Addis Ababa Institute of Technology

School of Graduate Studies

Mechanical Engineering Department

Diagnosis and Modeling of Productivity Improvement in Manufacturing Industries

(A Case study In Awassa Textile Share Company)

A Thesis Submitted to School of Graduate Studies of Addis Ababa Institute of Technology in Partial Fulfillment of the requirement for the Degree of Masters of Science in Mechanical Engineering (Industrial Engineering Stream)

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DECLARATION

I, the undersigned, declare that this Thesis report entitled “Diagnosis and Modeling of Productivity Improvement in Manufacturing Industries: A Case of Awassa Textile Share Company” is the result of my own research carried out under the supervision of Dr.-Ing Daniel Kitaw and Mr. Amare Matebu. It has not been presented as a thesis in any other university and all source of material used for this thesis are duly acknowledged.

_____ _____

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This is to certify that the above declaration made by the candidate is correct to the best of my knowledge.

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ABSTRACT

The intent of this empirical research is to identify the critical factors that are potentially fatal to productivity improvement in Ethiopian textile industries and to analyze these factors. The Ethiopia government is now adopting policy measures that support productivity of the textile sector. But there is strong competition on the international market for textile and garment products, which are an important part of world trade. This was the imperative stand to carry out this study.

The aim of the research is enhancing the productivity of textile sector after analyzing the productivity affecting factors.

These study focuses on some selected textile companies in Addis Ababa and Oromia region which are representatives of the textile sector found in the country and based on the study productivity affecting factors were identified. According to the respondents the major problems are shortage of raw material, low labor productivity, absence of strong maintenance policy, low capacity utilization etc. And based on this a productivity improvement model which comprises technology based technique, material based technique, employee based technique and product based technique were developed. At the end of this study conclusion and recommendations are made on the basis of the problems faced in textile sectors.

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1. INTRODUCTION

1.1 Background of the Thesis

Productivity has become a household word as almost everyone talks about it. Yet, the term 'productivity' means different things to different persons. As a phenomenon, it ranges from efficiency to effectiveness, to rates of turnover and absenteeism, to output measures, to measure of client or consumer satisfaction, to intangibles such as disruption in workflow and to further intangibles such as morale, loyalty and job satisfaction **[4].**

The concept of productivity, generally defined as *the relation between output and input*, has been available for over two centuries and applied in many different circumstances on various levels of aggregation in the economic system **[11]**

Productivity is one of the key factors affecting profitability and overall competitiveness of a firm. Improving productivity is not vital only for firms, but it is vital also for a whole nation. Change in productivity have been recognized to be the major influence on many social and economical phenomena, like rapid economic growth, higher standard of living, improvements in a nation's balance of payment, inflation control, and even on the amount and quality of leisure (Aggarwall 1981, wait 1980).And moreover, the improvement in productivity by each individual enterprise is necessary for it to remain competitive and to improve its profitability. Improve productivity would result in higher wages to labor, more jobs and incremental gains in standards of living, greater profits for management through greater output at reduced costs, and lower prices to consumers (Mammone 1980) **[5].**

One must keep in mind that productivity is influenced by many factors such as worker skill, motivation and effort, job methods used, quality of workmanship, employee innovation, the machines used and effectiveness of management.

Productivity is the backbone of economic progress of any nation. Higher productivity leads to higher standard of living. Higher productivity results if more output can be got from same input or same output can be got from less input or more increase in output with correspondingly lesser increase in input.

Current economic realities (liberalized and dynamic markets, constantly changing customer preferences, new structure of production and work, etc.) are leading to a rethinking of the notion/concept of productivity. Whereas traditionally, productivity is viewed mainly as an efficiency concept (amount of outputs in relation to efforts or resources used), productivity is now viewed increasingly as an efficiency and effectiveness concept, effectiveness being how the enterprise meets the dynamic needs and expectations of customers (buyers/users of products and services) i.e. how the enterprise creates and offers customer value. Productivity is now seen to depend on the value of the products and services (utility, uniqueness, quality, convenience, availability, etc) and the efficiency with which they are produced and delivered to the customers.

The globalization of the economy and other associated trends require a much broader conception of productivity and a fuller appreciation of the changing dynamics of the determinants involved in the process of its improvement. The increased competitiveness, internationalization and sophistication of markets, the globalization of manufacturing and the increased concern about social and ecological issues make productivity improvement more important. At the same time, a broader meaning of productivity is emerging. Correspondingly, such broader conception of productivity calls for a wider set of indicators to catch and reflect the new elements and parameters involved **[6].**

Like other manufacturing sectors, current business climate for textile manufacturers must now focus on value creation rather than on minimization of inputs. Managers are trying to develop their current systems or looking for new productivity improvement techniques in order to keep pace with the rapid changes in the industry

The textile and garment are highly produced by eastern countries like china, India, Pakistan etc. In Ethiopia, the government's policy of AGLI (Agricultural Development lead Industrialization) gives the highest priorities for the agricultural sector, and encouragements for those have high labor- intensive industries like textile and garment sectors, for two purposes ; one to utilize the surplus labor force of the country and secondly to get hard currency by exporting these products.

Though there are high opportunities for growth of textile and garment sectors; due to availability of raw material, focus of Government in the sector as well as other opportunities

like African Growth and opportunity Act (AGOA), the overall productivity in the sector is very low. Hence the benefit the country acquires from this sector has been low **[8], [9].**

The existing textile factories in Ethiopia are not profitable due to poor productivity. This study is aimed at increasing the productivity of textile industries in Ethiopia by developing appropriate model.

The document has six chapters. The **first chapter** covered the project background, problem statement, the objectives aimed to achieve, the scope and significance of this study. This will be the guiding outline followed by the study. The **second chapter** will cover the related literature review about productivity, types of productivity, productivity affecting factors & variables and other important points will also be discussed in this chapter. On **the third** chapter research methodology will be discussed. In the **forth chapter,** data collection and analysis of the data will be made. After a thorough analysis of the collected data, observations etc. the major problems will be identified using Pareto analysis and cause and effect diagram; quantitative and qualitative solutions are suggested based on the impact they have on the improvement and ease of implementation. **The fifth** chapter is model development of productivity improvement for Ethiopian textile sector. The **final part** will be conclusion and recommendations.

1.2 Statement of the Problem

Globalization has made the world one big market place. However, due to low productivity Ethiopian Textile industries are unable to compute with foreign companies like in china, India etc.

The Ethiopian government has declared to give the textile and garment sector a priority area for industrial development and export. During the past years, the government has already intervened in support of the sector in order to make it competitive in the global market. Expectations have been high, but have not been fulfilled so far by the industry. Despite many well-intended efforts of the government, Ethiopian textile industries posses many challenges they couldn't even satisfy the local market demand. The major factors for this are low productivity of the industries, quality problems, inefficient management system, on time delivery failures and higher production cost, etc.

Due to the above potential problem the textile product quantities produced so far are not adequate to satisfy the domestic demand. However, Ethiopia could get a better opportunity even in entering to external market if the textile sector improves its productivity. Productivity can be expressed as labor Productivity, material Productivity, machinery Productivity, capital Productivity etc. Therefore the existing Productivity problem should be essentially assessed based on the above parameters.

1.3 Objectives of the Thesis

General Objective

The main objective of this study is to critically examine and identify productivity related problems in Ethiopian textile industries and develop an appropriate and applicable productivity improvement model to improve the overall performance of the sector.

The specific objectives of the thesis are:

1. Critically examine and identify the efficiency & productivity associated problems of the company
2. To examine the existing productivity measurement practices.
3. To explore the enablers and barriers for the company productivity improvement
4. Identify the potential areas for improvement
5. Propose the best productivity improvement technique for the company

1.4 Scope of the Study

As the title indicates, this study focuses on identifying the existing productivity problem of textile sectors and come up with a better productivity improvement model. Firstly the existing productivity rate of the company will be assessed based on the company's major products. In the company the entire productivity affecting factors will be studied & prioritized using Pareto analysis and arrive at the better solution.

1.5 Significance of the Study

It is evident that productivity affects the competition power of a company. Developing an optimal productivity improvement model benefits mostly the company and its clients as well. Since the aim of any manufacturing industry is to increase its profit, sales volume, while creating convenience for its workers and satisfying the customer, productivity problem should be given highest priority. This study prepares guidelines to effective productivity improvement for textile industries of Ethiopia. Upon implementation the industries would attain higher profit. In addition, this study can be taken as a benchmark and motivation for other similar factories in Ethiopia to follow the productivity improvement model to effectively produce their products.

The study benefits the industries in attaining the mentioned advantages. Furthermore improved productivity reduces production cost which reduces unit cost. This in turn decreases the product price for competitive advantage in the market place. Ultimately the increased production volume will satisfy the unmet demand.

2. LITERATURE REVIEW

2.1 Introduction

2.1.1 Concept of Productivity

The word "productivity" has become such a buzz word these days. In fact, the term "productivity" often appears to be used to promote a product or service, just as though it is a marketing tool.

In a formal sense, probably, the first time the word "productivity" was mentioned was in an article by Quesnay in the year 1766. More than a century later, in 1883, Littre defined productivity as the "faculty to produce," that is, the desire to produce. It was not until the early twentieth century, however, that the term acquired a more precise meaning as a relationship between output and the means employed to produce that output.

In 1950, the Organization for European Economic Cooperation (OEEC) [1950] offered a more formal definition of productivity:

Productivity is the quotient obtained by dividing output by one of the factors of production. In this way it is possible to speak of the productivity of capital, investment or raw materials according to whether output is being considered in relation to capital, investment or raw materials, etc.

Enterprises produce goods and services for sale with the aim of making returns on their investments. The goods and services are the output of the enterprises. In the process of production, an enterprise makes use of scarce resources which are called factors of production, namely land, labour and capital. These factors of production are generally referred to as inputs in the production process and their owners are rewarded from the returns generated by the enterprise. How to combine the inputs to have a maximum result - greatest output with a given input - is the problem of productivity.

Unfortunately, there is no universal definition of the term, productivity. It has been defined by Economists as the ratio of output to input in a given period of time. In other words, it is the amount of output produced by each unit of input. Business Managers, on the other hand, see productivity not only as a measure of efficiency, but also connotes effectiveness and performance of individual organizations. For them,

productivity would incorporate quality of output, workmanship, adherence to standards, absence of complaints, customer satisfaction, etc (Udo-Aka, 1983).

The administrator is more concerned with organizational effectiveness, while the industrial engineer focuses more on those factors which are more operational and quantifiable, work measurement and performance standards (Adekoya, 1989).

Productivity can be computed for a firm, industrial group, the entire industrial sector or the economy as a whole. It measures the level of efficiency at which scarce resources are being utilized. Higher or increasing productivity will, therefore, mean either getting more output with the same level of input or the same level of output with less input.

The definition of productivity can be expressed in different ways: to mention some:

- The word "productivity" appears for the first time, Quesnay (1766)
- Change in product obtained for the resources expended", Davis (1955)
- "Always a ratio of output to input", Fabricant (1962)
- Total productivity-the ratio of tangible output to tangible input, Sumanth (1979)
- Productivity is the ability to satisfy the market's need for goods and services with a minimum of total resource consumption **[1].**

The basic content seems to be the same in many definitions of productivity. However, within the similar definitions, there are three broad categorizations: i) the technological concept: the relationship between ratios of output to the inputs used in its production; ii) the engineering concept: the relationship between the actual and the potential output of a process; and iii) the economist concept: the efficiency of resource allocation. **[1], [18].**

$$\text{Productivity} = \frac{\text{Out put}}{\text{Input}}$$

New Concepts of Productivity

Traditionally, productivity is viewed mainly as an efficiency concept (amount of outputs in relation to efforts or resources used), productivity is now viewed increasingly as an efficiency and effectiveness concept effectiveness being how the enterprise meets the dynamic needs and expectations of customers (buyers/users of

products and services) i.e. how the enterprise creates and offers customer value. Productivity is now seen to depend on the value of the products and services (utility, uniqueness, quality, convenience, availability, etc) and the efficiency with which they are produced and delivered to the customers.

2.1.2 Inputs and output

There are different measures of output, such as total output and value added, and different types of input, including capital, labour and raw materials. In practice, measuring productivity means measuring the outputs and inputs of an economic unit, for instance a sector, industry or firm.

Changes in output can be achieved by adding more inputs, or by changing the relationships between inputs and outputs (in economic terms this means a shift in the production function). Productivity growth occurs through improved efficiency, such as using fewer inputs to produce the same outputs, or through inputs being used more effectively to produce outputs of greater value **[17].**

For a better detail, types of tangible inputs are listed as follow:

- Human - Workers, Managers, Professionals, Clerical staff.
- Fixed capital - Land, Plant (buildings and structures), Machinery, Tools and equipment, and others
- Working capital - Inventory, Cash, Accounts receivable, Notes receivable.
- Materials - Raw materials, Purchased parts
- Energy - Oil, Gas, Coal, Water, Electricity and etc..

2.1.3 Efficiency and effectiveness

The terms effectiveness and efficiency further complicate the terminology within this field. These terms are frequently confused with each other. However, as stated by Sink and Tuttle (1989) effectiveness is usually in simple words described as “doing the right things”, while efficiency means “doing things right”. Several examples of other definitions are given in Table 2.1 Nevertheless, most researchers agree that efficiency is strongly connected to the utilization of resources and mainly affects the denominator (inputs) of the productivity ratio.

- Efficiency is commonly defined as the minimum resource level that is theoretically required to run the desired operations in a given system compared to how much resources that are actually used (see Fig.2.1). Further,

the efficiency ratio is rather simple to measure, whether it is based on time, money or other units. In addition, efficiency is very similar to the concept that is referred to as utilization rate (i.e. degree of utilization), which means how much equipment or a process is used in practice compared to its maximum.

- Effectiveness, on the other hand, is a more diffuse term and in most cases very difficult to quantify. It is often linked to the creation of value for the customer and mainly influences the numerator (outputs) of the productivity ratio. A good, simple description of effectiveness is "the ability to reach a desired objective" or "the degree to which desired results are achieved". Such definitions lead to an interesting concept: there are usually no limits as to how effective an organization can be **[18].**

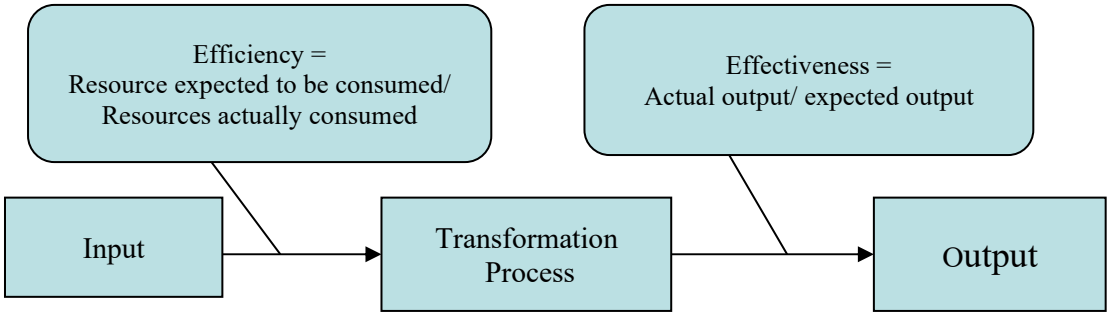


Fig 2.1: Efficiency and effectiveness

Table 2.1: Comparison of efficiency and productivity

Definitions of efficiency	Definitions of effectiveness
• Efficiency is an input and transformation process question, defined as the ratio between resources expected to be consumed and actually consumed • Efficiency is the ratio of actual output attained to standard output expected, and reflects how well the resources are utilized to accomplish the result • Efficiency is a measure of how economically the firm's resources are utilized when providing the given level of customer satisfaction • Efficiency means how much cost is expended compared with the minimum cost level that is theoretically required to run the desired operations in a given system.	• Effectiveness, which involves doing the right things, at the right time, with the right quality etc., can be defined as the ratio between actual output and expected output • Effectiveness is the degree of accomplishment of objectives, and shows how well a set of results is accomplished • Effectiveness refers to the extent to which the customer requirements are met • Effectiveness in manufacturing can be viewed as to what extent the cost is used to create revenues

- **Productivity index**

  = Output obtained / Input expended

  = Performance achieved / Resources consumed

  = f (Effectiveness) / F(Efficiency)

2.2 Production and Productivity

The difference between production and productivity is often neglected. These two economic terms are entirely different from each other. Production is all about the total amount of goods and services being produced while productivity refers to the efficiency of production. A manufacturing enterprise should always strive for higher productivity rate; a higher productivity means producing more within the given input resources or producing a given quantity with a lesser input resources. However, increase productivity should not be confused with an increase production because an increase production can be attained by increasing input resources while productivity will remain the same. Either way, productivity can be improved by the efficient use of input resources but at the same time the production may stay the same **[6], [11].**

Productivity is important not only in manufacturing but also in the country itself. A higher productivity means a greater opportunity for prosperity. It also leads to a lot of benefits such as it decreases the cost of production which results to a domino effect that also decreases the cost of the product therefore it would become more affordable and available to the public. It tends to lower the production cost and it increase production as it increase the profits of the company. It promotes social and economic progress. It alleviates poverty. It improves working conditions of the workers as it increases their wages. Lastly it advocates exporting companies to compete more in foreign markets. The following benefits are possible with a proper management of productivity **[11].**

2.3 The importance and role of productivity

The significance of productivity in increasing national welfare is now universally recognized. There is no human activity that does not benefit from improved productivity. This is important because more of the increase in gross national income, or GNP, is produced by improving the effectiveness and quality of manpower than using additional labor and capital. In other words, national income, or GNP, grows faster than the input factors when productivity is improved.

Productivity improvement, therefore, results in direct increases in the standard of living under considerations of distribution of productivity gain according to contribution. At present, it would be wrong to state that productivity is the only important world-wide source of real economic growth, social progress and improved standard of living. Thus changes in productivity are recognized as a major influence on many social and economic phenomena, such as rapid economic growth, higher standard of living, and improvements in a nation's balance of payments, inflation control, and even the amount and quality of leisure. These changes influence wage levels, cost/price relationships, capital investment needs and employment.

Productivity also largely determines how competitive a country's products are internationally. If labor productivity in one country decline in relation to productivity in other countries producing the same goods, a competitive imbalance is created. If the higher costs of production are passed on, the country's industries will lose sales as customers turn to the lower cost suppliers. But if higher costs are absorbed by industries, their profit will decrease. This means that they have to decrease production or keep production costs stable by lowering real wages.

Some countries that fail to keep pace with the productivity levels of competitors try to solve their problems by devaluing their national currencies. But this lowers real income in such countries by making imported goods more expensive and by increasing domestic inflation.

Thus, low productivity results in inflation, an adverse balance of trade, poor growth rate and unemployment.

It is clear, then, that the vicious circle of poverty, unemployment and low productivity can be broken only by increasing productivity. Increased national productivity not only means optimal use of resources, but also helps to create a better balance between economic, social and political structures in the society. Social goals and government policy largely define the distribution and utilization of national income. This in turn influence the social, Political, cultural, educational work environment which affects the productivity of individual and the social.

2.4 The Productivity cycle

Fig 2.2 shows the productivity cycle schematically, at any given time; an organization that is in the midst of an on-going "productivity program" may be involved in one of the four stages or phases: Productivity Measurement, Productivity Evaluation, Productivity Planning, and Productivity Improvement (MEPI).

