Alignment.

2.4 Review of Previous Related Studies

Dahal (2004) has made study about "Cost Reduction Tools: A Study on applying to strength manufacturing enterprises of Nepal." And her study has shown the following findings and recommendations:

Findings

- The main reason behind less use to JIT in Nepalese business environment is lack of information about JIT and non-availability of suppliers.
- There is the lack of skilled manpower and internal failure cost in applying TQM.
- The more useable cost reduction tool in business enterprises is training.
- The main cause of not applying benchmarking is lack of proper direction and co-ordination.

- And the constraint cause of ABM is poor organizations culture.
- Nepalese manufacturing firms believe in scientific management of cost.

Recommendation

- Japanese cost management tools should be widely used. And firms have to think how to make the practice effective.
- Specially, the electric firm, textile companies and engineering firms should give effort for JIT application.
- Firms should keep on benchmarking other's practices and bring corresponding practice to their own ground.
- Firms should mange the activities with cost.

Paudel (2005) has made study about "Cost Reduction Tools: A Study on applying to strength manufacturing enterprises of Nepal." And his study has shown the following findings and recommendations.

Findings

The research works have found that about 50.59% of the firms are practicing cost management/reduction. This shows that manufacturing sector in Nepal is not widely practicing cost reduction. Research made among the firms has shown that existing cost reduction practice is different between the sectors. The average figure shows that 61.67% of the samples from Chemical sub-sector were practicing cost reduction, which is the highest among all the sub-sectors. Similarly, about 61.11% of the textile firms were found practicing cost reduction. Hence, there is lack of mass participation for cost reduction practice in the manufacturing sector.

Similarly, cost reduction tools were found not equally applied in Nepalese manufacturing sector. Among the tools taken as study variables, training program was found widely applied. About 92% of the samples taken were found conducting training programs. The second highest cost reduction tools being applied has been found benchmarking (79.56% of the samples), and subsequently, M-audit, ABM, TQM, VA, Reengineering, Target Costing, Life Cycle Costing, Time and Motion Study, JIT System and Kaizen Costing. Study has shown that low practice to time and Motion Study is due to lack of study equipments. JIT System has been lowly

practiced due to lack of good relationship with the suppliers. Similarly, Kaizen Costing is being lowly practiced due to lack of Kaizen efforts from the employees.

Recommendations

The cost reduction should be accompanied by mass production and wide distribution as well. Based on the findings/conclusions of this research works following recommendation have been forwarded for Nepalese manufacturing sector for effective cost reduction purpose.

- Modern Japanese cost management tools should be widely used. Firms have to think how to make the practice effective. For this they have to find out each and every cause for ineffective practice and preventive measures should be taken.
- In the present context, Firms have to given enough strength to relationship with the suppliers and give a way out for easy application of JIT system. Specially, the electric/electronic firm's textile companies and engineering firm should give efforts for JIT system application.
- Firms should keep on benchmarking others' effective practices and bring corresponding practice to their own ground.
- Automated technologies have to be widely used. Firms should shift to automated and group technologies form the age-old manual and obsolete mechanized technologies.
- Management auditors have to conduct audits on varied areas and give improvement suggestions.
- Engineering firms should give a breakthrough practice to target costing FBT and chemical firms are suggested to give high efforts to target costing team than the top management.
- Employees of the firms should be motivated so that they shall give full Kaizen efforts.
- Firms should the activities with cost.
- The project should be analyzed in a way so that it turns profitable through the project life. Hence, firms are suggested to use life cycle costing measure.

Firms are suggested to conduct time and motion study in their workplace. However, unnecessary movement observed and recorded should be corrected with positive motivation to the employees for Kaizen efforts.

Karki (2006) has made study about "Practice of cost reduction tools and techniques in selected Nepalese manufacturing companies." And his study has shown the following findings and recommendations.

Major Findings:

After discussion of the different aspects of cost reduction tools and techniques major findings can be listed out as following.

- The major cause of suffering the loss by Nepalese manufacturing companies is due to lack of proper supervision and management.
- The companies are trying to achieve objective by means of increasing selling price. They are trying to reduce the purchasing cost by means of managing cost in proper way.
- Majority of the companies are not applying the JIT system currently. Major problem of the failure of the system is due to lack of skilled and experienced manpower. In order to make success of the system properly, Nepalese manufacturing companies should establish the long term stable relationship with the employees.
- Major of the companies are not using TQM system currently. They are bearing the internal costs as the quality related cost at present and giving first priority to the quality design as the improvement technique to TQM system.
- Majority of the companies are applying Target Costing System. Involvement of top management is higher in order to implement the system and majority of the companies are applying teardown analysis under the system. Major reason for failure of the system in the organization is lack of information.
- Major of the companies are applying benchmarking system currently and they are benchmarking with national and international big firms. Similarly, they are benchmarking in the stage of production process.
- Majority of the companies have failed to adopt the KAIZEN system and major reason of the failure is lack of organizational goal relating to KAIZEN.

- Majority of the firms are adopting the reengineering process technologies as the tools of cost reduction and they are applying the techniques as per the need in order to reduce the total cost.
- Majority of the sampled companies are adopting the ABM costing system at present and adapting activity reduction as the tool of cost reduction under the system.
- Application of life cycle costing system in selected Nepalese companies is lower. Major reason of not adopting the system is due to difficult determining lifetime cost of the products.
- Majority of the sample companies are conducting the training. Program currently in order to reduce the total cost of organization. They are applying both on-the-job and off-the-job training programs for their employees. The companies are applying the simulation exercise on the part of off-the-job training and job instruction as the part of 'on-the-job' training. For the measurement of training effectiveness, they are using cost effectiveness analysis.
- There is not proper application of time and motion study in the sample companies. The technique failed due to lack of study equipment in the organization.
- Simple regression analyses conclude that there is no role of cost of goods sold to explain the gross profit of the organization.
- Based on simple regression analysis of another model, it reveals that operating expenses can not explain the variance of the gross profit as well as net profit of the organizations.
- Multiple regression analysis shows that cost of goods sold and operating expenses do not play major role to change the net profit of the Nepalese sampled manufacturing companies although predicting power of the model increased after adding one more variable in the model.

Recommendations:

Analyzing the different aspect of cost reduction tools and techniques in selected Nepalese manufacturing companies real status relating to it has been observed. Based

on the status as the application of some cost reduction tools, some points are recommended here, these will be helpful to reduce the cost within the organization.

- Out of total tools and techniques under studied only 54.55% of them have been employed in majoring of the manufacturing companies. In order to manage and reduce the total cost in proper way, the managements are recommended to apply other famous tools and techniques as soon as possible.
- The management are recommended to apply the supervision system in order to implement the currently used tools and techniques properly. Similarly, they are suggested to establish an information system to use the new tools and techniques in other to reduce cost to the minimum level.
- Involvement of top management is higher is order to implement the target costing system in Nepalese manufacturing companies. Single effort may not sufficient to achieve the goal of cost reduction. Therefore. The top management of the companies are recommended to make participation of the subordinates staffing in the planning and implementation process.
- Cost will vary as per the life cycle stage of the products. However, majority of the idealess the life cycle costing system presently. They have failed to adopt life cycle costing system because of the difficulties in determining the life time cost. Therefore, the companies are recommended to estimate the product cost as per the life cycle.
- Majority of the companies are using cost effectiveness analysis as the measurement of training effectiveness. It would be more effective if they conduct refresher training as per the need.

2.5 Research Gap

Above review implied that most of Nepalese manufacturing organizations are not very serious regarding the application of cost reduction tools. That's why they have not been successful in meeting their target.

The other side, it is observed that the previous researchers did not focused on impact of cost reduction tools on overall performance. And previous researchers are failed to recommend to the government of Nepal, because the business mostly based on government rules and regulation. It is not considered the political instability, strike

and other various abnormal cases which is shown time to time, though the researcher only consider the scientific cost reduction tools. The practical difficulties are ignored by them.

So, this study will be fruitful to those interested persons, scholars, professors, students and business academically as well as from policy perspective.

CHAPTER - III

RESEARCH METHODOLOGY

3.1 Introduction

The prime objective of the present study is to identify the condition of application of cost reduction tools in Nepalese manufacturing organization. It will draw out how many organizations are applying such tools. Why others are not applying such tools? The research methodology adapted for the present study has been out lined in this chapter which deals with research design, sources of data, population and sampling, data collection procedures, data analysis procedure.

