COST REDUCTION OF WAFER BISCUITS MANUFACTURING THROUGH CLEANER PRODUCTION APPROACH

By

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(03/AS/039)

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DECLARATION

The work describe in this thesis was carried out by me at the Department of Food Science & Technology, Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka, under the supervision of Mr. Liyanage and Miss. W.A.K.de fonseka. The report on this has not been submitted to another university for another degree.

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DEDICATION

Affectionately Dedicated

To My Parents & teachers

ACKNOWLEDGEMENT

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ABSTRACT

This Study was focused on the reducing of production cost of wafer biscuit manufacturing with the prime focus on the generation of less waste materials. Wafers are very specialized type of biscuits requiring special equipment for production. Typically wafer sheets are thin and usually bear intricate surface patterns and difference shapes. They are in high demand in the recent market.

The research was carried out by the application of cleaner production techniques in wafer manufacturing; generation of waste materials during handling can be minimized. The method, which is science based and systematic, can reduce the cost of production through minimization of waste in terms of material and energy. In the source identification, the waste and emission sources within the premises were identified. Employees involved in the different sections were interviewed and most wasteful process steps were roughly identified. A process flow diagram was contrasted as a prequisiste for source inventory. Then each of the operation unit was studied carefully for the identification of waste generation streams.

During the cause evaluation the related output/waste was further quantified regarding each step. The most affected reasons for the waste generation were identified. With regard to each occasion the most wasteful points were selected and treated. Through option generations following steps were taken into account. Product modification, process modification, layout modification and on site recovery.

The points in the manufacturing process at which waste materials are generated were identified and altered to minimize waste material generation. It was also identified that by proper arrangement of machinery and modification of factory design, the production efficiency can be increased with the reduction of labour cost. Also by using cleaner production concepts to the wafer manufacturing process can significantly be minimized to 10-20% of production cost.

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CHAPTER 01

INTRODUCTION

1.1 Introduction

The name biscuit is derived from the Latin *bis coctus*, meaning cooked twice. In the USA, 'biscuit' means a small cake-like bun. Biscuit" covers a wide range of flour baked products, though it is generally an unleavened cake or bread, crisp and dry in nature, and in a small, thin, and flat shape. Biscuits are small baked products made principally from flour, sugar and fats. They typically have a moisture content of less than 4% and when packaged in moisture proof containers has a long shelf life perhaps six month or more. The appeal to consumer is determined by the appearance eating qualities.

Wafers are very specialized type of biscuits requiring special equipment for production. Typically wafer sheets are thin and usually bear intricate surface patterns and difference shapes. They are in high demand in the recent market. Wafers are unlike any other types of biscuits both in their form and their manufacture. They may be thin sheets deep relief sheets for making hallow wafers comes made in formed cavities, comes made by rolling baked discs, discrete discs or tubes may be continuously baked strips. In all cases, they may be made from a batter or baked rapidly between two hot surfaces.

The oven is the heart of the process as it both forms and bakes the wafer. It is therefore convenient to consider it first and the ingredients and recipe later. Originally wafers were made one at a time in hand held tongs heated over an open fire. The tongs considered of a pair of strong metal plates, which were latched immediately after butter was placed between them to resist the strong forces. Which developed as the water in the butter is flashed in to steam at the beginning to the bake. This technique has been mechanized and nearly all wafer ovens still works on this principle producing sheets typically 470*290 mm midsized plates are occasionally used.

Quality cost can be considered to be of 2 types,

1. Cost of compliance (related for success)- consists of prevention and appraisal cost
2. Cost of non-compliance (related for failures)- consists of internal and external cost

Cleaner production is a perspective and a decision making tool which assist industrialists to make environmentally and socially conducive economic choices. It is measured as a condition in which the natural resources consumed per unit of product or services are reduced and the impact of pollutants produced is minimized. This results in enhanced revenues and profitability as well as lower costs of production. Cleaner Production is a win-win-win approach where the industry, environment and society benefit equally.

The concept of Cleaner Production was developed to promote the application of pollution free production in industrial companies and the incorporation of concept in the national environmental legislation of developing countries. It is a continuous application of an integrated preventative environmental strategy introduced in the areas of production process, products and services in order make eco- friendly output and reduce risk to humans and the environment. The concept also help the government and private sector to ensure conservation of environmental resources in the most cost effective manner and help the industries in developing countries to respond to trends which may emerge from international environmental norms and standards.

1.2 Objectives

To reduce the production cost of wafer biscuits manufacturing with the price focus on the generation of less waste materials.

1.2.1 Specific Objectives

1. Studying the wafer biscuits manufacturing process.
2. Investigate the causes to unnecessary waste generation and reduce cost of wafers.
3. Determined waste cause categories
4. Giving treatments to the waste minimization
5. Check the effect of machine performance, baking, processing, cutting, packing and other operations of wafer manufacturing.

CHAPTER 02

REVIEW OF LITERATURE

2.1 Introduction of Wafers biscuits

Wafers are very specialized type of biscuits requiring special equipment for production. Typically wafer sheet are thin and usually bear intricate surface patterns and difference shapes. They are in high demand in the recent market. Wafers are unlike any other type of biscuits both in their form and their manufacture. They may be thin sheets deep relief sheets for making hallow wafers comes made in formed cavities, cones made by rolling baked discs, discrete discs or tubes may be winding continuously baked strips. In all cases, they may be made from a batter or baked rapidly between two hot metal surfaces. Biscuits are made from wheat flour and some other ingredients are added depending upon the variety to be produced. They are of many sizes, varieties and flavours. Wafer biscuits would have two wafers - like layers and cream will be stuffed between these two layers to form a sandwich-like biscuit. This is a versatile product with good market prospects. This note considers Assam as the preferred location in view of increasing demand and lack of local supply.

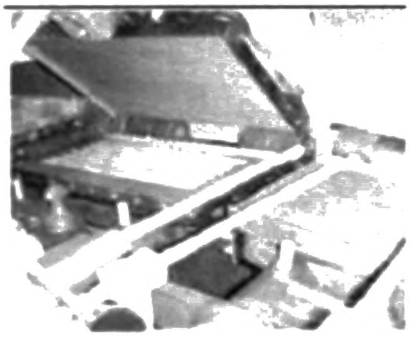

Fig. 2.1 wafer oven

2.2 Cookies, Crackers and Biscuit

2.2.1 Cookies

2.2.1.1 Definition of cookie

The term cookie or biscuit in many parts of the world generally refers to a "baked product containing high percentages of sugar and fat relative to the flour and relatively small percentages of water". This general statement on composition separates cookies from breads that contain relatively low percentage of sugar and fat and intermediate levels of water and from cake type products that have high levels of fat and sugar but also high levels of water (Faridi 1997).

2.2.1.2 Classification of cookie

Within various types of cookies, large differences in composition can occur. The types of cookies are defined not only by their relative composition but also by the method of production. Because there are several types of cookie, it is common practice to classify them by the dough which has a relationship with the rheological properties of dough. Such a classification allows the cookies to be divided into three major types.