An organization that begins a formal productivity program for the first time can begin with productivity measurement. Once the productivity levels are measured, they have to be evaluated or compared against planned values. Based on this evaluation, target levels of productivity are planned on both short- and/ or long-term bases. To achieve the planned targets, productivity improvement takes place in a formal manner. In order to assess the degree to which the improvement will take place next period, productivity levels must be measured again. This cycle thus continues for as long as the productivity program operates in the organization. **[25]**

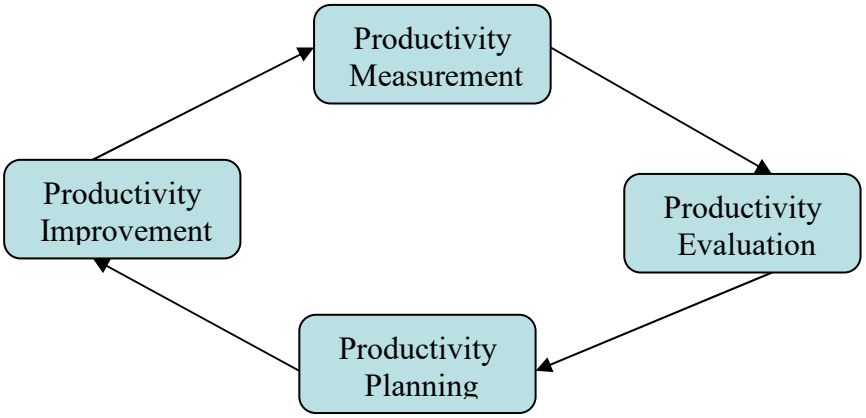


Fig 2.2: The productivity cycle: productivity measurement, evaluation, planning, and improvement, which form a continuous process **[25]**

The productivity cycle concept shows us that productivity improvement must be preceded by measurement, evaluation, and planning. All four phases are important, not just productivity measurement or just productivity improvement.

Also, this cycle emphasizes the "process" nature of the productivity issue. A productivity program is not a one-time project, but rather a continuous, on-going process.

2.5 Benefits of higher productivity in organizations

Some of the benefits that accrue from higher productivity:

1. Higher productivities in a company with respect to human and physical resources will mean higher profits, because Profits = revenue - cost of goods and services produced by the utilization of human and material resources

2. Higher company productivity is generally translated into higher real earnings for its employees.

3. The public realizes more social benefits because of increased public revenues.

4. The consumer has to pay relatively low prices because the cost of manufacture is reduced through higher productivity. **[25]**

2.6 Overview of productivity measurements

2.6.1 The importance of measuring productivity

To improve productivity, it is necessary to measure it. Only then can an organization effectively deal with it. Measuring productivity has a whole host of benefits. In addition to the general benefits of improving productivity such as inflation control, industry financial health, competitiveness of individual firms, and improvements in out quality of life, there are a number of specific reasons for measuring productivity in an organization with a system. These can be broken down into (1) general reasons why productivity measurement is important. (2) Advantages that occur through the process of developing the productivity measurement, and (3) beneficial uses of the resulting productivity measurement. These points are presented in list form below.

2.6.2 The most commonly used productivity measurement approaches in companies

In the literature there are four types of productivity measures. A description and a critique of the effectiveness of each type follows.

- **Partial productivity**

  Partial productivity is the ratio of output to one class of input. Output per labor hour is the best example of a partial productivity measure and is the one most commonly used. Since textile is a labor intensive sector most productivity indices are related to labor. However, there is a danger in using partial measures of productivity. As many authors pointed out that a partial measure of productivity could misleading when viewed alone. For example, a high

Specific (partial) productivity:

Such as: material productivity could project that a company is doing well although indeed, capital productivity, energy productivity, labor productivity and other indices may be low. The actual danger of partial measures is that it overemphasizes one input and others are neglected. **[23]**

- material productivity = total output / material cost
- labor productivity = total output / labor cost
- machinery productivity = total output / depreciation
- energy productivity = total output / energy cost
- capital productivity = total output / capital

❖ **Total-factor productivity** Total-factor productivity is defined as "the ratio of net output to the sum of associated labor and capital (factor inputs)." One such measures has been recommended by Mali (1978), and Taylor and Davis (1977). One disadvantage of this measure is that it omits the cost of materials, which is one of the vital inputs in business, from the denominator, although it is subtracted from the gross output. Omitting such items as raw materials, supplies, and purchased parts can make studies of cost-price relationships difficult, especially at the firm level. As with other inputs, material and computer inputs form important cost elements, and any savings obtained through their usage per unit of output affects the total unit cost of output and hence the prices.

Net output = Total output – Intermediate goods & services purchased

- TFP = Net output / (Labor + Capital)
- TFP = Output index / Input index

❖ **Total productivity measure**

The total productivity measure considers total output in relation to total input and has been proposed by most authors. For the most part there have been significant variations in the definition of the input and output elements. Various authors have also proposed different allocation criteria for specifying the proportional contributions of each input element to the final output.

Some total productivity measures are presented vaguely and as general relationships between some measurable input and output elements; others use unquantifiable descriptions. For example, Mali (1978) defined productivity as the

ratio of effectiveness to efficiency. It might be difficult to quantify effectiveness numerically in a real-world application.

- Total productivity = Total output / Total input
- Total input = Labor + Material + Services + Depreciation + etc

Other measures of productivity proposed in the literature include the array approach of Dewitt (1970, 1976), the financial ratio approach of Tucker (1961), Gold (1976), and Aggrawal (1979); the capital budget approach of Mao (1965); and the production function approach of Dhrymes (1963).**[23]**

2.6.3 Challenges of measurement of productivity

In essence, it can be said that the measurement of productivity is only simple conceptually. In practice, however, both measurement of outputs and inputs involves aggregation problem, and this problem alone has situated productivity measurement in the realm of complexity. For example, the question of how to aggregate different products that do not have constant quality or characteristics constitutes the veil to be removed from output measurement. In the same vein, the problem of how to aggregate the different types of inputs into a well-defined composite unit remains a critical one on the side of input measurement.

To solve output and input aggregation problem, particularly when heterogeneous inputs & outputs are combined, some authors have suggested that inputs should be added up in 'constant price' money values. The same thing should be done for output (Iyaniwura & Osoba, 1983, David, 1972).The loophole in this approach is that the resultant productivity index will be economic productivity and not physical productivity, which, obviously, should convey more meanings to most of the users of productivity measures **[4].**

2.7 Why productivity is everybody's concern?

Whether workers or employers, and whether a manager, farmer, professional, teacher or a housewife, we must display a keen interest toward the productivity matters. But why is productivity so important? Why should it be everybody's concern?

The following are the replies to the above questions:

- Because higher productivity enables the workers to get higher wages in less working hours under better working conditions.
- Because the employers obtain resources for new investments.
- Because the producers acquire higher profits at lower costs

- Because the consumers are thereby offered cheaper goods in greater quantities.
- Because the country seizes a sound economic growth that leads to rapid development.
- And finally, because the society attains a higher welfare level.

Consequently everyone will have the opportunity to benefit from the productivity improvement.

2.8 Productivity improvement factors

Productivity improvement is not just doing things better. More importantly, it is doing the right things better. The inter-relationships between labour, capital and the socio-organizational environment are important in the way they are balanced and co-ordinated into an integrated whole. Productivity improvement depends upon how successfully we identify and use the main factors of the socio-production system. It is important, in connection with this, to distinguish three main productivity factor groups.

- Job related;
- Resource related;
- Environment-related.

There are two major categories of productivity factors:

- External (not controllable)
- Internal (controllable)

Factors which are external and not controllable for one institution are often internal to another. Factors external to an enterprise, for example, could be internal to governments, national or regional institutions, associations and pressure groups. Governments can improve tax policy, develop better labour legislation. Provide better access to natural resources, improve social infrastructure, price policy, and so on, but individual organizations cannot.

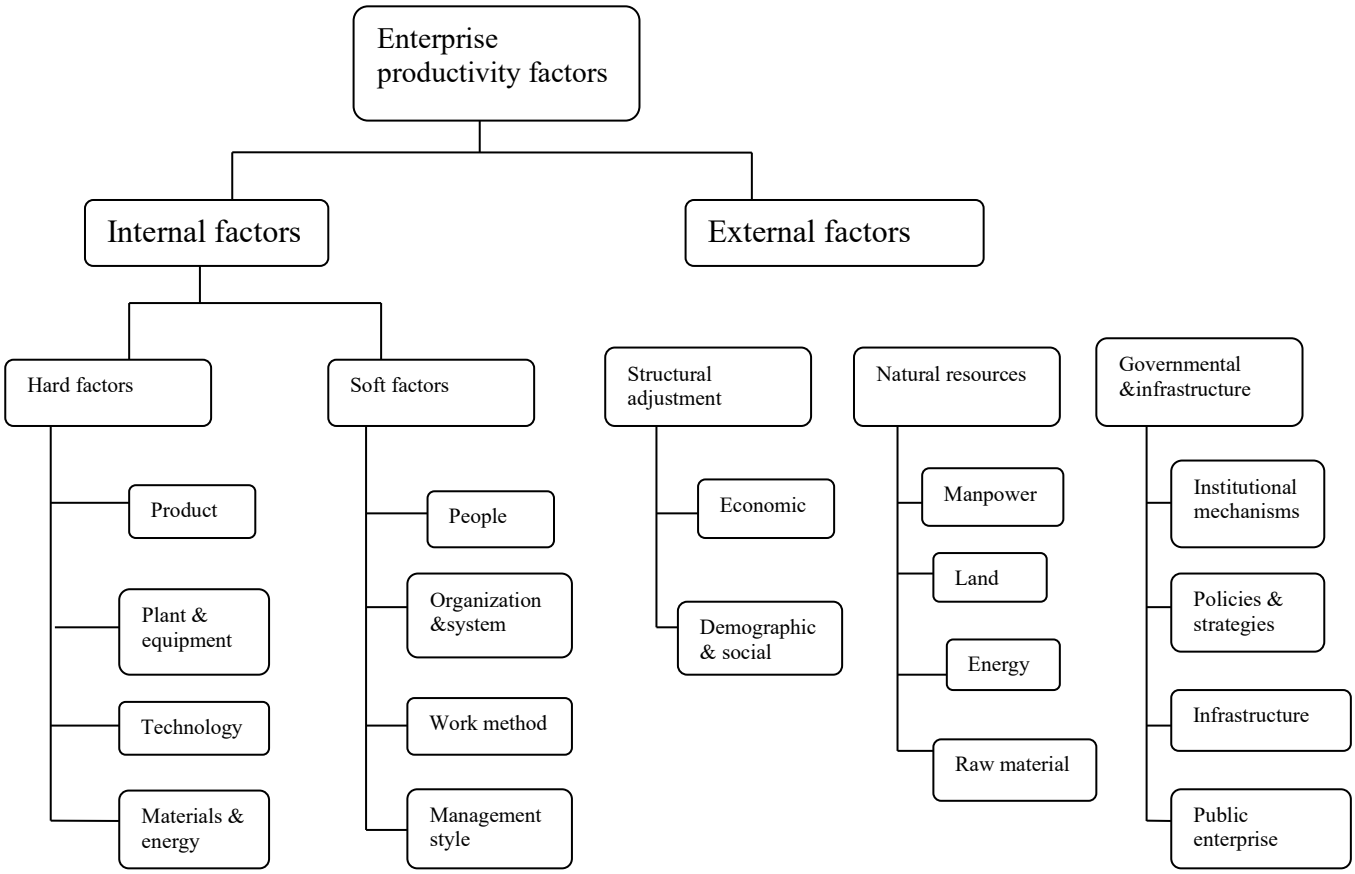


Fig 2.3: An integrated model of enterprise productivity factors

2.8.1 Internal factors of enterprise productivity

Since some internal factors are more easily changed than others, it is useful to classify them into two groups: hard (not easily changed) and soft (easily changed). The hard factors include products, technology, equipment and raw materials, while the soft factors include the labour force, organizational systems and procedures, management styles and work methods. This classification helps us build priorities - which factors can easily be dealt with and which factors require stronger financial and organizational interventions. A brief description of some key aspects of each internal factor follows.

- **Hard factors**
  - **Product**

    Product factor productivity means the extent to which the product meets output requirements. "Use value" is the amount that the customer is prepared to pay for a product of given quality. "Use value" can be improved by better design and specifications. Many companies around the world fight a constant battle to incorporate technical excellence into marketable products. Breaking down the walls between research, marketing and sales has become a major productivity factor. Product "place value", "time value" and "price value" refer to the availability of the product at the right place, at the right time and at the a reasonable price. The "volume factor" in particular gives us a better notion of the economies of scale through increased volume of production. Finally, the cost benefit factor can be enhanced by increasing the benefit for the same cost or by reducing the cost for the same benefit.
  - **Plant and equipment**

    These play a central role in a productivity improvement programme through:
    - Good maintenance;
    - Operating the plant and equipment in optimum process conditions;
    - Increasing plant capacity by eliminating bottle-necks and by corrective measures;
    - Reducing idle time and making more effective use of available machines to utilization, age, modernization, cost investment, internally produced equipment, capacity maintenance and expansion, inventory control, production planning and control, and so on.
  - **Technology**

    Technological innovation constitutes an important source of higher productivity.

    Increased volume of goods and services, quality improvement, new marketing methods, etc, can be achieved through increased automation and information technology. Automation can also improve material handling, storage, communication systems and quality control.

    During the past few years, considerable productivity increases have been realized through the use of automation and current developments in information technology. Significant example of the application of this

technology are the development of automatic downtime recording systems and automatic lubrication systems which have reduced the idle time of men and machines, and reduced overtime expenditure. New technology is normally introduced as a result of such productivity improvement programmes as fighting obsolescence, process design, R & D and the training of scientists and engineers.

- **Material and energy**

  Even small efforts to reduce materials and energy consumption can bring remarkable results. These vital sources of productivity include raw materials and indirect materials (process chemicals, lubricants, fuels, spare parts, engineering materials, packing materials). Important aspects of materials productivity include:

  - Material yield: output of useful product or energy per unit of material used. This is dependent upon selection of the right material, its quality, process control and control of rejects;
  - Use and control of wastage and scrapings;
  - Upgrading of materials by initial processing to improve utilization in the main process;
  - Use of lower grade and cheaper materials;
  - Import substitution;
  - Improving inventory turnover ratio to release funds tied up in inventories for more productive uses;
  - Improved inventory management to avoid holding excessive stock;
  - Developing sources of supply.

- **Soft factors**

  - **People**

    Mindset: There are many methods and tools for productivity, but first of all we should change our mindset. Having the right mindset gives us strong foundation for the productivity techniques and methods to run smoothly.

    Changing an employee's mindset in textile industries will produce far more positive results than merely getting some other action. Of course, if this methodology proves to be ineffective, you may have to take some other action, but give it a chance to work.

To change a mindset you first need to know that your mindset needs changing. Many people don't know that they need to change their mindset.

Since textile sector is a labor intensive one this factor is more concern than others. As the principle resource and the central factor in productivity improvement drives, the people in an organization all have a role to play as workers, engineers, managers. Each role has two aspects: application and effectiveness.

Application is the degree to which people apply themselves to their work. People differ not only in their ability but also in their will to work. This explained by a law of behavior: motivation decreases if it is either satisfy or blocked from satisfaction. For example, workers may do their jobs without working hard (no motivation), but even if they did work to their full capacity they would not be satisfied (motivation is blocked from satisfaction). Basically the following key approaches, methods and techniques can be used to improve labour productivity: wages and salaries; training and education; social security - pensions and health plans; rewards; incentive plans; participation or co-determination; contract negotiations; attitudes to work, to supervision and to change; motivation to higher productivity; co-operation; organization development; improved communications etc.

- **Organization and systems**

  The well-know principles of good organization such as unity of command, delegation and span of control, are intended to provide for specialization and division of work and co-ordination within the enterprise. Organization like textile industry needs to be dynamically operated and led towards objectives and must be maintained, serviced and reorganized from time to time to meet new objectives.

  One reason for the low productivity of many organizations is their rigidity. They fail to anticipate and respond to market changes, ignore new capacities in the labor force, new developments in technology and other external (environmental) factors. Rigid organizations lack good horizontal communication. This slows down decision-making and inhibits delegation of authority close to the point of action, encouraging inefficiency and bureaucracy. Compartmentation according to professional groups or functions also inhibits change. For example, the decision-making steps may have been

designed for a particular existing technology, for a definite product or service mix. Things have now changed, but procedures have survived because managers want to minimize change.

No system, however well designed, is efficient in all situations. Dynamism and flexibility should be incorporated into the system design in order to maximize productivity.

- **Work methods**

  Improved work methods, especially in developing economies where capital is scarce, technology intermediate and labour-intensive methods dominant, constitute the most promising area for productivity improvement. Work method techniques aim to make manual work more productive by improving the ways in which the work is done, the human movements performed, the tools used. The workplace laid out, the materials handled and the machines employed. Work methods are improved by systematically analyzing present methods, eliminating unnecessary work and performing the necessary work more effectively with less effort, time and cost. Work study, industrial engineering and training are the main tools of improving work methods.

- **Management styles**

  There is a view that in some countries management is responsible for 75 percent of productivity gains, because management is responsible for the effective use of all resources under enterprise control.

2.8.2 External factors affecting enterprise productity

External factors include government policies and institutional mechanisms, politics, social and economical condition, the business climat, the availability of finance, power, water, transport, communications and raw materials. They affect individual textile enerprise productivity, but the organizations concerned cannot actively control them.

These factors should be understood and taken into consideration by management when planning and implementing productivity programmes.

2.9 Productivity analysis in the enterprise

There are many approaches to productivity measurmenet and analysis in enterprises. This is because different groups of people are concerned with the enterprise (managers, workers, investors, customers, trade unions) and these

groups have different goals. Some simple and practical approaches to productivity analysis are:

- Measurement of workers' productivity;
- Measurment systems for planning and analysing unit labour requirements;
- Measurement systems of labour productivity aimed at the structure of labor resource use;
- Value added productivity at the enterprise level.

Normaly the method of measurement is determined by the pupose of the productivity analysis. Three of the most common purposes are:

- Comparing the ethiopian textile industries with its competitors;
- Determining the relative performance of departments and workers;
- Comparing relative benefits of various types of input for collective bargaining and gains sharing.

For example, if an industry's goal at a particular time is to maximize the return on invested capital and to expand its operations, the company should measure its cost and profit structures.

Let us discuss a few of the most practical approach in productivity measurent.

1. The kurosawa structural approach

Dr. Kazukiyo Kurosawa, Professor of Management Science at the Tokyo Institute of Technology, is well known for his research and publications on productivity measurment.

In accordance with his concept, productivity measurement in the enterprise helps to analyse the past and to plan new activities. It can be used to set up an information system for monitoring operational activities.

❖ Individual productivity

A worker's productivity (Pw) is defined as follows:

$$Pw = \frac{\text{Out put}}{\text{Input of worker's effort}}$$

Productivity measurement ratios (PMR) are based on the structure of worker-hours given in fig.2.4

Thus, the ratio system is devised as follows:

$$e = Ew \times le(1) \times le(2)$$

$$\frac{Ls}{Lr} = \frac{Ls}{Le} \times \frac{Le}{Lr'} \times \frac{Lr'}{Lr}$$

$$e'r = \frac{Ls}{Lr'}$$

Where

- Ls =standard work-hours (quantity produced x standard time)
- Lr = total input work-hours (number of workers on payroll) x duty hours)
- Le = effective work-hours
- Lr = Lr' + Lo
- Lr' = input work-hours
- Lo =work-hours omitted from this account such as work-breaks, mealtimes, cleaning and maintenance time, transport time
- Lm =lost time due to supervisor or management such as breakdown and repair, shortage or defect of materials or parts, last-minute assignment to another task
- le (1) = ratio of effective work-hours to input work-hours
- le (2) = ratio of input work-hours to total input work-hours
- e'r = Ls/Lr'; process efficiency
- e = overall efficiency of labour
- Ew = worker efficiency.

  Then the meaning of the above equation is as follows:

  Overall efficiency of labour = worker's efficiency x ratio of effective work-hours x ratio of input work-hours = process efficiency x ratio of input work-hours.