3.2 Research Design

Keeping in mind the objective of the study, descriptive cum analytical research design has been followed. It is descriptive in sense that it clarifies different aspects of cost reduction. It tries to search the qualitative and quantitative aspects of cost reduction especially in Nepalese manufacturing organizations. It is analytical in sense that it uses different analytical tools to show the respondents view towards the use of some famous tools and techniques in Nepalese manufacturing organizations.

3.3 Sources of Data

The main source of data for this study is primary. The information has been collected through unit visits. It, therefore, means that primary data have been collected. A questionnaire with multiple-choice answer was prepared before the visit, and distributed during the visit to the unit under study.

3.4 Population and Sampling

All the manufacturing organization established and operating in Nepal has been taken as population of the research study. The sample has been taken using stratified, convenient, random and judgmental (Purposive) sampling procedure. The sample will be stratified as follows.

- Food and Beverage
- Irons and steels
- Plastics and foam
- Liquors
- Shoes

All those manufacturing organizations having Kathmandu-based head offices or contact offices have been taken as target population. Out of target population at least 15 organizations have been sampled selecting at two samples from each strata.

3.5 Data Collection Procedure

For the collection of the necessary data, questionnaires and schedules were distributed to the respondents of the sample firms. Answers, received thereon, have been changed into numerical data. Respondents are offered for multiple answers to the questions.

3.6 Data Analysis Procedure

The collected information has been tabulated in a frequency distribution for the purpose of data presentation, analysis and extract of findings. As the respondents are given opportunities for giving more than just one answers to the questions, the column to tools reflects sampled organizations from each sub-sectors and the row totals shows the total number of organizations choosing a particular answer. For the analysis of data, percentage analysis method has been adopted.

3.7 Testing of Hypothesis

The hypothesis taken in the research is that the cost reduction practices among the sub-sectors and among the tools of reduction is identical. For this purpose, F-test (Two ways ANOVA) test has been conducted choosing a particular answer.

3.8 Research Variables

This search has been conducted using the following research variables.

i. Benchmarking
ii. Total Quality Management
iii. KAIZEN

iv. ABM

v. Target Costing

vi. Reengineering

vii. Life Cycle Costing

viii. JIT System

ix. Balance Scorecard

x. Theory of Constraints.

CHAPTER - IV

DATA PRESENTATION AND ANALYSIS

4.1 Cost Reduction Practice in Nepal

4.1.1 Profit and Wealth Maximization Practice

A survey was conducted over fifteen manufacturing organizations in Kathmandu valley to explore about how they are trying to maximize profit cum wealth objective. The following results have been found.

Table 1

Profit cum Wealth maximization practice sub sector wise observation

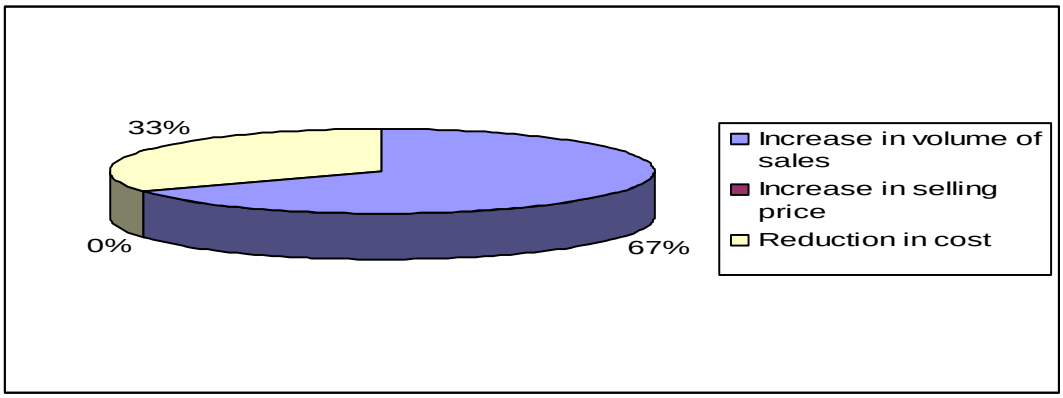
Particulars	Food and Beverage	Irons and Steel	Plastics and foam	Liquors	Shoes	Total	
						No	%
Increase in volume of sales	2	2	2	2	2	10	67
Increase in selling price	-	-	-	-	-	-	0
Reduction in cost	-	1	3	2	-	5	33
Total	2	3	5	3	2	15	100

Source- field survey, 2009

The above data can be presented with the help of following Pie-Chart:

Figure No. 1

Profit cum Wealth maximization practice sub sector wise observation



Out of fifteen manufacturing organizations sampled, ten (i.e. 67%) have been found going for increasing the volume of sales. And 5 (i.e. 33%) have been found emphasizing reduction in their costs for maximizing profit cam wealth. And it was found that no organizations are for increase in their selling price.

Based on the above, it can be analyzed that most of Nepalese manufacturing organizations want to maximize their sales volume. They think that sales is not problem. Demand exceeds the supply. So, it is good to maximize sales volume. Similarly, 33% organizations want to reduce in cost to maximize their profits cum wealth.

4.1.2 Managing Lower Price of Products

Study over those fifteen manufacturing organizations reveal the following results regarding the current practice of these organizations for setting lower price of their product.

Table 2

Measures applied for lowering price of products: sub-sector wise observation

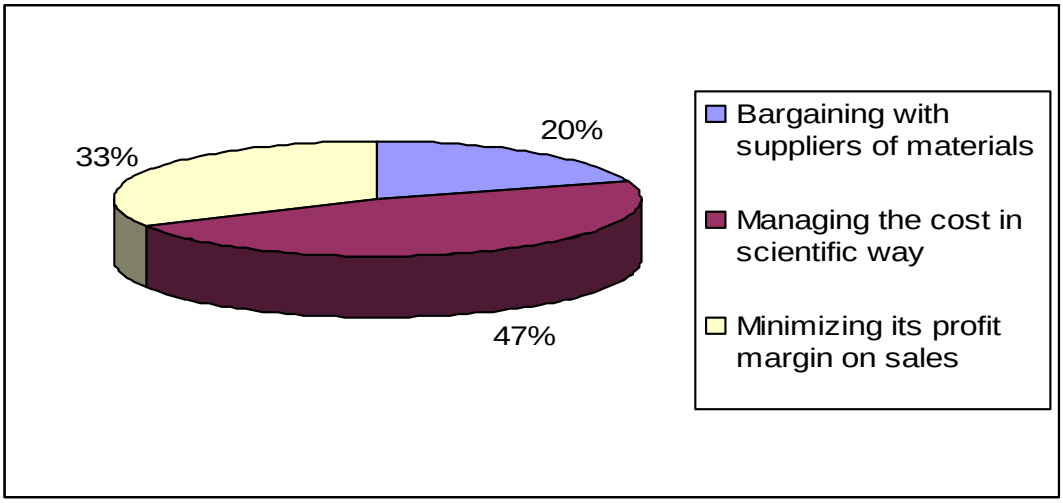
Particulars	Food and Beverage	Irons and Steels	Plastics and foam	Liquors	Shoes	Total	
						No	%
Bargaining with suppliers of materials	1	1		1	-	3	20
Managing the cost in scientific way	1	1	3	2	-	7	47
Minimizing its profit margin on sales	-	1	2		2	5	33
Total	2	3	5	3	2	15	100

Source: Field survey, 2009

The above data can be presented through following Pie-Chart:

Figure No. 2

Measures applied for lowering price of products: sub-sector wise observation



The above table shows that 47% manufacturing organizations sampled, were favoring scientific cost management techniques. About 20% organizations were also found bargaining with their material suppliers for managing low cost material. Similarly, 33% organizations were also found going for minimizing the profit margin on sales.

Based on the above, it can be analyzed that the bargaining with suppliers for material plays less important role to reduce cost. Most of the sampled organizations import their raw materials form foreign country. So it is harmful for them to bargain for material price.

4.1.3 Areas Selected for Cost Reduction

There are many areas which are required to apply the cost reduction program. A survey was conducted to gather information about areas on which organizations are suffering from cost related problem and applying cost reduction program. The study revealed the following results.

