PRODUCTIVITY MEASUREMENT IN A SMALL AND MEDIUM-SIZED MANUFACTURING COMPANY IN GAZİANTEP

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ABSTRACT

PRODUCTIVITY MEASUREMENT IN A SMALL AND MEDIUM-SIZE MANUFACTURING COMPANY IN GAZIANTEP

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In this thesis, a study on the productivity measurement in a small and medium-size manufacturing company is presented. An application is performed at two departments of a medium-size textile manufacturing company in Gaziantep.

The ultimate motivation of this study is the data collection required in order to determine productivity measures. To achieve this, daily production reports are prepared and filled in May 1998. Three basic types of the productivity indicators; partial productivity, total-factor productivity, and total productivity measures are calculated.

A computer program is written using Delphi 3.0 client/server programming language in order to prevent more paperwork and provide quick monitoring of the required productivity measures. Productivity measures are evaluated by storing and compiling all the data collected by the program.

Keywords: Productivity Measurement, Partial Productivity, Total-Factor Productivity, Total Productivity

ÖZET

GAZİANTEP'TE KÜÇÜK VE ORTA BÜYÜKLÜKTEKİ BİR ÜRETİM FİRMASINDA VERİMLİLİK ÖLÇÜMÜ

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Bu tezde, Gaziantep'te küçük ve orta büyüklükteki bir üretim firmasında verimlilik ölçümüne ait çalışma sunulmuştur. Orta ölçekli bir tekstil fabrikasının iki departmanında uygulama yapılmıştır.

Bu çalışmanın temelini, verimlilik ölçümlerinin hesaplanmasında kullanılacak verilerin elde edilmesi oluşturmaktadır. Bunu sağlamak amacıyla, günlük üretim raporları düzenlenmiş ve Mayıs 1998 ayına ait veriler derlenmiştir. Verimlilik göstergelerinin üç ana çeşidi olan kısmi verimlilik, toplam-faktör verimliliği ve toplam verimlilik ölçümleri hesaplanmıştır.

Dokümantasyon işlemlerini kolaylaştırmak ve gerekli verimlilik hesaplamalarını kolay elde edilebilmek için, Delphi 3.0 programlama dili ile bir program yazılmıştır. Bu programda gerekli veriler depolanıp derlenerek verimlilik hesaplamaları yapılmıştır.

Anahtar Kelimeler: Verimlilik Ölçümü, Kısmi Verimlilik, Toplam-Faktör Verimliliği, Toplam Verimlilik.

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CHAPTER ONE

1. INTRODUCTION

There is a close relationship between economic development and manufacturing industry in a country. One way of growth of manufacturing companies is to perform higher levels of productivity ratios. Increases in productivity are the main determinant of economic growth, and thus of increases in the standards of living.

Most organizations have more than one goal. In many business, profit maximization is considered to be a primary goal; but without a satisfactory level of productivity a profit-oriented organization cannot survive.

Today, productivity is accepted to play a vital role in economic development and national welfare. In underdeveloped countries, as well as in developed countries, whether they apply market system or centrally planned system, the base of the economic development is the increasing productivity. In order to increase productivity one should initially determine the productivity measures.

In this thesis, required parameters are defined and then compiled in order to determine productivity parameters.

In this chapter, productivity and its affects on the standard of living are defined. Chapter two is about the literature survey related to the productivity. In chapter three, concepts and definitions are presented and types of the productivity measures are explained. Productivity measurement and analysis models are explained in chapter

four. Chapter five covers a productivity measurement application in a textile manufacturing company. Chapter six contains discussion and conclusions derived from this research. In chapter seven, appendices are given, i.e. production reports prepared, and some views on running the program.

1.1 WHAT IS PRODUCTIVITY?

Productivity may be defined as the ratio between output and input; i.e,

$$\text{Productivity} = \frac{\text{Output}}{\text{Input}} \qquad 1.1$$

This definition applies to either an enterprise, an industry or an economy as a whole.

A general definition of productivity is that the relation between the output generated by a production or service system and the input provided to obtain this output.

Generally speaking, productivity could be considered as a comprehensive measure of how organizations satisfy the following criteria: [1]

→ Objectives : the degree to which they are achieved.
→ Efficiency : how efficiently resources are used to generate useful output.
→ Effectiveness : what is achieved compared with what is possible.
→ Comparability : how productivity performance is recorded over time.

For any given good, price is a given parameter for customers. The consumer will want to minimize the price he must pay so that he can maximize the total satisfaction he derives from his limited income. The consumer will also want to buy the same good in higher quality with the same price or he will prefer the similar goods

in equal quality, but with lower price. This will cause a competition among the sellers that produce goods which are relatively close substitutes to each other. Therefore, producers or service providers must efficiently use the resources -labour, capital, land, material, energy and information- in the production of various goods and services.

Higher productivity means accomplishing more with the same amount of resources or achieving higher output in terms of quality with the same input. If you produce more output with the same input, unit cost of the goods or services will therefore be reduced. In the case of achieving higher output in terms of quality, your goods or services will be preferred by the consumers. This shows that there is a close relationship between the price and the quality of goods and the productivity concept. If the rate of production has risen from 50 units per hour per person to 60 units per hour per person, productivity has risen 20 percent. If 50 units were produced last month and 50 units of higher quality output are produced today, productivity has also risen, although the measurement of it is more difficult.

The reasons behind the productivity in production of goods or services cannot solely be identified as reducing the price and/or increasing quality of goods or services. Inflation rate is said to be a continuing increase in the prices of goods or services. In Turkey, inflation rate has unfortunately reached to a near three-digit number [2]. One of the keywords, causing higher level of inflation rate is the decreasing productivity in Turkey.

Productivity is not only a technical and managerial problem. It is also a matter of concern to government bodies, trade unions, and to other social institutions. Productivity is a comparative tool for the managers, industrial engineers, economists and politicians. Production at different levels of the economic system can be compared with the resources consumed. The more different their goals are, the more

different their definitions of productivity. For example, a Chinese General is said to state the following properties of productivity: [3]

To improve productivity, you must manage.

To manage effectively, you must control.

To control consistently, you must measure.

To measure validly, you must define.

To define precisely, you must quantify.

Measurement of overall productivity is too complex to say "the overall productivity of the firm is a certain number, such as 90 percent, 70 percent, etc. One can say that his firm has 75 percent of labour productivity index, while the does 70 percent. But according to the given numbers we cannot conclude that the first firm has higher productivity unless both firms apply the same productivity measurement model.

The foundation of the productivity measurement is the data collection. Every step of production must be recorded and if exists it can be compared with the previous records. This can be achieved by using forms, schedules etc. So a control mechanism is required to collect the data for productivity studying purposes. Measurement and improvement productivity require a team study and include all the personnel in the company. First of all, the importance of the productivity studies should be understood by everyone in the company. To do this, seminars and courses about productivity can be arranged to make the personnel grasp the meaning of productivity. The measurements will have provide data for comparing actual outputs and resources usage with the planned inputs and outputs.

1.2 STANDARD OF LIVING

Productivity is always considered as one of the most important elements in determining the long-run success of a manufacturing firm. At the national level, a deterioration in productivity can lead to relatively low economic growth rate, high inflation, and an unfavourable balance of international payments [4]. Ultimately, this will have severe impacts on standard of living. It has been stated that the living

standard of a country is a function of its productivity and its natural resources. Other factors also come into play, but they do not override these two basic components. It seems not much can be done about natural resources; it is productivity which must be altered [1].

The standard of living of any man is the extent to which he is able to provide himself and his family with the things that are necessary for sustaining and enjoying life. The standard of living, that is minimum satisfactory life quality, is directly related to the productivity improvements [5]. This relation is explained in section 1.3 under the title of "Minimum Satisfactory Standard of Living".

The standard of living of the representative man or family in different nations or communities of the world varies greatly. A poor man in the United States and in some countries of Western Europe would be a rich man in other countries. The countries in which the ordinary man and his family are able to enjoy not only all the necessities for a healthy life but also many things which might be classed as luxuries, are still very few. In too many parts of the world the ordinary man is hardly able to obtain even the necessary things. He and his family are rarely able completely to satisfy their hunger, to dress up themselves properly or to enjoy housing conditions in which they can be comfortable and healthy [5].

It is stated that productivity is a key to Americans' standard of living since greater efficiency means businesses can increase wages without raising prices as workers are producing more in the amount of time [6].

1.3 MINIMUM SATISFACTORY STANDARD OF LIVING

Necessities of a minimum decent standard of living are [5]:

a. Enough food every day to replace the energy used in living and working (*Food*);
b. Enough clothes in order to permit bodily cleanliness and afford protection from the bad weather conditions (*Clothing*);
c. Housing of a standard to give protection under healthy conditions (*Housing*);
d. Sanitation and medical care in order to give protection against disease and treatment in illness (*Hygiene*);
e. Security against robbery or violence, against loss of the opportunity to work, against poverty due to illness or old age (*Security*);
f. Education to enable every man, woman and child to develop to the full their talents and abilities (*Education*)

Food, clothing and housing are generally the things which a man has to obtain for himself. In order to have them he must pay for them, either in money or work. Hygiene, security and education are public goods and generally matters for governments and other public authorities. The services of public authorities have to be paid for, generally by individual citizens through taxation, so each man must earn enough to pay his contribution to the public services as well as to support himself and his family.

The greater the amount of goods and services produced in any community, the higher its gross national product (GNP) and its average standard of living will be.

Two of the main ways of increasing the amount of goods and services produced are to increase employment and resources, and to increase productivity.

If in any community there are labours who are able and want to work, but are unable to find full-time work, the output of goods and services can be increased, when0 full-time productive work is provided for them, i.e. if employment can be increased production of goods and services will also be increased. Whenever there is unemployment or underemployment, efforts to increase employment become very important and should go hand in hand with efforts to increase the productivity of these employed workers. (Here, we primarily concern with the task of productivity increase of labour force)

We can have-

- more and cheaper ***food*** by increasing the productivity in **agriculture;**
- more and cheaper ***clothing*** and ***housing*** by increasing the productivity of industry
- more ***hygiene, security*** and ***education*** by increasing **overall** productivity and earning power.

CHAPTER TWO

2. LITERATURE SURVEY

A survey of available literature on the "Productivity Measurement Analysis" is presented here. Studies on the productivity measurement models are so few that you may count by your fingers. The classification of the productivity measurement and improvement models is very difficult because of the following reasons [3]:

a. Productivity is an inter-disciplinary subject and this is why productivity measurement models have different approaches: generally speaking, economists', engineers' and accountant's approaches.

b. Some models are original and some others are developed based on the original models. (Surrogated Models)

c. Because of being inter-disciplinary, models are too difficult to be applicable and therefore no significant developments in the models have been achieved.

d. The models are mostly based on the American, British, French and Japanese approaches which differ from each other.

- **Norman and Simcha Bahiri's Classification of Productivity**

Norman and Bahiri [7] have defined three categories for the Productivity Audit Models (PAM)

a) Accountant's approach
b) Economist's approach
c) Engineer's approach

They developed a model that consists of the combination of the three approaches and called "Integrated Productivity Model" that is later developed by the Alan Lawlor.

- **Scott Sink, Sandra J. De Vries and Thomas Tuttle's Classification of Productivity**

Authors examined the existing productivity models and defined four base approaches related to the productivity measurement. These approaches are given below [3].

1. Multi-Factor Productivity Measurement Model
2. Normative Productivity Measurement Model
3. Multi-Criteria Performance / Productivity Measurement Model
4. Secondary (Subordinate) Productivity Measurement Model

- **Sumanth Model**

This model is developed in 1979 by Sumanth, D. J. -professor at Miami University and an organizer at Miami Productivity Center-. The model is product focused. He categorized three types of productivity measures as [8]:

1. Partial Productivity Measurements,
2. Total-Factor Productivity Measurement,
3. Total Productivity Measurements.

- **Productivity Indicators Used by Major US Manufacturing Companies: The Results of a Survey**

Sumanth, D. J has surveyed and presented the type and nature of productivity indicators used in 17 typical functional departments of some industrial companies in The United States. His study is based on the results of this survey. A questionnaire was sent to 1000 largest industrial corporations that were asked to list two most useful productivity indicators they used in 17 functional departments: manufacturing, sales, marketing, purchasing, personnel, finance/accounting, legal, engineering, research and development, maintenance, industrial engineering, data processing, administration, word processing, distribution, warehousing, and planning.

Observations were based on completed questionnaires from 61 industrial corporations. As a result of this survey, productivity indicators reported by those corporations were compiled in four categories. These categories are: partial productivity indicators, total-factor productivity indicators, total productivity indicators, and other non-standard productivity indicators that include all those categories which do not qualify to be in the first three categories.

The distribution of the most commonly used productivity indicators in manufacturing companies are reported as follows: [8]

Type	Percentage of times mentioned
Partial Productivity Measures	41.1
Total-Factor Productivity Measures	1.4
Total Productivity Measures	2.7
Other Non-standard Productivity Measures	54.8

The result above shows that, though the companies seem to think that they have "productivity" measures, what they mean by "productivity" seems to be quite different from the formal meaning of the productivity.

On the other hand, in industrial engineering function, the distribution of the most commonly used productivity indicators interestingly reveals that none of them were in categories of partial productivity, total-factor productivity, or total productivity. All of them were categorized as non-standard productivity measures.

Another critical result of the survey is that among partial, total-factor and total productivity indicators the partial productivity indicators appeared to be the most popular. Unfortunately, partial productivity indicators can be quite misleading when they are used indiscriminately. For example, output per man-hour is one of the most frequently used labour productivity measure among the partial productivity indicators; however output per man-hour can mislead a company's management, if its increases are not viewed side by side with the changes in other partial productivities. A company may have used more technologically advanced equipment for a particular machining operation, therefore output per man-hour is increased, while it requires more skilled labour and hence greater labour cost. But at the same time, the greater expense of the equipment may have raised the depreciation so much that the dollar value of output per dollar of capital expense may have actually decreased much more than the increase in dollar value of output per dollar value of labour input. This may cause an increase in the total unit manufacturing cost even though the unit labour cost may have been reduced. Here, the goal is to gain a greater market share without sacrificing profits or to increase it without changing the selling price. Any productivity indicators which are used by a company should serve to accomplish this goal. Total productivity indicators are ideal in this respect, since denominator of the total productivity indicators includes all the inputs consumed in the production of goods and services. In the example above, change in the total productivity measure will actually reveal the situation achieved.

- **Relations between Productivity, Employment and Wages in Turkish Manufacturing Industry Since 1970**

The relationships between value added, wages, and employment in Turkish manufacturing industry between 1970 and 1991 are examined by Şenesen, Ü. & Erol, M. [9].

The manufacturing industry in Turkey produced 15-16 % of gross national product (GNP) during the 70s. In the first half of the 80s, this share reached to a level of 17-20 % and since 1986 it was around 22-23 %. The ratio between the number of employees in manufacturing industry and the economically active population was 8.8 % in 1970, 11.0 % in 1980, and 11.9 % in 1990. This trend shows that the importance of manufacturing industry has been increasing continuously in the last two decades.

According to the results of the study, the level of employment (EMP) in manufacturing industry in 1970 was 500,000 and has monotonously increased with an annual average growth rate of 3.6 % until 1990. EMP reached to 1,000,000 persons in 1990, but it decreased in 1991 by 7.9 % .

- **Productivity in Small and Medium-Sized Business: The Finnish Model**

Korhonen, J. examined the productivity in small and medium-sized enterprises (SMEs) in Finland. He also explained the importance of SMEs in the long-term development and requested to Finnish Productivity experts for an analysis model. A model selected and was then fine-tuned and trained by 50 experienced productivity consultants to carry out the analyses [10]. The analysis charts:

A. Prerequisites for productivity
   - strategy, marketing and sales
   - management and staff
   - product range and individual product structures
   - internal services

- management of operations

B. Productivity

- labour productivity
- raw material productivity
- capital productivity
- energy productivity

C. Productivity and quality

- synergy (combined or co-operative action or force)

They analyzed 300 SMEs in 1994 using the results of this analysis together with an action program.

- **Kotaro Tsujimaro's Model**

Tsujimaro, K. defined a model that productivity is measured as the ratio of production in units to the labour input. Tsujimaro also suggested to measure productivity according to a base of value added per labour input [3].

- **A Performance Measurement Method Which Remedies the "Productivity Paradox"**

Son, Y. K. developed a performance measurement model that is different from the other models. The model is developed in order to solve the productivity paradox some of which are listed below: [11]

→ General Motors Corporation invested more than the gross national products (GNP) of many countries in automation area, but finally conceded that its market had shrunked.

→ A company confessed that although (labour) productivity had increased by about 7 percent over three years, profits remained negligible and market share continued to fall.

→ On the other hand, another company that showed disappointing productivity although it generated handsome profits and cash flows.

In the model, Son proposed a new manufacturing cost system that consists of three costs items: productivity cost, quality cost and flexibility cost.

Productivity cost indicates input to the conventional total productivity measure and can be identified by traditional cost system; conventional direct labour, direct material, and overhead. However, quality and flexibility costs are nontraditional cost items and used as inputs to (total) quality and to (total) flexibility measures, respectively.

Quality cost is typically divided into four categories: preventation, appraisal, internal failure, and external failure. Preventation cost, incurred before defective parts are discovered, includes cost of training workers and salaries of quality control staff. Appraisal costs are those incurred to discover and correct quality problems. They include cost of laboratory tests, quality audits, and field testing. Internal failure cost is incurred when materials fail to meet company's quality standard and includes the cost of scrap and related rework. External failure cost is incurred when inferior quality products are delivered to customers; it consists of the cost of handling complaints and litigation, warranty replacement, and repairs of returned products.

By the term flexibility cost, four nonconventional costs of setup, waiting, idle, and inventory are considered. Setup cost is the cost of preparing machines for each production run. Waiting cost is the opportunity cost of parts waiting in the manufacturing processes, while idle cost is another opportunity cost associated with underutilization of manufacturing equipment. Finally, inventory cost is defined as the cost of carrying or lacking inventory.

Son's integrated manufacturing performance measure is then defined as the ratio of the total output value to the sum of productivity, quality, and flexibility costs.

CHAPTER THREE

3. BASIC CONCEPTS AND DEFINITIONS

3.1 INTRODUCTION

Since "productivity" is one of the "Performance Evaluation Indicators", it is necessary here to explain briefly the performance concept and some performance evaluation indicators.

Performance is the ability to perform capacity in order to achieve a desired result. It may be defined either and/or both quantitatively (amount) and/or qualitatively (quality) or in terms of how close one comes to meeting a target of quantity and quality of output. Some of the performance evaluation indicators are listed below.

a) Yield
b) Efficiency
c) Effectiveness
d) Productivity
e) Quality
f) Working Life Quality
g) Innovation
h) Profitability

Although productivity is a performance evaluation indicator, its concept covers the other performance evaluation indicators. Among the performance evaluation indicators listed above, yield, efficiency, effectiveness, and quality will be briefly explained in this chapter. Nowadays, these four terms have more worth in productivity concept.

3.2 YIELD

It is a measurement for output in a given short time interval; i.e. per minute, per hour, per day etc. Yield is generally used to explain the output capacity of shifts, fabrics, and workshops.

Example: Consider a knitting machine having 100 wefts per minute. The yield of this machine is calculated as follows:

$$\text{Yield} = 100\frac{\text{wefts}}{\text{minute}} \times 60\frac{\text{minutes}}{\text{hour}} = 6000 \text{ wefts/hour}$$

This is the technical yield of the knitting machine. If we add some factors for practical applications; considering labour efficiency, say 20/24, then

$$\text{Yield} = 6000\frac{\text{wefts}}{\text{hour}} \times \frac{20}{24} = 5000 \text{ wefts/hour}$$

Also considering the quality ratio of the product we may add a quality factor; then,

$$\text{Practical Yield} = \text{Technical Yield} \times \text{Labour and Machine efficiency} \times \text{Quality Ratio} \qquad 3.1$$

Here, the quality ratio is defined as the ratio of the number of excepted goods to the number of total goods produced.