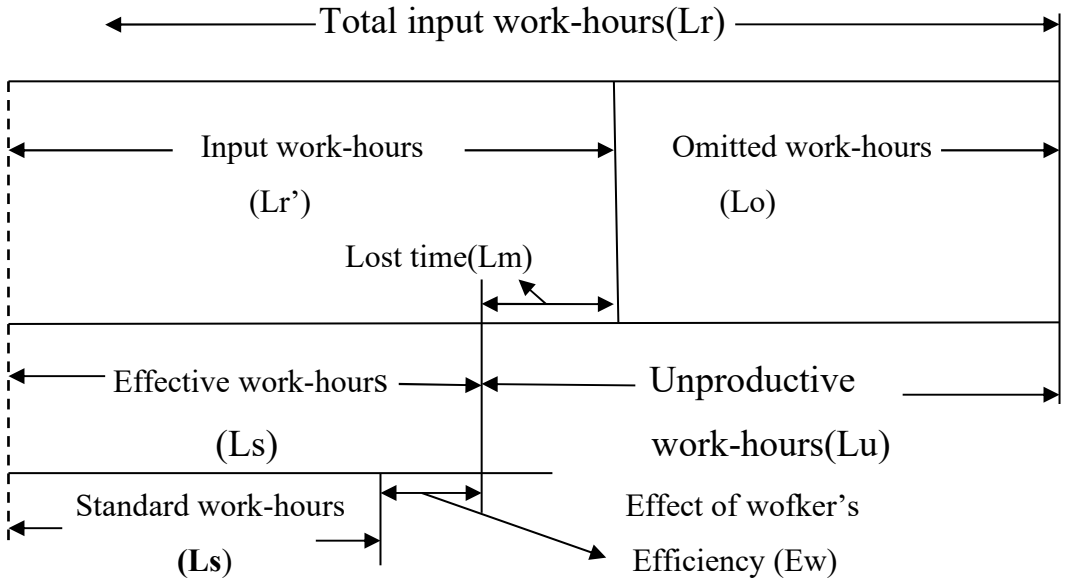


Fig 2.4: Structure of work hours

2.9.1 Productivity concept and appraisal

Alan lawlor considers productivity as a comprehensive measure of how efficiently and effectively organizations satisfy the following five aims: objectives, efficiency, effectiveness, comparability and progressive trends.

- ***Objectives*** can be met when the total fund is adequate to meet the demands of the organization and to measure the degree to which its principal objectives are achieved. This fund is called total earnings (TE).

  TE = Sales – materials = S – M

  TE serves to buy services, to pay wages and salaries and to invest in fixed capital, profit and taxes.

- ***Efficiency*** tells us how well actually needed output is generated from available input and indicates the use of available capacity. Efficiency measurement reveals the output to input relationship and the degree of use of resources compared with the total capacity (potential). This indicator should tell us where inefficiencies lie.

$$\frac{\text{Out put}}{\text{Input}} = \frac{\text{Input} + \text{profit}}{\text{Input}} \text{ Or } \frac{O}{I} = \frac{I+P}{I} = 1 + \frac{P}{I}$$

Where $\frac{\mathbf{P}}{\mathbf{I}}$ = profit productivity ratio.

- ***Effectiveness*** compares present achievement with what could be done if resources were managed more effectively. This concept includes an output target achieving a new standard of performance, or potential.

$$\frac{\text{Out put}}{\text{Input}} = \frac{\text{Effectivness(what could be achieved)}}{\text{Resource consumed}}$$

Productivity improvement involves a combination of increased effectiveness and a better use of available resources. It shows four basic ratios:

- Actual output divided by actual input, the status quo;
- Higher output divided by current actual input;
- Actual current output divided by lower input;
- The higher level of effectiveness; maximum output divided by minimum input.

- ***Comparability*** is a guide to organizational performance, since productivity ratios alone tells us little without some form of comparison. Generally speaking, productivity measurement means comparison at three levels:
  - Comparison of present performance with a historical base performance. This does not indicate whether current performance is satisfactory - only whether it is improving or deteriorating and to what extent.
  - Comparison of performance between one unit – an individual, a job, a section, a process – and another. Such a measure indicates relative achievement.
  - Comparison of actual performance with a target. This is best, because it concentrates attention on objectives.
- **Trends**, that are the aim of achieving progressive trends, must be associated with a comparison between current performance and a historical base in order to identify whether enterprise performance is moving up or down and how fast.

This approach calls for at least two levels of productivity measurement within the enterprise: primary and secondary. The primary levels deals with total earning productivity (E) which is:

$$E = \frac{\text{Total earnings}}{\text{Conversion cost}} = \frac{T}{C}$$

Where conversion cost (C) = total wages and salaries (W) + total purchased services (PS) + depreciation (K). Thus, obtaining a high level of total earnings ensures a healthy organization.

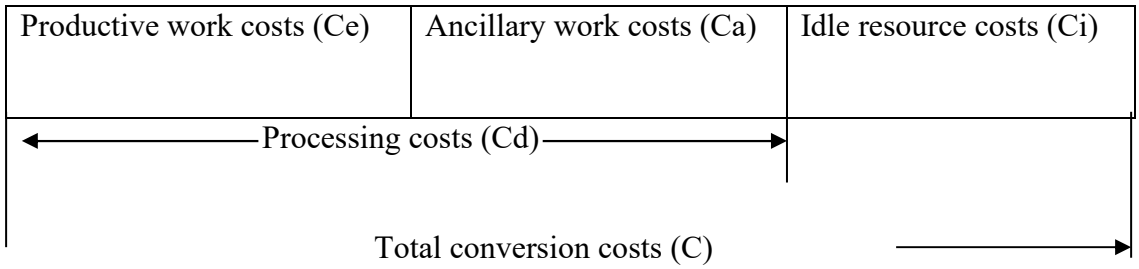
An example of the secondary level is profit productivity (Ep) which is:

$$Ep = \frac{P}{C} = \frac{T\text{-}C}{C} = \frac{T}{C} - 1 \text{ Or } Ep = E - 1$$

Secondary productivity measurement provides the ratio of used resources to the total cost of all available resources. The total conversion costs include two main divisions:

- The costs incurred when resources are used productivity (Cd). These costs can be subdivided into productive work costs (Ce) and ancillary work costs (Ca).
- Unused or idle resources cost (Ci), when people and equipment are wholly idle.

The relationship between these costs is shown below:



Thus it is possible to state resource or conversion utilization productivity as follows:

$$\frac{\text{Time or costs incurred on productive and ancillary work}}{\text{(Total time (or conversion costs) available (including idle time))}} = \frac{Cd}{C}$$

The basic resource productivity indicator is used to relate pure productive work (Ce) to total conversion costs (C). Thus,

$$\frac{\text{Time or costs incurred on purely productive work}}{\text{Total time or conversion costs available}} = \frac{Ce}{C}$$

Truly productive work, as distinguish from ancillary work, is what directly adds value to materials. The concept of productive work forms an important part of productivity measurement.

There are two other secondary productivity measurements: working capital and inventory productivity. Productivity of

$$\text{Working capital} = \frac{\text{Total earnings}}{\text{Throughput materials + conversion costs}} = \frac{T}{M+C}$$

This equation gives total earnings per unit of working capital employed or the rate of turnover of working capital. Similar ratios could be employed using sales (S) or profit (P) output, i.e.

$$\frac{S}{M+C} \quad and \quad \frac{P}{M+C}$$

The Productivity of inventory (total materials, work in progress and finished stocks) is similar to working capital, but should include carrying charges (Cinv) to cover the time the inventory has been in the system:

$$\frac{\text{Total earnings}}{\text{Throughput materials} + \text{carrying costs}} = \frac{T}{M + Cinv}$$

A more conventional way of measuring the productivity of inventory is the rate of stock turnover which is:

$$\frac{\text{Sales}}{\text{Average stock carried}}$$

- **Productivity potential**

The potential total earnings of an organization are the earnings that would be gaining if all input were fully used- with no idle capacity costs.

In other words, Cd = C

$$Tpot = \frac{T}{Cd} \text{ x } C$$

2.9.2 Some problems of productivity analysis

The problems and difficulties in prductivity analysis fall into two main groups: those concerned with the techniques of productivity measurment, and those concerned with the organization.

2.9.2.1 Technical productivity measurment problems

There is no single universal measure of productivity because various groups (such as material supplies, buyers, users, product sellers, etc.) have different goals and therefore use different sets of productivity measurements.

The most common problems which the designers of particular productivity measurement systems should take into consideration are:

- How to combine different types of input into one acceptable denominator;
- How to deal with qualitative changes in input or output over time;
- How to keep input and output measurments independent of each other.

Some organizations focus all their attention on the productivity of one particular section. Another mistake, especiall in public officers, is when managers confuse activities, output and results. For example, in training programmes an incorrect measure would be the number of people trained; the correct one would be the number of trainees who were placed in jobs or who improved their performance.

It should be remembered that some significant changes over time complicate measurment. Among these are:

- Major changes in textile plant facilities, wage rates, material costs, product prices, or even in accounting practices;
- Purchase of more fabricated components;
- Addition of more automated equipment;
- Increase in machine speeds without additional labour;
- Expansion of capacity through technology innovation;
- Change in output which cannot be quantified by the old measure.

Another complication arises because production input-output relationships are not always linear; so it is essential that productivity in such cases be measured over a long period of time.

Confusion about indirect costs and avoidable costs is another frequent mistake. Indirect input or costs (such as planning and control, product development, training, supervision, manintenance personnel) must never be ignored.

At the same time such avoidable costs as ill-designed accounting procedures, cost-allocation and overtime cannot be considered as input.

Here are a few important characteristics of a sound productivity measurment system which would help to avoid the above-mentioned problems and mistakes:

- Provide simple and unambiguous signals to improve performance (productivity, profit, quality);
- Break down changes in profit to reflect the contribution from each resource used in production (labour, capital, materials, energy);
- Break down the contribution to profit change from each resource into productivity terms and a price recovery term. This will isolate the effect of disparate change in product vis-à-vis resourec price;
- Use the price recovery term to evaluate whether productivity loss or gain for a given resource is appropriate;

- Transform the above measres of change in profit into corresponding measures of change in profitability, change in cost per unit of output, and change in performance index numbers (e.g. productivity index numbers);
- Provide consistent signals for profit improvement regardless of the units in which the measure is expressed.

❖ Implementing a measurment technique

The implementation of a productivity measurement technique involves several steps:

- ✓ Making the dicision to measure productivity;
- ✓ Defining the target organizational sytems and the required level for intervention;
- ✓ Defining the measurement time period;
- ✓ Selecting the measurment technique
- ✓ Use the measurment technique

To choose a specific measurment technique a number or variable should be considered:

- Purpose and audience: what the measure is supposed to do and who will use it;
- Commitment to measurement: the extent to which a textile sees productivity measurment as a critical part of its effort to remain commpetitive;
- Awareness/understanding of management: the extent of management understanding/ awareness of productivity measurement systems;
- Centeralization/decentralization: the extent to which measurement is a decentralized/centralized function;
- Maturity of control system: the extent to which measurement control systems are part of the organizational culture;
- Management syle: measurment techniques should complement and extend the existing management style;
- Output variability: the extent to which the physical characteristics of the output change over time;
- Type of technology: ranges in manufacturing technology where input and output may vary considerably over time;
- Process cycle time: length of time for one unit of textile output to be produced;
- Controllability: the extent to which management can “manage”or control

❖ Possible sources for productivity program failures

Failure sources

- Insufficient investment in work force training in textile sector
- Poor financial controls and /or information systems
- Weak middle managers in each textile plants
- Lack of incentives of appropriate regards (or disincentives)
- Poor relationship with union leaders
- Insufficient awareness by engineering of the manufacturing implications of product and process designs.
- Poor communication organization wide
- A piecemeal, Unplanned approach to improving productivity
- Inadequate/ineffective coordination among departments or functions (excessive functional or departmental autonomy)
- Poorly trained supervisory personnel in the area of productivity related problems
- Insufficient investment in management and supervisor training and development
- Lack of loyal, skilled workforce **[15].**

2.10 Productivity Improvement Techniques

There are several types of productivity improvement techniques in literature.

These techniques can be classified into seven basic groups: **[24]**

- ❖ Technology based techniques
- ❖ Material based techniques
- ❖ Product based techniques
- ❖ Employee based techniques
- ❖ Task based techniques
- ❖ Management based techniques
- ❖ Investment based techniques

1. **Technology based techniques:**
   - o New Production lines / Machines
   - o Rebuilding old machines
   - o Maintenance planning & control

2. **Material based techniques:**
   - o Inventory control
   - o Material Requirements Planning (MRP)
   - o Quality control
   - o Material handling improvement
   - o Material reuse & recycling
3. **Product based techniques:**
   - o Research & Development (R&D)
   - o Product design
   - o Product standardization
   - o Product reliability improvement
   - o Value engineering
4. **Employee based techniques:**
   - o Individual financial incentives
   - o Group financial incentives
   - o Training & education
   - o Quality circles
   - o Working conditions improvement

- Communication improvement

5. Task based techniques:

- Work study
- Job evaluation
- Job safety
- Human factors engineering (Ergonomics)
- Scheduling

6. Management based techniques:

- Marketing Management
- Production Management
- Quality Management
- Cost Management
- Maintenance Management
- Material Management
- Resource Management

7. Investment based techniques:

- Reducing the administration cost
- Increasing value added
- Increasing contribution
- Increasing profit

2.11 Introduction of the Textile Sector

The textile industry is a group of related industries which uses a variety of natural (cotton, wool, etc.) and/or synthetic fibers to produce fabric. It is a significant contributor to many national economies, encompassing both small and large-scale operations worldwide.

The textile industry is usually more capital intensive than the clothing industry and it is highly automated, particularly in developed countries. It consists of spinning, weaving and finishing, and the three functions are often undertaken in integrated plants. Traditionally, and in many markets, it is still the case that lead time in the textile sector is quite long and the capital intensity of the industry results in relatively large minimum orders. The textile industry is therefore less flexible in terms of adjusting to consumer tastes during a season than the clothing and retail sectors.

Primary capital to invest in new machinery with increased automation that will improve the consistency of the product is crucial for the textile industry. Only those companies that are capable of sustained investment in both plant and innovative products will have a share of the international market. The demand for higher quality standards in consumer markets has created a need to automate much of the manufacturing process in spinning & weaving processes**. [26]**

- Spinning is the process of creating yarn (or thread, rope, cable) from various raw fiber materials. Several fibers are twisted together to bind them into a strong, long yarn. Characteristics of the yarn vary based on the material used, fiber length and alignment, quantity of fiber used and degree of twist.
- Weaving is an ancient textile art and craft that involves placing two threads or yarn made of fiber onto a warp and weft of a loom and turning them into cloth. This cloth can be plain (in one color or a simple pattern), or it can be woven in decorative or artistic designs, including tapestries.

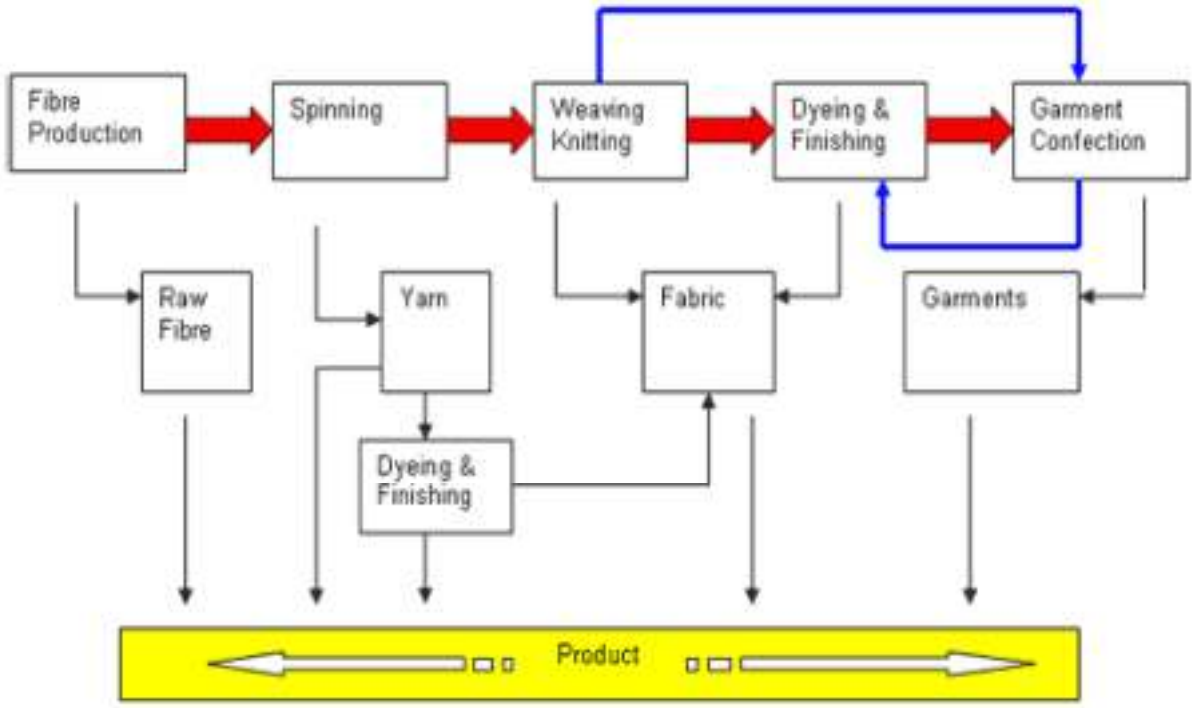


Fig 2.5: Textile Production process

2.11.1 Ethiopian textile Sector

Ethiopia's textile manufacturing industry embraces both medium and large public and private enterprises. Their main activities include spinning, fabric formulation, dyeing, finishing and sewing. The Ethiopian textile sector mainly produces 100% cotton textiles. Each enterprise produces one product range, such as cotton yarn, cotton fabrics, bed sheets, blanket, knitwear etc. All the cotton yarn in the Ethiopian market is supplied to the local handlooms.

The Ethiopian textile industry is the third largest manufacturing industry, only second to the food processing, beverage and leather industry. Ethiopia has potentials and opportunities to develop its textile and apparel industry. The country is endowed with climatic conditions for cultivating cotton and it has abundant and low-cost labour force for competitive production of textiles and garments. These comparative advantages combined with a conducive investment climate that already exists in the country might enable Ethiopia to become a much stronger player in the global textile and apparel chain.

On the basis of the adopted Industrial Development Strategy in August 2003 and the designed textile and garment Master Plan and Action Plan White Paper Documents, the primary objective is to focus on export activities by encouraging and supporting

the entrepreneurs to fully utilize their existing capacities and to attract as many new domestic and foreign investments as possible in order to arrive at the export target of US$ 500 million by the year 2010.

Excluding the cotton sub-sector for the mean while, historically the Ethiopian textile industry is composed of two major components. On the one hand it comprises the upstream segment called the textile mills (spinning, weaving, knitting, dyeing and finishing) and on the other the downstream activities known as the apparel segment which includes garments made out of woven and knitted fabrics.

As regards to the textile mills, currently there are twelve (12) large scale mills of which two (2) are nearly under completion of their investment project. There are also two (2) yarn and threads making factories as well as three (3) blanket factories.

Since 2009, there has been a trend towards setting up of new state of the art textile mills in the private sector and modernization of the state owned textile mills.

3. METHODOLOGY

Research methodology is the application of scientific procedures towards acquiring answers and solutions to a wide variety of research questions raised in the problem statement of the study. It provides tools for doing research and obtaining useful information. It incorporates the entire process of a study-conceptualizing and observing the problem, investigation of the research questions, data collection and analysis, and summarizing of the results. The detailed sources of data and tools for data collection are listed below.

- **Sources of Data Collection**

Literatures of relevant materials on productivity are surveyed. The materials central idea is on different concepts of productivity in textile manufacturing. The data of the study relies both from primary and secondary sources, believed to be the main sources of gathering information.

The primary data were collected through questionnaire and face-to-face interview. Specifically speaking, questionnaires had been designed and distributed to supervisors and selected staff members of selected industries on the basis of their position. Besides, structured interview was held to top management officials of each industry.

The secondary sources of data that the researcher used are different relevant books, Journals, Articles, senior thesis work, manuals, available documents, organizational chart, brochures, magazines (such as World Textile industries magazines), company manuals, and electronic retrievals.

Data collection is in both qualitative and quantitative nature. Basically qualitative data were used to gather the overall information from selected textile companies and based on the responses a specific quantitative data were prepared and distributed to the case study company to gather detailed information about productivity performance of the company.

To carry out this research, a sample size of 8 textile related Companies were selected. This includes two cotton factories (Shoa cotton & Africa cotton), four yarn and sewing thread factories (Edget textile, Adie Abeba, and Ethiopian sewing thread factory) and three textile industries (DH geda Textile, KK textile,

and Awassa Textile).The group selection is decided based on the nature of their vertical integration to one another.