Table 3

Areas Selected for Cost Reduction

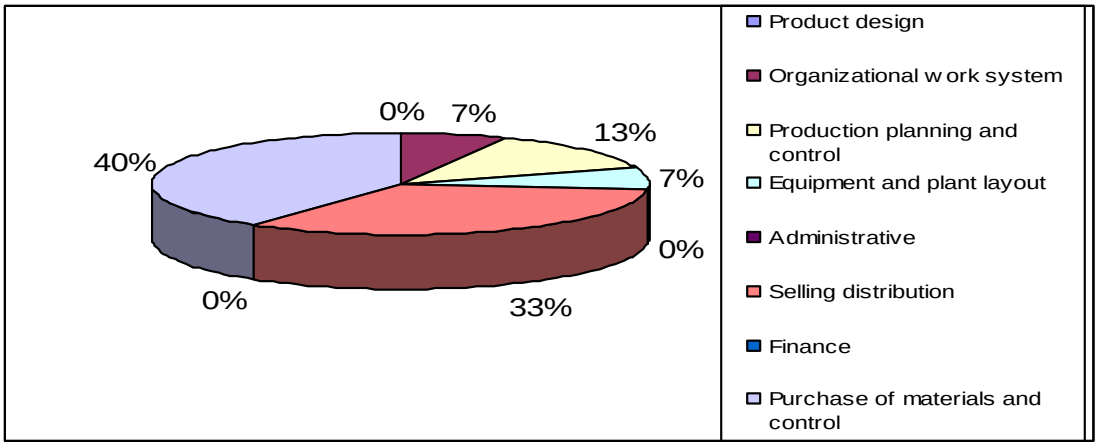
Particulars	Food and Beverage	Irons and Steels	Plastics and foam	Liquors	Shoes	Total	
						No.	%
Product design	-		-			-	
Organizational work system	-		1			1	7
Production planning and control	-	1	1			2	13
Equipment and plant layout	1		-			1	7
Administrative			-			-	
Selling distribution	-	2	1	2		5	33
Finance	-		-			-	
Purchase of materials and control	1		2	1	2	6	40
Total	2	3	5	3	2	15	100

Source: Field survey, 2009

The above data can be presented by following Pie-Chart:

Figure No. 3

Areas Selected for Cost Reduction



The above results shows that most of manufacturing organizations have been suffering from purchase of material and control cost i.e. 40% organizations consider it as the selected area for cost reduction program. Similarly 7% organizations are suffering from organizational work systems cost and equipment and plant layout cost. Least cost involved areas considered are product design. Administrative and finance cost are not problem for sampled organizations.

Based on the above, it can be analyzed that no organizations give the priority for product design. Because they are giving continuity for same product for years. They can control the administrative cost and do not have high finance related cost. So it is not necessary for them to select the cost reduction program in these areas.

4.1.4 Application of Cost Reduction Tools

As described earlier, there are various types of cost reduction tools, which are using by Japanese manufacturing organizations at present. This study deals whether Nepalese manufacturing organizations are applying the cost reduction program or not. It they are not applying such tools then it reveals the causes for it.

4.1.4.1 Application of JIT System

Table 4

Application of JIT System: sub-sector wise observation

Particulars	Food and Beverage	Irons and Steels	Plastics and foam	Liquors	Shoes	Total	
						No.	%
Applying (yes)	-	-	-	-	-	0	0
Not Applying (No)	2	3	5	3	2	15	100
Total	2	3	5	3	2	15	100

Source: Field survey, 2009

The study reveals that 100% organization are not applying JIT system as cost reduction tools. It means that application of JIT system in Nepal is likely to be impossible. The main cause for it was non availability of suppliers.

Table 5

Practical Difficulties in Application of JIT System : Sub Sector Wise Observation

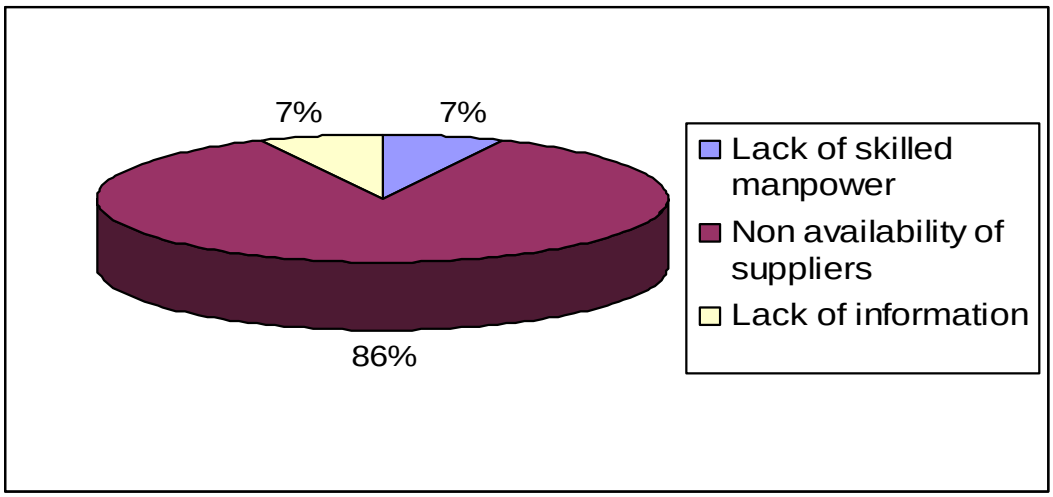
Particulars	Food and Beverage	Irons and steels	Plastics and foams	Liquors	Shoes	Total	
						No	%
Lack of skilled manpower	-	-	1	-	-	1	7
Non availability of suppliers	2	3	3	3	2	13	86
Lack of information	-	-	1	-	-	1	7
Total	2	3	5	3	2		15

Source: Field Survey, 2009

The above data can be presented by following Pie-Chart:

Figure No. 4

Practical Difficulties in Application of JIT System



4.1.4.2 Application of Total Quality Management (TQM)

Table 6

Application of TQM: Sub Sector Wise Observation

Particulars	Food and Beverage	Irons and Steels	Plastics and foam	Liquors	Shoes	Total	
						No.	%
Applying	2	3	5	3	2	15	100
Not Applying	-	-	-	-	-	-	-
Total	2	3	5	3	2	15	100

Source: Field survey, 2009

The data regarding application of Total Qualities Management reveal that organizations are conscious to apply the TQM approach. 100% sampled manufacturing organizations are applying TQM tools to reduce the cost.

The above table shows that 86% manufacturing organizations are not applying JIT due to non availability of suppliers. 7% organizations think that lack of skilled manpower is the main cause for it. And 7% organizations think that they are not applying JIT tool because they do not have any information about it.

4.1.4.3 Application of Target Costing

The status of applications of Target Costing in Nepalese manufacturing organizations can be presented as follows.

Table 7

Application of Target Costing: sub sector wise observation

Particulars	Food and Beverage	Irons and Steels	Plastics and foam	Liquors	Shoes	Total	
						No.	%
Applying	2	2	3	3	0	10	67
Not Applying	-	1	2	-	2	5	33
Total	2	3	5	3	2	15	100

Source: Field survey, 2009

The study reveals that 67% manufacturing organizations are applying Target Costing. And 33% manufacturing organizations are not applying Target Costing.

Table 8

Practical Difficulties for Applying Target Costing: Sub Sector Wise Observation

Particulars	Food and Beverage	Irons and Steels	Plastics and foam	Liquors	Shoes	Total	
						No.	%
Lack of skilled manpower	-	1	1	-	-	2	40
Lack of information	-	-	1	-	2	3	60
Lack of top management support	-	-	-	-	-	-	-
Total	-	1	2	-	2	5	100

Source: Field survey, 2009

The above data shows that only five organizations are not applying Target Costing tool and 10 organizations are applying. The practical difficulties for not applying the Target Costing tool are lack of skilled manpower and lack of information. Out of them 40% organizations are facing the problem of skilled manpower and 60% are facing the problem of information's.

4.1.4.4 Application of Benchmarking

The status of application of Benchmarking in Nepalese manufacturing organizations can be presented as follows.