3.3 EFFICIENCY

Efficiency, performance evaluation indicator, defines how efficiently resources (inputs) are used to generate useful output

Efficiency tells us how well actually needed output is generated from available input, therefore it indicates the use of available capacity.

$$\text{Efficiency} = \frac{\text{Standard Value (Theoretical)}}{\text{Practical Value (Observerd)}} \quad \text{or;} \qquad 3.2$$

Standard values are determined by the industrial engineering techniques. If standard time for a certain task is given as 2 hours, but if it is performed in 3 hours by a worker, then the efficiency of the worker for this task will be calculated as;

$$\text{Efficiency} = \frac{2\ \text{hours}}{3\ \text{hours}} = 0.666 \text{ namely, } 66.6\,\%$$

3.4 EFFECTIVENESS

It is related with the output and compares present achievement with what could be done, if resources were managed more effectively.

$$\text{Effectiveness} = \frac{\text{Observed Output}}{\text{Planned Output}} \qquad 3.3$$

Efficiency and effectiveness are similar to each other and in most cases they are confused with each other. In short description, efficiency is related to inputs while effectiveness is related to the aims, therefore to the outputs.

3.5 QUALITY

Quality is defined as a standard of goodness and a typical part of something. It can be divided into three main groups.

1) Design quality (Before production)
2) Adaptation quality (During production)
3) Usage quality (After production, during consumption)

There is a close relationship between the price and quality of the produced goods and services. During production, as the quality increases price of the goods and services also increase; i.e. higher quality of output requires more trained labour, expensive design quality, and development in the quality control and testing equipment. This is the cost before sales. After production, produced goods should be accepted by the market. Of course, there will be refusals from the customers, cost of repairs during warranty session. These types of the costs are defined as the cost after sales. It may be concluded that as the quality increases, costs after sales decrease; but costs before sales increase. This relationship is shown in Figure 3.1 [12].

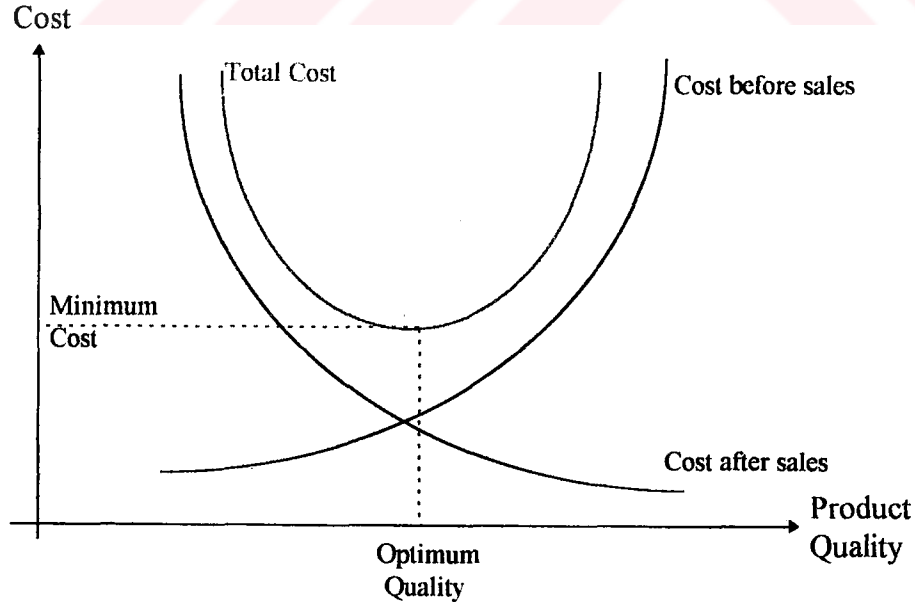


Figure 3. 1 Relationship Between Product Cost and Product Quality

Quality of a product should satisfy the customer needs as economically as possible. This is an important point in order to have more output sold in the market. It is known that low quality outputs cause a scarce in the number of customers. Since productivity is directly related to the output, low quality and/or expensive outputs will shrunk company's market and therefore decrease its productivity.

3.6 PRODUCTIVITY

Productivity is a product focused concept and is the combination of efficiency and effectiveness as well as the concept of yield, quality, working life quality and innovation due to the effect of them on productivity. Today, the meaning of productivity has been considered to be synonym with the performance. It is generally defined as the ratio of output to input. Measuring productivity in a large organization would be easy, if a simple ratio of work output to input could be established. Unfortunately, with contributions coming from many departments and production lines, the simplicity disappears.

3.6.1 OUTPUT CONCEPT IN PRODUCTIVITY

Output for productivity may be in

a) Physical quantities; i.e. tonnes, meters, liters etc.
b) Monetary terms; i.e. net national income, value of total sales, total profit, gross national product (GNP), value added, etc.

3.6.2 INPUT CONCEPT IN PRODUCTIVITY

What are the inputs to be considered in productivity measurement?

It can be classified into five categories, these are:

1) Labour
2) Capital
3) Raw material and other materials
4) Energy (Fuel, electricity, coal, etc.)
5) Other inputs

Labour

It can be explained either physically by the number of workers, working hours or in monetary terms as the labour cost. The major difficulty in the productivity measurement is the lack of the needed data. Since the labour cost may be easily determined in practice, labour productivity are worth measuring. In labour-hour measurement it is better to use direct hours actually consumed by the work instead of the planned working time such as eight hours per shift.

Capital

In our daily life, by the word "Capital", cash money is understood, but according to the economist's approach, money could not be accepted as the only agent of capital. By the economists' approach money can only be considered as a tool to buy the necessary capital goods.

Capital can be divided into two groups.

1) Working capitals, (Revolving Funds or Money Capital)
2) Fixed Capitals (Physical Capital); i.e. machines, tools, jigs and fixtures, etc.

Raw Material and Other Materials

Raw materials and other materials may be classified as:

1. Direct Materials: Materials that are directly used in the production of good and that form a base structure of the product are known as direct materials; i.e. for a carpenter, wood is the direct material and for a shoe maker direct material is the leather, since they are the main materials of production.

2. Indirect Materials: They are also materials directly used in the production but they are only details in the production; i.e. for a carpenter nail, paint, and glue are good examples to the indirect materials in carpentry.

3. Enterprise Materials: They are not related to the structure of the goods but they are needed during the production; i.e. machine oil, hygienic materials, office equipment, packaging materials, protective and safety equipment, etc.

Energy (Fuel, electricity, coal, etc.)

Energy consumed to produce goods is also considered as an input in the productivity analyses. If energy input has non-homogeneity in units, the combination may be determined by converting them into their equivalent in kilocalories. However, it may be computed by using monetary approach; i.e. their total cost may be determined as an input.

Other Inputs

All the other items, especially bought from outside, that can not be included in the four classes explained above are denoted as the other inputs; i.e. transportation services, etc.

3.7 APPROACHES TO PRODUCTIVITY MEASUREMENT

3.7.1 ACCOUNTANTS' APPROACH

Many of the productivity measures used today are developed by accountants and are based on the financial ratios. Financial ratio analysis includes valuable pointers in terms of liquidity (current ratio), funds and profitability.

In theory, there are no limits to the number of financial ratios that may be derived. Although, 500 or more ratios can be derived, but of course, the important factor is, whether relationship is practical and useful. [13]

Some of the important financial ratios are broadly concerned with "sales return on capital employed" or "profit to asset" ratios. Both may be used as measures of business efficiency and productivity. Some examples of ratios of accountants' measures of productivity are given below: [7]

$$\text{Current (Liquidity) Ratio} = \frac{\text{Current asset value}}{\text{Current liabilities}} \qquad 3.4$$

In this ratio current assets include cash, marketable securities, accounts receivable and useful inventories, while current liabilities are accounts outstanding, bank overdrafts, accrued expenses, and tax liabilities.

$$\text{Inventory turnover ratio} = \frac{\text{Sales value}}{\text{Average inventory}} \qquad 3.5$$

This ratio indicates the number of times that the average inventory is turned over in a given period of time.

$$\text{Return on assets} = \frac{\text{Net profit} + \text{Interests}}{\text{Total assets}} \qquad 3.6$$

$$\text{Return on sales} = \frac{\text{Net profit}}{\text{Sales}} \qquad 3.7$$

Return on sales ratio appraises the efficiency of pricing and the volume of sales that may affect its reliability. Sales in the equation above may be either physically or in monetary terms.

To all those ratios above, Weinstock [7] sets out seven key ratios to control the operational aspects of a decentralized complex. These ratios are as follows:

1. Profit per capital employed,
2. Profit per sales,
3. Sales per capital employed,
4. Sales per fixed assets,
5. Sales per stocks,
6. Sales per employee,
7. Profits per employee.

Finally, having looked at the accountants' productivity measures one can easily conclude that those are sales oriented and hence profit oriented ratios.

3.7.2 ECONOMISTS' APPROACH

Most economists study macro economics rather than the activities at the plant level. In this approach "Labour Time Methods of Measurement" conversion of all input factors into labour time are often used. Adam Smith and Karl Marx [7] converted all materials, depreciation, services and final products consisting of materialized labour into manpower equivalents. This is possible by dividing the output, or input, in financial terms by the current average annual wages.

Two of the economists' measures of productivity indicators -both of them are mostly used- are given below. First of them is,

$$\text{Output per man - year} = \frac{\text{Sales output}}{\text{Total number of employees} + \left[\frac{\text{Capital} + \text{External Expenses}}{\text{Annual Average Earning}}\right]} \qquad 3.8$$

Here, the bracketed ratio in the denominator is called "Materialized Labour".

The index used above is complex and not defined very precisely. An important weakness of this index is that sales output includes bought-out materials, supplies and services. Since these prices also include the profits of the supplying companies, sales figures are quite misleading.

The second method is value added which eliminates the weakness of the "labour time method". The term "value added" or sometimes "added value" means how much value is added to the value of bought-out materials and services during the production processes. Hence, the use of value added ratios excludes the profits of the other supplying companies.

$$\text{Net output per employee} = \frac{VA}{Lm} \qquad 3.9$$

where,

VA: Value added or added value,

Lm: Number of employees.

In some cases "work-hours completed" might be a better unit to use than "number employed" since we are measuring the effectiveness of all the workers. Also, note that total number of employees (Lm) is the sum of the operatives and other employees in units of man-years.

Value added can be determined by either subtracting the external expenses (X) including material costs from the total sales (S) value or directly summing the cost of labour, salary, selling, distribution, administration and profit.

$$VA = S - X \tag{3.10}$$

$$VA = L + Sc + Sa + P \tag{3.11}$$

where,

S: Total sales,

X: External expenses,

L: Labour cost,

Sc: Salary cost,

Sa: Selling, distribution, and administration costs,

P: Profit.

In this equation, total sales is the total value of sales and work done together with the value of stocks at the end of year adjusted for stocks hold at the beginning of the year. External expenses (X) consist of materials bought out, power supplied, fuel and water, packing and supplies, consumable items and tools. In Figure 3.2 value added approach of productivity measure is illustrated.

3.7.3 ENGINEERS' APPROACH

In engineers' approach, productivity is regarded as synonymous with the efficiency [7]. Engineers speak of efficiency of a machine as the ratio of the useful work converted to the energy supplied to generate this useful work.

$$\varepsilon = \frac{O}{I} \tag{3.12}$$

where,

ε : Efficiency

O: Output,

I: Input.

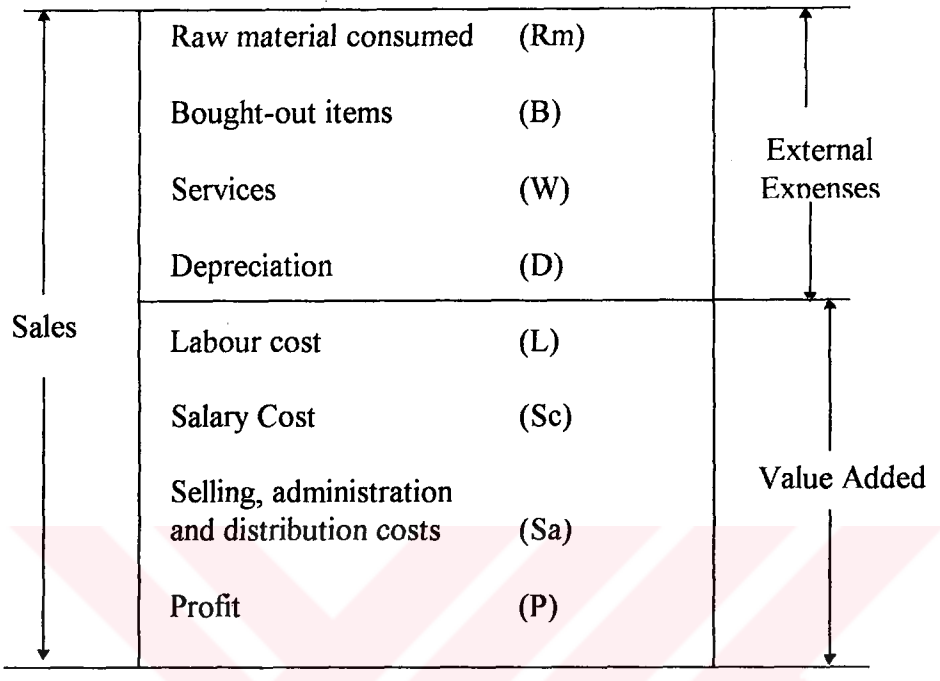


Figure 3.2 Elements of Output Used in Calculating Total Productivity

The above relationship is a version of the normal engineering expression for the efficiency of a machine generally based on the energy conversion. The input can be said to generate the useful output. As the input is converted to the output it can not exceed unity in the physical sense of the relation.

$$\varepsilon = \frac{O}{I} = P$$

$$\varepsilon = \frac{I - L}{I} = P \qquad 3.13$$

$$\varepsilon = \frac{I}{I} - \frac{L}{I} = 1 - \frac{L}{I} = P \leq 1 \text{ in the physical sense} \qquad 3.14$$

where,

ε : efficiency,

P : Productivity,

O : Output,

L : Losses,

I : Input.

In financial terms, the value of outputs must be greater than the total cost of the inputs if the company is to make some profit. Namely;

$$P = \frac{O}{I}$$

$$P = \frac{I + Pr}{I} \qquad 3.15$$

$$P = 1 + \frac{Pr}{I} \qquad 3.16$$

where, Pr is profit and $\frac{Pr}{I}$ is the profit productivity ratio.

This shows that if company makes some profit then productivity will be greater than unity. However, if the company is in loss from its production it is obvious that productivity will be less than unity. Here, as the profit or profit productivity ratio increases productivity increases.

From the expressions above two productivity-efficiency ratios can be defined.

1. Useful output generation by input (useful output / input)
2. Utilization of systems inputs (effective input / actual input)

General definition of the productivity, output per input, has a variety of names according to the structure of the ratio. For example, if one considers the ratio of total output to one certain type of input, say capital, it becomes capital productivity that indicates output (in physical or financial terms) per capital input and this type of productivity measures are known as partial productivity measures. On the other hand, if value added is used as output, the ratio is called value added per capital used for the previous example. This is also a partial productivity measure.

3.8 BASIC TYPES OF PRODUCTIVITY MEASURES

Basic types of the productivity measures may be divided into three main groups; partial productivity measures, total-factor productivity measures, and total productivity. [14]

3.8.1 PARTIAL PRODUCTIVITY MEASURES

Partial productivity is the ratio of gross or net output to one type of input. Partial productivity measures are defined according to the type of input used as the denominator.

Labour Productivity

As the name implies, in this type of partial productivity measures, the denominator is related to the labour as an input. Labour productivity is explained as either physical number of output per man-hour or number of units of output per man (worker) or $ output per man.

According to the definitions above, labour productivity equations can be written as given below:

$$\text{Labour Productivity} = \frac{\text{total \# of units produced (output)}}{\text{total \# of man - hour}} \quad \text{or;} \qquad 3.17$$

$$\text{Labour Productivity} = \frac{\text{total \$ output}}{\text{total \# of man - hour}} \quad \text{or;} \qquad 3.18$$

$$\text{Labour Productivity} = \frac{\text{total \# of units produced (output)}}{\text{total \# of workers}} \quad \text{or} \qquad 3.19$$

$$\text{Labour Productivity} = \frac{\text{total \$ output}}{\text{total \# of workers}} \qquad 3.20$$

Capital Productivity

It is expressed as physical units of output per $ capital input or $ output per $ input, namely;

$$\text{Capital Productivity} = \frac{\text{\# of units produced (output in quantity)}}{\text{total \$ capital input}} \text{; or} \qquad 3.21$$

$$\text{Capital Productivity} = \frac{\text{\$ output}}{\text{\$ capital input}} \qquad 3.22$$

It is not practical to define capital productivity with total dollar output per number of capital appearing in denominator, since it is not possible to add all different capital items, i.e. it will be like summing up apples and pears.

Material Productivity

Material productivity is expressed as physical units of output per $ material input, or $ output per $ material input. That is;

$$\text{Material Productivity} = \frac{\text{total \# of units produced}}{\text{total \$ material input}}; \text{ or} \quad 3.23$$

$$\text{Material Productivity} = \frac{\text{total \$ output}}{\text{total \$ material input}} \quad 3.24$$

Energy Productivity

Energy productivity can be either expressed as total physical units of output per $ or kWh energy, or $ output per $ or kWh energy.

$$\text{Energy Productivity} = \frac{\text{total \# of units produced}}{\text{total kWh energy input}} \text{ or;} \quad 3.25$$

$$\text{Energy Productivity} = \frac{\text{total \# of units produced}}{\text{total \$ energy input}} \text{ or;} \quad 3.26$$

$$\text{Energy Productivity} = \frac{\text{total \$ output}}{\text{total kWh energy input}} \text{ or;} \quad 3.27$$

$$\text{Energy Productivity} = \frac{\text{total \$ output}}{\text{total \$ energy input}} \quad 3.28$$

3.8.2 TOTAL-FACTOR PRODUCTIVITY MEASURES

Total-factor productivity is the ratio of value of net output (excluding value of materials from gross output) to the sum of the expenses of labour and capital inputs. The net value is also referred to as value-added output. Total-factor productivity may be expressed as:

$$\text{Total Factor Productivity} = \frac{\$ \text{ value added}}{\$ (\text{labour} + \text{capital}) \text{ input}} \qquad 3.29$$

3.8.3 TOTAL PRODUCTIVITY MEASURES

Total productivity is the ratio of gross output to all inputs, which include human, material, capital, energy and other expense inputs.

Examples of total productivity measures are:

$$\text{Total Productivity} = \frac{\text{tons of steel produced}}{\text{total } \$ \text{ input}} \text{ ; or} \qquad 3.30$$

$$\text{Total Productivity} = \frac{\$ \text{ value of steel produced}}{\text{total } \$ \text{ input}} \qquad 3.31$$

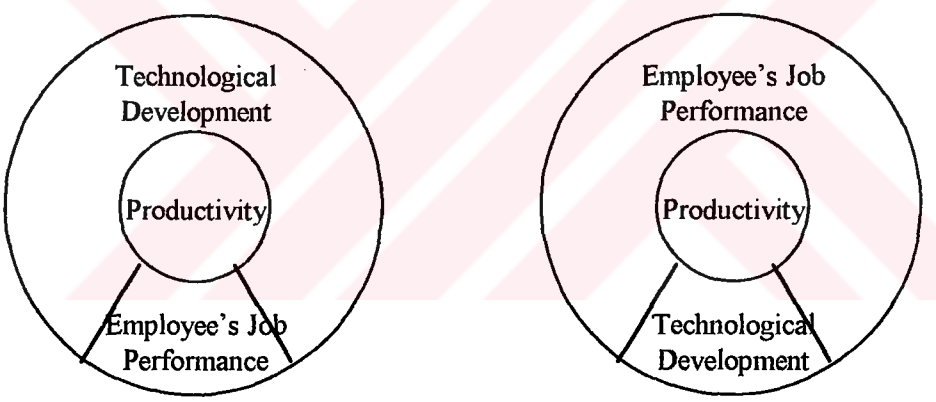
3.9 CONTRIBUTIONS TO PRODUCTIVITY

Contributions to productivity may be divided into two groups: technical and human contributions.

3.9.1 TECHNICAL CONTRIBUTIONS TO PRODUCTIVITY

Productivity is not solely determined by how hard and how well people work. The technical factors play a role, sometimes overwhelmingly important and sometimes minor, though.