1) Rotatory molded cookies
2) Wire cut cookies
3) Cutting machine cookies

The first two types are the most common (Faridi 1997).

2.2.2 Crackers

Cracker is a term used for biscuits of low sugar and fat content, frequently bland or savory. They are made from strong flour or developed dough. They generally contain 100 percent flour, 5-20 percent fat and 0-2 percent sugar. The dough generally contains low levels of water (20-30 percent). The leavening agent is either water vapour or a chemical leavening. Crackers and crisp breads are used as bread substitutes usually topped with savory foods like cheese, meat preparation and / or salad items.

2.2.3 Biscuits

The raw materials for biscuits are flour, sugar and shortening. In the manufacturing of biscuits on commercial level, Ammonium carbonate or bicarbonate (biscuit ammonia) or Sodium bicarbonate are used. Other leavening agents include baking powder containing Sodium bicarbonate and acid salts.

The steps involved in biscuit making are:

- Mixing and kneading
- Sheeting and shaping
- Backing and cooling
- Packaging

Fig. 2.2 wafer oven chain

2.2.3.1 Mixing and kneading

In a mechanical mixer, weighed amount of sifted flour, sugar, shortening and flavouring agents are added and mixed. Water and baking powder are added and mixed continuously to obtain dough of desired consistency. Optimum kneading (10-20 min) produces biscuits with fine structure, smooth crust and better appearance; over-kneading produces a compact toughened product. Under-kneaded doughs give biscuits that are very tender, coarse in texture, small in volume and having a rough crust

2.2.3.2 Sheeting and shaping

The dough is rolled into sheets of desired thickness by passing through pairs of rolls. The rolled dough sheet is cut by mechanically worked stamped divider fitted with dies.

2.2.3.3 Backing and cooling

The cut biscuits move forward on a continuous belt from plate sheet or wire mesh bands traveling through the ovens. The length of ovens depends upon the production capacity. The biscuits are baked at 450F^0 for 15 min and cooled after baking.

Packaging

The biscuits should be packed in moisture and grease proof cellophane or metal foil laminated packaging

2.3 Cleaner production

Cleaner production is a preventive, company-specific environmental protection initiative. It is intendend to minimize waste and emissions and maximize product output. By analysing the flow of materials and energy in a company, one tries to identify options to minimize waste and emissions out of industrial processes through source reduction strategies. Improvements of organisation and technology help to reduce or suggest better choices in use of materials and energy, and to avoid waste, waste water generation, and gaseous emissions, and also waste heat and noise.

Cleaner production means the continuous application of an integrated preventive environmental strategy to processes, products and services to increase efficiency and reduce risks to humans and the environment.

In the long run, cleaner production is the most effective way to design and operate industrial processes and to develop and produce products and services. The costs of wastes and emissions, including negative environmental and health impacts, can be avoided or minimized by applying the cleaner production concept continuously and throughout the entire life cycle; it is a preventive approach rather than reactive.

Implementing cleaner production may not solve all environmental problems at a facility, but it will decrease the need for end-of-pipe equipment and create less toxic waste to treat and dispose. It often reduces workers' exposure to hazardous chemicals, and usually reduces the number of accidents that can harm surrounding areas. Products that are designed and produced with cleaner production in mind are often less harmful for consumers to use, and their residuals are normally less of a burden to waste streams

Examples for cleaner production options are:

- Documentation of consumption (as a basic analysis of material and energy flows, etc...)
- Use of indicators and controlling (to identify losses from poor planning, poor education and training, mistakes)
- Substitution of raw materials and auxiliary materials (especially renewable materials and energy)
- Increase of useful life of auxiliary materials and process liquids (by avoiding drag in, drag out, contamination)
- Improved control and automatisation.

- Reuse of waste (internal or external)
- New, low waste processes and technologies

2.3.1 What is Cleaner Production?

Over the years, industrialized nations have progressively taken different approaches to dealing with environmental degradation and pollution problems,

- diluting or dispersing the pollution so that its effects are less harmful or apparent;
- controlling pollution using 'end-of-pipe' treatment;
- preventing pollution and waste at the source through a 'Cleaner Production' approach.

The gradual progression from 'ignore' through to 'prevent' has culminated in the realization that it is possible to achieve economic savings for industry as well as an improved environment for society. This, essentially, is the goal of Cleaner Production. Cleaner Production is defined as the continuous application of an integrated preventive environmental strategy applied to processes, Products and services to increase overall efficiency and reduce risks to humans and the environment.

- For production processes, Cleaner Production involves the conservation of raw materials and energy, the elimination of toxic raw materials, and the reduction in the quantities and toxicity of wastes and emissions.
- For product development and design, Cleaner Production involves the reduction of negative impacts throughout the life cycle of the product: from raw material extraction to ultimate disposal.
- For service industries, Cleaner Production involves the incorporation of environmental considerations into the design and delivery of services.

The key difference between pollution control and Cleaner Production is one of timing. Pollution control is an after-the-event, 'react and treat' approach, whereas Cleaner Production reflects a proactive, 'anticipate and prevent' philosophy. Prevention is always better than cure. This does not mean, however, that 'end-of-pipe' technologies will never be required. By using a Cleaner Production philosophy to tackle pollution and waste problems, the dependence on 'end-of-pipe' solutions may be reduced or in some cases, eliminated altogether. Cleaner Production can be and has already been applied to raw material extraction, manufacturing, agriculture, fisheries, transportation, tourism, hospitals, energy generation and information systems. It is important to stress that Cleaner Production is about attitudinal as well as technological change. In many cases, the most significant Cleaner Production benefits can be gained through lateral thinking,

Without adopting technological solutions. A change in attitude on the part of company directors, managers and employees is crucial to gaining the most from Cleaner Production. Applying know-how means improving efficiency, adopting better management techniques, improving housekeeping practices, and refining company policies and procedures. Typically, the application of technical know-how results in the optimization of existing processes. Technological improvements can occur in a number of ways:

- changing manufacturing processes and technology;
- Changing the nature of process inputs (ingredients, energy sources, etc...)
- changing the final product or developing alternative products;
- On-site reuse of wastes and by-products.

2.3.2 Types of Cleaner Production options

Housekeeping Improvements to work practices and proper maintenance can produce significant benefits. These options are typically low cost. Process optimization Resource consumption can be reduced by optimizing existing processes. These options are typically low to medium cost.

Raw material substitution Environmental problems can be avoided by replacing hazardous materials with more environmentally benign materials. These options may require changes to process equipment. New technology adopting new technologies can reduce resource consumption and minimize waste generation through improved operating efficiencies. These options are often highly capital intensive, but payback periods can be quite short. New product design changing product design can result in benefits throughout the life cycle of the product, including reduced use of hazardous substances, reduced waste disposal, reduced energy consumption and more efficient production processes. New product design is a long-term strategy and may require new production equipment and marketing efforts, but paybacks can ultimately be very rewarding.