Table 9

Application of Benchmarking: sub sector wise observation

Particulars	Food and Beverage	Irons and Steels	Plastics and foam	Liquors	Shoes	Total	
						No.	%
Applying	2	3	5	3	-	13	87
Not Applying	-	-	-	-	2	2	13
Total	2	3	5	3	2	15	100

Source: Field survey, 2009

The above data shows that 87% manufacturing organizations are practicing the Benchmarking system. It means, there are high competitions among the organizations. Only 13% organizations are not applying the Benchmarking. Two shoes manufacturers are not applying Benchmark pricing because they thought that the demand is higher than the supply. So, it is not necessary to provide low price shoes in the market. They said that it was not necessary to follow such reductions tool.

4.1.4.5 Application of KAIZEN Costing

For knowing whether Nepalese firms conduct KAIZEN efforts in the area of cost reduction or not, the study reveals the following results:

Table 10

Application of KAIZEN Costing: Sub Sector Wise Observation

Particulars	Food and Beverage	Irons and Steels	Plastics and foam	Liquors	Shoes	Total	
						No	%
Applying	1	1	1	1	-	4	27
Not applying	1	2	4	2	2	11	73
Total	2	3	5	3	2	15	100

Source: Field survey, 2009

The data reveals that 27% manufacturing organizations are using KAIZEN costing. But most sampled organizations (i.e. 73%) are not using KAIZEN costing. It sows that Nepalese Manufacturing organizations are not conscious about KAIZEN costing.

Table 11

Practical Difficulties in Applying KAIZEN Costing: Sub Sector Wise Observations

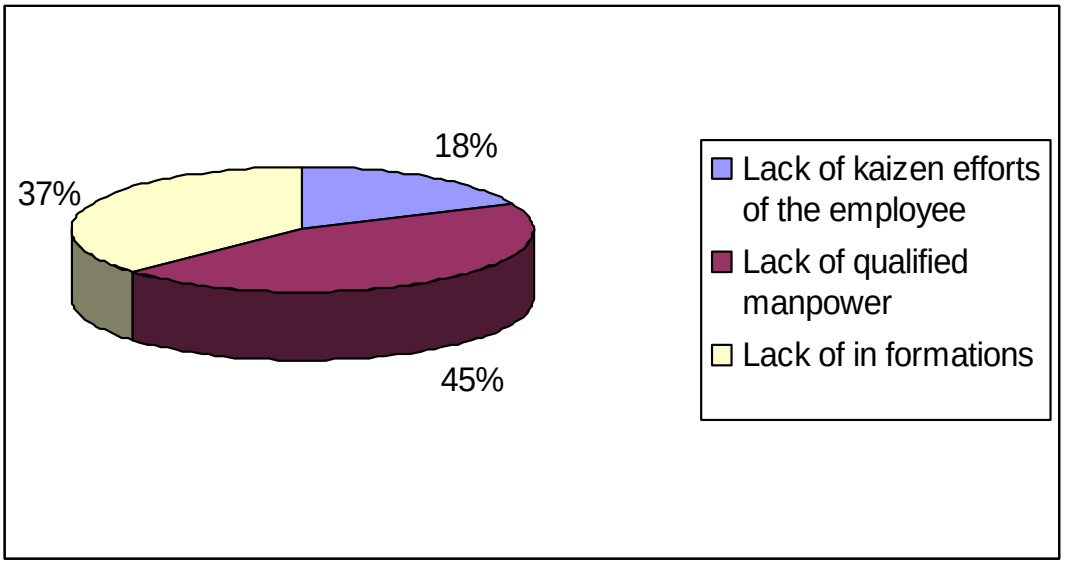
Particulars	Food and Beverage	Irons and steels	Plastics and foam	Liquors	Shoes	Total	
						No	%
Lack of kaizen efforts of the employee	-	1	-	1	-	2	18
Lack of qualified manpower	1	1	2	1	-	5	45
Lack of in formations	-	-	2	-	2	4	37
Total	1	2	4	2	2	11	100

Source: Filed Survey, 2009

The above data can be presented through following Pie-Chart:

Figure No. 5

Practical Difficulties in Applying KAIZEN Costing



The above table shows that 18% organizations are not applying the KAIZEN costing due to the lack of KAIZEN efforts of the employee, 45% manufacturing organizations are facing the difficulties of qualified manpower where as 37% manufacturing organizations do not have proper information about KAIZEN.

4.1.4.6 Applications of Activity Based Management

The study made for knowing whether or not Nepalese manufacturing organizations are conducting ABM for reducing their cost, the date reveals the following facts:

Table 12
Applications of Activity Based Management: Sub Sector wise observation

Particulars	Food and Beverage	Irons and Steels	Plastics and foam	Liquors	Shoes	Total	
						No	%
Applying	2	3	4	2	2	13	87
Not applying	-	-	1	1	-	2	13
Total	2	3	5	3	2	15	100

Source: Filed Survey, 2009

The above table shows the 87% manufacturing organizations are applying Activity Based Management as cost reduction tool. It shows that most of organizations can define their activities clearly and they are able to reduce their cost by using ABM activity. Only 13% organizations are not applying such tool.

4.1.4.7 Applications of Life Cycle Costing

Most of Japanese manufacturing firms use life cycle costing before adopting any big project. Life Cycle Costing helps reduce the overall cost of the project throughout the life of the project by selecting a best costing option. Reviewing the high success of Japanese firms, it is significant here to identify status of Life Cycle Costing practice in Nepalese manufacturing sector. Following facts are revealed:

Table 13
Application of Life Cycle Costing: Sub Sector Wise Observation

Particulars	Food and Beverage	Irons and steels	Plastics and foams	Liquors	Shoes	Total	
						No	%
Applying	1	1	3	2	2	9	60
Not Applying	1	2	2	1	-	6	40
Total	2	3	5	3	2	15	100

Source: Filed Survey, 2009

The above table shows that only 60% manufacturing organizations are applying Life Cycle Costing to reduce cost and only 40% organizations are not applying life cycle costing. Comparatively, there is no high difference between the organizations applying and not applying the tool. It indicates lower portion of organizations are not applying the Life Cycle Costing.

Table 14

Practical Difficulties in Applying Life Cycle Costing: sub sector wise observation

Particulars	Food and Beverage	Irons and Steels	Plastics and foam	Liquors	Shoes	Total	
						No	%
Lack of Information	-	-	2	1	-	3	50
Lack of top management support	-	-	-	-	-	0	0
It does not help to cost reduction	1	2	-	3	-	3	50
Total	1	2	2	1		6	100

Source: Filed Survey, 2009

The above table sows that six organizations are not applying the cost reduction tool. Out of them, three organizations i.e. 50% are facing the problems of lack of information and three organizations i.e. 50% think that Life Cycle Costing does not help in reducing cost. And non of organizations think that they do have problem of top management support.

4.1.4.8 Application of Reengineering as Cost Reduction Tool

Reengineering is the change of production process. When a process technology seems more consuming or ineffective or time consuming, it needs change. It is called Reengineering process technology. In the context of Nepalese manufacturing organizations, these facts are identified:

Table 15

Application of Reengineering: Sub Sector Wise Observation

Particulars	Food and Beverage	Irons and Steels	Plastics and foam	Liquors	Shoes	Total	
						No	%
Applying	2	2	2	3	-	9	60
Not applying	-	1	3	-	2	6	40
Total	2	3	5	3	2	15	100

Source: Filed Survey, 2009

The above table shows that 60% organizations are applying Reengineering as cost reduction tool where as 40% organizations are not applying Reengineering as cost reduction tools. It can be said that there are high problems in applying Reengineering as cost reduction tool. Out of fifteen organizations, nine organizations are applying the tool and six organizations are not applying reengineering as cost reduction tool.