The technical factors are all those other than employee performance which can affect output per hour. They include such factors as technological development (the machinery and equipment that employees have to work with), the quality of raw materials, the layout of the work, and the methods and techniques of production. In industrial plants, technological development will often be the most important factor influencing productivity, as illustrated in Figure 3.3 (a). For example, Goodman in Man and Automation cites, the use of a tape to operate a machine tool which manufactures an aircraft spar. "The time taken by the conventional method was ten hours. By the computer method, ninety-two minutes were taken in planning time, and the actual tape-controlled machining time was fourteen minutes" [15]. In a department store, on the other hand, the degree of technology would have relatively little effect on productivity, except, perhaps, in the office. The segments in the diagram for a department store might be similar to those shown in Figure 3.2 (b).



(a) (b)

Figure 3.3 Contributions to Productivity

A short list of other technical factors which have a bearing on productivity includes the followings:

The Plant: Its size, capacity the percentage of capacity utilized. All of these are related to the ability to sell and distribute the product.

The Product: Its design and quality (which may be improved from year to year). This is related to research and development expenditures.

The Product Mix: If some items are produced more efficiently than others, the proportion in which they are combined will affect the overall productivity of the plant, without any change in the productivity of any individual item.

Plant and Job Layout: Work flow and methods. In most plants, small changes in present layout, one of the classes of plant layout problems, are made guide frequently. Existing layout rearrangement may also provide less production time. In general, minor changes in present layout require less planning and man-power to devise a workable solution to a layout [16].

Design of Machines and Equipment: To best match the limitations and capacities of people.

Degree of Integration of Production Processes: A plant which buys its raw materials partly processed will have a higher output of finished product per employee-hour than the plant which starts from scratch. Moreover, a single highly integrated plant should have fewer employee-hours spent for handling, sorting, shipping, etc., than two separate plants which are performing the same steps.

Utilization of Power: Output per employee-hour is usually increased with increased use of power.

Raw Materials: Quality of raw materials and the continuity of their supply are the basic concerns.

Percentage of Indirect Workers Employed: The firm staff of planners, quality control experts, industrial engineers, etc., should be able to devise methods which would result in greater output per employee per hour.

Scientific Management: With its emphasis on better planning and co-ordination, simplified methods, standardization, time and motion study, reduced waste scrap loss and spoilage, contributes notably to increased productivity. Although in some cases, the employees' attitudes and performance prevent the attainment of the full potential for increased productivity with scientific management, the significance of scientific management can not be ignored.

3.9.2 HUMAN CONTRIBUTIONS TO PRODUCTIVITY

"Employees" includes executives and managers, supervisors, professional staff such as engineers and scientists, other white-collar workers, and blue-collar workers [17]. Even if a plant has but one employee, that person's satisfactory performance is vital to the proper functioning of the machinery and equipment; and of course, in a company with many employees and little automation, productivity is likely to be determined largely by what the employees, rather than the machines, do.

Human contributions to productivity, or employees' job performance are considered to result from ability and motivation, or more accurately, ability *times* motivation. Thus, if a person had no motivation, even if he/she could be the most capable individual in the world, his/her performance would certainly unsatisfactory. Or, if a person had no ability, in spite of his/her motivation, once again, his/her performance would be far from fulfilling. Thus, ability and motivation are prerequisites to good employee performance.

Ability

Ability is deemed to result from knowledge and skill. Knowledge, in turn, is affected by education, experience, training, and interest. Skill is affected by aptitude and personality, as well as by education, experience, training, and interest.

Motivation

Motivation is here considered as the result of the interacting forces in physical and social conditions of the job, and individuals' needs

One might jump to the conclusion that individuals whose needs are being fairly well met will be motivated to improve their performance and contribute to greater productivity; of course, this is an unwarranted assumption.

CHAPTER FOUR

4. PRODUCTIVITY MEASUREMENT AND ANALYSIS MODELS

4.1 INTRODUCTION

There are many approaches to productivity measurement and analysis in companies. This is due to the fact that different groups are concerned with the enterprise (managers, investors, customers, etc.) and all those groups have different goals from the productivity measurement and analysis.

Normally, productivity measurement is determined for productivity analysis. One have to measure in order to analyze and then improve. For a company, three of the most common purposes of productivity analyses are;

1. Comparing an enterprise with its competitors,
2. Determining the relative performance of departments and workers within the same company.
3. Comparing relative benefits of various types of input for collective bargaining and gain sharing.

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

4.2 PURPOSES OF PRODUCTIVITY MEASUREMENT

In the broadest sense, productivity is an indicator of the utilization of resources that are measured in some type of physical or financial terms. Since it is difficult to define an absolute level of productivity, relative productivity levels are defined. For instance, a company may compare itself with a level achieved in the past or with the level achieved by another similar company at the same time interval.

Productivity measurement has variety of purposes, three of which have already been given in section 4.1. It is better to summarize these purposes in a more general view, since productivity is not only a concern for a company itself. Hence, general purposes of productivity analyses can be categorized into three areas as follows [18]:

a. General Economic Analysis

One of the determinants of the national product is the productivity. Productivity estimates are increasingly used for forecasting the national income and output, occupational shifts, labour requirements, resource allocation and so on. Users of general economic analysis include politicians, economic planners both in industry and government, trade unions and general public.

b. Intensive Industry Studies

These studies bring out common characteristics and interfirm differences in productivity levels in selected industries and indicate the technical, managerial and economic factors determining the productivity level. The first of the three most common purposes falls into this category.

c. Measurement at the Plant Level

The measurement at the plant level may be related to:

1. the whole plant,
2. individual processes,
3. individual operations and operatives.

One may conclude that the productivity concept and the method of measurement relevant to those various uses will obviously differ. One can measure the variation in productivity of the various producing units (plants within the industry) or the changes in productivity over the time of the same units and of the industry as a whole. Also one can compare the productivity of selected units or the industry as a whole. The last two of the three most common purposes given in the previous page are referred to this category.

4.3 PRODUCTIVITY MEASUREMENT MODELS

Productivity measurement and analysis in the enterprise help to analyze the past and to plan new activities to increase productivity. For monitoring productivity measures and improvement purposes a strong information system must be present and available.

In this section productivity measurement models and approaches will be presented.

4.3.1 THE KUROSAWA STRUCTURAL APPROACH

This approach is derived by Kurosawa, K., Professor of Management Science at the Tokyo Institute of Technology. He is well known for his research on productivity measurement. His model is focused on the structure of the enterprise and its

fundamental framework of productivity measurement in management is given in Figure 4.1 [1].

Productivity measurement ratios are based on the structure of work-hours. Kurosawa structure of productivity may become more understandable by looking at the structure of work-hours shown in Figure 4.2

Omitted work hours (Lo) includes work-breaks, meal times, cleaning and maintenance times, transport times etc. and they are in the charge of management. Lost times such as breakdown and repair, shortage of materials or parts, last-time assignment to another task are charged to supervisor.

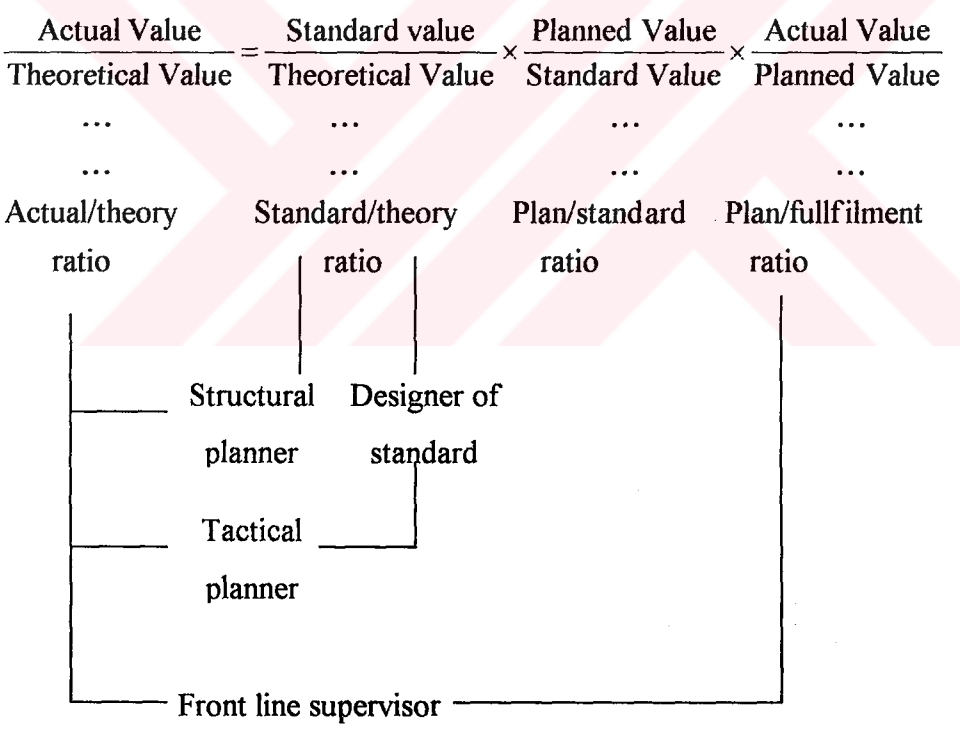


Figure 4.1 Fundamental Framework of Productivity in Management
(Source: K. Kurosawa, 1980, p.97.)

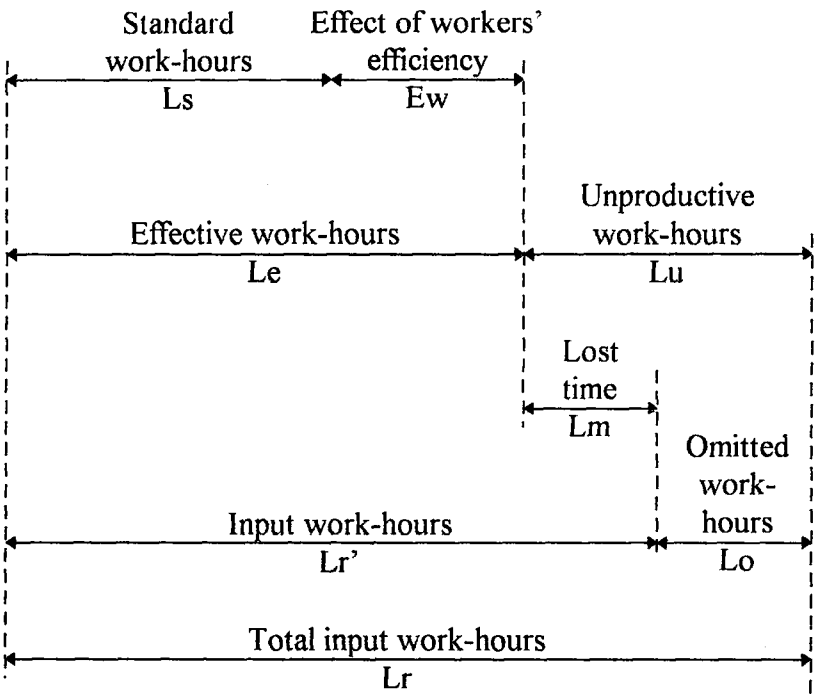


Figure 4.2 Structure of Work-hours

In Kurosawa structural approach individual productivity (Pw) is defined as follows:

$$Pw = \frac{O}{Iw} \qquad 4.1$$

where,

Iw : Input of worker's effort.

Productivity measurement ratios (PMR) based on the structure of work-hours are devised as given below.

$$T'r = Ew \times le(1) \times le(2) \qquad 4.2$$

$$\frac{Ls}{Lr} = \frac{Ls}{Le} \times \frac{Le}{Lr'} \times \frac{Lr'}{Lr} \qquad 4.3$$

where,

T'r = overall efficiency of labour

Ew = worker efficiency

le (1) = ratio of effective work-hours to input work-hours

le (2) = ratio of input work-hours to total input work-hours

Ls = Standard work-hours (quantity produced times standard time)

Lr = Total input work-hours (number of workers on payroll times duty hours)

Le = Effective work-hours

Lr' = input work-hours

$$Lr = Lr' + Lo \quad (4.4)$$

$$Lr' = Le + Lm \quad (4.5)$$

where,

Lo = omitted work-hours

Lm = Lost time

On the other hand, process efficiency, T''r, is defined as:

$$T''r = \frac{Ls}{Lr'} \quad (4.6)$$

4.3.2 LAWLOR'S APPROACH

Alan Lawlor considers productivity as a comprehensive measure of how efficiently and effectively companies satisfy the objectives, efficiency, effectiveness, comparability and progressive trends. [1]

Objectives can be met when the total fund is satisfactory to meet the demands of the company and to measure the degree to which its principal objectives are achieved. This fund is known as "Total Earnings (TE)" that serve to buy services, to pay wages and salaries and to invest fixed capital, profit, and taxes.

$$TE = S - M \tag{4.7}$$

where,

S: Sales,

M: Value of materials

Efficiency indicates the use of available capacity that means how well actually required output is produced from the available input.

$$\epsilon = \frac{O}{I} = \frac{I + P}{I} = 1 + \frac{P}{I} \tag{4.8}$$

Note that, equation 4.8 is the same with equation 3.16, only the name of the equation differs.

Effectiveness is the comparison of present achievement with what could be done if resources were managed more effectively.

$$\frac{\text{Output}}{\text{Input}} = \frac{\text{Effectiveness (what could be achieved)}}{\text{Resources consumed}} \tag{4.9}$$

Productivity improvement shows four basic ratios;

1. Actual output divided by actual input; the status quo;
2. Higher output divided by current actual input;
3. Actual current output divided by lower input;
4. The higher level of effectiveness; maximum output divided by minimum input

Comparability is a guide to organisational performance, because productivity ratios alone tell little without some form of comparison.

Trends, that is the aim of achieving progressive trends, must be associated with a comparison between current performance and a historical base to identify whether company performance is moving up or down and also how fast those changes occur.

Lawlor's approach suggests at least two levels of productivity measurement within the enterprise; primary and secondary levels. The primary level deals with total earning productivity (E) and defined as [1]:

$$E = \frac{TE}{C} \tag{4.10}$$

where,

TE: Total earnings,

C: Conversion cost.

$$C = W + Ps + D \tag{4.11}$$

where,

W: Total wages and salaries,

Ps: Total purchased materials,

D: Depreciation.

Profit productivity (Ep) is considered as the secondary level of productivity.

$$Ep = \frac{P}{C} = \frac{TE - C}{C} = \frac{TE}{C} - 1 \quad \text{or;} \tag{4.12}$$

$$Ep = E - 1 \tag{4.13}$$

Primary productivity ratio, total earning productivity, reveals a primary or overall measurement of efficiency while secondary productivity measurement provides the ratio of used resources to the total cost of available resources. The divisions of the total conversion cost are shown in Figure 4.3

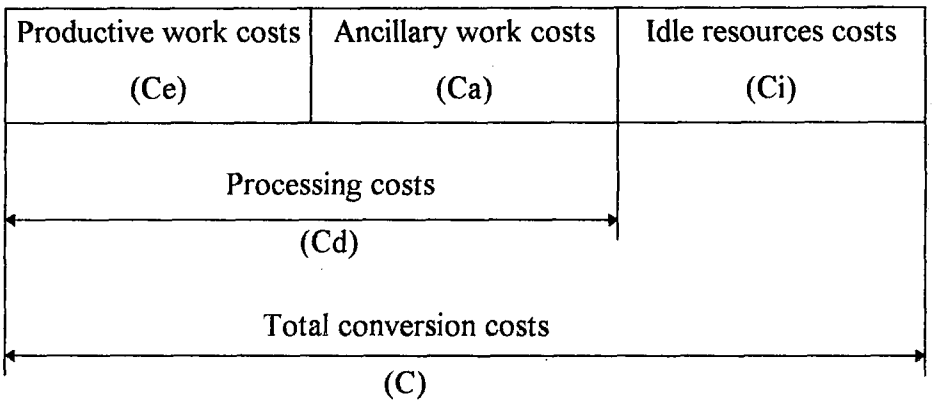


Figure 4.3 Schematic Representation of the Total Conversion Cost

According to the figure above, resource or conversion utilization factor is stated as follows:

$$\frac{\text{time or cost incurred on productive and ancillary work}}{\text{(total time (or conversion costs) available (including idle time))}} = \frac{Cd}{C} \qquad 4.14$$

In addition to resource (or conversion utilization factor) productivity, Cd/C, productive work productivity is defined as the ratio of productive work time or cost to total time or total conversion costs.

$$\frac{\text{time or cost incurred on purely productive work}}{\text{(total time (or conversion costs) available (including idle time))}} = \frac{Ce}{C} \qquad 4.15$$

In this approach, there are two other secondary productivity measurements; working capital productivity (PWC) and inventory productivity (PI) measurement.

$$PWC = \frac{TE}{M + C} \qquad 4.16$$

$$PI = \frac{TE}{M + Cinv} \qquad 4.17$$

where,

TE : Total Earnings,

M : Throughput materials,

Cinv : Carrying charge.

Productivity of working capital gives total earnings per unit of working capital employed or the rate of turnover of working capital while productivity of inventory is similar to working capital, but should include a carrying charge to cover the time the inventory has been in the system.

A more conventional way of measuring inventory productivity is the rate of stock turnover (RST) that is:

$$RST = \frac{S}{AS} \qquad 4.18$$

where,

S: Total sales,

AS : Average stock carried

The framework of productivity analysis for Lawlor's approach is given in Figure 4.4, where steps of the framework arranged vertically from the top to the bottom.

4.3.3 GOLD'S APPROACH

Gold has been concerned with productivity studies for many years in the United States and his research program in industrial economics has covered different types of industry, ranging from steel to agriculture. His measures of productivity focus on the rate of return on investment and is related with five specific elements of performance:

1. Product prices;
2. Unit costs;

3. Use of facilities;

4. Productivity of facilities;

5. Allocation of capital resources between fixed and working capital.

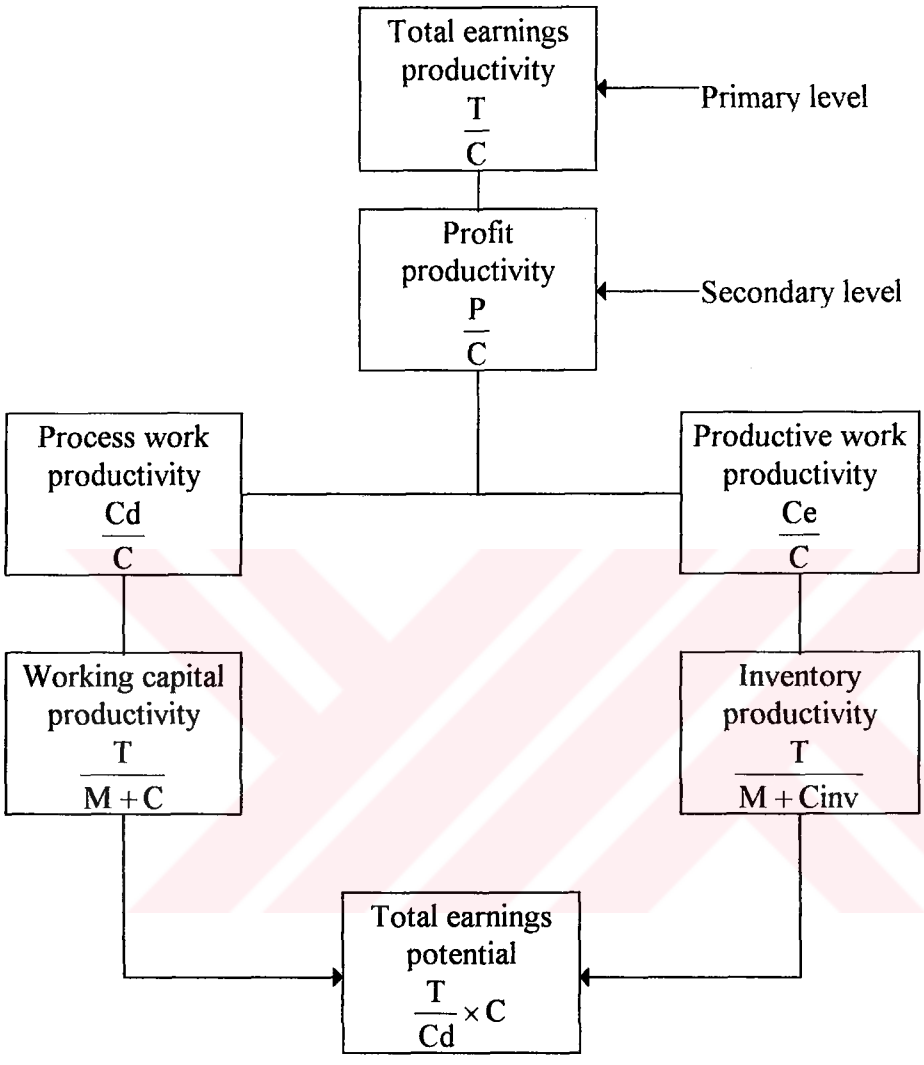


Figure 4.4 Framework of Productivity Analysis by Lawlor's Approach.