2.3.3 Why invest in Cleaner Production?

Investing in Cleaner Production, to prevent pollution and reduce resource consumption is more cost effective than continuing to rely on increasingly expensive 'end-of-pipe' solutions. When Cleaner Production and pollution control options are carefully evaluated and compared, the Cleaner Production options are often more cost effective overall. The initial investment for Cleaner Production options and for installing pollution control technologies may be similar, but the ongoing costs of pollution control will generally be greater than for Cleaner Production. Furthermore, the Cleaner Production option will generate savings through reduced costs for raw materials, energy, waste treatment and regulatory compliance. The environmental benefits of Cleaner Production can be translated into market opportunities for 'greener' products. Companies that factor environmental considerations into the design stage of a product will be well placed to benefit from the marketing advantages of any future ecolabelling schemes.

Some reasons to invest in Cleaner Production

- improvements to product and processes;
- savings on raw materials and energy, thus reducing production costs;
- increased competitiveness through the use of new and improved technologies;
- reduced concerns over environmental legislation;
- reduced liability associated with the treatment, storage and disposal of hazardous wastes;
- improved health, safety and morale of employees;
- improved company image;
- reduced costs of end-of-pipe solutions

2.3.4 Cleaner Production can be practiced now

It is often claimed that Cleaner Production techniques do not yet exist or that, if they do, they are already patented and can be obtained only through expensive licences. Neither statement is true, nor this belief wrongly associates Cleaner Production with 'clean technology'. Firstly, Cleaner Production depends only partly on new or alternative technologies. It can also be achieved through improved management techniques, different work practices and many other 'soft' approaches. Cleaner Production is as much about attitudes, approaches and management as it is about technology. Secondly, Cleaner Production approaches are widely and readily available, and methodologies exist for its application. While it is true that Cleaner Production technologies do not yet exist for all industrial processes and products, it is estimated that 70% of all current wastes and emissions from industrial processes can be prevented at source by the use of technically sound and economically profitable procedures

2.3.5 Cleaner Production and sustainable development

In the past, companies have often introduced processes without considering their environmental impact. They have argued that a tradeoff is required between economic growth and the environment, and that some level of pollution must be accepted if reasonable rates of economic growth are to be achieved. This argument is no longer valid, and the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in June 1992, established new goals for the world community that advocate environmentally sustainable development. Cleaner Production can contribute to sustainable development, as endorsed by Agenda 21. Cleaner Production can reduce or eliminate the need to trade off environmental protection against economic growth, occupational safety against productivity, and consumer safety against competition in international markets. Setting goals across a range of sustainability issues leads to 'win–win' situations that benefit everyone. Cleaner Production is such a 'win–win' strategy: it protects the environment, the consumer and the worker while also improving industrial efficiency, profitability and competitiveness. Cleaner Production can be especially beneficial to developing countries and those undergoing economic transition. It provides industries in these countries with an opportunity to 'leapfrog' those more established industries elsewhere that are saddled with costly pollution control.

2.3.6 Cleaner Production and quality and safety

Food safety and food quality are very important aspects of the food industry. While food safety has always been an important concern for the industry, it has received even greater attention over the past decade due to larger scales of production, more automated production processes and more stringent consumer expectations. A stronger emphasis is also being placed on quality due to the need for companies to be more efficient in an increasingly competitive industry. In relation to food safety, Hazard Analysis Critical Control Point (HACCP) has become a widely use tool for managing food safety throughout the world. It is an approach based on preventing microbiological, chemical and physical hazards in food production processes by anticipating and preventing problems, rather than relying on inspection of the finished product. Similarly, quality systems such as Total Quality Management (TQM) are based on a systematic and holistic approach to production processes and aim to improve product quality while lowering costs. Cleaner Production should operate in partnership with quality and safety systems and should never be allowed to compromise them. As well, quality, safety and Cleaner Production systems can work synergistically to identify areas for improvement in all three areas

2.3.7 Cleaner Production and environmental management systems

Environmental issues are complex, numerous and continually evolving, and an *ad hoc* approach to solving environmental problems is no longer appropriate. Companies are therefore adopting a more systematic approach to environmental management, sometimes through a formalized environmental management system (EMS). An EMS provides a company with a decision-making structure and action programme to bring Cleaner Production into the company's strategy, management and day-to-day operations. As EMSs have evolved, a need has arisen to standardize their application. An evolving series of generic standards has been initiated by the International Organization for Standardization (ISO), to provide company management with the structure for managing environmental impacts. The UNEP/ICC/FIDIC *Environmental Management System Training Resource Kit*, mentioned above, is compatible with the ISO 14001 standard. UNEP DTIE, together with the International Chamber of Commerce (ICC) and the International

Federation of Engineers (FIDIC), has published an *Environmental Management System Training Resource Kit*, which functions as a training manual to help industry adopt EMSs.

2.3.8 Goals and objectives of cleaner production

Cleaner Production (CP) has been pursued in many countries for several years under various names such as pollution prevention, waste minimization, clean technology, environmental management, materials productivity, global competitiveness, natural resource conservation, green productivity etc. However all these approaches represent different facets of Cleaner Production. Collectively however, they address the triple objectives of sustainable development, namely economy, environment and society.

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The site is designed to provide information on Sri Lanka's Cleaner Production policy and legislation and on existing and planned activities to implement Cleaner Production in Sri Lanka by the National Cleaner Production Centre and other relevant organizations. Information is also included on other organizations in Sri Lanka and in other countries on aspects of Cleaner Production or on combating pollution.

2.3.8.1 Policy

Ministry of Environment & Natural Resources has initiated action to formulate a National CP policy, strategies and action plan to main stream CP in Sri Lanka's economic development. NCPC works closely with the ministry in this activity of the initiative.

- Integrate CP concepts and practices into the sectoral policies with a view to improve new-efficiency and environmental performance in process, products and services.
- Provide incentives and disincentives to improve the effectiveness of CP policies and practices in all sectors.
- Establish supportive legislation to promote CP.
- Establish and implement performance measurement and benchmarking to evaluate efficiency of sectoral policies and overall impact of these policies on environmental, economic and social development.
- Promote changing of consumption patterns to sustainable levels through CP.
- Build capacity to implement CP policies at all levels.
- Apply CP policies at local authority level to improve system efficiencies.
- Incorporate CP concepts into the Education System.
- Secure multi-sectoral stakeholder participation in CP activities.

2.3.8.2 Objectives

- Reducing consumption pressure on the natural resources base by efficient use of raw material.
- Improving environmental performance by using ecologically sound practices in the processes, products, services and all human activities.
- Improving efficiency of water and energy consumption by minimization and excessive exploitation use.
- Improving competitiveness in the local and global economy through environmentally sound practices.

- Improve social responsibility towards sustainable development.

2.3.8.4 Goals

- Achieve Sustainable Development
- Improve environmental quality
- Improve efficiency across all the sectors of the economy
- Alleviate productivity & improve standard of living of people

2.4 Cost and production

Instructional Goals: You will understand:

- The difference between opportunity costs and accounting costs.
- The importance of sensitivity analysis.
- How to derive long run cost curves from production functions by minimizing long run costs using both marginal and incremental analysis.
- How to derive short run cost curves from short run production functions.
- How to perform a shut down analysis.
- How to use Break-even analysis as a rule of thumb.