Table 16

Practical Difficulties in Applying Reengineering: Sub Sector Wise Observation

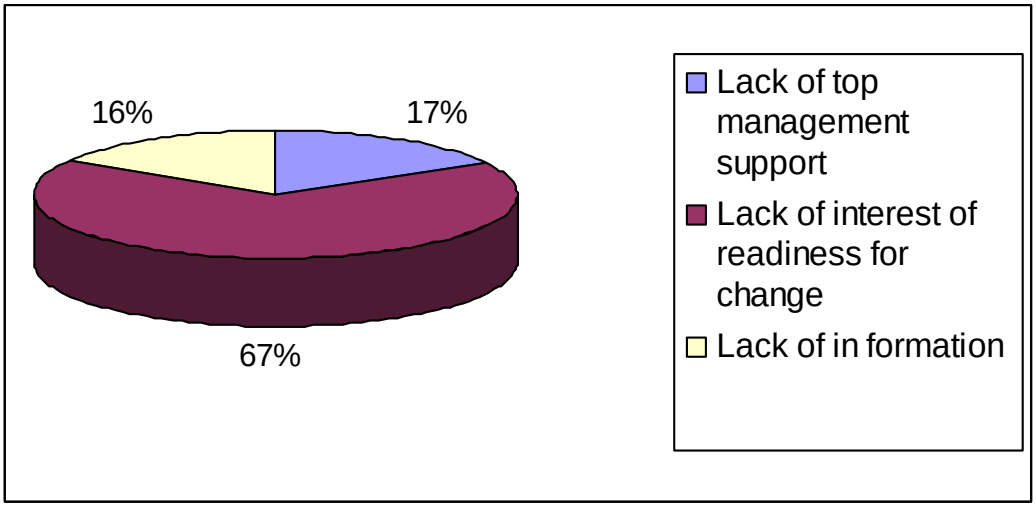
Particulars	Food and Beverage	Irons and steels	Plastics and foam	Liquors	Shoes	Total	
						No	%
Lack of top management support	-	-	1	-	-	1	17
Lack of interest of readiness for change	-	1	1	-	2	4	67
Lack of in formation	-	-	1	-	-	1	16
Total		1	3		2	6	100

Source: Filed Survey, 2009

The above data can be presented by following Pie-Chart:

Figure No. 6

Practical Difficulties in Applying Reengineering



The above table shows that 67% manufacturing organizations are not applying the Reengineering as cost reduction tool due the lack of interest of readiness for change. And 17% organizations are facing the difficulties of lack of top management support. Where as, 16% organizations do not have proper information's. So, it can be said that most of the organizations are not ready to adopt new production system.

4.1.4.9 Application of Theory of Constraints

The study made for knowing whether or not Nepalese manufacturing organizations are conducting Theory of Constraints as cost reduction tool, the following data are revealed:

Table 17

Application of Theory of Constraints: Sub Sector Wise of Observation

Particulars	Food and Beverage	Irons and Steels	Plastics and foam	Liquors	Shoes	Total	
						No	%
Applying	2	3	-	-	-	5	33
Not Applying	-	-	5	3	2	10	67
Total	2	3	5	3	2	15	100

Source: Filed Survey, 2009

The above table shows that 67% manufacturing organizations are not applying Theory of Constraints as a cost reduction tool. Only 33% organizations are applying such

tool. It means that only few organizations are conscious about using of Theory of Constraint. Most of organizations are not aware about Theory of Constructions.

Table 18

Practical Difficulties in Applying Theory of Constraint: sub sector wise observation

Particulars	Food and Beverage	Irons and Steels	Plastics and foam	Liquors	Shoes	Total	
						No	%
Lack of know ledge	-	-	5	3	2	10	100
Lack of top management support	-	-	-	-	-	0	0
Not applied by other organizations	-	-	-	-	-	0	0
Total	0	0	5	3	2	10	100

Source: Filed Survey, 2009

The above table shows that ten organizations are facing practical problems in applying Theory of Constraints. Out of ten organizations, ten organizations, i.e. 100% do not have proper knowledge about Theory of Constraints. So, Knowledge of TOC is the main problem to apply this tool for reducing cost.

4.1.4.10 Application of Balance Scorecard

Study of these fifteen manufacturing organizations shows the following results regarding the current practice of these organizations for applying of Balance Scorecard.

Table 19

Application of Balance Scorecard: Sub Sector Wise Observation

Particulars	Food and Beverage	Irons and Steels	Plastics and foam	Liquors	Shoes	Total	
						No	%
Applying	1	1	-	-	-	2	13
Not applying	1	2	5	3	2	13	87
Total	2	3	5	3	2	15	100

Source: Filed Survey, 2009

The above table shows that thirteen organizations i.e. 87% of total sampled organizations are not applying Balance Scorecard. It can be said that most of the organizations are not applying Balance Scorecard as cost reduction tool.

Table 20

Practical Difficulties in Application of Balance Scorecard: Sub Sector Wise Observation

Particulars	Food and Beverage	Irons and Steels	Plastics and foam	Liquors	Shoes	Total	
						No	%
Lack of knowledge	1	2	5	3	2	13	100
Lack of top management support	-	-	-	-	-	0	0
Lack of information	-	-	-	-	-	0	0
Total	1	2	5	3	2	13	100

Source: Filed Survey, 2009

The above table shows that 100% organizations are facing practical problems to use Balance Scorecard due to lack of knowledge. They do not have proper knowledge about balance scorecard.

4.1.4.11 Management View Regarding Necessity for Applying Cost Reduction Tools in Organizations

The survey made for knowing whether top managerial level think, the necessity for applying cost reduction tools in organizations reveal the following results:

Table 21

View Regarding Necessity for Applying Cost Reduction tools: Sub Sector Wise Observation

Particulars	Food and Beverage	Irons and Steels	Plastics and foam	Liquors	Shoes	Total	
						No	%
Yes	2	3	5	3	2	15	100
No	-	-	-	-	-	-	0
Total	2	3	5	3	2	15	100

Source: Filed Survey, 2009

The above table shows that 100% organizations have positive views regarding application of cost reduction tools. No one of them think that such tools can not be helpful to reduce the cost of organizations.

4.2 Testing of Hypothesis

The hypothesis is that application of cost reduction tools is identical i.e. no significant difference among sub-sectors and among tools of cost reductions.

The total numbers of sampled manufacturing organizations are fifteen from different sub sectors. From Food and Beverage sub sector total two organization were sampled, where three organizations were sampled from each Liquors and Irons and steels sub sector. Similarly, five organizations were sampled from Plastics and foam and two organizations were sampled form Shoes sub sector.

To give equal justice to all sub sectors, LCM has been computed which comes 30. Then weight has been calculated dividing that 30 by the number of samples form each particular sub sector and assigned to them. Based on the weight assigned, the data regarding the number of organizations from different sub-sectors applying different cost reduction tools has been restructured. The works have been shown in the restructured data as follows:

Table 22
Data Regarding Number of Organizations from Different Cost Reduction Tools: Sub Sectors Wise Observation

Sub Sector / Tools	Food (XA) Beverage	(XB) irons and Steels	(XC) plastics foam	(XD) liquor's	(XE) shoes	Total
JIT system (X1)	0	0	0	0	0	0
TQM Approach (X2)	30	30	30	30	30	150
Target Costing (X3)	30	20	18	30	0	98
KAIZEN (X4)	15	10	6	10	0	41
ABM (X5)	30	30	24	20	30	134
Reengineering (X6)	30	20	12	30	0	92
TOC (X7)	30	30	0	0	0	60
Life Cycle Costing (X8)	15	10	18	20	30	93
Balance Score card (X9)	15	10	0	0	0	25
Benchmarking (X10)	30	30	30	30	0	120
Total	225	190	138	170	90	813

Assuming level of significance is 5%

i) Null Hypothesis: H_o: $\Uparrow_A = \Uparrow_B = \Uparrow_C = \Uparrow_D = \Uparrow_E$

(i.e. There is no significant differences by sub sector areas)

Alternative Hypothesis: H_1: $\Uparrow_1 \mid \Uparrow_A \mid \Uparrow_B \mid \Uparrow_C \mid \Uparrow_C \mid \Uparrow_D \mid \Uparrow_E$

(i.e. there is significant difference by sub sector areas)

ii) Null Hypothesis: H_0: $\Uparrow_1 = \Uparrow_2 = \Uparrow_3 = \Uparrow_4 = \Uparrow_5 = \Uparrow_6 = \Uparrow_7 = \Uparrow_8 = \Uparrow_9 = \Uparrow_{10}$

(i.e. There is no significant difference by types of cost reduction tools)

Alternative Hypothesis: H_1: $\Uparrow_1 \mid \Uparrow_2 \mid \Uparrow_3 \mid \Uparrow_4 \mid \Uparrow_5 \mid \Uparrow_6 \mid \Uparrow_7 \mid \Uparrow_8 \mid \Uparrow_9 \mid \Uparrow_{10}$

(i.e. There is significant difference by types of cost reduction tools)

All values are presented below:

Table 23

Two-Way ANOVA Table

Source of variation	Degree of freedom	Sum of squares	Mean sum of squares	F-Ratio
Due to column factor	5-1=4	1057.52	264.38	Fc = 3.63
Due to row factor	10-1=9	4276.42	457.16	Fr=6.27
Due to error	4×9=36	2625.68	72.94	

i) The variance ratio for column/sub sector is 3.63. The critical value of F at 5% level of significance for (4,36) d.f. is 2.66

Decision: Since, the calculated value of F is greater than the tabulated value for (4,36) d.f. Thus, Null Hypothesis is not accepted. Therefore, it is concluded that application of cost reduction tools is not identical among sub sectors.

ii) The variance ratio for row/cost reduction tools is 6.27. The critical value of F for (9,36) d.f. is 2.16.