The sample size was determined after considering the expected response rate, the closeness to make frequent contact between the researcher and the company, available time and survey cost. Moreover, the selected Companies cover most types of products – Cotton ginneries; yarn and sewing thread factories, knitted and woven fabrics of different sizes. Although the selected samples were limited to firms in Addis Ababa and Oromia Region, it is assumed that the samples from these regions can give directions on the whole situation of Textile industries in Ethiopia.

- **Data Synthesis and Analysis:** Data were analyzed and synthesized using statistical quality control tools for the interpretation of the collected information and relevant productivity technique for productivity improvement of the Ethiopian textile sector is developed based on the data analysis. In the data analysis, cause & effect diagram and Pareto analysis tools were used to understand the root causes of the existing productivity problems and consequently to identify the critical ones among the stated problems.
- **Conclusion and recommendation:** Concluding comments and recommendations on the overall study are given based on the results of the data analysis and the productivity improvement model developed for the companies.

3.1 Survey Questionnaire

The type of questionnaire used to collect data is presented in Appendix 6 The survey questionnaire contains 77 questions and categorized in to 9 parts. The first category of questions (4qs) briefs about the respondent personal information, the second category of questions (9qs) was designed to explore organizational information, the third part of questions (5qs) asked about the financial performance of the company, the fourth type questions (18qs) explore about different types of productivity and its related problems, the fifth type questions (13qs) seeks information about the company maintenance policy, The sixth category of questions (11qs) related to quality awareness of the company, the seventh ones 3 questions highlight quality of work life, the eighth part 7 questions explore status of inventory, and the last part (7qs) deal with production performance to understand the effectiveness and efficiency evaluation criteria of the firm.

3.2 Structured Interviews

The design of the interviews was based on the research objectives. Interviews were conducted with top managements & supervisors of the selected companies. The interviews were used to cross check the reliability of the response to the questionnaire. It is also used to gather additional information to strengthen the collected data.

3.3 Direct Observation

In this research direct observation is used to observe the production process and its techniques used by the company, facilities of the company and its working environment, the cooperation of each department and documentation methods, the nature of the company (traditional or modern).

4. DATA COLLECTION AND ANALYSIS

4.1 Data collection and Analysis for selected textile companies

A total of 94 questionnaires were distributed out of which 47% were completed by the respondents. The most common reasons for non-response were low educational level and carelessness. The result of the statistical investigation of the questionnaire is presented in Appendix 6 According to the second category of questions, regarding the organizations information, even though most of them set clearly their goal and targets they did not follow the accomplishment and consequently never plan to alleviate productivity problems.

The third category of the questions (related to financial performance). Majority of them have working capital problem and the cause for decreasing sales are stated as Shortage of raw material, excessive waste, high production cost, lack of working capital, poor working condition, aged machinery, maintenance problem etc. And the percentage contribution for each problem is shown below.

Table 4.1: Causes of low performance

S/N	Type of problem	Contribution (%)	Cumulative %
1	Shortage of raw material	26	26
2	labor productivity	20	46
3	Aged machinery	19	65
4	Poor maintenance	15	80
5	Excessive waste	14	94
6	Others	6	100
Total		100	

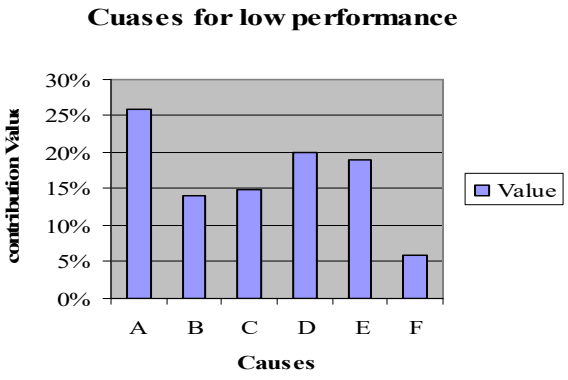


Fig 4.1: Causes for low performance

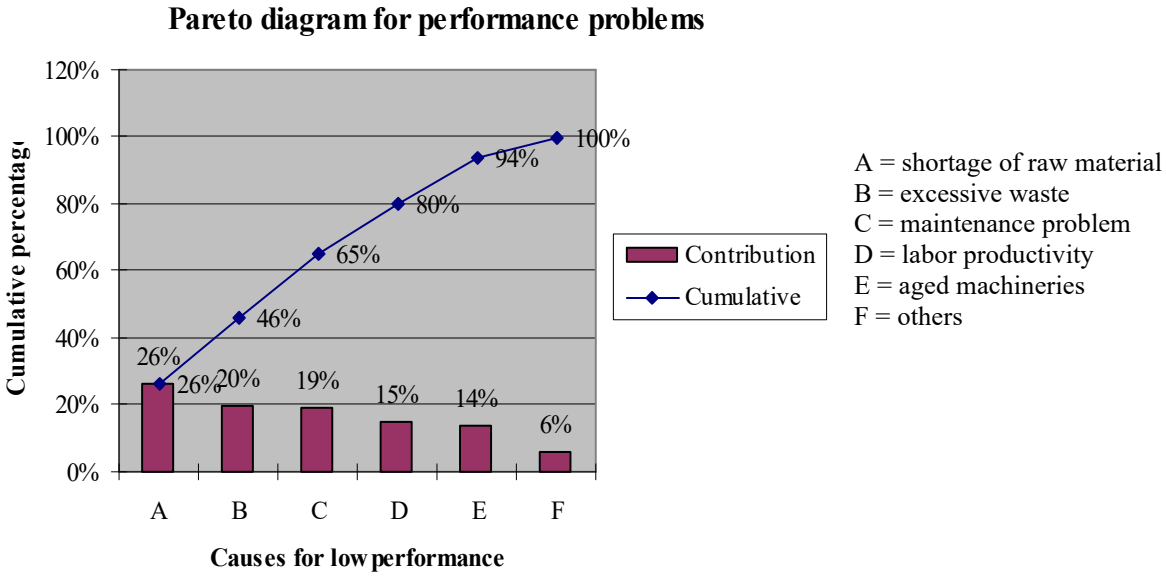


Fig 4.2: Causes for low performance

As can be seen from the above chart the main challenges for performance improvement are shortage of raw material and low labor productivity.

Root causes for low labor productivity

- Lack of motivation (recognition & reward)
- Lack of training & education
- Less wage
- Poor working condition
- Lack of experience

Referring to the subjective answers, regarding the quality practices, majority of them have low

- Quality awareness
- Customer focused understanding
- Inspection and testing procedures
- Customer compliant handling system
- Low quality management system
- Product quality

These industries don't have quality improvement programs and they spend most of their time on detecting the defects of the products rather than preventing the defects.

As a result, the quality control activities are inspection-based instead of prevention-based. They use visual inspection techniques which are not an effective method and there is no awareness and application of the statistical process control tools.

According to the respondents for the problems related to management, 30 % the respondents say that cost management system for majority of the industries is poor. About 20 % of the respondents agree that the industries maintenance management is low and instead of preventive maintenance people adapts break down maintenance after the machines stop production. The material management problem placed at the third stage according to 17 % respondents. Quality management and Production management problems has to be given emphasis to avoid them since 13 % 11% of the respondents declared that as the major problems of productivity. In addition to the above managing problems marketing management should be given great emphasis.

Regarding the machinery productivity there is a lot of problem in use of plant machineries as per their capacity. Generally the main reasons for machine failure are:

- Lack of preventive maintenance 33 %
- Spare part problem 26 %
- Due to aging of machineries 16 %
- Maintaining skill problem 13 %
- Improper handling by operators 12 %

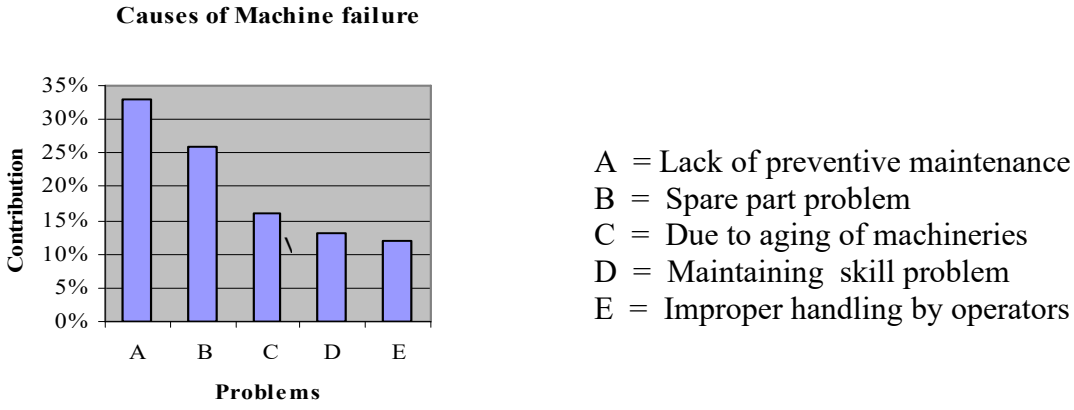


Fig 4.3: Causes of machine failure

4.2 Case Study

4.2.1 Profile of Awassa Textile Share Company

Awassa Textile share company was established in 1989.it is located in the Southern People Regional Administration, Capital city Awassa 275Km south of Addis Ababa.

It is designed to produce various kinds of woven fabrics form 100% cotton as well as to finish polyester-cotton blended and 100% polyester fabrics. The equipment's of the factory, an automatic bale pluckier and high-speed spinning machines, rapier looms are among the others. Almost all are of Italian origin.

Its land holding is 371,000 square meters of which 31,275 is covered by buildings and 31,000 square meters by an effluent treatment lagoon.

The total manpower of the factory is 1013 & Capital (Initial) is 112,400,000 Birr. The work force is relatively young, with basic knowledge to operate and maintain the installed machineries and equipment.

- **Production Mixes & Capacity**
  - **Production mixes**

The factory is designed to weave & finish the following product mix.

Table 4.2: Production mix of the company

S/N	Article	Design
1	Dyed bed sheet	Green, Red, L.Green, Lemon
2	Printed bed sheet	Blue Stripe,2542A,Blue print, Red Stripe, Green stripe,166A,2662D.Green
3	Printed French Twill	Kangaroo foam, Kangaroo sun
4	Printed Curtain	2609Brown,2609Green,2609Red
5	Dyed Poplin	Dyed
6	Dyed Twill	R.Blue, Khaki, Orange,D.Blue
7	PC Twill 65/35	D.Blue, Bordex, Khaki
8	PC Plain 65/35 single	D.Blue, Khaki, Brown
9	PC Plain 65/35 double	Khaki, D.Blue

Even though the factory was designed on the above product mix its operation is flexible enough to produce various other articles, based on market demands.

The factory has both local and foreign markets. The domestic market is supplied through various distributors while the factory, directly handles products for the foreign markets. To date, it has exported to the United Kingdom, Belgium, Italy, Switzerland Sweden and Germany.

➢ Production capacity

Table 4.3: Production capacity

Plant	UOM	Annual capacity	Remark
Spinning	Kg	2,114,000	
Weaving	Mt	7,782,000	
Finishing	”	14,460,000	

❖ Plant Operation

- No of shifts operated/ day 3
- No of hours/shift 7.5
- No of days/year 315

❖ Facilities

- Electric power is supplied from the national grid of the Ethiopian Electric Light Power Authority (EELPA). The total installed capacity is 10.000 KVA.
- Water is supplied from own deep wells and from the municipality.
- Fuel fired boilers and diathermic oil are the source of steam and heating system.
- Well equipped mechanical and electrical workshops for maintenance services.
- Communication services of telephone, telex, fax, E-mail and post are available.
- A branch office in Addis Ababa which handles purchasing & marketing activities.

❖ Raw materials and location

- Cotton, which is grown locally, is the basic raw material. Tendaho, Middle Awash, Upper Awash are sources for raw material
- The other materials used, such as chemical, dye-staffs and spare parts are fully imported via Addis Ababa airport, the port of Djibouti which are 275km, & 1132km respectively away from the factory**.** Raw material needed per year: 1,641,675kg of Cotton, 703,705 kg of polyester.

❖ Manpower Profile

Table 4.4: Manpower Profile

S/N	Department	Number
1	General Manager	5
2	Production Dep't	2
3	Spinning	262
4	Weaving	185
5	Finishing	170
6	Technical Service	96
7	Finance Dep't	15
8	Audit service	0
9	Human Res. & development Admin. Dep't	88
10	Quality control service	37
11	Plan & Management Information Service	3
12	Marketing Dep't	25
13	Procurement Dep't	26
14	Garment & Knitting	99
15	**TOTAL**	**1013**

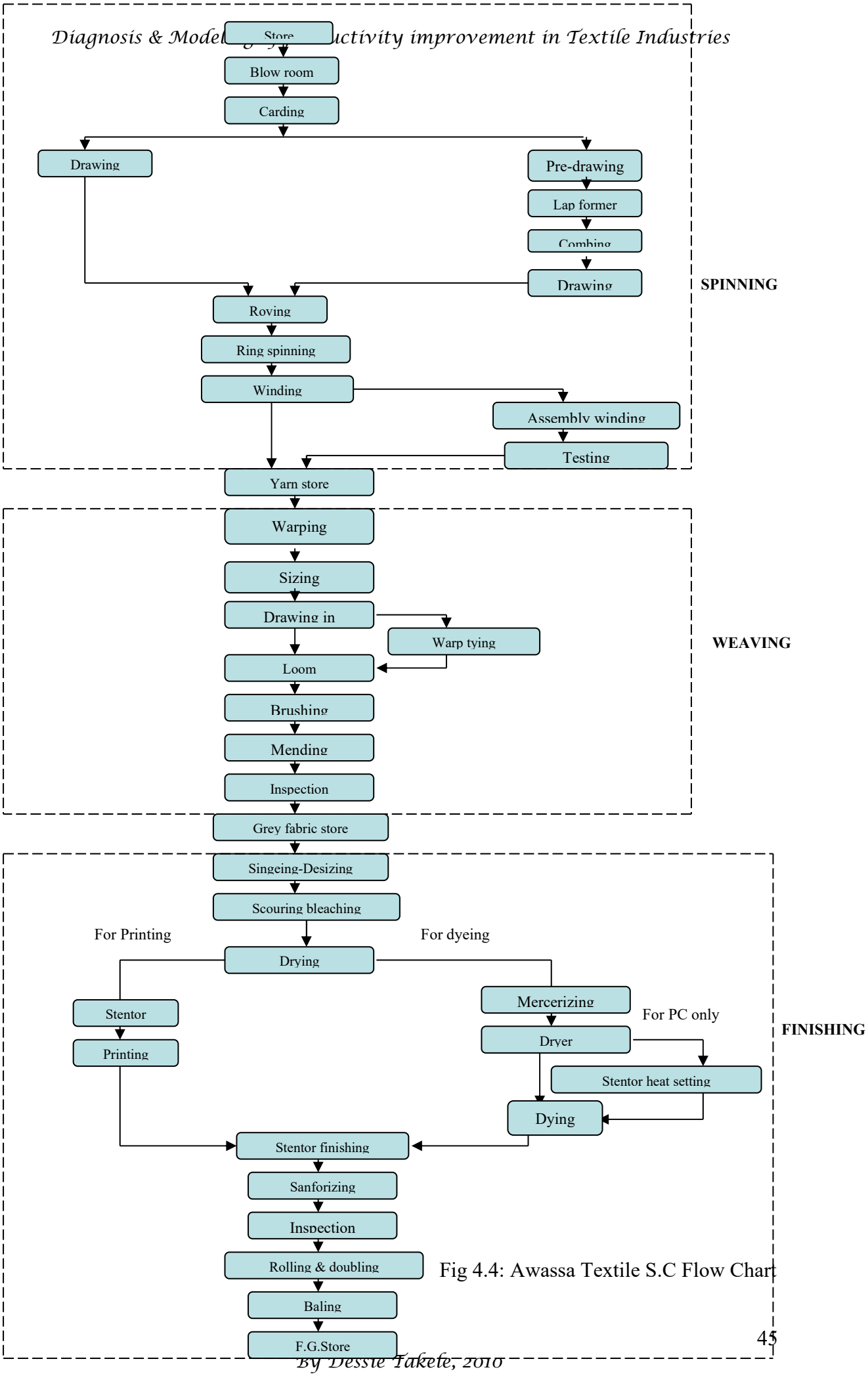


Fig 4.4: Awassa Textile S.C Flow Chart

4.2.2 Data collection & analysis

Data collection

Prior to the productivity analysis first it was decided to collect data about the production accomplishment of the **Sinning, Weaving** and **Finishing** plants of the company. Therefore the performance of each plant for 2001 and 2002 E.C was as shown below.

Table 4.5: Production performance for 2001 E.C

Table 4.5a: Spinning

S/N	Month	UOM	Capacity	Plan	Actual	%
1	July	Kg	176,667	156000	112839	72
2	August	"	176,667	156000	74301	48
3	October	"	176,667	156000	37511	24
4	November	"	176,667	156000	71440	46
5	December	"	176,667	156000	75140	48
6	January	"	176,667	156000	63913	41
7	February	"	176,667	156000	62656	40
8	March	"	176,667	155175	51255	33
9	April	"	176,667	155175	56474	36
10	May	"	176,667	155175	30772	20
11	June	"	176,667	155175	57834	37
Total			**1,943,333**	**1712700**	**694135**	**446**
Average			**176,667**	**155700**	**63103**	**41**

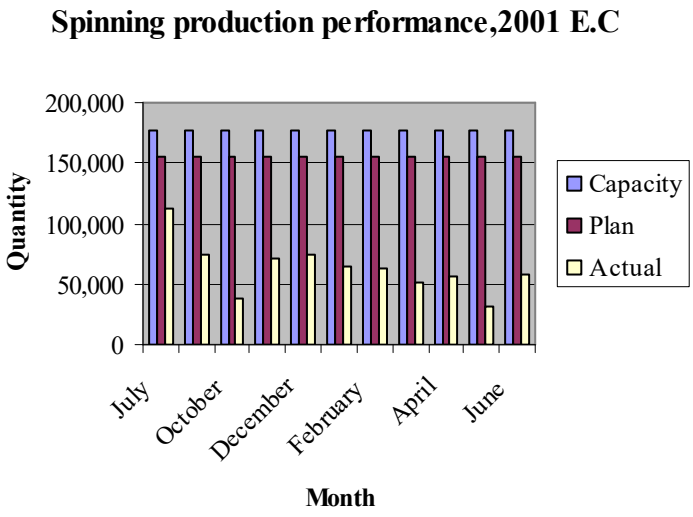


Fig 4.5: Production performance for 2001 E.C

Fig 4.5a: Spinning production performance

Table 4.5b.

Weaving Production performance for 2001 E.C

S/N	Month	UOM	Capacity	Plan	Actual	%
1	July	Mt	648,500	492278.76	307258	62.42
2	August	"	648,500	492278.76	315373	64.06
3	October	"	648,500	492278.76	119957	24.37
4	November	"	648,500	492278.76	166454	33.81
5	December	"	648,500	492278.76	197702	40.16
6	January	"	648,500	492278.76	160605	32.62
7	February	"	648,500	492278.76	119717	24.32
8	March	"	648,500	401693.00	156269	38.90
9	April	"	648,500	401693.00	252829	62.94
10	May	"	648,500	401693.00	123839	30.83
11	June	"	648,500	468000	204677	43.73
Total			**7,133,500**	**5119030**	**2124680**	**458**
Average			**648,500**	**465366.39**	**193152.73**	**41.65**

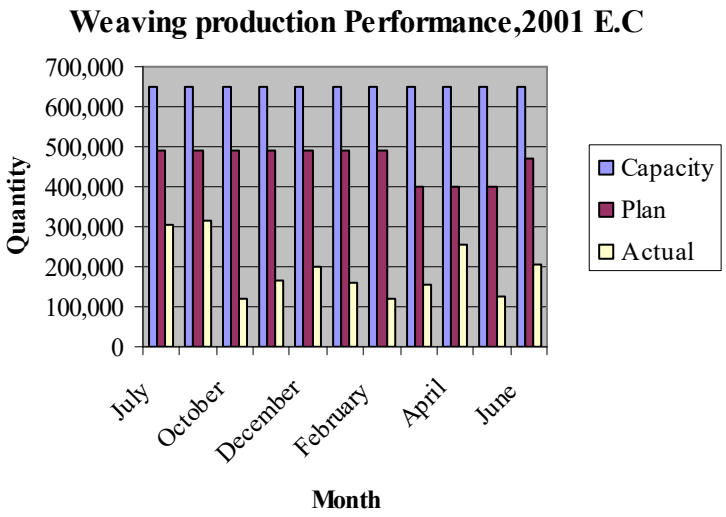


Fig 4.5b. Weaving production performance

Table 4.5c.