And the relevance of these concepts to operational decision making. These concepts will also have relevance to more complex questions of marketing policy and strategy.

2.4.1 Opportunity costs vs. accounting costs

Costs are bad things endured or good things lost. Cost always means cost to do something. You cannot have a cost without a cost objective. Most of the confusion about costs reflects a failure to be clear about cost objectives. Nevertheless, where economists and accountants are concerned, there is a second and equally critical source of confusion about costs: economists and accountants use the term "cost" to mean different although related things.

Economists define cost in terms of opportunities that are sacrificed when a choice is made. Hence, economic costs are simply benefits lost (and, in some cases, benefits are merely costs avoided). Economic costs are subjective -- seen from the perspective of a decision maker not a detached observer -- and prospective. Moreover, economic cost is a stock concept -- economic costs are incurred when decisions are made. Economic cost estimates are used for making decisions about pricing, output levels, buying or making, alternative marketing tactics/strategies, product introductions and withdrawals, etc.

Accountants define cost in terms of resources consumed. Hence, from an accountant's standpoint, costs are objective -- seen from the perspective of a detached observer -- and retrospective. Accountants usually define costs as flows. Accounting costs reflect changes in stocks (reductions in good things, increases in bad things) over a fixed period of time. Accounting cost measures are used in the evaluation of managerial performance (usually together with information on income) and as a basis for economic cost estimation.

There are two kinds of mistakes you can make when you use accounting costs to estimate economic costs: you can include cost measures that should be ignored; or, you can ignore costs that should be included. You should ignore costs that will not vary as a result of your decision; you should include all costs that will vary as a result of your decision.

2.4.2 Long run production functions and cost functions

Q = f(K, L). Quantity is a function of the inputs used to produce it: in this example capital and labor. Quantity is measured as a rate of production (flow) as are capital and labor, e.g. the amount of cars washed per day is a function of the amount of labor and capital used each day.

- The production function specifies a technically efficient use of labor and capital necessary to produce output, i.e. no resources are "wasted."
- The cost function specifies an economically efficient use of resources, i.e. the firm chooses the least cost combination of inputs, to produce a given output.
- This yields the long run cost function: total costs (C) = g(Q), which depends on the prices of inputs. This function can be a pretty good proxy for the opportunity cost of delivering Q, at least where we measure costs in units of present value: i.e., the change in present value or owner's equity caused by some specified action (and where for purposes of

measurement the attendant increase in wealth is excluded from the computation of equity).

2.4.3 Long run cost minimization: marginal analysis

Here we will assume that the firm can choose any level of capital and labor to produce output, Q. More capital leads to more output; less capital to less output. More labor leads to more output; less labor to less output. This is known as a variable proportions production technology because labor can substitute for capital, and vice-versa, in production.

- The marginal product of labor is the additional output from one extra unit of labor.
- The marginal product of capital is the additional output from one more unit of capital.

The cost minimization rule for producing a given quantity: choose labor and capital such that (MP of labor)/(Price of labor) = (MP of capital)/(price of capital).

Proof: dividing the marginal products of each input by the price of the input tells you how much output you can produce for a dollar. If it costs more to produce output using labor than it does using capital, then sell labor and buy capital. This allows you to produce the same amount at lower cost. Only when the costs of production using each input are the same are no further cost savings possible.

- If (MP of labor)/(Price of labor) is greater than (MP of capital)/(price of capital), sell capital, buy labor.
- If (MP of labor)/(Price of labor) is less than (MP of capital)/(price of capital), sell labor, buy capital.

2.4.4 Short run production functions

- A long run production function relates the output produced to the inputs used, e.g. Q = f (capital, labor). In the short run, some inputs cannot be varied, so the firm does not have as much flexibility as in the long run. In this case, the short run production function is a function of only the inputs that can be varied. Suppose that capital is fixed in the short run. Then Y = g(labor)
- The "usual" shape of the short run production function:
- 1. In the short run, output at first increases at an increasing rate with increases in labor (increasing returns to labor)
- 2. Then output increases at a constant rate with increases in labor (constant returns to labor).
- 3. Finally, output increases at a decreasing rate with increases in labor (diminishing returns to labor).
- Short run cost functions are larger than long run cost functions because, in the short run, fixed inputs can not be varied. In the long run, all inputs can be varied, and this greater flexibility allows you to achieve lower costs, i.e. h(Q) is greater than or equal to g(Q).

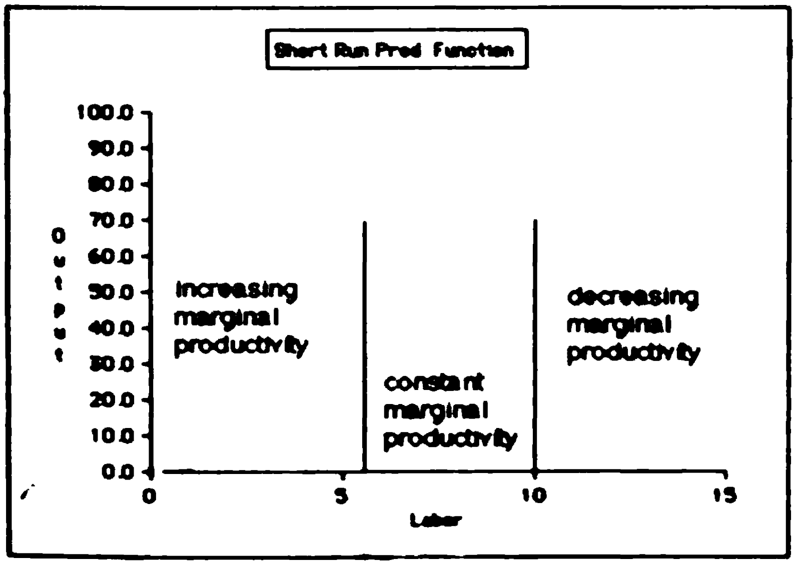

Fig. 2.3 curve of short run production

2.5 Cost of production and economics

In economics, the cost-of-production theory of value is the theory that the price of an object or condition is determined by the sum of the cost of the resources that went into making it. The cost can compose any of the factors of production (including labour, capital, or land) and taxation.

The theory makes the most sense under assumptions of constant returns to scale and the existence of just one non-produced factor of production. These are the assumptions of the so-called non-substitution theorem. Under these assumptions, the long run price of a commodity is equal to the sum of the cost of the inputs into that commodity, including interest charges.

Historically, the most well known proponent of such theories is probably Adam Smith. Piero Sraffa, in his introduction to the first volume of the "Collected Works of David Ricardo", referred to Adam Smith's adding up theory. Smith contrasted natural prices with market price. Smith theorized that market prices would tend towards natural prices, where outputs would be at what he characterized as the "level of effectual demand". At this level, Smith's natural prices of commodities are the sum of the natural rates of wages, profits, and rent that must be paid for inputs into production. (Smith is ambiguous about whether rent is price-determining or price determined. The latter view is the consensus of later classical economists, with the Ricardo-Malthus-West theory of rent.)