Decision: Since, the calculated value of F is greater than the tabulated value for (9,36) d.f. Thus, Null Hypothesis is not accepted. Therefore, it is concluded that application of cost reduction tools is not identical among cost reduction tools.

4.3 Percentage of Applying and not Applying Cost Reduction Tools

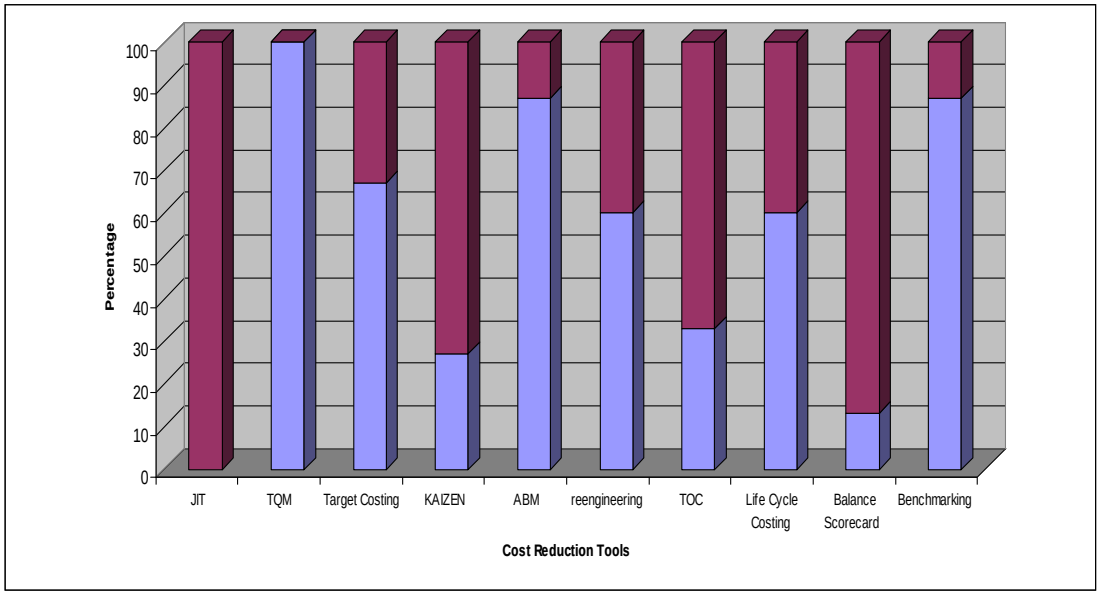
Table No. 24
Percentage of Applying and not Applying Cost Reduction Tools: Tools Wise Observation

Tools	Applying	Not Applying	Total
JIT	0	100	100%
TQM	100	0	100
Target Costing	67	33	100
KAIZEN	27	73	100
ABM	87	13	100
reengineering	60	40	100
TOC	33	67	100
Life Cycle Costing	60	40	100
Balance Scorecard	13	87	100
Benchmarking	87	13	100

Source: Filed Survey, 2009

The above table can be presented by following Bar-Diagram

Figure No. 7
Percentage of Applying and not Applying Cost Reduction Tools: Tools Wise Observation



The above figure shows the individual position of cost reduction tools. JIT system has not been applied by any organizations. TQM has been applied by all organizations. And other facts are shown on above figure.

4.4 Percentage of Applying and not Applying Cost Reduction Tools

Table No. 25

Percentage of Applying and not Applying Reduction Tools: Overall Observation

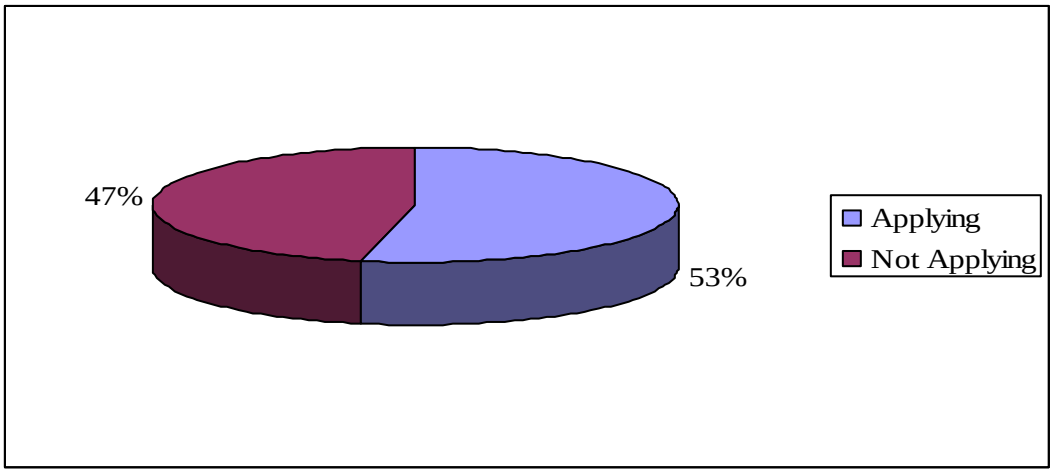
Particular	Percentage
Applying	53.4%
Not Applying	46.6%
Total	100%

The above table shows the percentage of applying cost reduction tools in sampled fifteen organizations is 53.4% and the percentage not applying cost reduction tools is 46.6%.

The above data can be presented by following Pie Chart

Figure No. 8

Percentage of Applying and not Applying Reduction Tools: Overall Observation



The above figure shows that 53.4% organizations are applying cost reduction tools whereas 46.6% organizations are not applying cost reductions tools.

4.5 Major Findings

The research works related to Application of Cost Reduction Tools in Nepalese manufacturing organizations based on Kathmandu valley have found the following facts:

- It is found that 53.4% cost reduction tools are being applied by manufacturing organization at present and 46.6% tools are not being applied.
- It is found that 100% manufacturing organizations are not applying JIT system as cost reduction tools at present. Most of the firms (i.e. 86%) think it is due to non availability of suppliers.
- Cent percent manufacturing organizations are applying Total Quality Management approach as cost reduction tool. It means that all organization are conscious about quality aspect of product.
- It is found that 67% manufacturing organizations are applying Target Costing as cost reduction tool and 33% are not applying. The main cause for not applying Target costing is lack of information (i.e. 60%) and secondary cause is lack of skilled manpower.
- Only 27% organizations are applying KAIZEN system as cost reduction tools. It is found that Khajuriko Nepal Pvt. Ltd is selected as model organizations using KAIZEN costing in Kathmandu valley. It is also found that Nebico Pvt. Ltd. usded KAIZEN for 3 years only. But now, it is not using due to lack of top management support.
- Most of organizations (87%) are applying ABM as cost reduction tool. The main cause that they who are not applying ABM, is difficulties in defining activities.
- It is found that the percentage ratio between applying and not applying Reengineering and Life Cycle Costing as cost reduction tool is 60:40. The practical problems in applying such tools are lack of proper information, lack of skilled manpower.
- 33% organizations are applying TOC as cost reduction tools and 13% organizations are applying balance scorecard as cost reduction tools. These tools are totally new for Nepalese manufacturing organizations.

- It is found that 87% Nepalese manufacturing organizations are applying benchmarking as cost reduction tool. Only 13% manufacturing organizations are not applying benchmarking.
- It is found that cent percent organizations think application of cost reduction tools help to reduce cost scientifically.
- It is also found from research work that 67% manufacturing organizations think that increase in volumes of sales maximize profit cum wealth. And only 33% organizations think that reduction of cost scientifically helps to maximize profit cum wealth maximization objectives.
- Similarly, 47% manufacturing organizations believe that management of the cost in a scientific way helps in lowering the price of product to customer. 33% of the organizations minimize the profit margin on sales. 20% of the organizations bargain with suppliers of materials for lowering the price of products.