Finishing Production performance for 2001 E.C

S/N	Month	UOM	Capacity	Plan	Actual	%
1	July	Mt	1,205,000	700000	666005	95.14
2	August	"	1,205,000	700000	574203.7	82.03
3	October	"	1,205,000	700000	385070.4	55.01
4	November	"	1,205,000	700000	391391	55.91
5	December	"	1,205,000	700000	274852.8	39.26
6	January	"	1,205,000	700000	256905.5	36.70
7	February	"	1,205,000	700000	317839.6	45.41
8	March	"	1,205,000	601700	286228.6	47.57
9	April	"	1,205,000	601700	314618.2	52.29
10	May	"	1,205,000	601700	210650.9	35.01
11	June	"	1,205,000	668000	233483	34.95
Total			**13,255,000**	**7373100**	**3911248.7**	**579.28**
Average			**1,205,000**	**670281.818**	**355568.06**	**52.66**

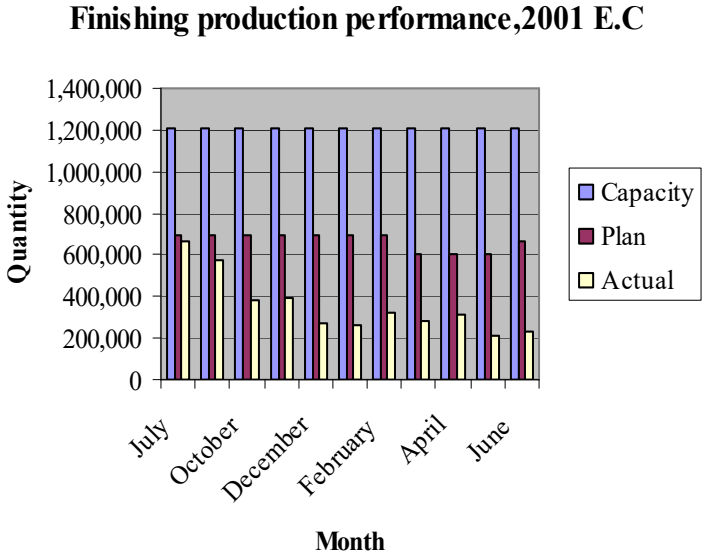


Fig 4.5c. Finishing production performance

Table 4.6: Production performance for 2002 E.C

Table 4.6a: Spinning

S/N	Month	UOM	Capacity	Plan	Actual	%
1	July	Kg	176,667	147698.71	38833	26.29
2	August	"	176,667	35204.00	25628	72.80
3	September	"	176,667	105612.00	24167	22.88
4	October	"	176,667	96811.00	60151	62.13
5	November	"	176,667	92411.00	61739	66.81
6	December	"	176,667	92411.00	88025	95.25
7	January	"	176,667	110013.00	68940	62.67
8	February	"	176,667	110013.00	74923	68.10
9	March	"	176,667	110013.00	98099	89.17
10	April	"	176,667	105612.00	90993	86.16
11	May	"	176,667	105612.00	86414	81.82
Total			**1,943,333**	**1111410.71**	**717912.00**	**734.09**
Average			**176,667**	**101037.34**	**65264.73**	**66.74**

Fig 4.6: production performance for 2002 E.C

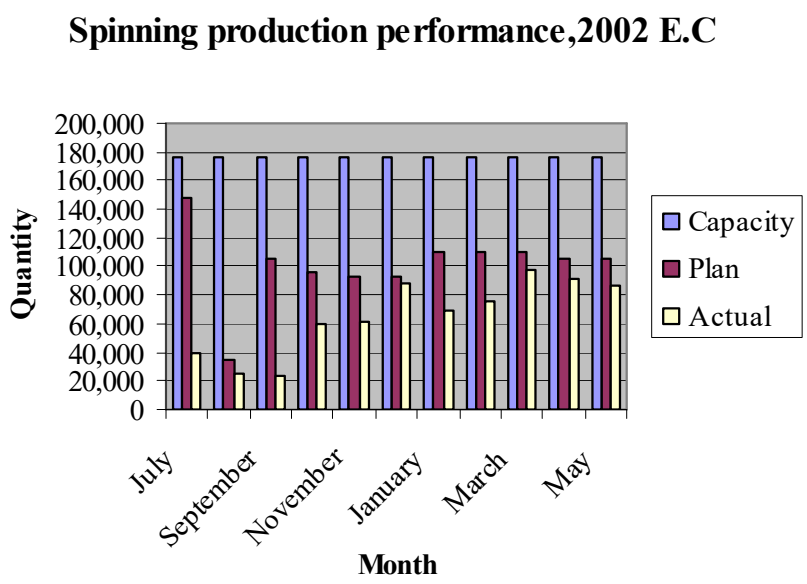


Fig 4.6a.Spinning

Table 4.6b: Weaving Production

S/N	Month	UOM	Capacity	Plan	Actual	%
1	July	Mt	648,500	471876.00	92227	19.54
2	August	"	648,500	86072.00	84426	98.09
3	September	"	648,500	312269.00	98038	31.40
4	October	"	648,500	367084.00	183670	50.03
5	November	"	648,500	350553.00	228070	65.06
6	December	"	648,500	350553.00	264956	75.58
7	January	"	648,500	416659.00	184753	44.34
8	February	"	648,500	416659.00	199016	47.76
9	March	"	648,500	416659.00	290774	69.79
10	April	"	648,500	400128.00	221746	55.42
11	May	"	648,500	400128.00	218508	54.61
Total			**7,133,500**	**3988640.00**	**2066184.00**	**611.63**
Average			**648,500**	**362603.64**	**187834.91**	**55.60**

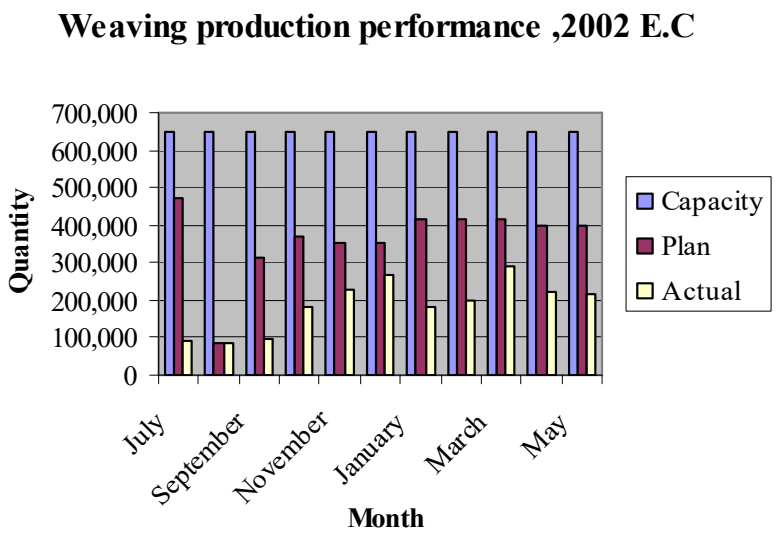


Fig 4.6b: Weaving

Table 4.6c: Finishing

S/N	Month	UOM	Capacity	Plan	Actual	%
1	July	Mt	1,205,000	634167	151788	23.94
2	August	"	1,205,000	105285	82892.2	78.73
3	September	"	1,205,000	454707	73592	16.18
4	October	"	1,205,000	446806.00	183827.3	41.14
5	November	"	1,205,000	456918.00	252124.1	55.18
6	December	"	1,205,000	468918.00	347291	74.06
7	January	"	1,205,000	508764.00	193776.2	38.09
8	February	"	1,205,000	508764.00	275100.9	54.07
9	March	"	1,205,000	508764.00	356183	70.01
10	April	"	1,205,000	490765.00	241344	49.18
11	May	"	1,205,000	490765.00	286416.94	58.36
Total			**13,255,000**	**5074623**	**2444335.6**	**558.943**
Average			**1,205,000**	**461329.364**	**222212.33**	**50.813**

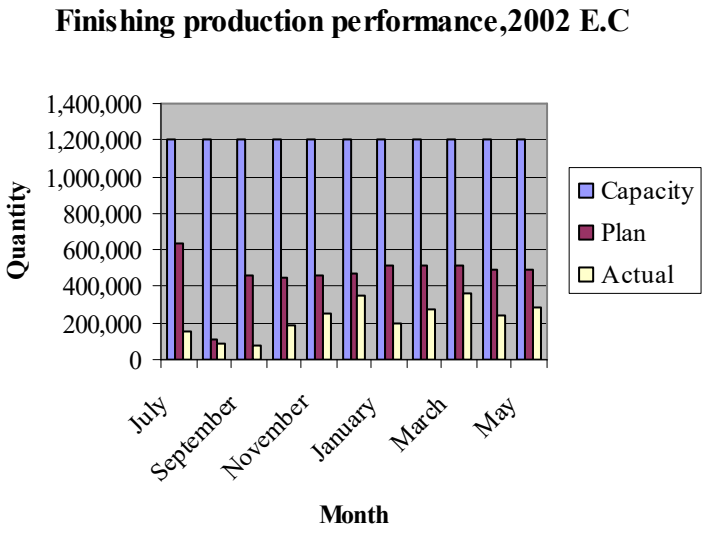


Fig 4.6c: Finishing

Interpretation

- **Spinning & Weaving:** even though the planned quantity approaches to the designed capacity of each plant there is a big difference to the actual volume achieved.
- **Finishing plant:** the facility of the plant is designed to provide the dying and bleaching service for both Awassa & Arbaminch textile factories. However at this time Arbaminch textile factory already installed its own finishing plant. Therefore the finishing plant of Awassa Textile Share Company never plans close to its designed capacity. Besides since the finishing plant receives input from the weaving plant, the output of this plant depends on the feeding capacity of the weaving plant. Hence currently the finishing plant is not working at its full capacity.

Table 4.7: Summary of average production performance per month

Plant	**UOM**	**2001 E.C**	**2002 E.C**	**Remark**
Spinning	Kg	**41**	**66.74**	
Weaving	Mt	**41.65**	**55.60**	
Finishing	Mt	**52.66**	**50.813**	

As can be seen from the above table the average production accomplishment for each plant for 2002 E.C is greater than that of 2001 E.C. However it doesn't mean that the performance of 2002 E.C is quite enough. The production performance for both years is very low.

Even though the potential of each plant is very high the company doesn't utilize it properly. Especially the finishing plant is quite capable to rendering many services like dying, bleaching etc for other similar companies which have shortage of such services.

Major Causes for low accomplishment are listed below

- Machinery: the company is equipped with old machineries and not effectively and efficiently used. In addition due to absence of proper maintenance and shortage of spare parts the machines are getting weak in efficiency.
- Material: since the company has shortage of working capital it is unable to compute with other similar companies in purchasing quality raw material. There for the company is forced to use second grade raw materials like cotton. This resulted excessive waste during transformation of input to output.
- Labor: the productivity of labor is not as expected. The reason is there is no motivation like training, rewarding system, attractive salary etc.
- Management: unfortunately the company experiences different management styles. It was managed by wish textile, Chinese and Narin orme Textile group, turkey start from 2000/2001- 2004/2005 and 2005-2007 respectively. During these years it was not effective as well as these days. Therefore there is no stability in this regard.
- Working conditions: the working environment of the company is very poor. For the three production plants there is excessive dust, warm temperature, noisy especially in finishing plant etc. This discourages the workers to work effectively.

Fig 4.7: Cause and effect diagram

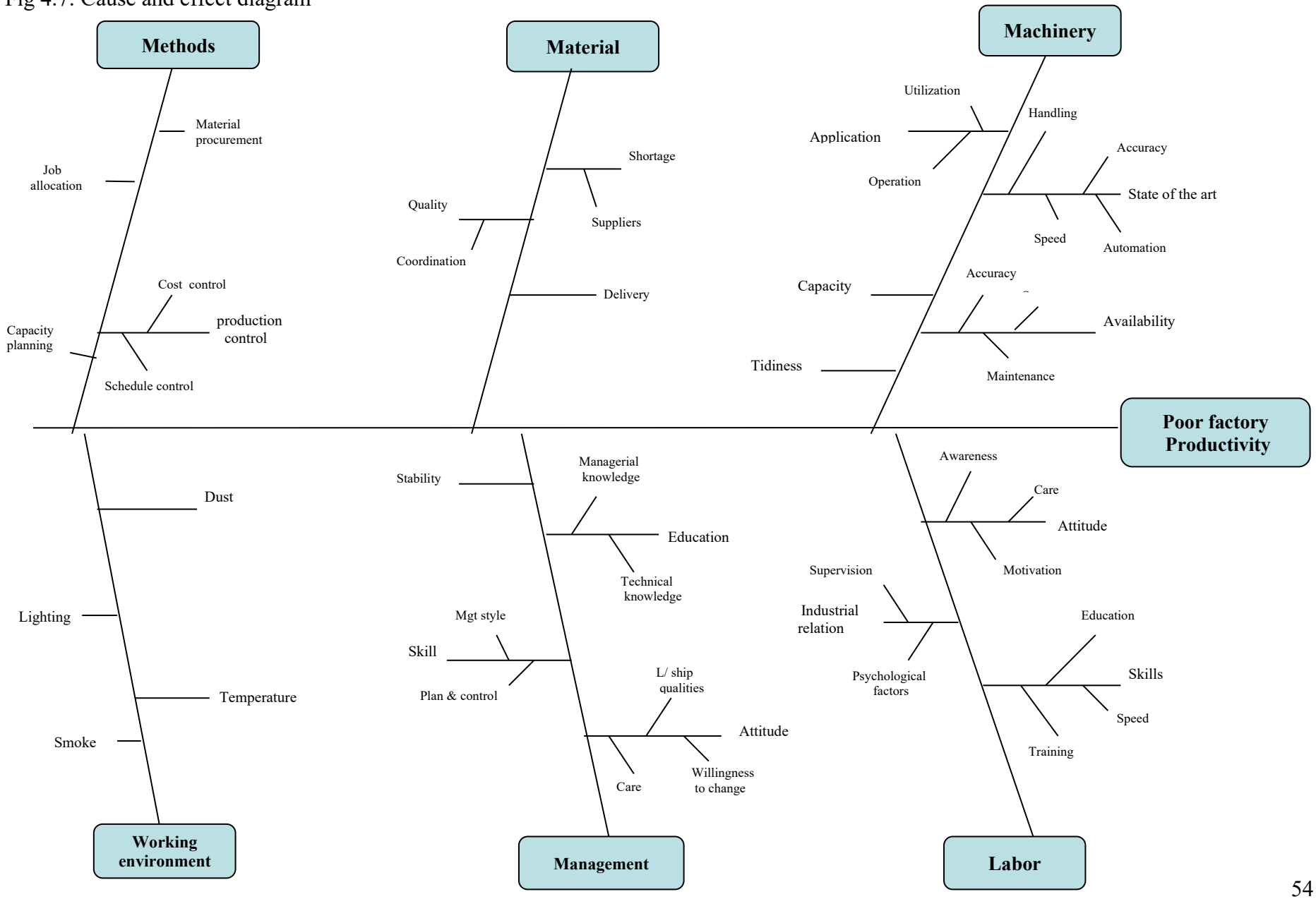


Table 4.8: Weaving machines stoppage for 2001 E.C

Month	Lost Prod. In meter	REASON FOR MACHINE STOP(2001), Minutes										
		Mechanical	Electrical	Cleaning	Yarn Shortage	Instr/tal Air Prob.	Spare Part	Beam Changing	Beam Waiting	power Int/ion	Total	Loss/Minute(in meter)
July	82,189								13025	1	**13026**	**6**
August	119,393						9977		12656	2	**22635**	**5**
October	79,135						11864		2381	5	**14250**	**6**
November	191096						31023		4365		**35388**	**5**
December	194477						30735		4847	4	**35586**	**5**
January	181948						32430		3815	11	**36256**	**5**
February	271831						39291		4625	3	**43919**	**6**
March	207826				1126		26592		2385	2	**30105**	**7**
April	265701				2356		27132		15252	2	**44742**	**6**
May	252746						31200	782	143	2	**32127**	**8**
June	357157	3373					33600	5254		140	**42367**	**8**
Total	**2,203,499**	**3,373**	**0**	**0**	**3,482**	**0**	**273,844**	**6,036**	**63,494**	**172**	**350,401**	**68**
Average	**200,318**	**307**	**0**	**0**	**1,741**	**0**	**27,384**	**3,018**	**6,349**	**17**	**31,855**	**6**

Table 4.9. Weaving machines stoppage for 2002 E.C

Month	Lost Prod. In meter	REASON FOR MACHINE STOP(2002), Minutes										
		Mechanical	Electrical	Break down	Yarn Shortage	Instr/tal Air Prob.	Spare Part	Beam Changing	Beam Waiting	power Int/ion	Total	Loss/Minute
July	186410						24170		921	12,986	**38077**	**5**
August	87601			844			8653		31	99	**9627**	**9**
October	297162			3514			5760		529	360	**10163**	**29**
November	203843						10032	3583	2158	10246	**26019**	**8**
December	198735			6042			11175	5989	5404	3	**28613**	**7**
January	168988		6	4351			6426	8147	14735		**33665**	**5**
February	123607			4304			15408	2015	1504	1665	**24896**	**5**
March	121021			4754			14376	2457		9	**21596**	**6**
April	140392			6562			16244	1255	1699	1	**25761**	**5**
May	146679			6890			14352	1811	3733	184	**26970**	**5**
June	140972			7080			14976	1639	877	1	**24573**	**6**
Total	**1815410**		**6**	**44341**			**141572**	**26896**	**31591**	**25,554**	**269,960**	**90**
Average	**165037.3**	**0**	**0.6**	**4926.78**	**0**	**0**	**12870.2**	**3362**	**3159.1**	**2,555**	**24,542**	**8**

Total lost time due to machine stoppage = 24,542 min/year = 409 hrs/year

Total output/ year = 49,835,982 birr

Table 4.10a, productivity in terms of time (2001)

S/N	Month	UOM	Utilized Mandate	Actual production	labor productivity/day
1	July	Mt	23802	307258	12.9089152
2	August	"	25727.5	315373	12.2582062
3	October	"	22097.8	119957	5.42845894
4	November	"	23080.1	166454	7.21201381
5	December	"	24639.3	197702	8.02384808
6	January	"	22852	160605	7.02805006
7	February	"	22782	119717	5.25489421
8	March	"	22962	156269	6.8055483
9	April	"	23302.9	252829	10.8496797
10	May	"	11739	123839	10.5493654
11	June	"	23922.4	204677	8.55587232
Total			**246907**	**2124680**	**8.60518333**
Average			**22446**	**193152.73**	**8.6052183**

Table 4.10b, productivity in terms of time (2002)

S/N	Month	UOM	Utilized Mandate	Actual production	labor productivity/day
1	July	Mt	22657.9	92227	4.07041253
2	August	"	1278.5	84426	66.0351975
3	September	"	17715	98038	5.53418007
4	October	"	17063	183670	10.7642267
5	November	"	19745.3	228070	11.5505969
6	December	"	22947.3	264956	11.5462821
7	January	"	21763.7	184753	8.48904368
8	February	"	19359.3	199016	10.2801238
9	March	"	22900.75	290774	12.6971387
10	April	"	19123.63	221746	11.5953927
Average			**184554**	**1847676**	**10.0115738**
Total			**18455**	**184767.6**	**10.0117908**

As can be seen from the above table the average labor productivity for 2001 E.C and 2002 E.C is 8 and 10 meters of textile per day. However, from appendix 3, the average percentage of mandate utilization (efficiency of time) per month is 87% & 83 % respectively. This indicated that the productivity of the company in terms of time is very low.