David Ricardo mixed such cost of production theory of prices with the labor theory of value, as that latter theory was understood by Eugen von Bohm-Bawerk and others. This is the theory that prices tend toward proportionality to the socially necessary labor embodied in a commodity. Ricardo sets this theory at the start of the first chapter of his "Principles of Political Economy and Taxation". Ricardo also refutes the labor theory of value in later sections of that chapter. This refutation leads to what later became known as the transformation problem. Karl Marx later takes up that theory in the first volume of "Capital", while indicating that he is quite aware that the theory is untrue at lower levels of abstraction. This has led to all sorts of arguments over what both David Ricardo and Karl Marx "really meant". Nevertheless, it seems undeniable that all the major classical economics and Marx explicitly rejected the labor theory of price.

A somewhat different theory of cost-determined prices is provided by the "neo-Ricardian school" of Piero Sraffa and his followers.

The Polish economist Michał Kalecki distinguished between sectors with "cost-determined prices" (such as manufacturing and services) and those with "demand-determined prices" (such as agriculture and raw material extraction).

One might think of this theory as equivalent to modern theories of markup-pricing, full-cost pricing, or administrative pricing. Ever since Hall and Hitch economists have found that the evidence gathered in surveys of businessmen support such theories.

Most contemporary economists accept neoclassical economics or mainstream economics. The non-substitution theorem is presented in graduate level microeconomics textbooks as a theorem of mainstream economics. Also many mainstream economists think they can justify theories of full-cost pricing within their theory. The majority of mainstream economists would probably then accept this theory as an element in their theory which does not give adequate attention to issues of consumer demand and marginal utility.

2.5.1 Market price

Market price is an economic concept with commonplace familiarity; it is the price that a good or service is offered at, or will fetch, in the marketplace; it is of interest mainly in the study of microeconomics. Market value and market price are equal only under conditions of market efficiency, equilibrium, and rational expectations.

In economics, returns to scale and economies of scale are related terms that describe what happens as the scale of production increases. They are different terms and are not to be used interchangeably.

2.5.2 Marginal utility

An individual will typically be able to partially order the potential uses of a good or service. For example, a ration of water might be used to sustain oneself, a dog, or a rose bush. Say that a given person gives her own sustenance highest priority, that of the dog next highest priority, and lowest priority to saving the roses. In that case, if the individual has two rations of water, then the marginal utility of either of those rations is that of sustaining the dog. The marginal utility of a third gallon would be that of watering the roses.

The notion that marginal utilities are diminishing across the ranges relevant to decision-making is called "the law of diminishing marginal utility" (and also known as a "Gossen's First Law"). However, it will not always hold. The case of the person, dog, and roses is one in which potential uses operate independently — there is no complementarity across the three uses. Sometimes an amount added brings things past a desired tipping point, or an amount subtracted causes them to fall short. In such cases, the marginal utility of a good or service might actually be increasing.

2.5.3 Labor theory of value

The labor theories of value (LTV) are theories in economics according to which the true values of commodities are related to the labor needed to produce them.

There are many different accounts of labor value, with the common element that the "value" of an exchangeable good or service is, or ought to be, or tends to be, or can be considered as, equal or proportional to the amount of labor required to produce it (including the labor required to produce the raw materials and machinery used in production).

Different labor theories of value prevailed amongst classical economists through to the mid-19th century. It is especially associated with Adam Smith and David Ricardo. Since that time it is most often associated with Marxian economics; while among modern mainstream economists it is considered to be superseded by the marginal utility approach.

Chapter 3

Material and Methodology

3.1 Materials

Electronic balance

Previous documentation

Audit report

Costing analysis reports

3.2 Methodology

3.2.1 Cleaner production assessment was created.

3.2.1.1 Step 1: Getting started

3.2.1.1.1 CP Team was designated

Requirements of CP Teams:

- Team should be capable of identifying opportunities, developing solutions and implementing them.
- Size and composition should match with company's organization
- Different functions/stakeholders should be represented

Suggested team members:

- Works/Production Manager
- Maintenance Manager
- Shop Floor Personnel: Engineers, Supervisors, Workers
- Finance/Purchase/Sales Representative
- Quality Controller
- External Expert

3.2.1.1.2 Process Steps were listed out

- Specify all processes, including production, material handling and storage, utilities etc.
- Special attention to occasional processes (cleaning etc.).
- Identify - most important - inputs and outputs, including materials, energy, water, wastes and emissions.

Assessment Focus was selected

- economic considerations
  - monetary losses with waste streams
- environmental considerations
  - volume and composition of waste streams
- .technical considerations
  - expected improvement potential

3.2.1.2 Step 2: process steps were analyzed

3.2.1.2.1 Flow Chart was prepared

- Compile process flow chart for audit focus:
- Identify all unit operations;
- Link unit operations and material flows;
- Match all inputs and outputs.

3.2.1.2.2 Material Balances and energy balances were made

Data sources:

- On-site measurements;
- Purchase and sales records;
- Production records.

Assess data quality:

- Reliability;
- Accuracy;
- Representatively

Review guidelines:

- Check consistency of units used
- The more expensive or toxic the materials, the more precise the balance should be
- Balances are more meaningful if made for each constituent material
- Cross checks can help reveal inconsistencies

3.2.1.2.3 Costs of waste streams was assigned

Internal costs and external cost

- loss of raw materials & (intermediate) product;
- operation of treatment facilities;
- Waste collection & handling.

Waste causes processes were identified

- Impact of product specifications
- Impact of choice & quality of input materials
- Impact of technical factors - process/equipment design, equipment/piping layout, monitoring equipment, ...
- Impact of operating practices - production planning, operating procedures, maintenance schedules, worker training, ...
- Impact of waste handling procedures

Step 3: CP Opportunities were generated

CP Opportunities were developed

Information sources:

- Brainstorm in project team
    - o overcome obstacles, encourage innovative thinking
- Solicit ideas outside project team
    - o encourage all players in enterprise
- Example options
    - o Data bases, manuals, earlier CP reports etc.
- Technology surveys and benchmarks

Check on all prevention practices:

- o Product modification
- o Input material change
- o Technology change
- o Equipment modification
- o Better process control
- o Good housekeeping

3.2.1.2.4 Workable opportunities were selected

Categorize options into:

- Implement obviously feasible options
- Reject obviously non-feasible options
- Remaining options - conduct feasibility analysis

Preliminary evaluation of remaining options:

- ease of implementation;
- expected technical feasibility;
- expected economic feasibility;
- expected reduction of waste/emission.

Involve appropriate experts and technicians in preliminary evaluation:

3.2.1.3 Step 4: CP opportunities were selected

3.2.1.3.1 Technical feasibility was assessed

Technical checklist:

- Availability and reliability of equipment
- Requirements for utilities, process monitoring and control, space
- Maintenance requirements
- Required technical skills (operators, technicians etc.)

Financial viability was assessed

Consists of:

Data collection:

- investments;
- Operational costs & benefits.

Choice of economic criteria

Economic calculations

Data collection (from technical evaluation):

1. Investment:

   Equipment, construction, training, start up etc.