These five elements can be combined by integrating into one equation:

$$\frac{Pr}{In} = \left\{\frac{R}{O} - \frac{TC}{O}\right\} \times \frac{O}{Cp} \times \frac{Cp}{If} \times \frac{If}{It} \qquad 4.19$$

where,

R: Product revenue,

In: Investment,

TC: Total cost,

Cp: Capacity,

If : Fixed investment,

It : total investment.

In the right hand side of equation 4.19, the first three ratios are related to the short-term changes and the last two ratios stand for long-term changes.

This expression also shows how changes in profitability between periods depend upon interactions between product contribution (the first two ratios, enclosed by the parenthesis, in the right hand side of this equation), capacity utilization (third ratio), and the proportion of total investment (fourth and fifth ratios) allocated to production capacity.

4.3.4 COMPANY PERFORMANCE APPRAISAL (CPA)

CPA studies are related to the trends of specific profitability and productivity ratios derived from financial statements for the past four (at least three) periods (year, quarter, or month). The main purpose of the CPA is to diagnose problem areas through establishing productivity indicators for a continuous monitoring and control of the whole enterprise, in order to set up an appropriate productivity improvement programme (PIP).

Conducting CPA requires two basic comparisons:

1. Comparison between current performance and a historical base performance;
2. Comparison between actual performance and target (effectiveness).

The first one indicates changes in performance; namely, whether the performance is improving or not and at what rate. The latter is about the effectiveness of the enterprise and requires that performance or productivity targets be set and matched against actual performance or productivity.

The use of profitability alone as a basis for evaluating the overall productivity of an enterprise makes it difficult to define the cause of profitability changes. Because it may be caused from either productivity movement or price-cost movement. The following demonstrates this relationship. In order to decide whether profitability changes are due to the productivity improvement or price-cost movements one can refer to this chart.

$$\begin{array}{lcl} \text{Output value} = \text{Quantity sold} & \times & \text{Unit price of output} \\ \Downarrow \qquad\qquad \Downarrow & & \Downarrow \\ \text{Profitability} = \text{Productivity} & \times & \text{Price recovery} \\ \Uparrow \qquad\qquad \Uparrow & & \Uparrow \\ \text{Input value} = \text{Quantity used} & \times & \text{Unit cost of input} \end{array}$$

If one considers the above relationships over time, profitability is defined as the change in output value compared with change in input value. Productivity is defined as the change between quantity of output and/or output unit price, and change in unit cost. Hence in conducting CPA performance ratios can be classified into three groups:

1. change in profitability;
2. change in productivity;
3. change in price recovery.

The effects of these ratios on profitability are then evaluated. Generally speaking; a drop in profitability, in productivity or price recovery reduces profit. A drop in productivity signals a need for further analysis and for a corrective action. On the other hand, increased productivity does not necessarily lead to profitability on the short-term basis, since the effect of increased productivity is realised only in terms of long-term profitability.

The general relations between profitability and productivity ratios are tabulated in the Table 4.1. These relationships can also be seen in Figure 4.5, that shows a flow chart of the CPA.

Steps of the company performance appraisal are as follows:

Step 1: Compute return on assets (ROA) for the past periods (a year, a quarter, a month)

$$ROA = \frac{Pr}{Ta} \qquad 4.20$$

where,

Ta: Total assests.

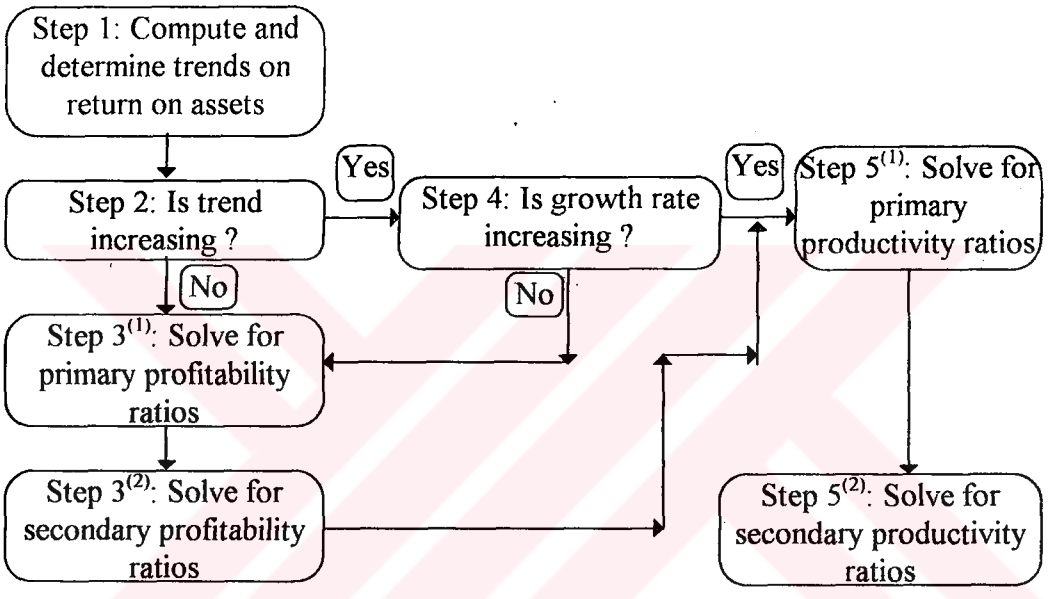


Figure 4.5 Flow Chart of Company Performance Appraisal

Step 2: Determine the trends of ROA. If trend is increasing go step 4; otherwise continue.

Step 3(1): Compute primary profitability ratios as:

a. $$\frac{\text{Net profit}}{\text{Net Sales}} \qquad 4.21$$

b. $$\frac{\text{Cost of goods sold}}{\text{Net sales}} \qquad 4.22$$

c. $$\frac{\text{Operating expenses}}{\text{Net sales}}$$ 4.23

d. $$\frac{\text{Interest expense}}{\text{Net sales}}$$ 4.24

Determine the trends of these ratios (increasing, constant or decreasing)

Table 4.1 Profitability and Productivity Relationships
(Adapted from E. Avedillo-Cruz, 1984, p. 9)

		PRODUCTIVITY	
		LOW	HIGH
PROFITABILITY	LOW	Shut-down / bankruptcy: *Improve productivity and strengthen market*	The company may soon be operating at a loss and may be on the brink of a shut-down: *Improve profitability, strengthen market, market research, market promotion / advertising, and price policy*
	HIGH	High profitability may not be sustained on a long-term basis. In the long run, low productivity will eat up profits: *Improve productivity*	Financial conditions will be sound and stable: *Maintain or increase productivity further*

Step 3[(2)]: Compute secondary profitability ratios as:

a. $$\text{Total assets turnover} = \frac{\text{Net sales}}{\text{Total assets}}$$ 4.25

b. $$\text{Accounts receivable turnover} = \frac{\text{Net sales}}{\text{Total inventory}}$$ 4.26

c. $$\text{Fixed assets turnover} = \frac{\text{Net sales}}{\text{Fixed assets}} \quad 4.27$$

d. $$\text{Inventory turnover} = \frac{\text{Net sales}}{\text{Total inventory}} \quad 4.28$$

Determine the trends of these ratios (increasing, constant or decreasing)

Go to *step 6*

Step 4: If ROA trend is increasing, compute growth rate (GR) of (ROA) as follows:

$$\text{GR}(\%) = \frac{\text{ROA present - ROA preceeding}}{\text{ROA preceeding}} \times 100 \quad 4.29$$

If GR of ROA is decreasing or constant, go to *step 6*, otherwise go to step 3, and then *step 5*.

Step 5[(1)]: Determine primary productivity ratios:

$$\text{Total Productivity} = \frac{\text{Value added}}{\text{Labour + capital inputs}} \quad 4.30$$

Labour Productivity

$$= \frac{\text{Value added}}{\text{Total work - hours worked}} \text{ or;} \quad 4.31$$

$$= \frac{\text{Value added}}{\text{Number of workers}} \text{ or;} \quad 4.32$$

$$= \frac{\text{Value added}}{\text{Total cost of man - power}} \quad 4.33$$

Capital Productivity

$$= \frac{\text{Value added}}{\text{tangible and intangible assets}} \text{ or;} \qquad 4.34$$

$$= \frac{\text{Value added}}{\text{Tangible and financial capitals}} \text{ or;} \qquad 4.35$$

$$= \frac{\text{Value added}}{\text{Tangible assets}} \text{ or;} \qquad 4.36$$

$$= \frac{\text{Value added}}{\text{Fixed assets}} \text{ or;} \qquad 4.37$$

$$= \frac{\text{Value added}}{\text{Machinery + equipment}} \qquad 4.38$$

In the equations 4.34-4.38, we may add different kinds of fixed assets to each other using their monetary equivalents.

Determine trends.

Step 5[(2)]: Calculate secondary productivity ratios:

Labour productivity

a. By the type of worker:

$$= \frac{\text{Value added}}{\text{Number of direct workers}} \text{ or;} \qquad 4.39$$

$$= \frac{\text{Value added}}{\text{Number of indirect workers}} \qquad 4.40$$

b. By shift:

$$= \frac{\text{Value added}}{\text{Number of hours worked on i}^{th}\text{ shift}} \qquad 4.41$$

c. By functional area:

$$= \frac{\text{Value added}}{\text{Salaries and wages of production department}} \text{ or;} \qquad 4.42$$

$$= \frac{\text{Value added}}{\text{Salaries and wages of finance department}} \qquad 4.43$$

Capital Productivity

a. Tangible and intangible assets (i.e. marketable securities, cash, accounts receivable, notes receivable, land, building and structures, etc.)

$$\text{Example}: \quad \frac{\text{Value added}}{\text{Marketable securities}} \qquad 4.44$$

b. Tangible and financial capital (i.e. cash, accounts receivable, notes receivable, land, building and structures, etc.)

$$\text{Example}: \quad \frac{\text{Value added}}{\text{Accounts receivable}} \qquad 4.45$$

c. Tangible assets (i.e. inventories, land, building and structures, etc.)

$$\text{Example}: \quad \frac{\text{Value added}}{\text{Inventories}} \qquad 4.46$$

d. Fixed assets (i.e. land building and structures, machinery and equipment, furniture and office equipment, transport equipment, etc.)

$$\text{Example}: \quad \frac{\text{Value added}}{\text{Machinery and equipment}} \qquad 4.47$$

e. Specific machinery and equipment (i.e. hydraulic press, lathe, drill, press, milling machine, etc.)

$$\text{Example}: \quad \frac{\text{Value added}}{\text{Milling machine}} \qquad 4.48$$

4.4 REMARKS ON THE PRODUCTIVITY MEASUREMENT AND ANALYSIS MODELS

Some of the productivity measurement and analysis models are mentioned in the previous sections of this chapter. Ratios given in the models are similar in scope, but differ in the view of approaches already explained in section 3.3. Although they differ in scope, it is possible to classify these ratios by the Sumanth's classification of productivity mentioned in chapter two and in section 3.4. This is why we decided on three types of productivity in section 3.4. For example, individual productivity (equation 4.1) given in Kurosawa structural approach (see section 4.3.2) is the labour productivity that is a ratio of the partial productivity measures. For this reason, we used Sumanth's ratios of productivity in the application of this thesis.

Kurosawa structural approach is mainly based on the labour efficiency while Lawlor's approach concerns with the company level of the productivity.

It is necessary to restate -we have already mentioned in chapter three- that productivity is one of the performance indicators, as well as efficiency, effectiveness, quality, profitability, quality, yield, and like, since some of the ratios given in the models are performance indicators but not productivity ratios, i.e. equations 4.12 and 4.14 are profitability ratios of the economists. However, in today's literature, the concept of productivity has been accepted as synonym with the concept of performance, i.e. engineers approach of productivity is likewise the efficiency concept.

CHAPTER FIVE

5. PRODUCTIVITY MEASUREMENT APPLICATION

5.1 INTRODUCTION

In this chapter, a productivity measurement application performed in a manufacturing company in Textile Industry is presented. The content of the application covers two departments of the company:

1. Continuous Filament (CF) Department,
2. Circular Weaving (CW) Department.

Company works throughout the day and working times are based on three shifts. Labours in the first, second, and third shift work from 00 a.m. to 08 a.m., 08 am to 04 p.m.; and 04 p.m. to 00 a.m., respectively.

In the first department, product item is synthetic yarn produced by a continuous filament machine (CFM) and twisted by two yarn twisting machines (YTM) while in the second department the product item is synthetic bag produced by the circular weaving machines (CWM).

5.2 DATA COLLECTION FOR PRODUCTIVITY MEASUREMENT

Productivity measurement requires all the information about the work done. Therefore, as the first step of the productivity measurement, what and how the company produces the output must be examined. In order to achieve this and to make some calculations on the productivity measurement, daily production reports are arranged and with the aid of a computer program written in Delphi (version 3.0 Client/Server) programming language, all data is stored and compiled.

Daily production report forms for CF Department and CW Department are shown in Tables 5.1 and 5.2, respectively. Both tables include production process properties of the products such as machine parameters, product specifications and effective working hours, etc.

Standard production for CF machine depends upon the denier (weight of the 9000 meters yarn in grams), velocity of the machine. Standard production is calculated as follows:

$$\text{Standard Production}\left(\frac{\text{kg}}{\text{hr}}\right)=[\text{Denier}]\left(\frac{\text{gr}}{9000\,\text{m}}\right)\times\left\{\frac{1\,\text{kg}}{1000\,\text{gr}}\right\}\times[\text{Velocity}]\left(\frac{\text{m}}{\text{min}}\right)\times\left\{\frac{60\,\text{min}}{1\,\text{hr}}\right\}\times[\text{no. of thread lines}] \quad (5.1)$$

For a CW machine, standard production can be determined by using the formula given below:

$$\text{Standard Production}\left(\frac{\text{m}}{\text{hr}}\right)=[\text{Velocity}]\left(\frac{\text{picks}}{\text{min}}\right)\times\left\{\frac{60\,\text{min}}{1\,\text{hr}}\right\}\times[\text{Thread Width}](\text{mm})\times\left\{\frac{1\,\text{m}}{1000\,\text{mm}}\right\} \quad (5.2)$$

Table 5.1 Production Report Form for CF Department

	Month:		Year:		Shift No:	
DATE	Denier (gr/9000m)	Velocity (m/min)	Production (kg/shift)	Scrap (kg/shift)	Effective Working Time (hr)	Comments

Table 5.2 Production Report Form for CW Department

	Month:		Year:		Shift No:			
DATE	Labour Code	Machine No	Velocity (pick/min)	Yarn Width	Bag Width	Production (m/min)	Effective Working Time (hr)	Comments
	L1	1						
		2						
		3						
		4						
		5						
	L2	1						
		2						
		3						
		4						
		5						
	L3	1						
		2						
		3						
		4						
		5						
	L4	1						
		2						
		3						

In the equations 5.1 and 5.2, items in the parenthesis are the units of the parameters enclosed by the square brackets. Unit conversion constants are shown between { } signs.

"Effective Working Time (EWT)", in the columns of tables 5.1 and 5.2, is not meant as planned working time (eight hours per day). Here, working times that are in the charge of labour are considered as EWT. It does not include any times that a labour has no opportunity to continue the production. For example, in case, if shortage of electricity occurs, what can a labour do? The answer is "nothing". So, the times that a labour can not produce should be subtracted from his planned working time. Consider that a machine stops to produce due to a fault which is under the responsibility of a labour for troubleshooting, in this case, the time passed on troubleshooting is included in the EWT. Repair times, denier setting times, electricity shortage times, and like are excluded from the planned working times. Values of the EWT in Tables 5.4 to 5.6 are based on this approach. EWT may greatly differ day by day, according to the shortage of electricity, setting up the machine, repair, etc. (Daily loss times in planned working times were not exactly given us.) For this reason, in some days, EWT suddenly drops with respect to EWT values of other days. This may normally cause a high value of standard deviation of EWT's.

Everyday, at the end of a shift, standard production for that shift can be calculated using the formula above. CF machine used here has eight yarn lines. These data is to be used in the determination of the productivity measures. At the end of each month, material consumption, machinery and equipment usage, labour usage, and energy consumption are recorded in order to calculate partial productivity, total-factor productivity, and total productivity measures.

5.3 PRODUCTIVITY MEASUREMENT

In this thesis, the following productivity measures are determined.

1. Partial productivity measures:
    a. Labour productivity measures,
    b. Material productivity measures,
    c. Energy productivity measures
    d. Machinery and equipment (fixed capital) productivity measures.
2. Total-Factor productivity measures,
3. Total productivity measures

In the determination of the productivity measures above, some assumptions were made because of the availability of some necessary parameters related to the company. These are:

1. Capital (fixed and revolving capitals) productivity measure is simplified as machinery and equipment productivity measure, because working (or revolving) capital and other parameters of the fixed capital (except for the machinery and equipment) were not achieved or available for us due to the management policy of the manufacturing company.

2. In the calculation of the labour productivity measures, direct labour productivity was used, since production-based common productivity measures were considered in this thesis.

3. All produced items were considered as sold items unless they are returned by the customers (refusals), or become useless (waste or scrap). Scraps are related to the material efficiency and not included in the volume of production. If refusals can be corrected, volume of the refusals are not summed to the volume of the production; but the times and cost of

correcting refusals (i.e rework cost such as labour and energy) are added to the related inputs; otherwise, volume of the refusals will be subtracted from the volume of production, but not from the inputs.

4. As a monetary unit, U.S. dollar is used, since it is a relatively more stable currency. In the determination of the following month's productivity measures all prices must be converted to its "Constant Dollar" equivalence. Index of constant dollar is meant that prices are deflated in order to eliminate the effect of the inflation rate, otherwise it may mislead the productivity measures. If input and output data are only available in terms of dollar amounts, deflation must be performed in order to remove the affects of the price changes. For example, if sales are $ 100 million one year and $ 113 million the next, then dollar sales rose by 13 percent. If inflation rate in that product category was 5 percent, then unit sales must have risen to $ 105 million in the next year. Hence, the actual increase in the dollar sales, from $ 105 million to $ 113 million, must be considered that $ 8 million increased per $ 105; namely 7.62 percent. Economists refer to deflated dollar figures as constant dollars. In productivity calculations, constant dollars are often used a surrogate for units of input or output [19].

5.3.1 PRODUCTIVITY MEASUREMENT FOR CF DEPARTMENT

Production reports filled for CF department during the May 1998 are given in the Appendix A and in Tables 5.4 to 5.6. Labours in CF department work together like as a team. All labours in a shift have some contributions in synthetic yarn production. Therefore, in CF department, EWT for a shift consists of all labours' EWT.