Fig 4.8: causes of machine stoppage

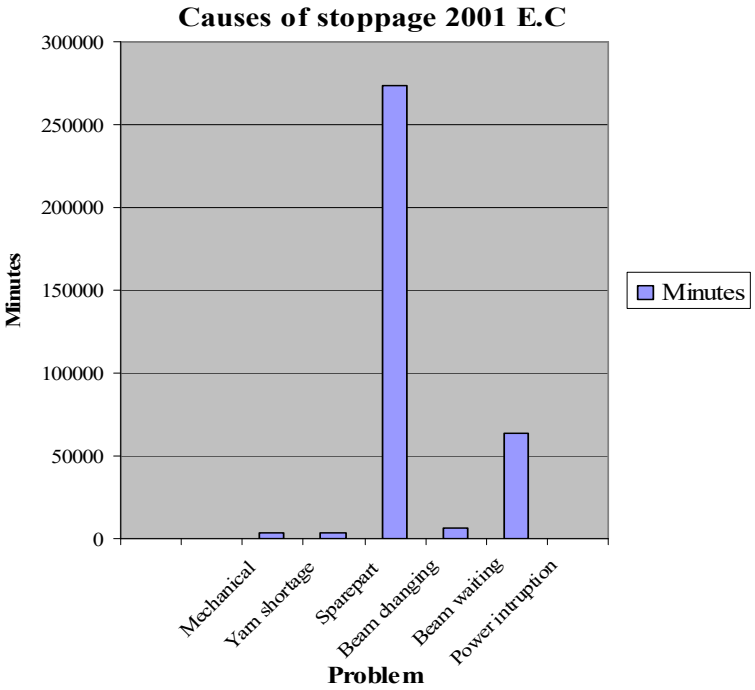


Fig 4.8 a. Causes of machine stoppage

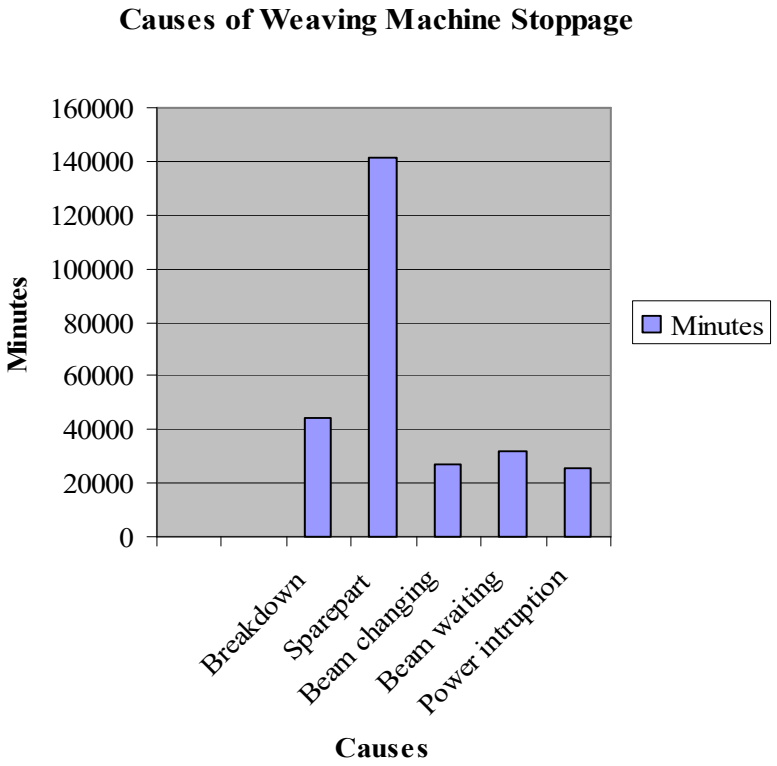


Fig 4.8b. Causes of machine stoppage

Interpretation

As can be seen from the above graphs the shortage of the spare part affects the machinery productivity. And it is considered to be the serious problem. Hence it's better to counter check the degree of its seriousness by taking the purchasing rate of the spare part in the company. Below are some data about the spare part consumption rate per month.

Table 4.11: Spare part consumption

Spare part consumption in 2001 E.C, in birr

Month	Spare part
July	28,854.66
August	60,713.59
October	96,594.89
November	28,329.33
December	76,196.57
January	273,305.87
February	141,382.36
March	60,668.84
April	124,852.19
May	45,166.78
June	102,889.67
Total	**1,038,954.75**

Spare part consumption in 2002 E.C, in birr

Month	Spare part
July	28,854.66
August	60,713.59
September	96,594.89
October	28,329.33
November	76,196.57
December	273,305.87
January	145,557.36
February	320,426.76
March	268,067.08
April	712,475.26
May	102,889.67
Total	**2,113,411.04**

As clearly seen from the above data the company has made its own effort to fulfill the spare part demand during the fiscal years. Therefore it might not be a convincing reason in this case. Rather it's better to see the productivity of the company resources.

4.2.3 Productivity analysis

All inputs were recorded in terms of their monetary values. The monetary value of output was calculated by multiplying the number of units produced by their sales price. Each partial productivity value is the ratio of total output for each period to the appropriate input value, i.e. labor, materials, energy and machinery. The monetary value of labor included direct and indirect labor cost, administration cost, factory overheads, and distribution expenses. The monetary value of material is based on direct & indirect material cost. Energy cost includes electric power, fuel & water and lastly machinery

cost comprises mainly the depreciation cost. Total productivity is the ratio of total output to total input.

- **For year 2001 E.C**

Total output of the company is **56,891,214.25 birr**

The major Annual costs incurred by the company

- **Material Consumption**
  - Direct material = 26,424,593.29
  - Indirect material = 10,868,624.24

    Subtotal = 37,293,217.53 birr

$$\text{Material productivity} = \frac{\text{Total out put}}{\text{Material input}}$$

$$= \frac{56,891,214.25}{37,293,217.53} = \mathbf{1.5}$$

- **Labor Cost:**
  - **Salary:** this is a monthly payment made for the company workers it includes

    Direct labor (A) + indirect labor (B) + Distribution Expenses (C) + Administration expenses (D) + Factory overhead (E)

    = A + B+ C + D + E

    = 2,603,001.66 + 5,416,220.74 + 1,483,132.98 + 1,735,736.77 + 1,070,565.15 = **12,308,657.3**

  - **Employee benefit** = the payment made twice a year on the occasion in every New Year and Christmas holidays**.**

    (A + B) + C + D + E

    = 424,070.88 + 74,599.60 + 452,694.37 + 45,980.66

    = 997,345.51

    Subtotal = 12,308,657.3 + 997,345.51=13,306,003.24 birr

$$\text{labor productivity} = \frac{\text{Total out put}}{\text{labor input}}$$

$$= \frac{56,891,214.25}{13,306,003.24} = 4.28$$

❖ **Energy Cost**

The annual consumption of energy like Electric Power, Fuel (for furnace, & vehicles), and water is as shown below.

- **6,058,335.33 birr**

$$\text{Energy productivity} = \frac{\text{Total out put}}{\text{energy input}}$$

$$= \frac{56,891,214.25}{6,058,335.33} = 9.39$$

❖ **Machinery cost**

In this case the main cost to be considered is depreciation cost

Therefore the annual depreciation cost is as shown below.

- **3,592,334.82 birr**

$$\text{Machinery productivity} = \frac{56,891,214.25}{3,592,334.82} = 15.84$$

❖ **Other costs = 19,858,365.45**

$$\text{Hence total productivity} = \frac{\text{Total out put}}{M.cost + L.cost + E.cost + M/C\ cost + other\ costs}$$

$$= \frac{56,891,214.25}{80,108,256.37} = 0.71$$

Here as we can see from the calculation material and labor productivity are less than energy and machine productivity. Since material and labor costs are 46.55 % and 16.6%. Therefore priority for productivity improvement must be done on material and labor.

Productivity analysis for year 2002 E.C

Total output of the company is **33,291,077.26** birr

❖ **Material Consumption**

- Direct material = 10,356,752.96
- Indirect material = 11,095,045.69

Subtotal = 21,451,798.65 birr

$$\text{Material productivity} = \frac{33,291,077.26}{21,451,798.65} = 1.55$$

❖ **Labor Cost:**

- **Salary:** this is a monthly payment made for the company workers it includes

  Direct labor (A) + Indirect labor (B) + Distribution Expenses (C) + Administration expenses (D) + Factory overhead (E)

  = A + B+ C + D + E

  = 1,702,233.24 + 3,547,110.83 + 926,771.01 + 1,313,760.29 + 815,386.76 = **8,305,262.13**

- **Employee benefit** = the payment made twice a year on the occasion in every New Year and Christmas holidays**.**

  (A + B) + C + D + E

  = 265,745.84 + 79,078.26 + 244,912.15 + 39,604.70

  = 629,340.95

  Subtotal = 8,305,262.13 + 629,340.95 = 8,934,603.08 birr

  $$\text{labor productivity} = \frac{33,291,077.26}{8,934,603.08} = 3.72$$

❖ **Energy Cost**

The annual consumption of energy like Electric Power, Fuel (for furnace, & vehicles), and water is as shown below.

- **3,235,682.96 birr**

$$\text{Energy productivity} = \frac{33,291,077.26}{3,235,682.96} = 10.29$$

❖ **Machinery productivity**

In this case the main cost to be considered is depreciation cost

Therefore the annual depreciation cost is as shown below.

- **2,497,020.67 birr**

$$\text{Machinery productivity} = \frac{33,291,077.26}{2,497,020.67} = 13.33$$

❖ **Other costs = 5,545,872.36 birr**

$$\text{Hence total productivity} = \frac{33,291,077.26}{41,664,977.72} = 0.80$$

In both cases the productivity value shows materials productivity is closest in magnitude to total productivity and labor productivity displays a similar pattern to material productivity. Material and labor costs are significant contributor to total cost. Here while calculating the productivity index there are other costs which must be included. Hence if we consider them the total productivity value will still decline below the above value. Material and energy productivity for 2002 E.C is slightly increased than that of 2001 E.C. However labor and machinery productivity seems to be good in 2001 E.C as compared to 2002 E.C. Nevertheless the overall productivity shows some increment for 2002E.C. Overall the factory is at loss condition as per the data collected for consecutive two years. Therefore some significant measures must be taken to alleviate such problem.

Table 4.12: Productivity indexes

	2001 E.C	**2002 E.C**	**Index**
Output	**56,891,214.25**	**33,291,077.26**	**0.58**
Material input	37,293,217.53	21,451,798.65	0.57
Labor input	13,306,003.24	8,934603.08	0.67
Energy input	6,058,335.33	3,235,682.96	0.53
Machine input	3,592,334.82	2,497,020.67	0.69
Total input	**80,108,256.37**	**41,664,977.72**	**0.52**
Material productivity	1.5	1.55	1.03
Labor productivity	4.28	3.72	0.87
Energy productivity	9.39	10.29	1.1
Machine productivity	15.84	13.33	0.84
Total productivity	**0.71**	**0.80**	**1.12**

4.3 Summary of Basic problems of Ethiopian textile productivity

According to the study the basic problems of the selected companies as well as the case study company (Awassa textile S.C) are common. Most of the companies are unable to compute with foreign companies of the same category.

The major problems faced by the companies are shown below:

- Cost of production is high
- Shortage of raw material
- Labor productivity is low
- Poor capacity utilization
- Poor maintenance policy
- Poor inventory control
- Poor product quality
- Scarce product diversification
- High rate of rework and rejects

4.4 Bench marking

Bench marking Ethiopia Textile industries with best practices in different measurements related to productivity

Benchmarking is the process of identifying and adapting outstanding practices from organizations and companies around the world to assist an organization or company in measuring and improving its performance. The basis of a successful benchmarking exercise is a thorough understanding and knowledge of best practices in the relevant areas. Benchmarking reveals the gaps between Ethiopian textile industries and the best practices around the world. Table 4.13 shows the benchmarking analysis.

Table 4.13: Bench marking

The benchmarking factors highlighted above have direct relation to productivity of the textile sector. As can be seen from the above data the

S/N	Type of Bench marking	UOM	Country					Remark
			Turkey	China	India	Pakistan	**Ethiopia**	
1	Working time/year	Days	340 - 350	340 - 350	340 - 350	340 - 350	**300**	
2	Wage	USD/Month	600	175	125	80	**50**	
3	Energy cost	USD/KWH	0.10	0.09	0.10	0.08	**0.03**	
4	Average Capacity utilization of spinning	%	94-98	94-98	94-98	94-98	**45 - 70**	
5	Average Capacity utilization of weaving	"	94-98	94-98	94-98	94-98	**22-65**	
6	Cotton productivity	Yield(Kg/ha)	1,339	1,216	502	687	**263**	

Source: Textile and Apparel Industry Development Institute

production cost with respect to labor and energy gets minimum in Ethiopia textiles as compare to others. However since textile is a labor intensive sector Ethiopian textiles never used this comparative advantage. Regarding the capacity utilization including the working time our country is lagging behind others.

5. PRODUCTIVITY IMPROVEMENT MODEL IN ETHIOPIAN TEXTILE SECTOR

5.1 Productivity improvement model

From the study one can understood that Ethiopian textiles are not in the right track to compute with international market. The companies have multi problems as mentioned from the problem summary above. The degree of the problem seriousness differs from company to company. Therefore developing a single type improvement technique may not address the stated problems equally and unable to improve the companies productivity. A general model needs to be designed to improve the textile productivity. As a result of this it is decided to develop a general model by adopting from David J. Sumanth's "productivity improvement technique" (productivity engineering and management).even though his model comprises about seven basic improvement techniques it's believed that four improvement techniques are convenient to tackle the existing productivity problems of Ethiopian textile companies. Such as maintenance based, material based, employee based and product based techniques. The model is developed based on the existing problems faced by the selected textile companies. And it is feasible technically and economically. It is depicted in detail in the next page.

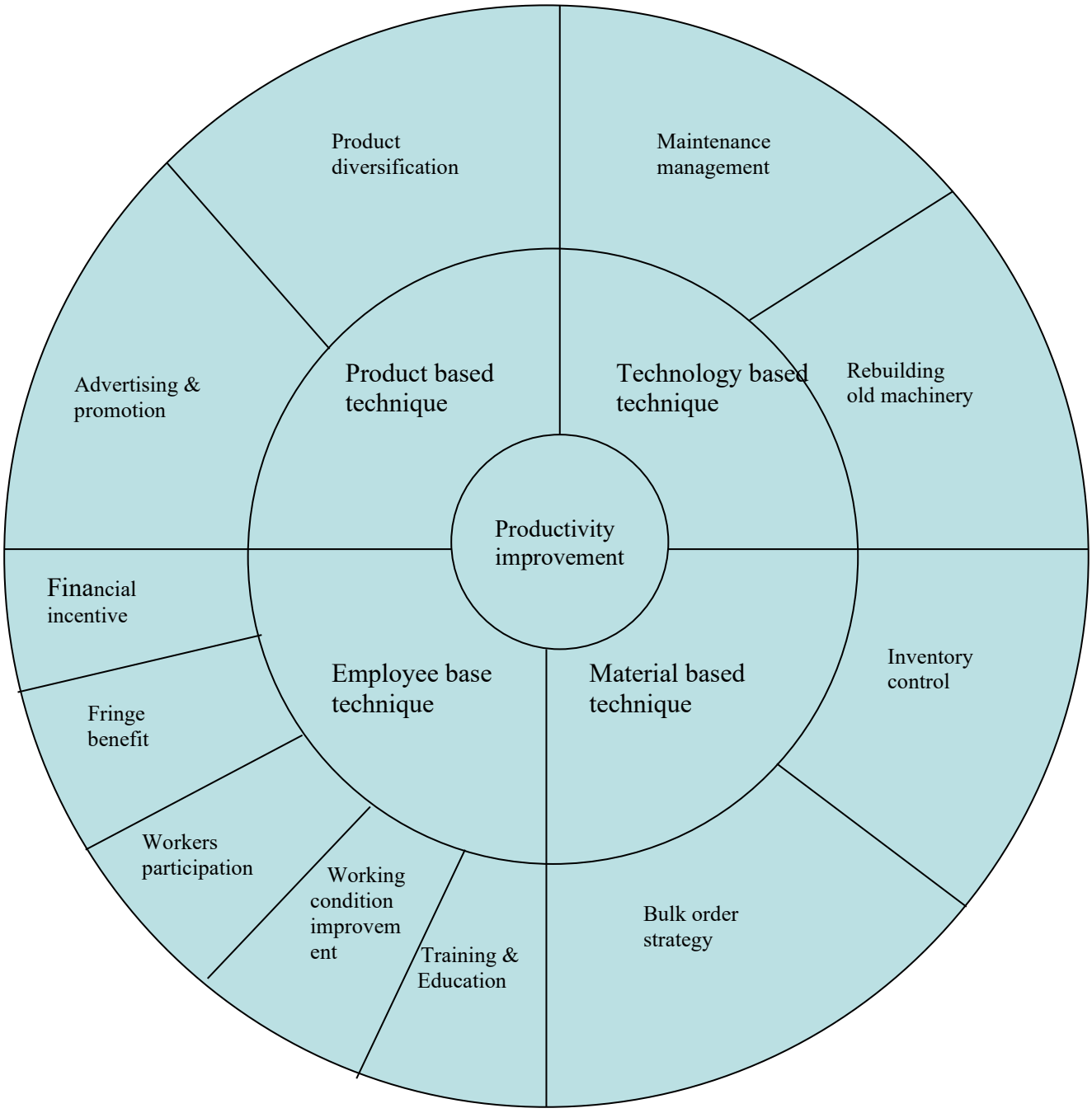


Fig 5.1: Productivity improvement model

5.1.1Technology based Technique

1. Maintenance management

Maintenance management, rebuilding old machinery and energy-conservation technology are three approaches to productivity improvement concerned with what a company already has in terms of plant and equipment rather than new technologies.

Maintenance management is a formalized approach to maintaining the currently available textile producing machinery and equipment to help them function according to the maintainability and reliability characteristics. Preventive maintenance can be a very effective means of cutting down breakdown and corrective maintenance costs and increasing human productivity, fixed capital productivity, and energy productivity, in most cases.

Maintenance management results in many benefits, including the following:

1. Machine-availability time for production goes up, resulting in higher outputs and lower machine costs per hour.
2. Labor productivity in production areas goes up.
3. Breakdown maintenance is reduced, and with it human input in terms of birr.
4. Because of a general reduction in overtime, the cost of maintenance operation itself goes down.
5. Maintenance management is an effective technique to get the most out of the existing machinery and equipment. Therefore, it is almost always likely to increase the output and decrease the human input.

2. Rebuilding old machinery

Quite often most company managements in Ethiopia do not realize the potential in modifying the existing machinery and their tooling, but instead purchase brand-new machinery. In our case purchasing several new brand textile processing machines is too costly. Therefore those companies should exercise to remodel the existing machineries by replacing some critical parts of the machines.

Many large corporations in the world have their own machine-building departments where the remodeling is undertaken very methodically [25]. Of course, the remodeling effort can be made easier if the shop floor employees are encouraged to suggest the modifications themselves. Companies that have participatory management, say, with quality control circles, can take up the redesign of existing

machinery and tools. After all, workers on the shop floor know more about their machines' capabilities than anyone else-at least in most cases.

This technique can have a positive effect in the long run (for the most part) on total productivity in Ethiopian textile industries.

5.1.2 Materials-based productivity improvement techniques

1. Inventory control

Majority of Ethiopian textile companies are suffered from inventory control system. From the study it is understood that majority the textile companies are under utilized due to input material shortage. As a result unnecessary cost is incurred with in the companies. Thus companies should run off from this crisis soon. Regular and consistent supply of inputs both from local and foreign must be provided. Orders are placed within a proper lead time in order to prevent stoppage of production due to such problems.