2. Operational costs and benefits:

   Before and after comparison

Decision criteria:

Payback time:

- < 1-2 years (low-cost project)
- < 3-4 years (medium cost project)

- < 5 years (high cost project)

Net Present Value >> 0 (after depreciation time)

Internal Rate of return >> bank interest

Environmental aspects were evaluated

Evaluate environmental improvements:

- Reduction in quantity of pollutants and waste generated;
- Reduction of pollutant/waste toxicity;
- Reduction in materials consumption;
- Reduction in use of non-renewable materials;
- Reduction in energy consumption;
- Reduction in consumption of energy from non-renewable resources;
- Reduction of water consumption;

3.2.1.3.2 Solutions for implementation was selected

- Combine results of technical, economic and environmental evaluation of the CP opportunities.
- Properly document expected results and benefits for each option to facilitate fund raising and monitoring of implementation results.

3.2.1.4 Step 5: CP solutions were implemented

3.2.1.4.1 Implementation details were prepared

Detailed preparations:

- Write detailed technical equipment specifications;
- Prepare detailed construction plans;
- Do a comparative evaluation of equipment from different suppliers and make the final selection;
- Ensure proper planning to reduce installation downtime.

3.2.1.4.2 CP implementation was executed

Supervise construction and installation:

- control progress of work;
- control equipment & installation specification.

Prepare for start up:

- purchase start up chemicals, spare parts etc.;
- prepare preventive maintenance schedule;

3.2.1.4.3 Results were monitored and evaluated

Considerations to monitor progress:

1. Choice of measurement method:

    - change in waste quantities;
    - change in resource consumption;
    - changes in profitability.

Take account of:

- changes in total production output;
- changes in products.

Evaluate progress!

- Compare measured benefits with expected benefits;
- Identify ways to further improve the benefits of the technical installations;
- Verify installation and operation according to specifications.

3.2.1.5 Step 6: Cleaner Production solutions were sustained

3.2.1.5.1 CP solutions were sustained

Plan elements:

1. set up organizational structure for CP;
2. employee involvement through training & incentives;
3. long-term CP strategies & policies;
4. Integration into technical development.

Organizational structure:

- key responsibility to implement CP is to be rooted in production departments;
- managers & supervisors have to be accountable for waste generation;
- Technical & environmental departments are to participate in further improvements.

Employee involvement in CP:

- change of attitude calls for continuous staff education and efforts;
- cleaner production benefits from two-way internal communication practices;
- cleaner production raises staff satisfaction levels;
- Appropriate reward programs for champions (individuals and teams).

CP in technical development:

- preventive maintenance schedules;
- environmental check of new equipment;
- Integration of CP concepts in technological research and development.

3.2.1.5.2 Wasteful process steps were selected

- Appraisal of all process units on:
    - seriousness of waste/emission generation;
    - internal and external environmental costs;
    - managerial level;
    - Expected improvement potential.

- Selection of most promising focuses.
- Tailor planning of audits to long-term innovation and expansion plans

CHAPTER 04

RESULTS AND DISCUSSION

4.1 Feasibility Study

4.1.1 Heating

The plates are made of special alloy. The selection of alloy and casting procedure ensures dimensional stability, a homogenous and dense surface, thermal stability, good heat accumulation characteristics and excellent thermal conductivity. Special finishing is done to ensure trouble free release of wafer sheets. The wafer thickness is quickly and easily adjusted by applying spacing shims.

4.1.2 Baking plates

Wheat flour, Maize starch, Vegetable fat, preservatives etc are mixed with water to form the wafer batter. The batter is discharged onto the baking plates by a cam operated pump. The pump can be very accurately set to give an efficient distribution of batter with maximum economy and minimum wastage. Adjustment, clearing and maintenance of the pump is simple and quick.

4.1.3 Batter

The batter is discharged onto the baking plates by a cam operated pumps. The precision-built pump gives an efficient distribution of batter. Air blowing facility for simple removal of the wafer sheet from the baking plates.

4.1.4 Feeding and sheet take-off

The control panel can be mounted at the discharge end of the oven or at a distance of up to one meter for ease of operation. This provides control for the drive, batter pump, blowers and ignition. The drive is by an electric motor through a gear box and chain drive protected by an overload safety clutch. Baking time is adjustable between 1.5 and 3 minutes by means of potentiometer on the control panel, provided suitable batter is used.

4.2 Data analysis

4.2.1 Amount of biscuits (box) for one batch

Variety		Batter	Cream
Crunchy	vanilla	13.28	12.24
	c	15.13	12.90
Real	vanilla	16.94	18.70
	c	18.34	24.26
Punchy	vanilla	36.38	24.39
	c	39.01	26.53
9og	vanilla	18.58	17.10
	c	19.33	20.42
Music	vanilla	-	-
	c	32.54	27.27

4.2.2 Losses of Raw materials

4.2.2.1 Wheat flour

Varity		Actual	Expect	Loss	
				Total	Per 1 day
crunchy	Vanilla	13888.85	13872	16.85	0.76
	c	2921.4	2880	41.4	10.35
Real	Vanilla	8005	7896	109	8.38
	c	1983	1920	63	21
Punchy	Vanilla	3748	3744	4	0.5
	c	1776.5	1752	24.5	8.166
9og	Vanilla	1129.5	1104	25.5	12.75
	c	1873.5	1824	49.5	16.5
Music	Vanilla	-	-	-	-
	c	568.5	552	16.5	8.25

4.2.2.2Sugar

Varity		Actual	Expected	Loss	
				Total	Per 1 day
Crunchy	Vanilla	10437.5	10395	42.5	1.93
	c	2286.1	2310	-23.9	-4.78
Real	Vanilla	4291	4321	30	2.30
	c	1209.5	1023	186.5	62.16
Punchy	Vanilla	3908.3	3894	14.5	1.81
	c	1706.5	1716	-9.5	-3.166
9og	Vanilla	887.7	891	-3.3	-1.65
	c	1131.5	1122	0.5	3.166
Music	Vanilla	-	-	-	-
	c	407	403	4.6	2.8

4.3 Product

Biscuits are made from wheat flour and some other ingredients are added depending upon the variety to be produced. They are of many sizes, varieties and flavours. Wafer biscuits would have two wafers - like layers and cream will be stuffed between these two layers to form a sandwich-like biscuit. This is a versatile product with good market prospects. This note considers Assam as the preferred location in view of increasing demand and lack of local supply.

4.4 Market potential

4.4.1 Demand and Supply

Consumption of biscuits is steadily going up year after year as they are nutritious, have longer shelf life, easily available and one of the cheaper items in the category of ready-to-eat eatables. Biscuits are consumed by all age groups round the year and from all income groups.

4.4.2 Marketing Strategy

Thus, the market is very vast and scattered. Yet another positive aspect is increasing rural and semi-urban markets. Some of the national brands are very well established but there are hundreds of local or regional brands catering to the vast market and a new entrant would have to face this local competition. Good quality and competitive price coupled with wellorganised marketing network shall be the critical aspects.