5.3.1.1 Partial Productivity Measures

5.3.1.1.1 Labour Productivity Measures

Four types of "Labour Productivity Measures (LP)" are presented here. The type of labour productivity is shown by the symbol Lp^i_j, where superscript "i" indicates type of productivity (i=1,2,3,4), and subscript "j" refers to the number of shift (j=1,2,3). This notation is going to be used throughout the thesis. Labour productivity equations given as eqn. 3.17 to 3.20 are going to be used in this section.

$$\mathbf{LP^1} = \frac{\text{total number of units produced}}{\text{total number of man - hour}}$$

$$LP^1_1 = \frac{21722\ \text{kg/month}}{181.1\ \text{hours/month/shift}} = 119.94\ \text{kg / hour / shift}$$

$$LP^1_2 = \frac{21434\ \text{kg/month}}{180.2\ \text{hours/month/shift}} = 118.95\ \text{kg / hour / shift}$$

$$LP^1_3 = \frac{21577\ \text{kg/month}}{177.3\ \text{hours/month/shift}} = 121.70\ \text{kg / hour / shift}$$

$$\mathbf{LP^2} = \frac{\text{total \$ output}}{\text{total number of man - hour}}$$

Unit price of the produced item in CF department is $ 1.88 per kg. During the May 1998, 21722 kg. of output is produced by shift 1 (for volume of production by each shift see appendix A). For comparison purposes between CF and CW departments this type of labour productivity is calculated here in units of $ output per hour per worker.

$$LP^2_1 = \frac{21722\ \text{kg/month} \times \$1.88\ \text{/kg}}{181.1\ \text{hours/month/shift} \times 7\ \text{workers/shift}} = \$\ 32.21\ \text{/ hr / worker}$$

$$LP^2_2 = \frac{21434\ \text{kg/month} \times \$1.88\ \text{/kg}}{180.2\ \text{hours/month/shift} \times 7\ \text{workers}} = \$31.95\ \text{/hour / worker}$$

$$LP^2_3 = \frac{21577\ \text{kg/month} \times \$1.88\ \text{/kg}}{177.3\ \text{hours/month/shift} \times 7\ \text{workers/shift}} = \$32.68\ \text{/hour / worker}$$

$$\mathbf{LP^3} = \frac{\text{total number of units produced}}{\text{total number of direct workers}}$$

$$LP^3_1 = \frac{21722\text{kg/month}}{7\ \text{workers}} = 3103.14\text{kg/month/worker}$$

$$LP^3_2 = \frac{21434\ \text{kg/month}}{7\ \text{workers}} = 3062.00\ \text{kg/month/worker}$$

$$LP^3_3 = \frac{21577\ \text{kg/month}}{7\ \text{workers}} = 3082.43\ \text{kg/month/worker}$$

$$\mathbf{LP^4} = \frac{\text{total \$ output}}{\text{total number of direct workers}}$$

$$LP^4_1 = \frac{21722\ \text{kg/month} \times 1.88\ \$/\text{kg}}{7\ \text{workers}} = \$5833.91\ \text{/month/worker}$$

$$LP^4_2 = \frac{21434\ \text{kg/month} \times \$1.88\ \text{/kg}}{7\ \text{workers}} = \$5756.56\ \text{/month/worker}$$

$$LP^4_3 = \frac{21577\ \text{kg/month} \times \$1.88\ \text{/kg}}{7\ \text{workers}} = \$5794.97\ \text{/month/worker}$$

Complete results of the labour productivity measures are tabulated in the Table 5.3 shown below.

Table 5.3 Complete Results of the Labour Productivity Measures in the May of 1998 in CF Department.

	Labour Productivity for May 1998			
Shift No	LP1 kg/hour per shift	LP2 $/hour per direct worker	LP3 kg per direct worker	LP4 $ per direct worker
1	119.94	32.21	3103.14	5833.91
2	118.95	31.95	3062.00	5756.56
3	121.70	32.68	3082.43	5794.97

Continuous filament machine does not require high skilled workers, therefore worker has little impact during the run of the machine. The main function of the labour is to change the cylinder that the yarn is wrapped around and to interfere in case of any breakdown. This is the efficiency of the labour. During a labour changes cylinder some scrap loss occurs. When cylinder requires a change, machine can not be stopped. At this time, although machine is working properly, output becomes scrap. For this reason, in the calculation of machine efficiency, scrap loss is added to the actual (useful) production. Scrap loss is not considered in the calculation of the labour efficiency, otherwise all the labour efficiency will be about the same that is machine efficiency. As the labour efficiency increases, actual (useful) production increases and therefore labour productivity moves up. Tables 5.4 to 5.6 present efficiency parameters of the CF machine and labour. There is no significant difference in terms of labour efficiency and labour productivity differences among the shifts 1, 2, and 3, since the production in CF department is not much labour intensive.

In the efficiency tables labour efficiency is determined by using the formula given below:

$$\text{Machine Efficiency } (\%) = \frac{\text{Actual (Useful) Production} + \text{Scrap Loss}}{\text{Standard Production}} \times 100 \qquad 5.3$$

$$\text{Labour Efficiency } (\%) = \frac{\text{Actual Production}}{\text{Standard Production}} \times 100 \qquad 5.4$$

$$\text{Labour Efficiency}^{*} (\%) = \frac{\text{Actual Production}}{\text{Actual Production} + \text{Scrap Loss}} \times 100 \qquad 5.5$$

Note that, equation 5.5 is the ratio of equation 5.4 to 5.3. Theoretical standard production, in terms of kg/hour, given in section 5.1 would not be exactly achieved in actual production. This is the point in what we also measured machine efficiency. As can be obviously seen from the equations 5.3 and 5.4, as scrap gets smaller (hypothetically approaches to zero), actual production increases and labour efficiency (eqn. 5.4) moves up and finally approaches to machine efficiency. As a result equation 5.5 (Labour efficiency*) approaches to 1. So, labour efficiency would never reach to a value greater than machine efficiency. One can say: "In case of a labour has no scrap, why his labour efficiency is not regarded as 100 %, since the labour completely fulfils his responsibility?" To overcome this, in the equation 5.5 (Labour efficiency*), effect of the machine efficiency is got rid of the labour efficiency.

Table 5.4 Machine and Direct Labour Efficiency Calculations for Shift 1 of CF Department

	EFFICIENCY CALCULATIONS (CONTINIOUS FILAMENT DEPARTMENT)									
	SHIFT 1									
Date	Denier	Velocity (m/min)	Standard Production kg/hour	Effective Working Time (hr)	Standard Production kg/shift	Actual (Useful) Production kg/shift	Scrap Loss (kg/shift)	Machine Efficiency (%)	Labour Efficiency (%)	Labour Efficiency (considering mach.eff)
01.May.98	900	2100	100.8	6.7	675.4	604	40.0	95.4	89.4	93.8
02.May.98	900	2100	100.8	5.3	534.2	432	83.0	96.4	80.9	83.9
03.May.98	NOT WORKED									
04.May.98	900	2100	100.8	6.4	645.1	600	24.5	96.8	93.0	96.1
05.May.98	900	2100	100.8	6.2	625.0	560	19.0	92.6	89.6	96.7
06.May.98	900	2100	100.8	6.6	665.3	644	10.2	98.3	96.8	98.4
07.May.98	900	2100	100.8	6.6	665.3	600	31.0	94.8	90.2	95.1
08.May.98	1300	2100	145.6	6.4	931.8	860	45.0	97.1	92.3	95.0
09.May.98	1300	2100	145.6	7.8	1135.7	1072	32.6	97.3	94.4	97.0
10.May.98	NOT WORKED									
11.May.98	1300	2100	145.6	7.6	1106.6	1032	7.8	94.0	93.3	99.2
12.May.98	1125	2150	129.0	7.7	993.3	892	43.4	94.2	89.8	95.4
13.May.98	1300	2350	162.9	7.4	1205.7	1103	22.3	93.3	91.5	98.0
14.May.98	1125	2300	138.0	7.9	1090.2	1078	11.6	99.9	98.9	98.9
15.May.98	1125	2350	141.0	7.9	1113.9	1074	10.0	97.3	96.4	99.1
16.May.98	1125	2350	141.0	7.9	1113.9	1096	4.0	98.8	98.4	99.6
17.May.98	NOT WORKED									

Table 5.4 Machine and Direct Labour Efficiency Calculations for Shift 1 of CF Department (Continued)

	EFFICIENCY CALCULATIONS (CONTINIOUS FILAMENT DEPARTMENT)									
	SHIFT 1									
Date	Denier	Velocity (m/min)	Standard Production kg/hour	Effective Working Time (hr)	Standard Production kg/shift	Actual (Useful) Production kg/shift	Scrap Loss (kg/shift)	Machine Efficiency (%)	Labour Efficiency (%)	Labour Efficiency (considering mach.eff)
18.May.98	1125	2100	126.0	4.8	604.8	544	23.9	93.9	89.9	95.8
19.May.98	1125	2100	126.0	5.8	730.8	688	17.0	96.5	94.1	97.6
20.May.98	900	2300	110.4	7.9	872.2	799	26.9	94.7	91.6	96.7
21.May.98	1250	2100	140.0	7.2	1008.0	934	19.5	94.6	92.7	98.0
22.May.98	1250	2100	140.0	6.7	938.0	854	36.9	95.0	91.0	95.9
23.May.98	900	2100	100.8	7.9	796.3	770	17.7	98.9	96.7	97.8
24.May.98	NOT WORKED									
25.May.98	900	2300	110.4	7.9	872.2	848	12.8	98.7	97.2	98.5
26.May.98	1300	2100	145.6	6.5	946.4	861	13.0	92.3	91.0	98.5
27.May.98	1125	2300	138.0	6.7	924.6	902	6.1	98.2	97.6	99.3
28.May.98	900	2350	112.8	7.9	891.1	865	14.5	98.7	97.1	98.4
29.May.98	1300	2300	159.5	7.0	1116.3	1035	26.8	95.1	92.7	97.5
30.May.98	1300	2300	159.5	6.4	1020.6	975	24.4	97.9	95.5	97.6
31.May.98	NOT WORKED									
TOTAL / AVERAGE				181.1	23222.5	21722.0	623.9	96.2	93.5	97.2

Table 5.5 Machine and Direct Labour Efficiency Calculations for Shift 2 of CF Department

	EFFICIENCY CALCULATIONS (CONTINIOUS FILAMENT DEPARTMENT)									
	SHIFT 2									
Date	Denier	Velocity (m/min)	Standard Production kg/hour	Effective Working Time (hr)	Standard Production kg/shift	Actual (Useful) Production kg/shift	Scrap Loss (kg/shift)	Machine Efficiency (%)	Labour Efficiency (%)	Labour Efficiency (considering mach.eff) (%)
01.May.98	900	2100	100.8	7.5	756.0	700	32.1	96.8	92.6	95.6
02.May.98	900	2100	100.8	6.3	635.0	608	9.4	97.2	95.7	98.5
03.May.98	NOT WORKED									
04.May.98	900	2100	100.8	6.9	695.5	628	25.7	94.0	90.3	96.1
05.May.98	900	2100	100.8	6.3	635.0	600	27	98.7	94.5	95.7
06.May.98	900	2100	100.8	6.8	685.4	644	10.3	95.5	94.0	98.4
07.May.98	900	2100	100.8	6.8	685.4	600	32.8	92.3	87.5	94.8
08.May.98	1300	2100	145.6	4.9	713.4	644	39.4	95.8	90.3	94.2
09.May.98	1300	2100	145.6	6.1	888.2	768	58.4	93.0	86.5	92.9
10.May.98	NOT WORKED									
11.May.98	1300	2100	145.6	7.4	1077.4	1028	27.8	98.0	95.4	97.4
12.May.98	1125	2300	138.0	7.9	1090.2	1040	25.1	97.7	95.4	97.6
13.May.98	1300	2300	159.5	7.1	1132.2	1102	26.2	99.6	97.3	97.7
14.May.98	1125	2300	138.0	7.9	1090.2	1050	31.5	99.2	96.3	97.1
15.May.98	1125	2400	144.0	7.9	1137.6	1119	14.2	99.6	98.4	98.7
16.May.98	1125	2300	138.0	7.9	1090.2	1060	22	99.2	97.2	98.0
17.May.98	NOT WORKED									

Table 5.5 Machine and Direct Labour Efficiency Calculations for Shift 2 of CF Department (Continued)

EFFICIENCY CALCULATIONS (CONTINIOUS FILAMENT DEPARTMENT)										
SHIFT 2										
Date	Denier	Velocity (m/min)	Standard Production kg/hour	Effective Working Time (hr)	Standard Production kg/shift	Actual (Useful) Production kg/shift	Scrap Loss (kg/shift)	Machine Efficiency (%)	Labour Efficiency (%)	Labour Efficiency (considering mach.eff) (%)
18.May.98	1125	2100	126.0	7.2	907.2	816	26.9	92.9	89.9	96.8
19.May.98	1125	2100	126.0	7.8	982.8	955	13.5	98.5	97.2	98.6
20.May.98	900	2400	115.2	8.0	921.6	883	32.4	99.3	95.8	96.5
21.May.98	1250	2050	136.7	6.2	847.3	760	44.4	94.9	89.7	94.5
22.May.98	1250	2100	140.0	6.3	882.0	820	22.8	95.6	93.0	97.3
23.May.98	900	2350	112.8	7.8	879.8	853	6.5	97.7	96.9	99.2
24.May.98	NOT WORKED									
25.May.98	900	2300	110.4	7.9	872.2	812	32.4	96.8	93.1	96.2
26.May.98	1300	2100	145.6	5.9	859.0	791	12.3	93.5	92.1	98.5
27.May.98	900	2300	110.4	7.4	817.0	779	8.5	96.4	95.4	98.9
28.May.98	900	2350	112.8	7.4	834.7	770	29.4	95.8	92.2	96.3
29.May.98	1300	2300	159.5	4.3	685.7	672	9.5	99.4	98.0	98.6
30.May.98	1300	2300	159.5	6.3	1004.6	932	52.8	98.0	92.8	94.6
31.May.98	NOT WORKED									
TOTAL / AVERAGE				180.2	22805.9	21434.0	673.3	96.9	94.0	97.0

Table 5.6 Machine and Direct Labour Efficiency Calculations for Shift 3 of CF Department

EFFICIENCY CALCULATIONS (CONTINIOUS FLAMENT DEPARTMENT)										
	SHIFT 3									
Date	Denier	Velocity (m/min)	Standard Production kg/hour	Effective Working Time (hr)	Standard Production kg/shift	Actual (Useful) Production kg/shift	Scrap Loss (kg/shift)	Machine Efficiency (%)	Labour Efficiency (%)	Labour Efficiency (considering mach.eff) %
01.May.98	900	2100	100.8	6.8	685.4	665	5.1	97.8	97.0	99.2
02.May.98	900	2100	100.8	7.1	715.7	700	8.8	99.0	97.8	98.8
03.May.98	NOT WORKED									
04.May.98	900	2100	100.8	6.9	695.5	600	61	95.0	86.3	90.8
05.May.98	900	2100	100.8	6.4	645.1	631	11.2	99.5	97.8	98.3
06.May.98	900	2100	100.8	6.6	665.3	644	9.5	98.2	96.8	98.5
07.May.98	900	2100	100.8	7.0	705.6	651	41.2	98.1	92.3	94.0
08.May.98	1300	2100	145.6	6.1	888.2	847	31.7	98.9	95.4	96.4
09.May.98	1300	2100	145.6	7.0	1019.2	931	78.8	99.1	91.3	92.2
10.May.98	NOT WORKED									
11.May.98	1300	2000	138.7	5.3	734.9	694	33	98.9	94.4	95.5
12.May.98	1125	2300	138.0	7.1	979.8	944	22.8	98.7	96.3	97.6
13.May.98	1300	2350	162.9	7.3	1189.4	1158	11.6	98.3	97.4	99.0
14.May.98	1125	2350	141.0	7.4	1043.4	1031	10	99.8	98.8	99.0
15.May.98	1125	2350	141.0	7.5	1057.5	1027	9.5	98.0	97.1	99.1
16.May.98	1125	2350	141.0	7.7	1085.7	1060	10.7	98.6	97.6	99.0
17.May.98	NOT WORKED									

Table 5.6 Machine and Direct Labour Efficiency Calculations for Shift 3 of CF Department (Continued)

EFFICIENCY CALCULATIONS (CONTINIOUS FLAMENT DEPARTMENT)										
SHIFT 3										
Date	Denier	Velocity (m/min)	Standard Production kg/hour	Effective Working Time (hr)	Standard Production kg/shift	Actual (Useful) Production kg/shift	Scrap Loss (kg/shift)	Machine Efficiency (%)	Labour Efficiency (%)	Labour Efficiency (considering mach.eff) %
18.May.98	1125	2100	126.0	6.9	869.4	853	8	99.0	98.1	99.1
19.May.98	1125	2100	126.0	7.3	919.8	905	9.7	99.4	98.4	98.9
20.May.98	900	2400	115.2	7.8	898.6	864	30	99.5	96.2	96.6
21.May.98	1250	2100	140.0	6.2	868.0	828	24.4	98.2	95.4	97.1
22.May.98	1250	2100	140.0	6.8	952.0	917	11.9	97.6	96.3	98.7
23.May.98	900	2300	110.4	6.9	761.8	744	13.5	99.4	97.7	98.2
24.May.98	NOT WORKED									
25.May.98	900	2300	110.4	7.4	817.0	791	23.4	99.7	96.8	97.1
26.May.98	1300	2000	138.7	6.1	845.9	825	12	99.0	97.5	98.6
27.May.98	900	2300	110.4	7.3	805.9	796	9.1	99.9	98.8	98.9
28.May.98	900	2350	112.8	7.2	812.2	770	28.7	98.3	94.8	96.4
29.May.98	1300	2300	159.5	5.1	813.3	777	5.5	96.2	95.5	99.3
30.May.98	1300	2300	159.5	6.1	972.7	924	45.8	99.7	95.0	95.3
31.May.98	NOT WORKED									
TOTAL / AVERAGE				177.3	22447.2	21577.0	566.9	98.6	96.1	97.4

5.3.1.1.2 Material Productivity Measures

During the May 1998, 64733 kg (see appendix A) of useful output (yarn) is produced. Related material consumption to achieve this output and their unit and total costs are tabulated in the table given below. Material productivity equations given as eqn. 3.23 and 3.24 are going to be used in this section.

Table 5.7 Material Consumption During the May 1998 in CF Department

Material Item	Usage (kg/month)	% in total material	Unit Cost ($/ton)	Total Cost ($/month)	$ % in total cost
Polypropylene	64025.00	98.86	750	48018.75	94.75
White Master Batch	152.20	0.24	2000	304.40	0.60
Black Master Batch	507.80	0.78	3210	1630.04	3.22
Red Master Batch	17.10	0.03	8000	136.80	0.27
Dark Blue Master Batch	42.80	0.07	10000	428.00	0.84
Green Master Batch	15.90	0.02	10000	159.00	0.31
TOTAL	64760.80	100		50676.99	100

$$\textbf{Material Productivity}^1 = \mathbf{MP^1} = \frac{\text{total number of units produced}}{\text{total \$ material input}}$$

$$MP^1 = \frac{64733\ \text{kg/month}}{\$\,50676.99\ \text{/month}}$$

$$MP^1 = 1.28\ \text{kg output/\$ material input}$$

$$\mathbf{MP^2} = \frac{\text{total \$ output}}{\text{total \$ material input}}$$

$$MP^2 = \frac{64733\ \text{kg/month} \times \$\,1.88\ \text{/kg}}{\$\,50676.99\ \text{/month}}$$

MP^2 = $ 2.40 output/$ material input, which means for each dollar spent on material input the company generates $ 2.40.

5.3.1.1.3 Energy Productivity Measures

93600 kWh of electrical energy is consumed in CF department to produce 64733 kg of useful output. Hence, energy productivity (EP) measures (see eqn. 3.25 to 3.28) are as follows:

$$\mathbf{EP^1} = \frac{\text{total number of units produced}}{\text{total \$ energy input}}$$

$$EP^1 = \frac{64733\ \text{kg/month}}{93600\ \text{kWh/month} \times \$\,0.07\ \text{/kWh}}$$

$$EP^1 = 9.88\ \text{kg output/\$ energy input}$$

$$\mathbf{EP^2} = \frac{\text{Dollar output}}{\text{total dollar energy input}}$$

$$EP^2 = \frac{64733\ \text{kg/month} \times \$\,1.88\ \text{/kg}}{93600\ \text{kWh/month} \times \$\,0.07\ \text{/kWh}}$$

$$EP^2 = \$\,18.57\ \text{output/\$ energy input}$$

$$\mathbf{EP^3} = \frac{\text{total number of units produced}}{\text{total kWh energy input}}$$

$$EP^3 = \frac{64733\ \text{kg/month}}{93600\ \text{kWh/month}}$$

$$EP^3 = 0.69\ \text{kg output/kWh energy input}$$

$$\mathbf{EP^4} = \frac{\text{Dollar output}}{\text{total kWh energy input}}$$

$$EP^4 = \frac{64733\ \text{kg/month} \times \$1.88\ /\text{kg}}{93600\ \text{kWh/month}}$$

$$EP^4 = \$1.30\ \text{output/kWh energy input}$$

Energy productivity measures are also tabulated in the Table 5.8.