2. Bulk order strategy

Right now most Ethiopian textile companies are unable to compute with foreign companies due excessive costs in purchasing raw materials and indirect materials. To reduce this cost they must follow aggregate purchasing by cooperating with one another.

Bulk order strategy is used to get benefits:

- Least unit price of the items
- Best quality
- Minimum transportation cost
- Exact delivery etc.

5.1.3 Employee based productivity improvement technique

1. Financial incentive

Financial incentive like profit sharing encourages employee participation in solving production problems. The companies should avoid over time payment and adopting like project allowance system by setting appropriate proportion of payment. It may be by computing savings in labor cost (allowable labor cost - actual labor cost).

2. Fringe benefit

Many organizations find it necessary to provide incentives to management and supervisory people. However, in many cases, apart from the regular bonuses, or profit

sharing, companies come up with some intangible means of rewarding and encouraging a management employee.

These benefits are usually referred to as the "fringes."

Some typical forms of fringe benefits include the following:

- Medical insurance
- Subsidies for renting a home
- Free or subsidized higher education etc.

If the management and supervisory people get such type of benefit they will be motivated and encourages to solve several productivity problems in the company. Therefore as much as possible the executives should create such environment with out affecting the company's survival.

3. Worker participation

Participation is an approach to overcoming resistance to change through employee involvement in *planning* and *implementing* the change. It is the mental and emotional involvement in a group situation that encourages the person to contribute to group goals and to share responsibility in them.

There are several participation approaches to improving partial or total productivity. These include:

- Quality-control (QC) circles
- Productivity quality (PQ) teams
- Productivity action teams
- Productivity circles
- Productivity maintenance groups
- Employee participation groups (EPGs)

The principle behind all these approaches is the basic premise that group wisdom is better than individual knowledge, and that employees know their job better than anyone else.

The PQ teams concept is an extension of quality circles in some respects, but is different in some basic features.

PQ teams are an effective means of improving employee morale, quality, and productivity in an organization. They have one single purpose in mind: To surface the talents of individuals working in the organization to the maximum extent possible by

providing the specialized training and management support necessary to accomplish this.

Team spirit, positive thinking, and the philosophy of achieving excellence are three important characteristics of PQTs, making them not only efficient in accomplishing improvement in morale, communication, loyalty, productivity, and quality, but also making them effective in achieving organizational goals.

4. Working condition improvement

Working condition improvement is another employee-based productivity improvement technique that is often emphasized but rarely applied consistently. This technique involves a detailed audit of the working conditions at each of the operations.

- Designing improved conditions of working
- Installing and maintaining improvements in the working conditions.

The factors that must be audited to assess the present working conditions at each workplace area are

- Temperature, light, and humidity
- Noise
- Colors of the surroundings
- Extent of handling hazardous materials, parts, or products
- Extent of manual handling of heavy items

During the assessment in the case study company it is seen that the working condition of the finishing plant is extremely poor. Due to this a lot of defect come into view and consequently affects the company productivity.

5. Training & education:

- **Training**: Training seeks to achieve improved human productivity by increasing the ability levels of the workforce. It seeks to meet the demands of growth and change

Some of the common forms of training are

- On-the-job training
- Apprenticeship training
- Internship training
- Outside courses

- Visitation training (i.e., visits to other organizations, both domestic and foreign)

❖ **Education:** *Education* refers to the level of high school, college, or vocational training acquired by an employee. It is believed that a worker who has acquired a good and sufficient education, *and* is able to *apply* it, is more capable of effecting a positive change in productivity. A company or organization can play a great role in increasing an employee's level of education by providing programs that support such employees while they are serving the company. Such programs are usually provided in the form of evening courses in local high schools or colleges.

Although we do not have positive evidence that education level and total productivity are related, there may be a definite impact of education on human productivity because of the ease of learning new procedures, methods, or techniques as a result of the educational base. From the study I can understood that most textile companies don't focus on training and education to develop workers skill. So far only few people have got training and education access.

5.1.4 Product-based productivity improvement techniques

1. Product diversification: involves the addition of new product types or models to the existing ones. Generally speaking, the reasons for product diversification may include one or more of the following:

- The competition introduced a new product recently
- Since clothing is a fashion based product the existing models of products are not sustaining the market share
- The company has developed a product that is far ahead of the competition
- Penetration into the international market is necessary
- Penetration into the competitors' markets is essential for survival and growth

Although each of these reasons may be viewed as important enough for product diversification in a traditional sense, the managements must look at one other factor: Ethiopian textile industries produce very limited variety of products which don't address people's sophisticated demand.

2. Advertising and promotion

Advertising and promotion is an effective technique to improve the total productivity for textile products.

One of the major impacts of advertising and promotion for an existing product is to increase the demand, which, in turn, is likely to improve the capacity utilization of manufacturing and operations. Improvement in capacity utilization should generally have a positive impact on both fixed capital productivity and total productivity. Also, employee layoffs may be prevented if there is more work as a result of the increased demand through advertising and promotion.

Minimizing employee layoffs is beneficial for an organization in the long run because, if the organization layoff employees and cannot get them *all* back, new hiring must involve the additional costs of hiring and training. In addition, the morale of the employees not laid off is affected when they see their colleagues sent away because of poor capacity utilization. Thus, the net effect of advertising and promotion might be a long-term reduction in human input factor in the total productivity equation.

Another benefit of advertising and promotion when there is an acute capacity utilization problem is the avoidance of excessive re-start-up and maintenance costs. For example, a company may close down a part of its manufacturing facilities for extended periods of time due to lack of sufficient demand, sometimes for as long as six months or one year. When the demand position improves later and this part of the plant has to be restarted, maintenance crews spend considerably more time and effort to get the whole plant going again. Obviously, all this translates into cost terms, increasing the total input.

Clearly, advertising and promotion, if planned and executed well in times of low demand and low capacity utilization, might be an effective tool for improving the total productivity and the profit position.

The proposed model gives a productivity improvement framework for textile companies of Ethiopia. It only guides the activities of the companies towards achieving better productivity in their products. The main problems of the companies have been identified in this study. Hence, the companies shall focus on those problems elimination. This study will also help for them to avoid unnecessary wastages. Generally, the companies will come to a better position and become competitive in the international market, if the problems mentioned in this paper addressed properly

5.2 Implementation of Productivity improvement

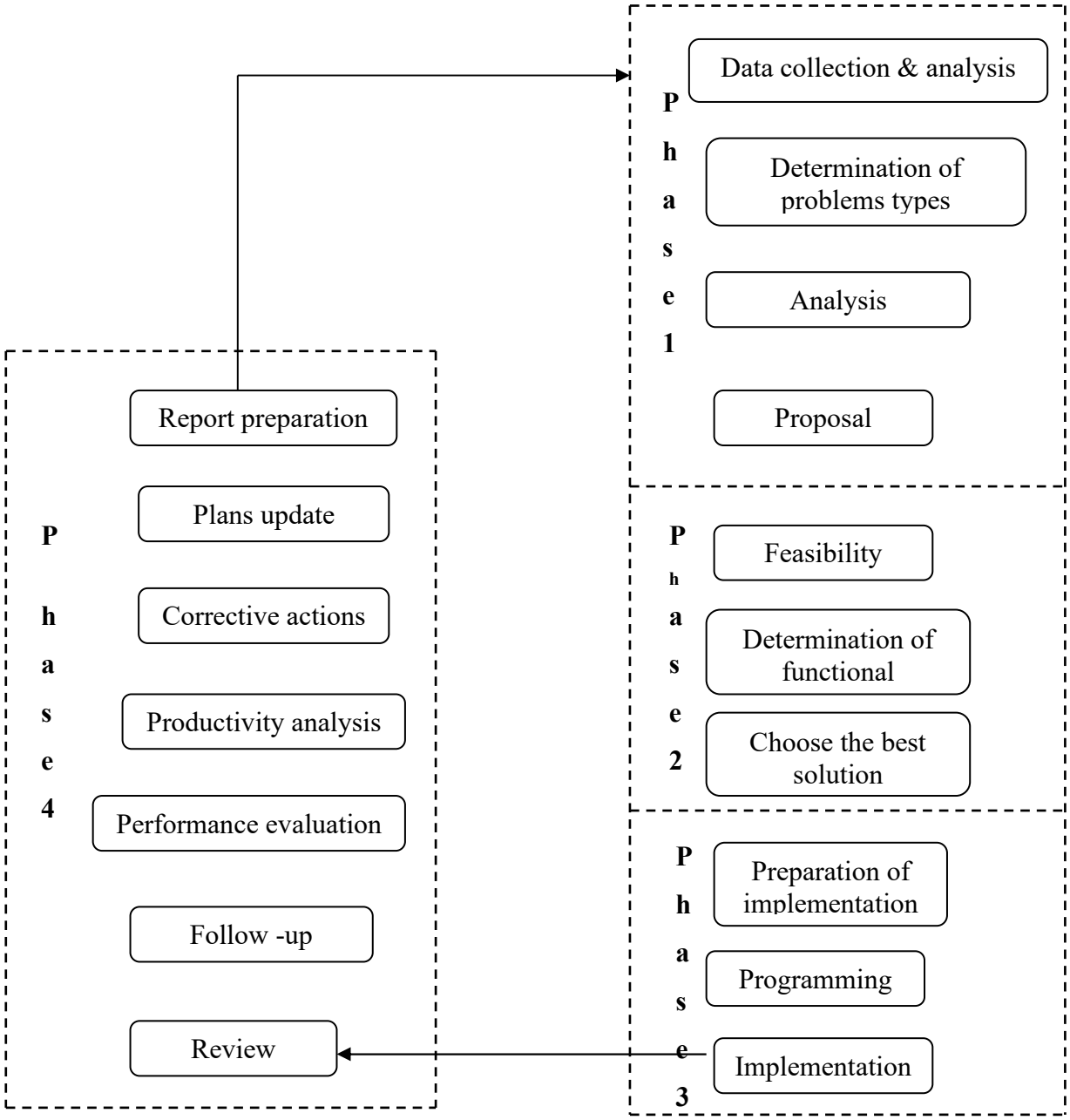


Fig 5.2: Implementation of Productivity improvement

Key:

Phase I = Measurement

Phase II = Evaluation

Phase III = Planning & Implementation

Phase IV = Control & Updating

The productivity improvement model should be implemented in the following manner. The Textile companies shall begin the productivity program with productivity measurement. Once the productivity levels are measured, they have to be evaluated or compared against planned values. Based on this evaluation, target levels of productivity are planned. To achieve the planned targets, productivity improvement takes place in a formal manner. In order to assess the degree to which the improvement will take place next period, productivity levels must be measured again. This cycle thus continues for as long as the productivity program operates in the organization. **[25]**

As shown from the above diagram the productivity cycle comprises productivity measurement, evaluation, planning, and improvement, which form a continuous process;

The productivity cycle concept shows us that productivity improvement must be preceded by measurement, evaluation, and planning. All four phases are important, not just productivity measurement or just productivity improvement.

Also, this cycle emphasizes the "process" nature of the productivity issue. A productivity program is not a one-time project, but rather a continuous, on-going process. Generally to manage productivity in a true sense of the term, four formal phases must be recognized**.**

6. CONCLUSION AND RECOMMENDATION

This study focuses on productivity of textile products in Ethiopia. A thorough analysis has been made to fill any possible gap for improvement.

Generally, in this study major factors affecting textile productivity are assessed. Based on the finding of the study the following conclusion and recommendations are forwarded.

6.1 Conclusion

What can be concluded from the results of the assessment is presented as below.

From the study what we can understood is that the productivity of Ethiopian textile sector is very low (on average it's about 40- 50%) as compared to foreign textile industries like in china, India and Pakistan which have 80-90% of productivity rate. obviously these countries are equipped with modern production facilities as compared to ours which have limited production facilities and besides absence of state of the art. However, they didn't even use the existing potential as expected. Most of them are under utilization.

There are several reasons for low productivity in the sector like shortage of raw materials, poor labor productivity, lack of modern technology, absence of strong maintenance policy with the companies are the major problems.

Regarding raw material luckily Ethiopia is gifted with enormous potential for cotton production. A study by the Ministry of Agriculture indicates that there is 2.6 million hectares of land suitable for cultivation of cotton. Although the enormous potential, it's estimated that cotton is produced only on 85,000 hectares representing 3% of the potential area. Regarding other inputs, our textile industry sector faces a major disadvantage resulting from a lack of local availability of spare parts, dyes and chemicals and accessories used in garment making.

In terms of labor productivity referring to my case study company, especially spinning and weaving mills suffer from over staffing which is mainly due to old machinery, lack of automation and deficiencies in operator skills.

In summary, based on the average ranking of the various answers made by the participants, this study identifies critical factors that are potentially serious to productivity improvement in the textile sector. Raw material shortage, low labor productivity, poor capacity utilization and absence of strong maintenance policy are placed in the first rank orders. And the rest factors i.e. Poor inventory control, Poor product quality, scarce product diversification and high rate of rework & rejects are also contributed to low productivity.

6.2 Recommendation

- Firstly, Improving the quantity and quality of cotton in Ethiopia is critical to the future development of the textile industry in Ethiopia.

  This effort should be mainly in the hands of the government to encourage cotton farming in the country. In this regard as certain study concerning cotton cultivation revealed that the cultivated area (2009) by the government, private and small holders is 3,522, 28,984, and 42,948.5 hectares respectively. And its productivity per hectare is 18.94, 22 and 13.25 quintals.

  As seen from cotton farm productivity rate, the private sector is relatively efficient and effective indicating that the government must embark on specific measures to develop the textile and clothing sector by attracting FDI, modernization and privatization of state owned enterprises and encouraging cotton cultivation. In this case conducive environment has to be created for the participation of investors both in cotton and textile production.
- As the questionnaire result indicated there are some textile companies which are not aware about customer needs, therefore market orientation needs to be considerably improved to understand customer needs, conducting market research, strengthening the distribution channels, quality assurance and improving customer service.
- Technical skills of the managers should be improved by exposing them to new technology, international best practices in production management through process control and machine maintenance. The maintenance practices need to be improved to place more emphasis on preventive maintenance of machines rather than typical breakdown approach.
- An attempt must be made to educate people in proper understanding of the concepts of productivity and the need to improve it including the reasons why productivity is not currently improving. If people lack proper training, then the people become part of the productivity problem.
- Purchasing input material separately is costly. Therefore a sort of strategy must be assessed like to pursuing aggregate purchase by combining one industry with other so as to minimize the material cost.
- Finally, the current financial constraint faced by cotton and textile producers needs to be addressed by the government.

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Appendix 1-A, Production performance for 2001 E.C

Article		**July**			**August**			**October**		
Spinning	**U.M**	**Planned**	**Actual**	**%**	**Planned**	**Actual**	**%**	**Planned**	**Actual**	**%**
100 % cotton Yarn	Kg	74,305.92	99577	134.01	74,305.92	59563	80.16	74,305.92	26138	35.18
P/C OR /& POLYESTER	"	49,624.58	13262	26.72	49,624.58	14738	29.70	49,624.58	11373	22.92
Total										
Weaving										
100 % cotton Yarn	Mt	74,305.92	99577	134.01	323225.98	306049.00	94.69	323225.98	78562.00	24.31
P/C GREY FABRIC	"	169,052.78	5832	3.45	169,052.78	9324	5.52	169,052.78	41395	24.49
Total										
Finishing										
100% COTTON	Mt	56,581.24	51,995.30	91.89	56,581.24	11,391.00	20.13	56,581.24	11,391.00	20.13
Bleached Canvas	"	-	5640		-	8668				
Half bleached chesse	"		77							
Dyed	"	132941.66	234995.40	176.77	132941.66	59029.00	44.40	132941.66	59029.00	44.40
Printed	"	323560.44	360632.10	111.46	323560.44	268521.00	82.99	323560.44	268521.00	82.99
P/C OR & 100% POLYSTER	"	186916.66	12665.00	6.78	186916.66	37461.00	20.04	186916.66	37461.00	20.04
GREY FABRICS (100% cotton) Export	"	115,833.33	119,460.00	103.13	115,833.33	57,303.00	49.47	115,833.33	57,303.00	49.47
Total										
Grand total		**1,183,122.53**	**1003713**	**84.83**	**1,432,042.59**	**832047**	**58.10**	**1,432,042.59**	**591173**	**41.28**

Appendix 1-A, Continued

Article		**November**			**December**			**January**		
Spinning	U.M	Planned	Actual	%	Planned	Actual	%	Planned	Actual	%
100 % cotton Yarn	Kg	74,305.92	57833	77.83	74,305.92	57833	77.83	74,305.92	50632	68.14
P/C OR /& POLYESTER	"	49,624.58	13607	27.42	49,624.58	13607	27.42	49,624.58	13281	26.76
Total										
Weaving										
100 % cotton Yarn	Mt	323225.98	144370.00	44.67	323225.98	152950.00	47.32	323225.98	132299.00	40.93
P/C GREY FABRIC	"	169,052.78	22084	13.06	169,052.78	44752	26.47	169,052.78	28306	16.74
Total										
Finishing										
100% COTTON	Mt	56,581.24	53,998.00	95.43	56,581.24	53,998.00	95.43	56,581.24	9,335.00	16.50
Bleached Canvas	"									
Half bleached chesse	"									
Dyed	"	132941.66	65874.80	49.55	132941.66	65874.80	49.55	132941.66	27283.50	20.52
Printed	"	323560.44	110665.10	34.20	323560.44	110665.10	34.20	323560.44	178991.00	55.32
P/C OR & 100% POLYSTER	"	186916.66	44314.90	23.71	186916.66	44314.90	23.71	186916.66	41296.00	22.09
GREY FABRICS (100% cotton) Export	"	115,833.33	3,000.00	2.59	65,833.33	-	-	115,833.33	8,010.00	6.92
Total										
Grand total		**1,432,042.59**	**515747**	**36.01**	**1,382,042.59**	**543995**	**39.36**	**1,432,042.59**	**489434**	**34.17**

Appendix 1-A, Continued

Article	U.M	Month								
		February			March			April		
spinning		Planned	Actual	%	Planned	Actual	%	Planned	Actual	%
100 % cotton Yarn	Kg	74,305.92	52104	70.12	91,324.89	40728	44.60	91,324.89	44138	48.33
P/C OR /& POLYESTER	"	49,624.58	10552	21.26	15,689.04	10527	67.10	15,689.04	12336	78.63
Total										
Weaving	Mt									
100% COTTON GREY FABRIC	"	323225.98	99678.00	30.84	355888.00	143999.00	40.46	355888.00	191735.00	53.88
P/C GREY FABRIC	"	169,052.78	20039	11.85	45,805.00	12270	26.79	45,805.00	61094	133.38
Total										
Finishing	Mt									
100% COTTON	"	56,581.24	51,124.00	90.36	68,388.00	19,985.00	29.22	68,388.00	6,243.20	9.13
Dyed	"	132941.66	60351.60	45.40	147743.00	40194.00	27.21	147743.00	14289.00	9.67
Printed	"	323560.44	193909.00	59.93	205967.00	219074.60	106.36	205967.00	195064.00	94.71
P/C OR & 100% POLYSTER	"	186916.66	12455.00	6.66	461608.00	286228.60	62.01	461608.00	314618.20	68.16
GREY FABRICS (100% cotton) Export	"	65,833.33	-	-	110,000.00	-	-	110,000.00	30,000.00	27.27
Total										
Grand total		**1,382,042.59**	**500213**	**36.20**	**1,502,412.93**	**773006**	**51.42**	**1,502,412.93**	**869517**	**57.85**

Appendix 1-A, Continued

Article		Month						
		May			June			
spinning	U.M	Planned	Actual	%	Planned	Actual	%	
100 % cotton Yarn	Kg	91,324.89	25058	27.44	2,496,118.93	1338488	53.62	
P/C OR /& POLYESTER	"	15,689.04	5714	36.42	1,612,412.93	2111494.6	130.95	
Total								
Weaving	Mt							
100% COTTON GREY FABRIC	"	391593.00	71326.00	18.21	6182552.79	4509217.80	72.93	
P/C GREY FABRIC	"	50,402.00	52513	104.19	10,291,084.65	7959201	77.34	
Total								
Finishing	Mt							
100% COTTON	"	79,300.00	-	-	84,468.00	1,027.00	1.22	
Dyed	"	154202.00	5435.00	3.52	158848.00	20984.00	13.21	
Printed	"	218356.00	182708.90	83.67	470,390.00	150,310.00	31.95	
P/C OR & 100% POLYSTER	"	495810.00	210650.90	42.49	517378.00	233483.00	45.13	
GREY FABRICS (100% cotton) Export	"	110,000.00	-	-	110,000.00	-	-	
Total								
Grand total		**1,606,676.93**	**553406**	**34.44**	**21923253.3**	**16324205.6**	**30.25**	