4.5 manufacturing possess

It is conventional and simple. Various ingredients like wheat flour, starch, sugar, salt, soda, vanaspati, preservatives, flavours, colours etc. can be procured from local sources. Initially, wheat flour, starch, salt, soda etc. are mixed with water in a mixer and paste is formed. This paste is poured into pre-heated moulds and wafer-like sheets are baked. Simultaneously cream is prepared in the planetary mixer by mixing sugar, vanaspati, essence, colours and flavours and this cream is spread on baked sheets to make sandwiches. Finally, they are cut into required sizes and packed. The process flow chart is as follows.

4.5.1 Process flow diagram of the product

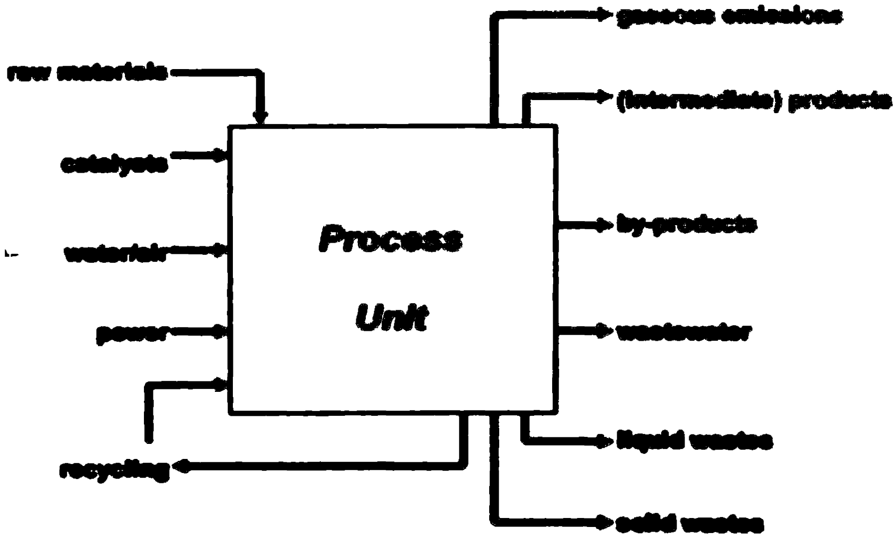

Fig. 4.1 flow diagram

4.6 Data analysis of wafer biscuits (Rs)

Wafer manufacturing cost of possess as can be divided into many parts. This figure is shown by cost of batter and cream production cost. Absorption rate is taken also calculating of production cost.

Varity		batter	cream	Absorption rate	cost	
					Per one batch	Per 1 day
crunchy	Vanilla	1724	6617	1.8	8870	230620
	c	1838	6885	1.15	9756	214632
Real	Vanilla	1724	9635	.9	10396	259900
	c	1838	14778	.8	13660	327840
Punchy	Vanilla	1724	6617	1.5	11650	233000
	c	1838	6885	1.45	11821	271883
9og	Vanilla	1724	6617	1.12	9135	210105
	c	1838	6982	.95	8571	205704
Music	Vanilla	-	-	-	-	-
	c	1838	14919	1.22	20039	240468

4.6.1 Waste analysis damages

These figures are shown by cost of damages

verity	Biscuits damage		Oven damage		molly	
Crunchy	V -227.78	228	V -72.21	72	V -120.92	121
	C -202.8	203	C -59.4	59	C -111.2	111
Real	V -182.65	183	V -61.15	61	V -115.23	115
	C -199	199	C -43.33	43	C -135	135
Punchy	V -166.75	167	V -41.5	41	V -98.62	99
	C -226.33	223	C -43.33	43	C -81.33	81
90g	V -169.5	170	V -63	63	V -142.0	142
	C -129	129	C -39.66	40	C -145.33	145
music	96	96	33.00	30	62.5	62

4.6.2 Waste analysis (Rs)

Variety		o.damage	molly	Wheat flour	sugar	total
Crunchy	vanilla	4985	8378	51	116	13530
	c	4338	8161	694	287	13430
Real	vanilla	4224	7963	562	138	12887
	c	3161	9925	1407	373	14866
Punchy	vanilla	2908	6855	34	71	9868
	c	5220	5955	547	190	11912
9og	vanilla	4362	9832	854	99	15147
	c	2941	10660	1106	190	14897
Music	vanilla	-	-	-	-	-
	c	2206	4558	553	168	7485

4.6.3 Production overhead of the factor

Factory Overhead Calculation	Per month	Per day
Electricity	90,000.00	2,045.45
Water	3,000.00	136.36
Gas		45,000.00
Loading & Unloading	1,000.00	45.45
Lab expenses	2,000.00	90.91
Repair & maintenances fact	4,000.00	90.91
building	12,000.00	272.73
Insurance	65,000.00	1,477.27
Repair & maintenance machine		
Depreciation	3,000.00	136.36
Other expenses		
Total Factory Overhead	180,000.00	49,295.45

4.6.4 Average overheads

Section	Sales (May) (Rs Million)	%	Selling & Dis (Per month)	Administration (Per month)	Finance & Other (Per month)	Other Over Heads (Per month)
Wafers	9	13.20	237,135.32	337,354.56	352,985.91	329,950.73

4.6.5 Overhead Absorption – Wafers

Category	Per Month	Per Day	Per Carton	Per packet
Selling	237,135.32	9,880.64	14.57	0.61
Administration	337,354.56	14,056.44	20.73	0.86
Finance	352,985.91	14,707.75	21.69	0.90
Other	329,950.73	19,747.95	20.28	0.84

But here there are unavoidable cost, therefore when calculate of the actual cost of the wafer biscuits manufacturing should be considered of those factors. Unavoidable cost means, a cost that cannot be influenced at the business unit level but is controllable at the corporate level.

Unavoidable cost of molly around 80%. Therefore voidable cost is 20%.

Variety		unavoidable	voidable	Percentage of loss (%)
Crunchy	vanilla	6702	6828	2.96
	c	6529	6901	3.21
Real	vanilla	6370	6517	2.50
	c	7940	6926	2.11
Punchy	vanilla	5484	4384	1.88
	c	4764	7148	2.62
9og	vanilla	7866	7281	3.46
	c	8528	6369	3.09
Music	vanilla	-	-	-
	c	3646	3839	1.59

4.7 Overhead costs

Overhead generally refers to indirect, in contrast to direct, costs. Indirect means that a cost cannot be matched or coupled in any obvious or objective manner with particular products, specific revenue sources, or a particular organizational unit. Manufacturing overhead costs are the indirect costs in making products, which are in addition to the direct costs of raw materials and labor. Manufacturing overhead costs include both variable costs (electricity, gas, water, etc.), which vary with total production output, and fixed costs, which do not vary with increases or decreases in actual production output.

4.8 Product cost

This is a key factor in the profit model of a business. Product cost is the same as purchase cost for a retailer or wholesaler (distributor). A manufacturer has to accumulate three different types of production costs to determine product cost: direct materials, direct labor, and manufacturing overhead. The cost of products (goods) sold is deducted from sales revenue to determine gross margin which is the first profit line reported in an external income statement and in an internal profit report to managers.