Table 5.8 Energy Productivity Measures for CF Department

Energy Productivity for the May of 1998			
EP1 kg output per dollar energy input	EP2 dollar output per dollar energy input	EP3 kg output per kWh energy input	EP4 dollar output per kWh energy input
9.88	18.57	0.69	1.30

5.3.1.1.4 Capital Productivity Measures

Since the amount of revolving funds or working capitals to be used in the calculation of capital measures were not made available to us, capital productivity measures were to be based on only the fixed capital that includes machines, tools, jigs and fixtures, and other necessary equipment (see eqn. 3.21 and 3.22)

In the CF Department, 1 CF machine with eight yarn lines, 2 twisting machines, and quality control equipment are used to produce 64733 kg of useful output. The table below gives the cost of each fixed capital and the summation of them is the total fixed capitals.

Table 5.9 Machinery and Equipment Usage in CF Department

Fixed Capital Items	**Number of Unit**	**Unit Cost ($/unit)**	**Total Cost ($)**	% of total fixed capital
Continious Filament Machine	1	2,500,000	2,500,000	67.4
Twisting Machine	2	480,000	960,000	25.9
Quality Control Equipment	--	250,000	250,000	6.7
Tools, Fixtures etc.	--	1,500	1,500	0.04
Total Fixed Capital ($)			**3,711,500**	100

Then, fixed capital productivity measure is formulized as follows:

$$\text{Fixed Capital Productivity (FCP)} = \frac{\text{total number of units produced}}{\text{total \$ depreciation value of fixed capital output}}$$

The life of the machines and other equipment is estimated to be 25 years. Applying "Straight Line (Linear) Depreciation Method" where the initial cost (purchased cost of the capital items) is divided into equal parts through its life, we may determine the annual depreciation as follows [20]:

$$\text{Annual Depreciation} = \frac{\text{total costs of fixed capitals}}{\text{life of the capital}} \qquad 5.6$$

$$\text{Annual Depreciation} = \frac{\$3711500}{25\ \text{years}} = \$148460/\text{year}$$

Since we are dealing with the monthly productivity measures, depreciation for a month can be calculated by dividing yearly depreciation into 12 months. That is;

$$\text{Monthly Depreciation} = \frac{\$148460/\text{year}}{12\ \text{months/year}} = \$\ 12371.67/\text{month}$$

$$FCP = \frac{64733\ kg/month}{\$12371.67}$$

FCP = 5.23 kg output/month/$ depreciation of fixed capital

Here, in the denominator of the equation above, dollar value of the depreciation cost of the fixed capital is used, since the only consumed part of the fixed capital is the depreciation. If we use dollar value of the fixed capital rather than depreciation value of the fixed capital, the ratio will be named as the rate of return of fixed capital.

Another way of the measuring capital productivity is defining the output in terms of its financial, or monetary, values. Hence,

$$\text{Fixed Capital Productivity (FCP)} = \frac{\text{total \$ value of output}}{\text{total \$ depreciation cost of fixed capital}}$$

$$FCP = \frac{64733\ kg/month \times \$1.88\ /kg}{\$12371.67}$$

$$FCP = \frac{\$121698.04\ /month}{\$12371.67}$$

FCP = $ 9.84 output/month/$ depreciation

5.3.1.2 Total-Factor Productivity Measures

In order to measure the value of the total-factor productivity value added (or added value, VA) output is to be determined initially (see eqn. 3.10 and 3.11).

$$VA = L + Sc + Sa + P = S - X$$

where,

L: Labour cost

Sc: Salary cost

Sa: Selling, administration and distribution costs

P: Profit

S: Total sales

X: External expenses

External expenses (X) consist of the following expenses:

Raw material consumed (Rm) = $ 50676.99 /month (see Table 5.7)

Bought-out items (B) = 0

Work services (W) = 0

External expenses also includes "Depreciation (D)" which was calculated as $12371.67 /month, on page 76.

VA = S - X

VA = (64733 kg/month × 1.88 $/kg)-(50676.99 $/month+12371.67 $/month)

VA = $ 58649.38 /month

Then, total-factor productivity measure (see eqn. 3.29) is calculated by the following formula:

$$\text{Total Factor Productivity} = \frac{\$ \text{ value added output}}{\$ (\text{labour} + \text{depreciation}) \text{ input}}$$

Total Depreciation of Fixed Capital = $ 12371.67 /month

The next parameter to be calculated in order to measure total-factor productivity is the $ value of the labour. Since actual production is done by the direct workers, total $ value of the direct labour cost is considered in this type of productivity measure.

There are 22 direct labours working in the CF department. Their positions and monthly wages are given in the Table 5.10 (Wages in TL are converted to their $ equivalent at the exchange rate of 269000 TL/$). A shift head works in each shift and a foreman, for all shifts. Foreman always works between 8 a.m. and 4 p.m., sometimes together with shift 1, or shift 2, or shift 3, and he does not directly contribute to the production. Therefore, foreman is not included in the number of workers in the previous calculations, but here included in the total number of workers.

Table 5.10 Direct Labour Cost for CF Department

Labour Type	Number of Labours	Salary ($/month)	Total Salary ($/month)
Foreman	1	249.07	249.07
Shift Head	3	193.31	579.93
Worker	18	156.13	2810.34
Total	22		3639.34

Total direct labour input = $ 3639.34

$$\text{Total Factor Productivity} = \frac{\$\,58649.38\ /\text{month}}{\$\,(3639.34 + 12371.67)}$$

$$\text{Total - Factor Productivity} = \frac{58649.38}{16011.01} = \$\,3.66\ \text{value added}/\$\,(\text{labour} + \text{depreciation})\ \text{input}$$

5.3.1.3 Total Productivity Measures

Total productivity measure (see eqn. 3.31) for CF Department is given as below:

$$\text{Total Productivity} = \frac{\text{Total Dollar Output}}{\text{Total Dollar Input}}$$

Total input consists of labour input, capital input, material input, energy input and other inputs.

$$\text{Total Productivity} = \frac{\text{Total Dollar Output}}{\text{Material Input} + \text{Labour Input} + \text{Energy Input} + \text{Capital Input}}$$

In our calculations, total dollar input consists of direct material input, direct labour input, energy input, and machinery and equipment input as fixed capital input.

$$\text{Total Dollar Output} = 64733 \frac{kg}{month} \times 1.88 \frac{\$}{kg}$$

Total Dollar Output = 121698.04 $/month

Direct Material Input = 50676.99 $/month [see page 73, Table 5.7]

Direct Labour Input = 3639.34 $/month [see page 79, Table 5.10]

Energy Input = 93600 kWh × 0.07 $/kWh = 6552 $/month

Fixed Capital Input (Depreciation) = $ 12371.67 [see page 76]

Then, total productivity is calculated as:

$$\text{Total Productivity} = \frac{\$121698.04 \text{ /month}}{\$(50676.99 + 3639.34 + 6552 + 12371.67) \text{ /month}}$$

Total Productivity = $ 1.66 output/$ input

5.3.2 PRODUCTIVITY MEASUREMENT FOR CW DEPARTMENT

Production reports prepared for CF department during the May of 1998 are given in appendix B.

5.3.2.1 Partial Productivity Measures

5.3.2.1.1 Labour Productivity Measures

Using the same quotations explained on page 63, four types of the labour productivity measures are calculated as given below.

$$\mathbf{LP^1} = \frac{\text{total number of units produced}}{\text{total number of man - hour}}$$

$$LP^1_1 = \frac{1169561\ \text{m/month}}{3330.6\ \text{hour/month}} = 351.16\ \text{m / hour}$$

$$LP^1_2 = \frac{1125352\ \text{/month}}{3221.5\ \text{hour/month}} = 349.33\ \text{m / hour}$$

$$LP^1_3 = \frac{1208224\ \text{m/month}}{3436.6\ \text{hour/month}} = 351.58\ \text{m / hour}$$

$$\mathbf{LP^2} = \frac{\text{total \$ output}}{\text{total number of man - hour}}$$

Unit price of the bag produced in CW department is \$ 0.10 /m^2 and width of the bag produced during May 1998 was 60 cm. Therefore, area of the produced bag can be calculated as given below:

$$\text{Area}\,(m^2) = [\text{Actual production}]\,(\text{m}) \times [\text{Width of bag}]\,(\text{cm}) \times \left\{\frac{1\ \text{m}}{100\ \text{cm}}\right\} \times 2 \qquad 5.7$$

The constant of "2" at the end of the equation above refers to both side of the bag produced.

Area of the bag produced by shift 1 = 1169561 × 60 × 1/100 × 2 = 1403473.2 m^2
Area of the bag produced by shift 2 = 1125352 × 60 × 1/100 × 2 = 1350422.4 m^2
Area of the bag produced by shift 3 = 1208224 × 60 × 1/100 × 2 = 1449868.8 m^2

$$LP^2_1 = \frac{1403473.2\ m^2/\text{month} \times \$\,0.10\ /m^2}{3330.6\ \text{work hour/month}} = \$\,42.14\ \text{/work hour}$$

$$LP^2{}_2 = \frac{1350422.4\ \text{m}^2/\text{month} \times \$\,0.10/\text{m}^2}{3221.5\ \text{work hour/month}} = \$\,41.92/\text{work hour}$$

$$LP^2{}_3 = \frac{1449868.8\ \text{m}^2/\text{month} \times \$\,0.10/\text{m}^2}{3436.6\text{work hour/month}} = \$\,42.19/\text{work hour}$$

$$\mathbf{LP^3} = \frac{\text{total number of units produced}}{\text{total number of direct workers}}$$

$$LP^3{}_1 = \frac{1169561\ \text{m/month}}{17\ \text{workers/month}} = 68797.71\ \text{m/direct worker/month}$$

$$LP^3{}_2 = \frac{1125352/\text{month}}{17\ \text{workers/month}} = 66197.18\ \text{m/direct worker/month}$$

$$LP^3{}_3 = \frac{1208224\ \text{m/month}}{17\ \text{workers/month}} = 71072.00\ \text{m/direct worker/month}$$

$$\mathbf{LP^4} = \frac{\text{total \$ output}}{\text{total number of direct workers}}$$

$$LP^4{}_1 = \frac{1403473.2\ \text{m}^2/\text{month} \times \$\,0.10/\text{m}^2}{17\ \text{workers/month}} = \$\,8255.72/\text{hour}$$

$$LP^4{}_2 = \frac{1350422.4\ \text{m}^2/\text{month} \times \$\,0.10/\text{m}^2}{17\ \text{workers/month}} = \$\,7943.66/\text{hour}$$

$$LP^4{}_3 = \frac{1449868.8\ \text{m}^2/\text{month} \times \$\,0.10/\text{m}^2}{17\ \text{workers/month}} = \$\,8528.64/\text{hour}$$

Complete results of the labour productivity measures are tabulated in Table 5.11

Table 5.11 Complete Results of the Labour Productivity Measures (CW) in the May 1998.

	Labour Productivity for May 1998			
Shift No	LP1 m/hour	LP2 $/hour	LP3 m per direct worker	LP4 $ per direct worker
1	351.13	33.71	68797.7	6604.58
2	349.33	33.54	66197.2	6354.98
3	351.58	33.75	71072	6822.91

5.3.2.1.2 Material Productivity Measures

During May 1998, total production of useful output (bag) is 3503137 m (4203764.4 m^2, or 260633.4 kg). Related material consumption to achieve this output, unit and total costs are tabulated in Table 5.12 below. All bags are of 60 cm width, and yarn with 660 denier (62 g/m^2) was used during May 1998.

Table 5.12 Material Consumption (CW) During the May 1998

Material Item	Usage (kg/month)	% in total material	Unit Cost ($/ton)	Total Cost ($/month)	$ % in Total Cost
Polypropylene	264442.90	99.54	600.00	158665.74	99.81
Other	1233.00	0.46	250.00	308.25	0.19
Total	265675.90	100		158973.99	100

$$\textbf{Material Productivity}^1=\textbf{MP}^1 = \frac{\text{total number of units produced}}{\text{total \$ material input}}$$

$$MP^1 = \frac{3503137\ \text{m/month}}{\$158973.99\ \text{/month}}$$

$$MP^1 = 22.04\ \text{m output/\$ material input}$$

$$\mathbf{MP^2} = \frac{\text{total \$ output}}{\text{total \$ material input}}$$

$$MP^2 = \frac{3503137\ \text{m/month} \times 60\ (\text{cm}) \times \left\{\frac{1\ \text{m}}{100\ \text{cm}}\right\} \times 2 \times \$\,0.10\ /\text{m}^2}{158973.99\ \$/\text{month}}$$

$$MP^2 = \$\ 2.64\ \text{output/\$ material input}$$

5.3.2.1.3 Energy Productivity Measures

400000 kWh of electrical energy is consumed in CW department to produce 3503137 m of useful output. Hence, energy productivity (EP) measures are as follows:

$$\mathbf{EP^1} = \frac{\text{total number of units produced}}{\text{total \$ energy input}}$$

$$EP^1 = \frac{3503137\ \text{m/month}}{400000\ \text{kWh/month} \times \$\,0.07\ /\text{kWh}}$$

$$EP^1 = 125.11\ \text{m output/\$ energy input}$$

$$\mathbf{EP^2} = \frac{\text{Dollar output}}{\text{total dollar energy input}}$$

$$EP^2 = \frac{3503137\ \text{m/month} \times 60\ (\text{cm}) \times \left\{\frac{1\text{m}}{100\ \text{cm}}\right\} \times 2 \times \$\,0.10\ /\text{m}^2}{400000\ \text{kWh/month} \times \$\,0.07\ /\text{kWh}}$$

$$EP^2 = \$\,15.01\ \text{output/\$ energy input}$$

$$\mathbf{EP^3} = \frac{\text{total number of units produced}}{\text{total kWh energy input}}$$

$$EP^3 = \frac{3503137\ \text{kg/month}}{400000\ \text{kWh/month}}$$

$$EP^3 = 8.76\ \text{m output/kWh energy input}$$

$$\mathbf{EP^4} = \frac{\text{Dollar output}}{\text{total kWh energy input}}$$

$$EP^4 = \frac{3503137\ \text{m/month} \times 60\ (\text{cm}) \times \left\{\frac{1\text{m}}{100\ \text{cm}}\right\} \times 2 \times \$0.10/\text{m}^2}{400000\ \text{kWh/month}}$$

$$EP^4 = \$1.05\ \text{output/kWh energy input}$$

Energy productivity measures are also tabulated in Table 5.13.

Table 5.13 Energy Productivity Measures for CW Department

Energy Productivity for May 1998			
EP1 kg output per dollar energy input	EP2 dollar output per dollar energy input	EP3 kg output per kWh energy input	EP4 dollar output per kWh energy input
125.11	15.01	8.76	1.05

5.3.2.1.4 Capital Productivity Measures

In the CW Department, 63 SL4 type of CW machines and quality control equipment are used to produce 3503137 m of useful output. Table 5.14 gives the cost of each fixed capital and the summation of them as the total fixed capitals.

Table 5.14 Machinery and Equipment Usage in CW Department

Fixed Capital Item	Number of Unit	Unit Cost ($/unit)	Total Cost ($)	% of Total Fixed Capital
Circular Weaving Machine	63	21,000	1,323,000	84.0
Quality Control Equipment	--	250,000	250,000	15.9
Tools, Fixtures etc.	--	1,500	1,500	0.10
Total Fixed Capital ($)			**1,574,500**	100

Rate of turnover (ROT) of machinery and equipment, as fixed capital items, may then be determined as given below:

$$ROT = \frac{\text{Total Dollar Output}}{\text{Total Dollar Machinery and Equipment}} \qquad 5.8$$

$$\text{ROT of machinery and equipment} = \frac{4203764.4\,m^2 \times \$\,0.10/m^2}{\$1574500 \text{ machinery and equipment}}$$

ROT of machinery and equipment = $ 0.27 output/$ machinery and equipment, i.e. each $ worth of output recovers $ 0.27 worth of machinery and equipment.

In the fixed capital productivity measures dollar value of the depreciation is to be replaced, rather than total dollar machinery and equipment since in the production of items only depreciation value is consumed. Life of the machinery and equipment is estimated to be 30 years and at the end of their life they are accepted to be fully scrap, or useless. Applying simple "Straight Line (Linear) Depreciation Method" [20] over 30 years of life yearly, depreciation is calculated as follow:

$$\text{Annual Depreciation} = \frac{\text{total costs of fixed capitals}}{\text{life of the capital}}$$

$$\text{Annual Depreciation} = \frac{\$1574500}{30 \text{ years}}$$

$$\text{Annual Depreciation} = \$\,52483.33 \text{/year}$$

$$\text{Monthly Depreciation} = \frac{\$\,52483.33 \text{/year}}{12 \text{ months/year}}$$

$$\text{Monthly Depreciation} = \$\,4373.61 \text{/month}$$

Hence, fixed capital productivity becomes;

$$\text{Fixed Capital Productivity (FCP)} = \frac{\text{total number of units produced}}{\text{total \$ depreciation of fixed capital}}$$

$$\text{FCP} = \frac{3503137 \text{ m/month}}{\$\,4373.61 \text{/month}}$$

FCP = 800.97 m output/month/$ fixed capital consumed

Fixed capital productivity as the output in terms of its financial (or monetary) values per dollar depreciation consumed is also given below:

$$\text{Fixed Capital Productivity (FCP)} = \frac{\text{total \$ value of output}}{\text{total \$ depreciation of fixed capital input}}$$

$$\text{FCP} = \frac{4203764.4 \text{ m}^2 \times \$\,0.10 \text{/m}^2}{\$\,4373.61 \text{ depreciation}}$$

FCP = $ 96.12 output/month/$ depreciation of fixed capital

5.3.2.2 Total-Factor Productivity Measures

Value added (or added value, VA) output for CW Department is as follows:

$$VA = L + Sc + Sa + P = S - X$$

Raw material consumed (Rm) = $ 158973.99 /month (from Table 5.12)

Bought-out items (B) = 0

Work services (W) = 0

Depreciation = $ 4373.61 /month

$$VA = S - X$$

$$VA = (4203764.4\ m^2/month \times \$\ 0.10\ /m^2) - (\$\ 158973.99\ /month + \$\ 4373.61\ /month)$$

$$VA = \$\ 257028.84\ /month$$

Then, total-factor productivity measures are determined as follows:

$$\text{Total Factor Productivity} = \frac{\$\ \text{value added output}}{\$\ (\text{labour} + \text{depreciation})\ \text{input}}$$

There are 52 direct labours working in the CW department. Their positions and monthly salaries are tabulated in Table 5.15 below.

Table 5.15 Direct Labour Cost for CW Department

Labour Type	Number of Labours	Salary ($/month)	Total Salary ($/month)
Foreman	1	249.07	249.07
Shift Head	3	193.31	579.93
Worker	48	156.13	7494.24
Total	52		8323.24

Total direct labour input = $ 8323.24 /month

$$\text{Total Factor Productivity} = \frac{\$\,257028.84\ /\text{month}}{\$\,(8323.24 + 4373.61)}$$

$$\text{Total - Factor Productivity} = \frac{257028.84}{12696.85}$$

Total - Factor Productivity = $ 20.24 value added/$ (labour + depreciation) input/month

5.3.2.3 Total Productivity Measures

Total productivity for CW Department is given as below:

$$\text{Total Productivity} = \frac{\text{Total Dollar Output}}{\text{Total Dollar Input}}$$

$$\text{Total Productivity} = \frac{\text{Total Dollar Output}}{\text{Material Input} + \text{Labour Input} + \text{Energy Input} + \text{Capital Input}}$$

In our calculations, total dollar input consists of direct material input, direct labour input, energy input, and machinery and equipment input as fixed capital input.

Total Dollar Output = 4203764.4 m^2/month × $ 0.10 /m^2

Total Dollar Output = $ 420376.44 /month

Direct Material Input = $ 158973.99 /month [see page 83, Table 5.12]

Direct Labour Input = 8323.24 /month [see page 88, Table 5.15]

Energy Input = 400000 kWh × $ 0.07 /kWh = $ 28000 /month

Fixed Capital Input (Depreciation) = $ 4373.61 [see page 87]

$$\text{Total Productivity} = \frac{\$\,420376.44\ /\text{month}}{\$\,(158973.99 + 8323.24 + 28000 + 4373.61)\ /\text{month}}$$

Total Productivity = $ 2.11output/$ input

CHAPTER SIX

6. DISCUSSION AND CONCLUSION

6.1 INTRODUCTION

Productivity measures for continuous filament and circular weaving departments are given in the previous chapter.