CHAPTER - V

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

Most of organizations are facing throat cutting competition in today's business environment. A single mistake can be the main cause to loose whole market share. That may be the cause of organizations' liquidation. So, running of any business organization successfully is very challenging job nowadays. After industrialization, American and European countries established multinational companies around the world in search of materials for productions. Though lack of materials for production for their companies, these countries have maintained low cost of production.

Nepalese manufacturing organizations are facing the problem of high cost of materials and lack of materials. Similarly, they also do not have proper knowledge of management and other ideas about running the business successfully. High cost of production is headache for Nepalese manufacturing organizations. There are lots of tools and techniques to reduce the cost of productions. Most of tools have been innovated by Japanese manufacturing organizations. And these tools are applying by Japanese manufacturing organizations at present. So, it is must understand that the key of success of Japanese organizations is proper application of such tools. This research work has been done with the objective of identifying the current state of the application of cost reduction tools in Nepalese manufacturing organizations, pointing out and finding the practical difficulties of applying cost reduction tools in Nepalese manufacturing organizations and providing suggestions for the application of cost reduction tools to organization as well as to government.

As Nepal has entered into WTO membership and has signed the protocol of SAFTA, it has to liberalize its market and resultantly the products of foreign manufacturing organization freely move within the country. Hence, Nepalese manufacturing organizations have to further compete with their foreign competitors. The work for the country is now for making Nepalese products cheaper than imported products. This necessitates cost reduction practice in Nepalese industrial sectors. Mass participation, wide communication and effective training within the organization can only help to use cost reduction tools in organizations. Management tools like

leadership, motivation etc should be used. There are several areas where cost reduction works can be exercised. Some of these areas are product design, organizations product planning and control, equipment and plant lay out, purchase and control of materials etc. For cost reduction, the modern Japanese tools are being used which are JIT system, TQM, ABM, Benchmarking, Target Costing, Reengineering, Lifecycle Costing, Theory Of Constraints, Balance Scorecard, and KAIZEN.

The one of the main factors of success of Japanese manufacturing organization is application of JIT as a cost reduction tools. The JIT philosophy made famous by Toyota which has been credited with success of many of the world's leading manufacturers. But in Nepal, non of the organizations are applying JIT as cost reduction tool. So, it is very miserable condition for Nepalese manufacturing organizations.

In 1980s, most European and American companies considered quality to be an additional cost of manufacturing, but by the end of the decade, they began to realize that quality saved money. Companies discovered that it was cheaper to produce items correctly the first time rather their wasting responses by making substandard items that have to be detected, reworked, scrapped or returned by customers. In other words, the emphasis of TQM is to design and build quality in, rather than trying to inspect it in, by focusing on the causes rather than the symptom of poor quality.

Similarly, Activity Based Management, KAIZEN costing, Benchmarking, Target Costing, Life Cycle Costing, Reengineering, Theory of Constraints also help to reduce the cost of production. Most of tools are innovated form Japan. So, Japanese manufacturing organizations are getting success. It is very much necessary to apply such tools in Nepalese manufacturing organization also.

5.2 Conclusion

After the research works made on the topic Application of Cost Reduction Tools in Nepalese manufacturing organizations, following conclusions have been drawn.

- In the context of Nepalese manufacturing organizations based on Kathmandu valley, most of organizations prefer to increase in volume of sales and reduction in operating cost for maximizing profit of the organization.

- Most of organizations prefer managing the cost scientifically for the purpose of lowering the operating cost and consequently the price of products.
- Nepalese manufacturing organizations are facing high cost problem in various sectors but major are production planning and control, advertising, and selling and distribution areas.
- JIT system is not applied by Nepalese manufacturing organizations. Its main cause is identified as non availability of suppliers.
- TQM is widely applied by Nepalese manufacturing organizations. It can be concluded that most of organizations are conscious about quality factors.
- Similarly most of the organizations are applying Target Costing as cost reduction tool.
- KAIZEN costing is not widely applied by Nepalese manufacturing organizations. The main problem for it, is lack of proper information as well as lack of skilled manpower.
- Major portion of sampled organizations are applying ABM as cost reduction tool. It shows that less organization are unable to use ABM. And they are facing the problem in defining of activity.
- TOC and Balance Scorecard are new for most of organizations. They do not have proper knowledge about them. So least organizations are applying such tools.
- The ratio of applying Life Cycle Costing and Reengineering is 60:40. So, it can be said that the application of these tools are satisfactory.
- Most of the organizations follow Benchmark techniques as cost reductions tool. It can be concluded that most of organizations want to follow what leading organizations are doing at present in overall cost reduction approach.
- In this way, it can be concluded that 53.4% organization are following cost reeducation techniques. But 46.6% organizations are not applying cost reduction tools.
- It can be said, that Nepalese manufacturing organizations are not applying cost reduction tools because null hypothesis is not accepted.

Finally, it can be concluded that Nepalese manufacturing organizations based on Kathmandu valley are not applying cost reduction tools.

5.3 Recommendations

We know that, Nepal is in transitional period. It is transferring into full democracy multiparty system. Nepal's largest communist party is running the government. So, Nepalese manufacturing organizations are in also transitional period. They are waiting the full fledge government policy regarding manufacturing organizations. So, they are thinking of facing new situations. On the other side, Nepal is now the member of economic groups like, WTO, SAFTA, BIMSTEC etc. Now, Nepalese manufacturing sectors must have to compete with international products. Cost reduction techniques may be the best tools to overcome such situation for Nepalese manufacturing organizations. Based on the findings, conclusions of this research work, following recommendation have been forwarded to Nepalese manufacturing sectors and Nepalese government and future researchers for effectiveness of cost reduction tools.

5.3.1 Recommendations to Nepalese Manufacturing Organizations

Due to the lack of knowledge about cost reduction tools, Nepalese manufacturing organizations are not applying such tools properly. So, they are facing high cost problem. From the findings and conclusions, it is recommended using cost reduction tools effectively. For it, they have to train their employees to use such tools. They have to collect informations about success of Japanese organizations by applying cost reduction tools. JIT system has not been applied by any organizations, so it's is necessary to use JIT system. Firms should manage activities with cost. Nepalese manufacturing organizations should follow KAIZEN costing as cost reduction tool.

5.3.2 Recommendations to Nepal Government

The knowledge about cost reduction in Nepalese manufacturing organizations is very low i.e. organizations have no enough knowledge about cost reduction tools. Although organizations who have knowledge about this facing various difficulties and complexities for cent percent application. So, government should have to take responsibility for it Government should run campaign in manufacturing organizations to increase the level of application for cost reduction in every sectors. For this government should play partnership role by giving various training and guideline to Nepalese manufacturing organizations. Government should make clear legal

provisions about cost reduction program. It is found that most of organizations want to apply tools but they do not have any idea about this. So, government should facilitate them.

5.3.3 Recommendation for Future Researchers

Present study can be a valuable piece of the research work in cost reductions system especially in manufacturing business sectors. It may be valuable for academicians, practicing managers and any others who are directly or indirectly involved in business, government and non government sectors. After analysis, the researcher recommends to highlight the guidelines to put forward for better improvement.

- A detail investigation of causal linkage of cost reduction system and organizational performance can be conducted.
- The study may be conducted to investigate the reasons behind efficiency or inefficiency of cost reduction system.
- It can be increased the sample size of the firm to get the more reliable result.
- It can be studied between public as well as private manufacturing organizations.

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Appendix- 1

Research Questionnaires

Date:

Dear Sir/Madam,

A research is going on to identify the application of cost reduction tools in Nepalese manufacturing organization. The title of this research is **" A Case Study on Effective Application and Implementation of Cost Reduction Tools in Nepalese Manufacturing Organizations "**. For this purpose, sample survey is being conducted and your organization is selected as sample for this research work. You are kindly requested to fill up the questionnaire designed with a view to collect the information. Your help and co-operation will facilitate this research intended for the fulfillment of the partial requirement of MBS degree. It is assured that you're invaluable responses will be used for research purposes only.

Thank You

Keshar Chandra Bhandari

Nepal Commerce Campus

Research Questionnaires

[Please make a tick-mark on the following options and express your opinion towards your choice wherever necessary]

Q.N.1 Which of the following options does your organization give priority for the profit cum wealth maximization?

a. Increase in volume of sales ( )

b. Increase in selling price( )

c. Reduction in cost ( )

Q.N.2 In your opinion, why most of the Nepalese manufacturing organizations are suffering from loss?