4.8.1 Total cost of wafer biscuits manufacturing (90g vanilla)

Factory Overhead	180,000.00
Selling	237,135.32
Administration	337,354.56
Finance	352,985.91
Other	329,950.73
Direct labor	232200.00
Production cost	6303150.00
total	7972776.52

4.9 Weighted-average cost of capital

Weighted means that the proportions of debt capital and equity capital of a business are used to calculate its average cost of capital. This key benchmark rate depends on the interest rate(s) on its debt and the ROE goal established by a business. This is a return-on-capital rate and can be applied either on a before-tax basis or an after-tax basis. A business should earn at least its weighted-average rate on the capital invested in its assets. The weighted-average cost-ofcapital rate is used as the discount rate to calculate the present value (PV) of specific investments.

4.10 Absorption costing

a cost accumulation and reporting method that treats the costs of all manufacturing components (direct material, direct labor, variable overhead, and fixed overhead) as inventoriable or product costs; it is the traditional approach to product costing; it must be used for external financial statements and tax returns

4.11 Conversion cost

Refers to the sum of manufacturing direct labor and overhead costs of products. The cost of raw materials used to make products is not included in this concept. Generally speaking, this is a rough measure of the value added by the manufacturing process.

In addition of those costs there are so many cost should be considered of calculating production cost of manufacturing of wafer biscuits.

CHAPTER 05

CONCLUSTION AND RECOMMENDATION

5.1 Conclusion

All types of wafers biscuits (crunchy, real, 90g, music) have high production loss percentage when compared with their production cost. When a one month period is considered there will be a high value. Therefore measures must be taken reduce to this cost accordingly using cleaner production techniques. It may have caused to earn high profit to the company. The figures as are follows for one month.

Variety		Percentage (%)	Per month
Crunchy	vanilla	2.96	204840
	c	3.21	207030
Real	vanilla	2.50	195510
	c	2.11	207780
Punchy	vanilla	1.88	131510
	c	2.62	214440
9og	vanilla	3.46	218430
	c	3.09	191070
Music	vanilla	-	-
	c	1.59	115170

When production losses are considered this per month becumes very high value in the company is point of view. In addition to material cost there will be an energy losses. It's also very high. Because when gas is used as an energy resources, oven efficiency is very low. Therefore gas losses of burner are became very high. It has caused a bad effect to the profit. Therefore should point out of material and energy balances of the process. When using cleaner production techniques to these two major fields the production cost can be reduced approximately 10-20%.

5.2 Recommendations

- The effect of energy balances of wafer biscuits production process should be studies. in addition to this energy audit should be done which related to production of wafer biscuits.

- The precise weight of wafer biscuits should be measured by a high performance electric balance.

- Should be select best packaging material for biscuits, its mean eco design and low cost.

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Appendix I

<u>Labour charge calculation</u>	Rs.	5,500.00
	Rs.	250.00
Average basic salary per worker per		
Average basic salary per worker per		
Labour Requirement per day		
Supervisors	1	
Batter Mixture	2	
Biscuit Block	4	
Cream mixture	2	
Oven Operators	1	
Cutter & Packing machine	11	
Damage cutting	1	
	Rs.	22
Basic labour charge per day		5,500.00
	Rs.	
Average overtime rate per worker	Hrs.	41.25
No: of OT hrs per day		44.00
	Rs.	
Overtime charge per day		1,815.00
Total Labour charge per day		7,315.00

Appendix II

Retail price		30.00	720.00
Retailer Margin		4.00	96.00
15.38%		26.00	624.00
Dealer price			
Less	0.39		9.36
Turn over tax			
1.5%	1.17		28.08
	1.43		34.32
Distribute Margins Commission	0.65		15.60
4.50%	0.65		15.60
Transport	0.78		18.72
5.50%			
Discounts		5.07	121.68
2.50%		13.37	320.76
Sales Returns			
2.50%			
Sales Rep. commission & expenses			
3.00%			
Less			
Confectionary Transfer price			
Contribution before absorbing overheads		7.57	181.56
		16.23%	16.23%
Selling & distribution Expenses	0.61		14.57
Administration	0.86		20.73
Finance	0.90		21.69
other	0.84		20.28
		3.22	77.27
contribution		4.35	104.29
Add Confectionary transfer Margin		(3.34)	(80.27)
Profit/ Loss per carton		1.00	24.02
Profit / Loss margin on dealer price		**3.85%**	**3.85%**

Appendix III

Packing material	Units	Unit price	Total	Value	Cost per carton	Cost per packet
Wrapper	Mts	6.25	3452	21,5573.65	31.82	1.33
Cartons	Nos	18.50	678	12,543.54	18.50	0.77
Gum tape	Nos	37.50	9	343.25	0.51	0.02
Ink roll	Nos	389.90	1.00	389.90	0.58	0.02
Packing material cost				34,850.35	51.40	2.14
Direct labor				7,315.00	10.79	0.45
Production overheads				49,295.45	72.70	3.03
Manufacturing cost				243,542.65	359.19	14.97
Cost per crtn					359.19	14.97
Margin (Loss)	-				-80.27	(3.34)
VAT 15%	22.35%				41.84	1.74
Transfer price					320.76	13.37

Appendix IV

Factory Overhead Calculation	Per month	Per day
Electricity	90,000.00	2,045.45
Water	3,000.00	136.36
Gas		45,000.00
Loading & Unloading	1,000.00	45.45
Lab expenses	2,000.00	90.91
Repair & maintenances fact	4,000.00	90.91
building	12,000.00	272.73
Insurance	65,000.00	1,477.27
Repair & maintenance machine		
Depreciation	3,000.00	136.36
Other expenses		
Total Factory Overhead	180,000.00	49,295.45

Appendix V

RAW MATERIALS	Units	Qty per batch	Unit Price	No of Batches	Value	Cost per Case	Cost per packet
Batter batch							
Flour	Kg	24.000	67.00	792.00	53,064.00	78.26	3.26
Lecithin	Kg	0.150	153.91	4.95	761.85	1.12	0.05
Ammonium Bicarbonate	Kg	0.125	50.00	4.13	206.25	0.30	0.01
Sodium bicarbonate	Kg	0.125	41.75	4.13	172.22	0.25	0.01
Coconut oil	Kg	0.250	320.00	8.25	2,640.00	3.89	0.16
water	kg	32.000		1056.00			
Cost		56.65			56,844.32	83.84	3.49
	Units	Qty per batch	Unit Price	No of Batches	Value	Cost per Case	Cost per packet
Cream Batch							
Sugar	Kg	33.00	54.00	597	32,253.21	47.57	1.98
Fat	Kg	20.00	170.00	362	61,538.10	90.76	3.78
Vanilla flavor	Kg	0.180	290.00	3	944.79	1.39	0.06
Lecithin	Kg	0.180	153.91	3	501.42	0.74	0.03
Wafer waste	kg	6.000	0.00	109	-	0.00	-
Total cost		59.36			95,237.53	140.46	5.85
Raw material cost					152,081.85	224.30	9.35

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