In this chapter, discussion, conclusions, and suggestions are presented. A discussion on the productivity measurement in small and medium-size enterprises (SMEs) and a conclusion are given in section 6.2 and 6.3, respectively. In section 6.4, suggestions for future work in order to reach higher levels of productivity ratios are explained.

6.2 DISCUSSION

No company can continue to exist, unless it maintains a level of productivity to compete with the companies in its market. Companies that do not succeed in this are doomed to fail through stagnation and finally a bankruptcy in the long-term.

Productivity is one of the most important long term resource for the success of companies, individuals, and even for the national economics, national welfare and social development. Productivity is also a measure of efficiency of the managers.

Productivity measurement alone has not much meaning, unless productivity improvement studies have been performed and reasons behind the productivity changes are identified. Productivity measurement should be the first point of any company: it should be planned, organized, measured, implemented, and improved. Unfortunately, there is a lack of productivity analysis in small and medium-size manufacturing companies in Gaziantep.

Since different approaches to productivity measurement are present and all measurements require point-to-point data, managers think that it is difficult to put into practice and has too much data, paperwork and calculations to be analyzed. To overcome these a computer program is written and compiled for data storing, analyzing and monitoring purposes.

In the computer program various types of productivity measures are determined; i.e. for types of labour productivity measures, two types of material productivity measures, two types of total-factor productivity measures that are differs in units. It is not necessary to determine all productivity measures calculated in this thesis. What type of productivity measures are better to use will be decided according to the type and some natures of the company. For a textile manufacturing company, it will be stated in the following section.

6.3 CONCLUSION

In this study, an engineering view of the productivity measures is presented. A computer program evaluation package, "Computer Aided Measurement of Productivity: CAMP", has been prepared for data collection, analysis, and easy determination of the productivity measures. Required data during the May of 1998 are collected and stored in the program. Standard times for production are based on the ideal production, as if process has no idle time for all operations. Then productivity measures are determined and the program is ready to store the following data and to

perform productivity measurements for comparison purposes. Menus and some outputs of the program are also given in the appendices.

In the circular weaving department (CW), productivity may be improved in a short-run, since the main determinant of the productivity is the labour performance. Here, the basic faults or troubles that are in the charge of the labour are given below.

1. warp break,
2. wet break,
3. weft change.

A labour working in the CW department is responsible for troubleshooting on any faults. One labour is in charge of three or four machines. As the troubleshooting time reduces, number of products increases and therefore productivity increases. This depends on the performance of the worker.

Approximately, through an eight-hour shift, warp break occurs ten times. For a worker, the troubleshooting time for warp break ranges from 0.5 minutes to 2 minutes. Troubleshooting time is about 0.5 minutes, if the labour is idle and quickly interferes to the fault. Here, "idle" is meant that labour is of long standing and completely ready to interfere on any fault. However, if warp break occurs in a machine, while the labour is trying to repair any fault in another machine, the troubleshooting time rises up to about 2 minutes. Thus, the troubleshooting time varies between 0.5 and 2.0 minutes.

In CW department, bags are woven from synthetic yarns that are passed through some guides and around a stationary cylinder. Therefore, some friction occurs between yarn and guides. For this reason, yarns are charged by static electricity. This lets yarns be glued to each other. To overcome this undesired fault, the cylinder that guides yarns are immersed into a box containing a liquid, anticiplit, which prevents the yarns from gluing to each other. The amount of anticiplit reduces over time and it must be properly added into the container, where nearly half of the

cylinder is located. Provided that the yarns are not passed through anticiplit, warp break will be of frequent occurrence. It was observed that workers do not properly take care of adding anticiplit into the container. This causes an increase in the number of occurrence of the wrap break.

On the other hand, wet break is one of the most frequently occurred fault in circular weaving. Wet break occurs due to the improper wrapping of the yarns to the weft, or improper strength contributions in the yarn, etc. Wet break is faced approximately six times through an eight-hour shift. Troubleshooting time for a wet break also ranges from 0.5 minutes to 2 minutes according to the performance of the worker.

Another fault occurring in a circular weaving machine appears when the machine requires a change for a weft. Approximately, the yarn in the weft is consumed in 30 minutes. Here, the machines have four wefts. The troubleshooting time for a weft change is about one minute. Hence, changing four wefts at the same time requires an average time of four minutes. In CW department, it was observed that consuming times of four wefts are nearly equal to each other. However, in some machines, when machine stopped due to the lack of the yarn in a weft (requires changing weft), it was observed that level of the yarn in other wefts differ from each other. Then, for each weft, when it was consumed up, machine is going to stop. Therefore, more time will be consumed for weft changes. Instead of this, four wefts should be set to be consumed up in the same time. This is possible changing four wefts once at the same time. Doing this, four wefts is going to be consumed up and changed at the same time if they are wrapped with nearly equal lengths. This will reduce the troubleshooting time and may prevent consecutive faults between machines.

One more time-consuming operation is re-setting up the bag width. For a machine, if bag width changes, CW machine requires re-setting. This approximately takes between 3.5 and 4.5 hours. At this point, machine planning must be carefully done in order to prevent unnecessary machine re-setting times, i.e. there may be a

machine whose bag width is to be reset from 55 cm. to 60 cm, and another machine from 60 cm. to 55 cm. It is an undesired loop that takes between 7 and 9 hours of time; but, physically nothing. This is the responsibility of production planner who should avoid such an undesired loops.

We defined troubles and faults frequently occurred in a CW machine, and troubleshooting times for these faults. How can they be reduced, in order to produce more; but, through the same effective working time? A solution that forces the workers to improve their performance may be related to the concept of "salary" and "wage". In a typical job shop, a worker handles only one machine and the wage calculation is simple. In advanced manufacturing systems, however, a worker handles many machines and is multifunctional. In this case, since the wage rate of each machine may be difficult to measure, the multifunctional worker often receives a salary rather than a wage. In CW department, a worker also handles three or four machines, but all machines and their outputs are similar. Wage rate, for CW department, can easily be determined.

Since workers receive salary rather than wage, in what rate they are working has no importance for them. A worker who performs higher level of efficiency in production, as compared with another worker, receives the same salary, however it should be determined according to their performance. To shorten the troubleshooting time of a labour, a promotion system, with respect to the performance, should be applied. In this case, if a labour earns extra money for his success in performance, he will try to do his best. Then, plant manager must define an average level of labour efficiency or productivity required. Afterward, having looked at the labour efficiency or productivity of a labour, for each extra level, a promotion may be given to that worker as an award for his/her success, and, inversely for each inferior level, a deduction may be applied to that worker's payment, as a punishment.

In continuous filament department (CF), continuous filament machine often breaks down because of the high temperature of the machine component. Since the place where continuous filament machine works has a room temperature of 40-45 °C,

machine is abnormally broken down. Working life quality should be improved in this department. There is no enough window for air circulation. To correct this problem an air circulator was installed and it was observed that the machine has not much breaking as compared before installation of an air circulator. This has provided the company more working time, and therefore more output produced in the CF department.

In this thesis, several types of productivity measures are calculated. Labour productivity, as one of the partial productivity measures, are defined as follows:

a. physical output per hour,
b. dollar output per hour,
c. physical output per direct worker,
d. dollar output per direct worker.

If unit price of the outputs frequently changes, any measure having dollar output, appearing in the numerator, may mislead the company manager. Namely, dollar output of a worker (W1) may be much more than that of another worker (W2). Therefore, W1 has a higher value of labour productivity in terms of dollar output per something than W2. However, W2 may have higher outputs in term of physical quantities, but unit price of this output would be less than that of W1. So, among the measures above, "physical output per hour" is a simple measure of employee job performance and capability, and it is best to use as a labour productivity measure.

On the other hand, as a material productivity measure "physical output per dollar material input"; as an energy productivity measure "physical output per kWh energy input"; as a capital productivity measure "output per dollar machinery and equipment" provide more meaningful implementation of the results. If physical quantities are not available, i.e. impossibility of adding different kinds of units, their monetary equivalence may be used. In CW department, labour productivity in terms of physical quantities per hour may be used as a partial productivity measure, since the department is labour intensive. CF department is machine intensive, however,

labour productivity may require an improvement. Labour productivity improvement should be the first point that a textile manufacturing company deals for both departments. Additionally, changes in any of the partial productivity results must be implemented together with the changes in total-factor and total productivity measures. For example, if change in output per hour is alone implemented, it attributes all other output increases to a single input factor, namely labour [19]. It is an important point that must be reminded here (see page 11).

Partial, total-factor, and total productivity measures were determined for both CF and CW Departments. Total-factor, and total productivity, and labour productivity measures are summarized in Table 6.1 for comparison purposes between CF and CW departments by means of gain sharing that is contribution of $ values of output for each type of productivity measure. Dollar values rather than physical quantities, because outputs for CF and CW departments are different in physical units; that is, kilograms and meters, respectively.

Table 6.1 Complete Results of the Productivity Measures for CF and CW

	Partial				Total-Factor ($ out./$ lab. and dep.)	Total ($ out./$ input)
Department	Labour ($/hr)	Material ($ output/$ mat input)	Energy ($ out./ $energy)	Fixed Capital ($ out./ $ dep.)		
CF	Shift 1: 32.21	2.40	18.57	9.84	3.66	1.66
	Shift 2: 31.95					
	Shift 3: 32.68					
CW	Shift 1: 42.14	2.64	15.01	96.12	20.24	2.11
	Shift 2: 41.92					
	Shift 3: 42.19					

As can be seen from the table, there is no significant differences among the labour productivities of the shifts 1, 2, and 3 of both departments; but between CF and CW departments. This may be stated as: earning capacity of CW department is more than that of CF department. Energy productivity in terms of dollar output per dollar energy input is 18.57 and 15.01 for CF and CW departments, respectively. By means of energy productivity, CF department earns more dollar output by using one dollar equivalent of energy. However, in the case fixed capital productivity, CW

department ($ 96.12 output per $ depreciation input per month) has more worth than CF department ($ 9.84 output per $ depreciation input). Since a CF machine is much more expensive as compared with a CW machine, depreciation value for a CF machine is also much more than a CW machine. This situation may be interpreted that to buy a CW machine rather than a CF machine. In comparison for total-factor productivity CW department has a higher ratio as in comparison for total productivity ratio too. CF department generated $ 1.66 using one dollar equivalent of (depreciation, labour, material, and energy) input, while for CW department generated $ 2.11 per equivalent of input. There was a significant difference between total-factor productivity for CF (3.66) and CW (20.24) departments. Total-factor productivity is affected by value added (VA), depreciation, and labour cost. As a result of comprehensive affect of the depreciation values (CF > CW), values of the VA (CW > CF), and labour costs (CW > CF), this significant difference appear between total-factor productivity measures of two departments.

6.4 SUGGESTIONS FOR FUTURE WORK

This study "Productivity Measurement in a Small and Medium-Size Manufacturing Company in Gaziantep" can be extended to the following fields in order to improve productivity:

1. Factors affecting productivity: After calculating productivity measures for the following two or three months the first areas can be examined to deal with an improved performance.
2. A study on the setting of ISO 9002 quality control certification: Requirement of this certification such as procedure handbook and quality control handbook enable the manager to involve with the productivity measurement and improvement for the company.
3. Production planning and control studies: This study provides higher levels of productivity ratios and arranges manpower, machine and material requirements. Therefore, it provides no idle time caused in waiting for labour, machine or material.

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APPENDIX - A

Monthly Production Report
for Continuous Filament (CF) Department

Table A-1 Production Report for Continuous Filament Department (01-31/05/1998)

PRODUCTION REPORT FOR CF DEP'T OF THE FIRM A (01-31/05/1998)

Date	SHIFT 1		SHIFT 2		SHIFT 3		Total Production (kg/day)	Total Scrap (kg/day)	Material Efficiency (%)
	Production (kg/shift)	Scrap (kg/shift)	Production (kg/shift)	Scrap (kg/shift)	Production (kg/shift)	Scrap (kg/shift)			
01.May.98	604	40	700	32.1	665	5.1	1969	77.2	96.08
02.May.98	432	83	608	9.4	700	8.8	1740	101.2	94.18
03.May.98	NOT WORKED								
04.May.98	600	24.5	628	25.7	600	61	1828	111.2	93.92
05.May.98	560	19	600	27	631	11.2	1791	57.2	96.81
06.May.98	644	10.2	644	10.3	644	9.5	1932	30	98.45
07.May.98	600	31	600	32.8	651	41.2	1851	105	94.33
08.May.98	860	45	644	39.4	847	31.7	2351	116.1	95.06
09.May.98	1072	32.6	768	58.4	931	78.8	2771	169.8	93.87
10.May.98	NOT WORKED								
11.May.98	1032	7.8	1028	27.8	694	33	2754	68.6	97.51
12.May.98	892	43.4	1040	25.1	944	22.8	2876	91.3	96.83
13.May.98	1103	22.3	1102	26.2	1158	11.6	3363	60.1	98.21
14.May.98	1078	11.6	1050	31.5	1031	10	3159	53.1	98.32
15.May.98	1074	10	1119	14.2	1027	9.5	3220	33.7	98.95
16.May.98	1096	4	1060	22	1060	10.7	3216	36.7	98.86
17.May.98	NOT WORKED								

Table A-1 Production Report for Continuous Filament Department (01-31/05/1998) (Continued)

PRODUCTION REPORT FOR CF DEP'T OF THE FIRM A (01-31/05/1998)

Date	SHIFT 1		SHIFT 2		SHIFT 3		Total Production (kg/day)	Total Scrap (kg/day)	Material Efficiency (%)
	Production (kg/shift)	Scrap (kg/shift)	Production (kg/shift)	Scrap (kg/shift)	Production (kg/shift)	Scrap (kg/shift)			
18.May.98	544	23.9	816	26.9	853	8	2213	58.8	97.34
19.May.98	688	17	955	13.5	905	9.7	2548	40.2	98.42
20.May.98	799	26.9	883	32.4	864	30	2546	89.3	96.49
21.May.98	934	19.5	760	44.4	828	24.4	2522	88.3	96.50
22.May.98	854	36.9	820	22.8	917	11.9	2591	71.6	97.24
23.May.98	770	17.7	853	6.5	744	13.5	2367	37.7	98.41
24.May.98	NOT WORKED								
25.May.98	848	12.8	812	32.4	791	23.4	2451	68.6	97.20
26.May.98	861	13	791	12.3	825	12	2477	37.3	98.49
27.May.98	902	6.1	779	8.5	796	9.1	2477	23.7	99.04
28.May.98	865	14.5	770	29.4	770	28.7	2405	72.6	96.98
29.May.98	1035	26.8	672	9.5	777	5.5	2484	41.8	98.32
30.May.98	975	24.4	932	52.8	924	45.8	2831	123	95.66
31.May.98	NOT WORKED								
Total	21722	623.9	21434	673.3	21577	566.9	64733	1864.1	97.12
Percentage in Total	33.56	33.47	33.11	36.12	33.33	30.41			
			Monthly Production for May 1998				64733	1864.1	97.12

APPENDIX - B

Monthly Production Report
for Circular Weaving (CW) Department

Table B-1 Production Report [illegible] Circular Weaving Department (01-31/05/1998)

PRODUCTION REPORT FOR CIRCULAR WEA[illegible] DEPARTMENT (01-31/05/1998)

Date	SHIFT 1			SHIFT 2			SHIFT 3			Total Standard Production (m/day)	Total Actual Production (m/day)
	Standard Production (m/shift)	Actual Production (m/shift)	Effective Working Time (hr)	Standard Production (m/shift)	Actual Production (m/shift)	Effective Working Time (hr)	Standard Production (m/shift)	Actual Production (m/shift)	Effective Working Time (hr)		
01.May.98	55308.9	47900.0	135.3	39765.0	32499.0	97.8	51704.3	43537.0	126.6	146[illegible]	[illegible]3936.0
02.May.98	42404.9	36204.0	105.5	44849.1	37548.0	109.4	54388.4	47209.0	133.2	141642.4	12[illegible]
03.May.98	NOT WORKED										
04.May.98	53184.2	45044.0	129.9	39185.6	32685.0	94.5	55143.8	48091.0	134.9	147513.6	125820.0
05.May.98	44700.6	38016.0	111.4	45944.3	39124.0	112.4	55215.5	46402.0	135.3	145860.4	123542.0
06.May.98	54322.4	45988.0	133.0	55098.8	48034.0	134.8	55273.4	46828.0	135.2	164694.6	140850.0
07.May.98	55003.5	47793.0	134.6	55134.3	46799.0	134.9	55222.5	47576.0	135.1	165360.3	142168.0
08.May.98	45171.8	38541.0	110.5	51834.2	44615.0	126.8	55262.7	47459.0	135.2	152268.7	130615.0
09.May.98	55396.5	47548.0	135.5	46597.4	40036.0	113.4	55262.1	47113.0	135.2	157256.0	134697.0
10.May.98	NOT WORKED										
11.May.98	46812.8	39363.0	115.1	54478.7	46451.0	133.4	48469.5	40699.0	118.6	149761.0	126513.0
12.May.98	54915.2	46907.0	134.4	42922.4	37678.0	105.0	55430.3	48004.0	135.6	153267.9	132589.0
13.May.98	53948.3	47147.0	132.1	48874.5	41699.0	120.4	55362.8	47799.0	135.4	158185.6	136645.0
14.May.98	54809.1	47069.0	133.7	51673.1	42944.0	127.1	55427.9	47578.0	135.6	161910.1	137591.0
15.May.98	55040.1	47319.0	134.7	50513.4	43726.0	124.6	44972.3	38953.0	110.0	150525.8	129998.0
16.May.98	55450.4	47114.0	135.6	51666.0	44014.0	126.2	55429.1	48024.0	135.6	162545.5	139152.0
17.May.98	NOT WORKED										

Table B-1 Production Report for Circular Weaving Department (01-31/05/1998) (Continued)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT (01-31/05/1998)

Date	SHIFT 1			SHIFT 2			SHIFT 3			Total Standard Production (m/day)	Total Actual Production (m/day)
	Standard Production (m/shift)	Actual Production (m/shift)	Effective Working Time (hr)	Standard Production (m/shift)	Actual Production (m/shift)	Effective Working Time (hr)	Standard Production (m/shift)	Actual Production (m/shift)	Effective Working Time (hr)		
18.May.98	48646.4	40995.0	119.0	55354.5	47271.0	135.4	47587.2	40444.0	113.6	151588.1	128710.0
19.May.98	54460.5	46527.0	133.2	55272.2	46896.0	135.1	55464.0	47971.0	135.7	165196.7	141394.0
20.May.98	55418.4	48301.0	135.6	44981.1	38557.0	110.2	55596.0	48174.0	136.0	155995.5	135032.0
21.May.98	55517.9	48126.0	135.8	55517.9	48250.0	135.8	51921.8	45844.0	127.0	162957.6	142220.0
22.May.98	54753.5	47418.0	133.6	44962.2	38841.0	110.0	55407.2	47896.0	135.5	155122.9	134155.0
23.May.98	45786.6	39751.0	112.0	55439.1	48121.0	135.6	55439.7	47628.0	135.6	156665.4	135500.0
24.May.98	NOT WORKED										
25.May.98	54996.9	47103.0	134.6	49738.7	42062.0	121.7	55451.6	47955.0	135.6	160187.2	137120.0
26.May.98	55431.5	48232.0	135.6	55450.4	47577.0	135.6	55247.3	47507.0	135.0	166129.2	143316.0
27.May.98	55596.0	48005.0	136.0	54903.6	47434.0	134.4	55596.0	47995.0	136.0	166095.6	143434.0
28.May.98	54988.7	47743.0	134.6	55562.3	47684.0	135.9	54305.4	46437.0	133.1	164856.4	141864.0
29.May.98	45128.6	38825.0	110.4	55596.0	47491.0	136.0	55596.0	47412.0	136.0	156320.6	133728.0
30.May.98	52660.1	46582.0	128.9	55207.2	47316.0	135.1	55596.0	47689.0	136.0	163463.3	141587.0
31.May.98	NOT WORKED										
Total	1359853.8	1169561.0	3330.6	1316522.0	1125352.0	3221.5	1405772.8	1208224.0	3436.6	4082148.6	3503137.0
Percentage in Total	33.31	33.39		32.25	32.12		34.44	34.49			
				Monthly Production for May 1998						4082148.6	3503137.0