Appendix 1-B, Production performance for 2002 E.C

Article		**July**			**August**			**September**		
Spinning	U.M	Planned	Actual	%	Planned	Actual	%	Planned	Actual	%
100 % cotton Yarn	Kg	105,907.85	29602	27.95	29,428.00	22577	76.72	38,284.00	19109	21.64
P/C OR /& POLYESTER	"	18,340.01	6876	37.49	5,776.00	3,051	52.82	17,328.00	5058	29.19
Total										
Weaving										
100 % cotton Yarn	Mt	421043.00	73746.00	17.52	75092.00	56271.00	74.94	272431.00	88134.00	32.35
P/C GREY FABRIC	"	439,383.01	80622	36.36	10,980.00	28155	256.72	39,838.00	9904	24.86
Total		860,426.01	154,368.00	17.94						
Finishing										
100% COTTON	Mt	40,001.00	4,977.00	12.44	6,768.00	13,333.00	197.00	20,303.00	4,446.00	21.90
Bleached Canvas	"									
Half bleached chesse	"									
Dyed	"	235000.00	37230.20	15.84	31458.00	10691.00	33.98	70615.00	28492.00	40.35
Printed	"	308333.00	84800.00	27.50	54139.00	46332.20	85.59	239274.00	34739.00	14.52
P/C OR & 100% POLYSTER	"	50833.00	24780.50	48.75	7919.00	12531.00	158.24	47512.00	5915.00	12.45
GREY FABRICS (100% cotton) Export	"	135,917.00	-	-	5,001.00	-	-	77,003.00	5,062.00	6.57
Total										
Grand total										

Appendix 1-B, Continued

Article		**October**						**December**		
Spinning	U.M	Planned	Actual	%	Planned	Actual	%	Planned	Actual	%
100 % cotton Yarn	Kg	80,927.00	55083	68.07	77,249.00	58759	76.06	77,249.00	82765	107.14
P/C OR /& POLYESTER	"	15,884.00	5068	31.91	15,162.00	2980	19.65	15,162.00	5260	34.69
Total										
Weaving										
100 % cotton Yarn	Mt	320304.00	166719.00	52.05	305901.00	228070.00	74.56	305901.00	241352.00	78.90
P/C GREY FABRIC	"	46,780.00	16951	36.24	44,652.00	0	-	44,652.00	23604	52.86
Total										
Finishing										
100% COTTON	Mt	329,501.00	158,291.90	48.04	334,522.00	219,338.00	65.57	314522.00	324274.00	103.10
Bleached Canvas	"									
Half bleached chesse	"									
Dyed	"									
Printed	"									
P/C OR & 100% POLYSTER	"	43552.00	25535.00	58.63	383790.00	252124.00	65.69	49,268.00	23,016.00	46.72
GREY FABRICS (100% cotton) Export	"	73,753.00	1,910.00	2.59	73,128.00	24,180.00	33.07	105,128.00	29,489.00	28.05
Total										
Grand total										

Appendix 1-B, Continued

Article	U.M	Month								
		January			February			March		
spinning		Planned	Actual	%	Planned	Actual	%	Planned	Actual	%
100 % cotton Yarn	Kg	91963	65774	71.52	88284	71253	80.71	91,963.00	88252	95.96
P/C OR /& POLYESTER	"	18,050.00	3166	17.54	17,328.00	3670	21.18	18,050.00	9847	54.55
Total										
Weaving	Mt									
100% COTTON GREY FABRIC	"	363503.00	173171.00	47.64	350262.00	196764.00	56.18	363503.00	285538.00	78.55
P/C GREY FABRIC	"	53,156.00	11582	21.79	51,028.00	2252	4.41	53,156.00	5236	9.85
Total										
Finishing	Mt									
100% COTTON	"	374,432.00	168,543.00	45.01	379,454.00	249239	65.68	374,432.00	328,296.00	87.68
Dyed	"									
Printed	"									
P/C OR & 100% POLYSTER	"	58654.00	25233.00	43.02	56308.00	25862.00	45.93	58654.00	27887.00	47.54
GREY FABRICS (100% cotton) Export	"	75,678.00	54,467.00	71.97	117,003.00	30,022.00	25.66	75,628.00	-	-
Total										
Grand total										

Appendix 1-B, Continued

Article		Month								
		April			May			June		
spinning	U.M	Planned	Actual	%	Planned	Actual	%	Planned	Actual	%
100 % cotton Yarn	Kg	88,284.00	82802	93.97	91,963.00	77846	84.65			
P/C OR /& POLYESTER	"	17,328.00	8191	47.27	18,050.00	8568	47.47			
Total										
Weaving	Mt									
100% COTTON GREY FABRIC	"	349100.00	221396.00	63.42	363803.00	198273.00	54.50			
P/C GREY FABRIC	"	51,028.00	350	0.69	51,156.00	20235	38.07			
Total										
Finishing	Mt									
100% COTTON	"	359,454.00	241,161.00	67.09	374,429.00	286,116.94	76.41			
Dyed	"									
Printed	"									
P/C OR & 100% POLYSTER	"	56308.00	183.00	0.32	58654.00	300.00	0.51			
GREY FABRICS (100% cotton) Export	"	75,003.00	-	-	75,628.00	43,763.00	57.87			
Total		**490,765.00**								
Grand total										

Appendix 2-A, Labor productivity in 2001 E.C

Month	Utilized Mandate	Actual Prod	Labor Productivity
July	23802	11051886	464
August	25728	10743071	418
October	22098	6169016	279
November	23080	300260	13
December	24639	5373870	218
January	22852	4789535	210
February	22782	5256797	231
March	22962	6242648	272
April	23303	11499445	493
May	11739	4159680	354
June	23922	4309812	180
Total	**246907**	**69896017**	**3132**
Average	**22446**	**6354183**	**283**

Appendix 2-B, Labor productivity Analysis in 2002 E.C

Month	Utilized Mandate	Actual Prod	Labor Productivity
July	22658	2576087	114
August	1279	1802692	1410
September	17715	1970910	111
October	17063	3623188	212
November	19745	4474238	227
December	22947	8097426	353
January	21764	5339637	245
February	19359	13437063	694
March	22901	18776700	820
April	19124	32213763	1685
Total	**184554**	**92311703**	**5871**
Average	**18455**	**9231170**	**500**

Appendix 3-A, Utilized and unutilized manpower for 2001 E.C

S/N	Month	Working days	Man power	Total mandate	Utilized Mandate	Unutilized Mandate	% of utilization
1	July	25	1069	26,725	23802	2,923	89
2	August	27	1079	29,133	25727.5	3,406	88
3	October	26	1079	28,054	22097.8	5,956	79
4	November	26	1067	27,742	23080.1	4,662	83
5	December	26	1065	27,690	24639.3	3,051	89
6	January	25	1028	25,700	22852	2,848	89
7	February	25	1029	25,725	22782	2,943	89
8	March	25	1030	25,750	22962	2,788	89
9	April	25	1021	25,525	23302.9	2,222	91
10	May	14	1013	14,182	11739	2,443	83
11	June	26	1009	26,234	23922.4	2,312	91
Total		**270**	**11489**	**282,460**	**246907**	**35,553**	**87**
Average		**25**	**1044**	**25678**	**22446**	**3232**	**87**

Appendix 3-B, Utilized and unutilized manpower for 2002 E.C

S/N	Month	Working days	Man power	Total mandate	Utilized Mandate	Unutilized Mandate	% of utilization
1	July	27	984	26568	22657.9	3910.2	85
2	August	8	987	7896	1278.5	6617.5	16
3	September	24	986	23664	17715	5949	75
4	October	22	981	21582	17063	4519	79
5	November	24	980	23520	19745.3	3774.8	84
6	December	27	967	26109	22947.3	3161.8	88
7	January	23	963	22149	21763.7	2311.3	98
8	February	23	954	21942	19359.3	2583.8	88
9	March	26	951	24726	22900.75	1825.25	93
10	April	25	953	23825	19123.63	3748.38	80
Total		**229**	**9706**	**221981**	**184554**	**38401**	
Average		**23**	**971**	**22198**	**18455**	**3840**	**83**

Appendix 4-A, Medication and its expenses (2001E.C)

S/N	Month	Work Accident		Sickness		Total (A+C)	Total (B+D)
		No of Pt	No of days	No of Pt	No of days		
		A	B	C	D	E	F
1	July	11	55	639	1065	650	1120
2	August	26	88	763	1013	789	1101
3	October	6	30	546	1145	552	1175
4	November	7	33	667	1251	674	1284
5	December	10	24	569	845	579	869
6	January	14	81	501	774	515	855
7	February	10	35	548	1000	558	1035
8	March	16	39	555	903	571	942
9	April	17	44	606	862	623	906
10	May	3	6	177	349	180	355
11	June	17	50	567	924	584	974
Total		**137**	**485**	**6138**	**10131**	**6275**	**10616**
Average		**12**	**44**	**558**	**921**	**570**	**965**

Appendix 4-B, Medication and its expenses (2002 E.C)

S/N	Month	Work Accident		Sickness		Total (A+C)	Total (B+D)
		No of Pt	No of days	No of Pt	No of days		
		A	B	C	D	E	F
1	July	7	46	384	696	391	742
2	August	6	15	300	513	306	528
3	September	2	7	253	422	255	429
4	October	4	16	627	1178	631	1194
5	November	8	18	751	1369	759	1387
6	December	19	54	683	1183	702	1237
7	January	6	14	412	693	418	707
8	February	14	29	489	821	503	850
9	March	9	16	503	635	512	651
10	April	7	36	399	706	406	742
11	May						
Total		**82**	**251**	**4801**	**8216**	**4883**	**8467**
Average		**8.2**	**25.1**	**480.1**	**821.6**	**488.3**	**846.7**

Appendix 5-A, Training provided in 2001 E.C

Month	Plan	Female	Male	Total
July		5	1	6
August				
October				
November				3
December			3	3
January			3	
February				
March			4	4
April				
May				
June			3	3
Total		**5**	**14**	**19**

Appendix 5-B, Training provided in 2002 E.C

Month	Plan	Female	Male	Total
July			13	13
August			4	4
September				
October				
November		2	4	6
December			3	3
January			1	1
February			4	4
March			4	4
April			2	2
May				
Total		**2**	**35**	**37**

Year	No trainee
2001	19
2002	37
Total	**56**
Average	**2.54**

Appendix .6

ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

DEPARTMENT OF MECHANICAL ENGINEERING (INDUSTRIAL ENG. STREAM)

Diagnosis and Modeling of Productivity Improvement in Ethiopian Textile Industries

Dear Participants;

With sincerity we would like to extend our deep appreciation to your company and the staff for the willingness and cooperation in undertaking this valuable research. We ask your kind cooperation in answering the questions as truthfully as possible and your response will be highly confidential.

This questionnaire is developed to conduct a scientific research by one of our student, **Mr. Dessie Takele** on "Diagnosis and modeling of productivity improvement in Textile Industries"

For other questions pertaining to this project, please contact Addis Ababa University, Faculty of Technology, and Department of Mechanical Engineering. Tel: +251111232414, P.o.box 385

Thank you for your assistance!

I. Personal data *(not necessary to write your Name!)*

- Current position (GM, Production Head, shift leader, etc) _____
- Qualification_____
- Service year _____
- Gender _____

II- Organizational Information

1. Does the organizational structure create suitable working environment?
   Yes 38% No 62 %
2. Does the company set its goals and targets for its performance? Yes 69 % No 31 %
3. Does the company evaluate its performance activities regularly? Yes 23% No 77%
4. Does the company identify problems of performance improvement?
   Yes 28 %No 72%
5. Does the company provide incentive based on performance for its operators?
   Yes 68 % No 32%

III. Financial Performance of the Company

1. Does the company have working capital problems? Yes 72% No 28%

2. Is the company's profit increasing for the last three years (1999, 2000, 2001 E.C)? Yes 68 % No 32 %

3. Has the company's market share increased for last three years (1999, 2000 &2001 E.C)? Yes 54% No 46 %

4. What are the factors believed to be the reason to increase or decrease sales of the company during 1999~2001?

- Increasing factors

  Market demand, product quality, export policy, state of the art etc

- Decreasing factors

  Shortage of raw material, excessive waste, high production cost, lack of working capital, poor working condition, aged machinery, maintenance problem etc.

- **IV. Productivity**

1. Does the company have Productivity Improvement Program? Yes 21% No 79%

2. Does the company determine its resource (labor, materials, machines, etc) utilization rate? Yes 35% No 65%

3. Does the company identify and recognize the productivity problems? Yes 48% No 52%

If the answer is yes, what are they? Shortage of raw material, excessive waste, production cost, working capital, working condition, aged machinery, maintenance problem etc

4. Does the employees in the company aware about productivity improvement?

Yes 24 % No 76%

5. What are the reasons for not being fully operational? (Select one or more of the following).

- Raw material shortage 36 %
- Shortage of spare parts 22 %
- Lack of market 5 %
- Working capital shortage 16 %
- Frequent machinery breakage 17 %
- Government rules and regulation 4 %

6. Which is the major problem of the company among the following?

- Marketing Management 6 %
- Production Management 11%
- Quality Management 13%
- Cost Management 30%
- Maintenance Management 23%
- Material Management 17%

❖ **Labor productivity**

8. How labor productivity measured in your company?

No of pieces/ labor hours, outputs/labor hour etc.

9. Are the company's work standards compared with both national & international standards? Yes 27% No 73%

10. How do you rate the productivity of the following workforces? (Tick the rating level in the box)

Work forces	High	Medium	Low
Top manager's level	7 %	41 %	52 %
Middle manger's level	13 %	57 %	30 %
Experts' level	12 %	53 %	35 %
Supporting staff	11 %	45 %	44 %
Shop floor level	8 %	73 %	19 %

12. Do you have "standard time" for each Textile style for all tasks required?

Yes 16 % No 84 %

❖ **Machine Productivity**

13. What are the reasons of machine failure?

Lack of preventive maintenance 33 % Spare part problem 26 %

Due to aging of machines/ equipments 16 % Skill problem 13 %

Improper handling of machines 12%

14. What is the lead time to obtain spare parts? From abroad 4-9 months

15. No of employees training per annum.

Mode of Training	Number of Persons per Annum
Foreign	8 %
Local	27 %
In house	65 %

❖ **Material productivity**

16. Please give the average percentage of the rework, defects, and scrap in the production process.

- Rework 45 % Defects 26 % Scraps 29 %

17. Does the company calculate the cost of quality? Yes 7 % No 93 %

V. Maintenance Policy

1. Is the equipment in the factory where preventive maintenance is to be carried out identified? Yes 37% No 63 %
2. Is preventive maintenance interval determined? Yes 44% No 56 %
3. Is Equipment failure loss for Spinning, weaving, and finishing machines measured thoroughly? Yes 38 % No 62 %
4. Is Set up and adjustment loss measured thoroughly? Yes 15 % No 85 %
5. Is minor stoppage and idling loss measured thoroughly? Yes 34 % No 66 %
6. Is defect and rework loss measured thoroughly? Yes 31% No 69 %

7. How do you evaluate the technology level of your company compared to others?

Low 48 % Medium 36 % High 7 % don't know 9 %

8. How do you evaluate the working culture of your company employee compared to others? Poor 47 Medium 44 % High 9 %

VI. Quality Practices in the company

1. What is the quality awareness level in the company?

High 23 % Moderate 35 % low 42 %

2. How high is your role and participation in quality activities?

High 31 % Moderate 46 % low 23 %

3. Does the company recognize & solve the quality related problems?

Yes 22 % No78 %

5. Does the company identified customer requirements? Yes 63 % No 37 %

6. Are objectives of the company linked to customer needs and expectations?

Yes 32 % No 68 %

7. Indicate, what is the current estimated customer satisfaction level in your company.

95 – 100% - 90 – 95% 7% . 85 – 90% 3 % 70 – 80% 56% don't know 34%

8. Are there inspection & tests for incoming, in-process and final products?

Yes 86 % No 14%

10. Does the company have quality management system (TQM, ISO 9000 QMS, etc)?

Yes 18% No 82 %

11. Does the company have customer's complaints handling mechanism?

Yes 21 % No 79 %

VII. Quality of Work Life in the company

1. Do you have the right materials handling equipments? (For safety and efficiency)

Yes 25 % No 75 %

2. Is the physical working environment suitable for workers? Yes 38 % No 62 %

3. Does the organizational structure create suitable working environment?

Yes 38 % No 62 %

VIII. Status of Inventory Control/Management in the Company

1. Access to the raw materials:

Own made 6 % Locally purchased 32 % Imported 28 %

Partially Imported 34 %

2. If the raw materials locally supplied then, what are the problems with local inputs?

Lack of inputs/ raw materials 39 % Inferior quality 27 %

Problem with reliability 10 % High cost of inputs relative to imported 24 %

4. Are you purchasing raw materials in economical quantities? Yes 37 % No 63 %

5. How the Company ensure the quality of goods (raw materials) from your suppliers?

Inspection 97 % Auditing ☐ ISO certification ☐ Performance measurement ☐

Other ☐ ----------

6. Please tell us if any of the following issues are a problem for performance improvement; please judge its severity as an obstacle on four point scale

(0 = No obstacle, 1= minor obstacle, 2 = moderate obstacle, 3 = major obstacle, 4 = very severe obstacle).

S/N	Type of problem	0	1	2	3	4
a	High production cost			25%	27%	48%
b	Old technology (machines, methods, etc)		3%	9%	31%	57%
c	Less diversified production		23%	52%	23%	2%
d	Poor quality & shortage of raw materials		6%	21%	36%	37%
e	Wastage of time, materials, etc		11%	43%	29%	17%
f	Manpower problems (shortage, low skill)		30%	35%	21%	14%
g	Poor management	1%	13%	18%	42%	26%
h	Poor inventory control system		34%	37%	20%	9%
i	High lead times (production & order)	6%	34%	25%	17%	18%
j	Shortage of working capital		7%	19%	48%	26%
k	Low demand for the products	5%	31%	36%	24%	4%
l	Poor layout of the facilities		47%	28%	14%	11%
m	Low resource utilization		12%	27%	35%	26%
n	Poor working conditions		6%	39%	33%	12%
o	If other, specify					

IX. Performance (Efficiency and Effectiveness) evaluation practices in the Company

1. The importance of performance measurement/evaluation for decision making in your company is;

Extremely Low 12 % Low 27 % Middle 38 % High 13 % Extremely High

2. Is your performance measurement/evaluation system computer-based?

Yes 2 % No 98 %

3. How often should the performance evaluation be reported?

Weekly 24 % Monthly 76 % Yearly 76% other □----------

THANK YOU FOR RESPONDING ALL THE QUESTIONS!

Appendix 7

List of inclusive textile companies in the study

S/N	Name of the company	Type of Products	Location	Telephone
1	Awassa Textile S.Co	Textile	Awassa	0462201330 0912107334
2	KK PLC	Acrylic yarn, Blanket	Akaki kality	0115159015 0911428235
3	DH Geda Textile	Blanket	Akaki kality	0114351205 0911129413
4	Shoa Cotton	Ginnery	Akaki kality	0911409279
5	Adei Ababa Yarn S.C	Yarn, Finishing, Knitting,	Addis Ababa (saris)	0114423455 0911359953
6	Ethiopian sewing thread S.C	Sewing threads	Addis Ababa (saris)	0114424968
7	Africa Cotton PLC	Knitting	Addis Ababa (saris)	0114404864 0911146805
8	Edget Yarn	Ginnery, Yarn	Addis Ababa (sarbet)	0912004344