(Please rank the following in order of their importance as per the following scheme Importance)

Very much much moderate little very little

(…..1….....2.....3.....4.....5.....)

a. due to high operating cost ( )

b. due to lack of knowledge ( )

c. due to unclear legal provision ( )

d. due to lack of proper supervision and management ( )

e. due to lack of raw materials ( )

Q.N.3 Do you know that the use of some tools can help to reduce cost?

a. Yes

b. No

Q.N.4 To reduce the cost of purchase to the customers, which of the following methods is your organization using at present?

a. Bargaining with the suppliers of materials ( )

b. Managing the cost in a scientific way ( )

c. Minimizing its margin on sales ( )

Q.N.5 In which of the following area is your organization suffering from cost problem and requires cost reduction program?

a. Product Design ( )

b. Organizational work system ( )

c. Production planning and control ( )

d. Equipment and plant lay out ( )

e. Administrative ( )

f. Selling and distribution ( )

g. Finance ( )

h. Purchase of materials and control ( )

Q.N.6 Do top managerial levels of your organization know about cost reduction tools existing in management system?

a) Yes ( ) b) No ( )

Q.N.7 Does your organization use JIT approach to reduce inventory cost?

a. Yes( )

b. No( )

Q.N.8 JIf JIT system has not been used in organization, what are the causes for it?

a. Lack of skilled and experienced man-power ( )

b. Non-availability of suppliers ( )

c. Lack of information ( )

d. Other, if any, please specify.....

Q.N.9 Does your organization use Total Quality Management (TQM) approach?

a) Yes ( )

b) No ( )

Q.N.10 If TQM has not been applied in organization, what are the causes for it?

a. Lack of skilled manpower ( )
b. Quality is not the problem ( )
c. Lack of team spirit in the employees ( )
d. Other, if any, please specify.....

Q.N.11 Does your organizations apply target costing tool for cost reduction?

a) Yes ( )
b) No ( )

Q.N.12If Target Costing has not been applied, what might be the reason for the failure for applying it?

a. Lack of skilled manpower ( )
b. Lack of information ( )
c. Lack of top management support ( )
d. Other, if any, please specify.....

Q.N.13 Does your organization follow Benchmarking?

a) Yes ( )
b) No ( )

Q.N.14 If Benchmarking Costing has not been applied, what might be reasons for it ?

a. Lack of perfect knowledge ( )
b. Lack of top management support ( )
c. Lack of information ( )
d. Other, if any please specify.....

Q.N.15Does your organization applies KAIZEN costing system?

a) Yes ( )
b) No ( )

Q.N.16 If KAIZEN has not been applied, what might be reasons for it?

a. Lack of KAIZEN efforts of the employees ( )
b. Lack of qualified manpower ( )
c. Other, if any please specify.....

Q.N.17 Does your organization apply Activity Based Management (ABM)?

a) Yes ( )
b) No ( )

Q.N.18 If ABM has not been applied, what might be the reasons for it?

a. Problems in defining activity ( )
b. Lack of top management support ( )
c. Lack of proper information ( )
d. Other, if any please specify.....

Q.N.19 Does your organization apply Reengineering as cost reduction tool?

a) Yes ( )
b) No ( )

Q.N.20 If Reengineering has not been applied what might be reasons for it?

a. Lack of top management support ( )
b. Lack of readiness for change ( )
c. Lack of proper market infor)
d. Other, if any, please specify.....

Q.N.21 Does your organization applies Theory of Constraints (TOC) as cost management tool?

a) Yes ( )
b) No ( )

Q.N.22 If TOC has not been applied, what might be the reason for it?

a. Lack of knowledge about TOC ( )

b. Lack of top management support ( )

c. Not applied by other organizations ( )

d. Other, if any please specify.....

Q.N.23 Does your organization apply Life Cycle Costing?

a) Yes ( )

b) No ( )

Q.N.24 If Life Cycle Costing has not been applied in your organization what might be the reason for it ?

a. Lack of proper information ( )

b. Lack of top management support ( )

c. Your organization think that it does not help in reducing cost ( )

d. Other, if any please specify....

Q.N.25 Does your organization use Balance Scorecard?

a) Yes ( )

b) No ( )

Q.N.26 If Balance Scorecard has not been applied in your organization, what might be the reason for it?

a. Lack of proper knowledge

b. Lack of top management support ( )

c. It requeres skilled manpower ( )

d. Other, if any, please specify.....

Q.N.27 Do you really think that cost reduction tools are effective in reducing cost?

a) Yes ( )

b) No ( )

Name of Respondent: .....

Position: .....

Organization: .....

Age: .....

Gender: .....

Again thank you for your valuable information and kind co-operation.

APPENDIX - II

1. Computation of weight

i. LCM comes to 30 from 2,3,5,3,2

ii. Weight of each sub-sector = $\frac{\text{LCM}}{\text{RespectiveNS}}$

iii. Value of each sub-sector = Weight ×No. of sample applying cost reduction tools.

2. Data have been restructured as follows.

Particulars	Food and Beverage (A)	Irons and steels (B)	Plastics and foam (C)	Liquors (D)	Shoes (E)	X^2_A	X^2_B	X^2_C	X^2_D	X^2_E	ϕϑϒ|	ϕϒ^∂|
JIT	15×0=0	10×0=0	6×0=0	10×0=0	15×0=0	0	0	0	0	0	0	0
TQM	15×2=30	10×3=30	6×5=30	10×3=30	15×2=30	900	900	900	900	900	150	4500
TC	15×2=30	10×2=20	6×3=18	10×3=30	15×0=0	900	400	324	900	0	98	2524
Kaizen	15×1=15	10×1=10	6×1=6	10×1=10	15×0=0	225	100	36	100	0	41	461
ABM	15×2=30	10×3=30	6×4=24	10×2=20	15×2=30	900	900	576	400	900	134	3676
Reengineering	15×2=30	10×2=20	6×2=12	10×3=30	15×0=0	900	400	144	900	0	92	2344
TOC	15×2=30	10×3=30	6×0=0	10×0=0	15×0=0	900	900	0	0	0	60	1800
Life cycle	15×1=15	10×1=10	6×3=18	10×2=20	15×2=30	225	100	324	400	900	93	1949
S	15×1=15	10×1=10	6×0=0	10×0=0	15×0=0	225	100	0	0	0	25	325
Benchmarking	15×2=30	10×3=30	6×5=30	10×3=30	15×0=0	900	900	900	900	0	120	3600
ϕϑϒ|	225	190	138	170	90	6075	4700	3204	4500	2700	T=813	ϕϒ^ΣΠ KKΛΧϑϒ ∂|

3. The computation of correction factor,

Total sum of squares (TSS), sum of squares due to sub sector (SSC) and sum of squares due to types of tools (SSR) have been calculated below:

i) Correction Factor (C.F.) $= \frac{T^2}{N} = \frac{(813)^2}{5 \mid 10}$

…C.F. = 13219.38

ii) Total sum of Squares (TSS) = $\phi x^2 rc$ - C.F.

= 21179-13219.38

= 7959.62

iii) Sum of Squares between columns/sub-sector

(SSC) = $\frac{\phi(Xc)^2}{nr} Z C.F.$

$= \frac{(225)^2}{10} + \frac{(190)^2}{10} + \frac{(138)^2}{10} + \frac{(170)^2}{10} + \frac{(90)^2}{10}$ -13219.38

= 14276.9-13219.38

…SSC= 1057.52

iv) Sum of squares between rows/types of tools

(SSR) = $\frac{\phi(Xr)^2}{nc} Z C.F.$

$= \frac{(0)^2}{5} + \frac{(150)^2}{5} + \frac{(98)^2}{5} + \frac{(41)^2}{5} + \frac{(134)^2}{5} + \frac{(92)^2}{5} + \frac{(60)^2}{5}$

$+ \frac{(93)^2}{5} + \frac{(25)^2}{5} + \frac{(120)^2}{5}$ - 13219.38

= 17495.8-13219.38

…SSR= 4276.42

v) Sum of squares as the residuals/errors

SSE = TSS - SSC - SSR

= 7959.62 - 1057.52 - 4276.42

…SSE = 2625.68