Table B-2 Production Report for Circular Weaving Department (01/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (01.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.9	3412.8	3100	90.8
L2	4	720	2.5	432.0	8.0	3456.0	2958	85.6
L3	4	720	2.5	432.0	7.9	3412.8	2894	84.8
L4	4	720	2.5	432.0	8.0	3456.0	3025	87.5
L5	4	720	2.5	432.0	8.0	3456.0	2927	84.7
L6	4	720	2.5	432.0	8.0	3456.0	2844	82.3
L7	4	740	2.5	444.0	7.8	3463.2	2591	74.8
L8	4	740	2.5	444.0	8.0	3552.0	2790	78.5
L9	4	740	2.5	444.0	7.9	3507.6	3305	94.2
L10	4	740	2.5	444.0	8.0	3552.0	3261	91.8
L11	4	740	2.5	444.0	8.0	3552.0	2875	80.9
L12	4	750	2.5	450.0	8.0	3600.0	2929	81.4
L13	3	750	2.5	337.5	7.9	2666.3	2513	94.3
L14	3	750	2.5	337.5	7.9	2666.3	2548	95.6
L15	3	750	2.5	337.5	8.0	2700.0	2465	91.3
L16	3	750	2.5	337.5	8.0	2700.0	2456	91.0
L17	3	750	2.5	337.5	8.0	2700.0	2419	89.6
Total	63			6949.5	135.3	55308.9	47900	
					Average Labour Efficiency (%) =		86.6	

Table B-3 Production Report for Circular Weaving Department (01/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (01.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	5.9	2548.8	2335	91.6
L2	4	720	2.5	432.0	5.0	2160.0	1876	86.9
L3	4	720	2.5	432.0	5.6	2419.2	1935	80.0
L4	4	720	2.5	432.0	5.8	2505.6	2118	84.5
L5	4	720	2.5	432.0	5.8	2505.6	1859	74.2
L6	4	720	2.5	432.0	6.1	2635.2	1994	75.7
L7	4	740	2.5	444.0	6.0	2664.0	1858	69.7
L8	4	740	2.5	444.0	5.9	2619.6	2345	89.5
L9	4	740	2.5	444.0	4.9	2175.6	1764	81.1
L10	4	740	2.5	444.0	5.3	2353.2	1908	81.1
L11	4	740	2.5	444.0	5.3	2353.2	2101	89.3
L12	4	750	2.5	450.0	5.4	2430.0	2227	91.6
L13	3	750	2.5	337.5	6.0	2025.0	1543	76.2
L14	3	750	2.5	337.5	6.2	2092.5	1621	77.5
L15	3	750	2.5	337.5	6.2	2092.5	1784	85.3
L16	3	750	2.5	337.5	6.1	2058.8	1498	72.8
L17	3	750	2.5	337.5	6.3	2126.3	1733	81.5
Total	63			6949.5	97.8	39765.0	32499	
					Average Labour Efficiency (%) =			81.7

Table B-4 Production Report for Circular Weaving Department (01/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (01.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.9	3412.8	2990	87.6
L2	4	720	2.5	432.0	7.9	3412.8	2912	85.3
L3	4	720	2.5	432.0	7.5	3240.0	2884	89.0
L4	4	720	2.5	432.0	7.1	3067.2	2431	79.3
L5	4	720	2.5	432.0	7.3	3153.6	2804	88.9
L6	4	720	2.5	432.0	8.0	3456.0	3121	90.3
L7	4	740	2.5	444.0	7.8	3463.2	2975	85.9
L8	4	740	2.5	444.0	8.0	3552.0	3044	85.7
L9	4	740	2.5	444.0	7.9	3507.6	3108	88.6
L10	4	740	2.5	444.0	6.3	2797.2	2253	80.5
L11	4	740	2.5	444.0	7.4	3285.6	2765	84.2
L12	4	750	2.5	450.0	6.0	2700.0	2047	75.8
L13	3	750	2.5	337.5	7.1	2396.3	2033	84.8
L14	3	750	2.5	337.5	7.3	2463.8	2172	88.2
L15	3	750	2.5	337.5	7.5	2531.3	1985	78.4
L16	3	750	2.5	337.5	7.7	2598.8	1867	71.8
L17	3	750	2.5	337.5	7.9	2666.3	2146	80.5
Total	63			6949.5	126.6	51704.3	43537	
					Average Labour Efficiency (%) =		84.2	

Table B-5 Production Report for Circular Weaving Department (02/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (02.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	3.9	1684.8	1387	82.3
L2	4	720	2.5	432.0	3.9	1684.8	1400	83.1
L3	4	720	2.5	432.0	3.8	1641.6	1395	85.0
L4	4	720	2.5	432.0	3.9	1684.8	1390	82.5
L5	4	720	2.5	432.0	3.8	1641.6	1430	87.1
L6	4	720	2.5	432.0	3.9	1684.8	1425	84.6
L7	4	740	2.5	444.0	4.1	1820.4	1630	89.5
L8	4	740	2.5	444.0	6.9	3063.6	2576	84.1
L9	4	740	2.5	444.0	7.9	3507.6	3141	89.5
L10	4	740	2.5	444.0	7.9	3507.6	3056	87.1
L11	4	740	2.5	444.0	8.0	3552.0	2984	84.0
L12	4	750	2.5	450.0	8.0	3600.0	3308	91.9
L13	3	750	2.5	337.5	7.7	2598.8	1998	76.9
L14	3	750	2.5	337.5	8.0	2700.0	2419	89.6
L15	3	750	2.5	337.5	8.0	2700.0	2104	77.9
L16	3	750	2.5	337.5	7.9	2666.3	2256	84.6
L17	3	750	2.5	337.5	7.9	2666.3	2305	86.5
Total	63			6949.5	105.5	42404.9	36204	
					Average Labour Efficiency (%) =		85.4	

Table B-6 Production Report for Circular Weaving Department (02/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (02.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	6.7	2894.4	2365	81.7
L2	4	720	2.5	432.0	6.5	2808.0	2351	83.7
L3	4	720	2.5	432.0	6.6	2851.2	2409	84.5
L4	4	720	2.5	432.0	6.1	2635.2	1980	75.1
L5	4	720	2.5	432.0	5.9	2548.8	1965	77.1
L6	4	720	2.5	432.0	6.7	2894.4	2309	79.8
L7	4	740	2.5	444.0	6.7	2974.8	2648	89.0
L8	4	740	2.5	444.0	6.7	2974.8	2761	92.8
L9	4	740	2.5	444.0	6.8	3019.2	2750	91.1
L10	4	740	2.5	444.0	6.6	2930.4	2594	88.5
L11	4	740	2.5	444.0	6.6	2930.4	2630	89.7
L12	4	750	2.5	450.0	6.5	2925.0	2325	79.5
L13	3	750	2.5	337.5	5.8	1957.5	1458	74.5
L14	3	750	2.5	337.5	6.3	2126.3	1535	72.2
L15	3	750	2.5	337.5	6.3	2126.3	1878	88.3
L16	3	750	2.5	337.5	6.1	2058.8	1692	82.2
L17	3	750	2.5	337.5	6.5	2193.8	1898	86.5
Total	63			6949.5	109.4	44849.1	37548	
					Average Labour Efficiency (%) =		83.7	

Table B-7 Production Report for Circular Weaving Department (02/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (02.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	3024	87.5
L2	4	720	2.5	432.0	8.0	3456.0	3125	90.4
L3	4	720	2.5	432.0	8.0	3456.0	3152	91.2
L4	4	720	2.5	432.0	7.9	3412.8	2884	84.5
L5	4	720	2.5	432.0	7.8	3369.6	2765	82.1
L6	4	720	2.5	432.0	8.0	3456.0	2978	86.2
L7	4	740	2.5	444.0	7.1	3152.4	2756	87.4
L8	4	740	2.5	444.0	7.0	3108.0	2667	85.8
L9	4	740	2.5	444.0	7.8	3463.2	3123	90.2
L10	4	740	2.5	444.0	7.9	3507.6	2884	82.2
L11	4	740	2.5	444.0	8.0	3552.0	2761	77.7
L12	4	750	2.5	450.0	8.0	3600.0	3054	84.8
L13	3	750	2.5	337.5	7.9	2666.3	2350	88.1
L14	3	750	2.5	337.5	8.0	2700.0	2519	93.3
L15	3	750	2.5	337.5	7.9	2666.3	2436	91.4
L16	3	750	2.5	337.5	8.0	2700.0	2411	89.3
L17	3	750	2.5	337.5	7.9	2666.3	2320	87.0
Total	63			6949.5	133.2	54388.4	47209	
						Average Labour Efficiency (%) =		86.8

Table B-8 Production Report for Circular Weaving Department (04/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (04.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.9	3412.8	3025	88.6
L2	4	720	2.5	432.0	8.0	3456.0	3150	91.1
L3	4	720	2.5	432.0	8.0	3456.0	2950	85.4
L4	4	720	2.5	432.0	7.7	3326.4	2975	89.4
L5	4	720	2.5	432.0	8.0	3456.0	2998	86.7
L6	4	720	2.5	432.0	8.0	3456.0	3200	92.6
L7	4	740	2.5	444.0	8.0	3552.0	3025	85.2
L8	4	740	2.5	444.0	7.9	3507.6	3014	85.9
L9	4	740	2.5	444.0	7.8	3463.2	2850	82.3
L10	4	740	2.5	444.0	8.0	3552.0	2904	81.8
L11	4	740	2.5	444.0	8.0	3552.0	3150	88.7
L12	4	750	2.5	450.0	7.9	3555.0	3125	87.9
L13	3	750	2.5	337.5	7.9	2666.3	2412	90.5
L14	3	750	2.5	337.5	8.0	2700.0	2350	87.0
L15	3	750	2.5	337.5	7.9	2666.3	2214	83.0
L16	3	750	2.5	337.5	7.9	2666.3	2444	91.7
L17	3	750	2.5	337.5	8.0	2700.0	2305	85.4
Total	63			6949.5	134.9	55143.8	48091	
					Average Labour Efficiency (%) =		87.2	

Table B-9 Production Report for Circular Weaving Department (04/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (04.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.9	3412.8	3003	88.0
L2	4	720	2.5	432.0	8.0	3456.0	2981	86.3
L3	4	720	2.5	432.0	8.0	3456.0	3211	92.9
L4	4	720	2.5	432.0	7.6	3283.2	2874	87.5
L5	4	720	2.5	432.0	7.7	3326.4	2766	83.2
L6	4	720	2.5	432.0	8.0	3456.0	2983	86.3
L7	4	740	2.5	444.0	7.9	3507.6	3120	88.9
L8	4	740	2.5	444.0	7.7	3418.8	2451	71.7
L9	4	740	2.5	444.0	7.9	3507.6	3354	95.6
L10	4	740	2.5	444.0	8.0	3552.0	2888	81.3
L11	4	740	2.5	444.0	6.0	2664.0	2091	78.5
L12	4	750	2.5	450.0	7.9	3555.0	2865	80.6
L13	3	750	2.5	337.5	8.0	2700.0	2415	89.4
L14	3	750	2.5	337.5	8.0	2700.0	2451	90.8
L15	3	750	2.5	337.5	7.9	2666.3	1877	70.4
L16	3	750	2.5	337.5	8.0	2700.0	2229	82.6
L17	3	750	2.5	337.5	5.4	1822.5	1485	81.5
Total	63			6949.5	129.9	53184.2	45044	
					Average Labour Efficiency (%) =			84.7

Table B-10 Production Report for Circular Weaving Department (04/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (04.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	3009	87.1
L2	4	720	2.5	432.0	7.9	3412.8	2884	84.5
L3	4	720	2.5	432.0	7.9	3412.8	2793	81.8
L4	4	720	2.5	432.0	7.8	3369.6	3073	91.2
L5	4	720	2.5	432.0	8.0	3456.0	2949	85.3
L6	4	720	2.5	432.0	7.9	3412.8	2980	87.3
L7	4	740	2.5	444.0	4.5	1998.0	1634	81.8
L8	4	740	2.5	444.0	4.4	1953.6	1636	83.7
L9	4	740	2.5	444.0	4.9	2175.6	1499	68.9
L10	4	740	2.5	444.0	4.1	1820.4	1400	76.9
L11	4	740	2.5	444.0	4.3	1909.2	1451	76.0
L12	4	750	2.5	450.0	3.9	1755.0	1437	81.9
L13	3	750	2.5	337.5	3.9	1316.3	1219	92.6
L14	3	750	2.5	337.5	4.2	1417.5	1214	85.6
L15	3	750	2.5	337.5	4.2	1417.5	1121	79.1
L16	3	750	2.5	337.5	4.2	1417.5	1136	80.1
L17	3	750	2.5	337.5	4.4	1485.0	1250	84.2
Total	63			6949.5	94.5	39185.6	32685	
					Average Labour Efficiency (%) =		83.4	

Table B-11 Production Report for Circular Weaving Department (05/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (05.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	3024	87.5
L2	4	720	2.5	432.0	8.0	3456.0	2980	86.2
L3	4	720	2.5	432.0	8.0	3456.0	3102	89.8
L4	4	720	2.5	432.0	7.8	3369.6	2858	84.8
L5	4	720	2.5	432.0	7.9	3412.8	2888	84.6
L6	4	720	2.5	432.0	7.9	3412.8	2765	81.0
L7	4	740	2.5	444.0	7.8	3463.2	2931	84.6
L8	4	740	2.5	444.0	8.0	3552.0	3020	85.0
L9	4	740	2.5	444.0	7.7	3418.8	2891	84.6
L10	4	740	2.5	444.0	7.7	3418.8	2711	79.3
L11	4	740	2.5	444.0	7.8	3463.2	2807	81.1
L12	4	750	2.5	450.0	8.0	3600.0	2719	75.5
L13	3	750	2.5	337.5	7.8	2632.5	1894	71.9
L14	3	750	2.5	337.5	8.0	2700.0	2465	91.3
L15	3	750	2.5	337.5	8.0	2700.0	2378	88.1
L16	3	750	2.5	337.5	7.9	2666.3	2300	86.3
L17	3	750	2.5	337.5	9.0	3037.5	2669	87.9
Total	63			6949.5	135.3	55215.5	46402	
					Average Labour Efficiency (%) =		84.0	

Table B-12 Production Report for Circular Weaving Department (05/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (05.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	3121	90.3
L2	4	720	2.5	432.0	7.9	3412.8	2979	87.3
L3	4	720	2.5	432.0	8.0	3456.0	3012	87.2
L4	4	720	2.5	432.0	7.9	3412.8	3110	91.1
L5	4	720	2.5	432.0	7.6	3283.2	2751	83.8
L6	4	720	2.5	432.0	8.0	3456.0	2994	86.6
L7	4	740	2.5	444.0	4.4	1953.6	1634	83.6
L8	4	740	2.5	444.0	3.8	1687.2	1287	76.3
L9	4	740	2.5	444.0	4.0	1776.0	1603	90.3
L10	4	740	2.5	444.0	3.9	1731.6	1548	89.4
L11	4	740	2.5	444.0	4.1	1820.4	1632	89.7
L12	4	750	2.5	450.0	4.2	1890.0	1529	80.9
L13	3	750	2.5	337.5	7.9	2666.3	1983	74.4
L14	3	750	2.5	337.5	7.8	2632.5	2136	81.1
L15	3	750	2.5	337.5	8.0	2700.0	2451	90.8
L16	3	750	2.5	337.5	8.0	2700.0	2275	84.3
L17	3	750	2.5	337.5	7.9	2666.3	1971	73.9
Total	63			6949.5	111.4	44700.6	38016	
					Average Labour Efficiency (%) =		85.0	

Table B-13 Production Report for Circular Weaving Department (05/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (05.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	6.6	2851.2	2551	89.5
L2	4	720	2.5	432.0	6.5	2808.0	2509	89.4
L3	4	720	2.5	432.0	6.7	2894.4	2436	84.2
L4	4	720	2.5	432.0	6.7	2894.4	2375	82.1
L5	4	720	2.5	432.0	6.6	2851.2	2408	84.5
L6	4	720	2.5	432.0	6.6	2851.2	2491	87.4
L7	4	740	2.5	444.0	6.4	2841.6	2387	84.0
L8	4	740	2.5	444.0	6.7	2974.8	2415	81.2
L9	4	740	2.5	444.0	6.6	2930.4	2100	71.7
L10	4	740	2.5	444.0	6.5	2886.0	2530	87.7
L11	4	740	2.5	444.0	6.7	2974.8	2644	88.9
L12	4	750	2.5	450.0	6.7	3015.0	2555	84.7
L13	3	750	2.5	337.5	6.5	2193.8	1876	85.5
L14	3	750	2.5	337.5	6.7	2261.3	1900	84.0
L15	3	750	2.5	337.5	6.6	2227.5	1963	88.1
L16	3	750	2.5	337.5	6.6	2227.5	2001	89.8
L17	3	750	2.5	337.5	6.7	2261.3	1983	87.7
Total	63			6949.5	112.4	45944.3	39124	
					Average Labour Efficiency (%) =		85.2	

Table B-14 Production Report for Circular Weaving Department (06/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (06.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	3025	87.5
L2	4	720	2.5	432.0	8.0	3456.0	2976	86.1
L3	4	720	2.5	432.0	8.0	3456.0	2889	83.6
L4	4	720	2.5	432.0	8.0	3456.0	2878	83.3
L5	4	720	2.5	432.0	7.9	3412.8	3021	88.5
L6	4	720	2.5	432.0	8.0	3456.0	2765	80.0
L7	4	740	2.5	444.0	8.0	3552.0	2846	80.1
L8	4	740	2.5	444.0	7.8	3463.2	2897	83.7
L9	4	740	2.5	444.0	7.9	3507.6	2799	79.8
L10	4	740	2.5	444.0	8.0	3552.0	3150	88.7
L11	4	740	2.5	444.0	8.0	3552.0	3200	90.1
L12	4	750	2.5	450.0	7.9	3555.0	3105	87.3
L13	3	750	2.5	337.5	7.8	2632.5	2157	81.9
L14	3	750	2.5	337.5	8.0	2700.0	2363	87.5
L15	3	750	2.5	337.5	8.0	2700.0	2354	87.2
L16	3	750	2.5	337.5	8.0	2700.0	2271	84.1
L17	3	750	2.5	337.5	7.9	2666.3	2132	80.0
Total	63			6949.5	135.2	55273.4	46828	
					Average Labour Efficiency (%) =		84.7	

Table B-15 Production Report for Circular Weaving Department (06/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (06.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.6	3283.2	2736	83.3
L2	4	720	2.5	432.0	7.2	3110.4	2578	82.9
L3	4	720	2.5	432.0	7.4	3196.8	2664	83.3
L4	4	720	2.5	432.0	8.0	3456.0	3100	89.7
L5	4	720	2.5	432.0	7.8	3369.6	2887	85.7
L6	4	720	2.5	432.0	7.8	3369.6	2930	87.0
L7	4	740	2.5	444.0	7.9	3507.6	2891	82.4
L8	4	740	2.5	444.0	7.9	3507.6	3012	85.9
L9	4	740	2.5	444.0	7.8	3463.2	2905	83.9
L10	4	740	2.5	444.0	8.0	3552.0	3200	90.1
L11	4	740	2.5	444.0	7.9	3507.6	2873	81.9
L12	4	750	2.5	450.0	8.0	3600.0	2765	76.8
L13	3	750	2.5	337.5	7.9	2666.3	2155	80.8
L14	3	750	2.5	337.5	8.0	2700.0	2450	90.7
L15	3	750	2.5	337.5	8.0	2700.0	2539	94.0
L16	3	750	2.5	337.5	7.9	2666.3	2074	77.8
L17	3	750	2.5	337.5	7.9	2666.3	2229	83.6
Total	63			6949.5	133.0	54322.4	45988	
					Average Labour Efficiency (%) =		84.7	

Table B-16 Production Report for Circular Weaving Department (06/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (06.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.9	3412.8	2885	84.5
L2	4	720	2.5	432.0	8.0	3456.0	2898	83.9
L3	4	720	2.5	432.0	8.0	3456.0	2994	86.6
L4	4	720	2.5	432.0	8.0	3456.0	3107	89.9
L5	4	720	2.5	432.0	7.9	3412.8	2887	84.6
L6	4	720	2.5	432.0	7.9	3412.8	3050	89.4
L7	4	740	2.5	444.0	7.8	3463.2	2925	84.5
L8	4	740	2.5	444.0	8.0	3552.0	2947	83.0
L9	4	740	2.5	444.0	7.8	3463.2	3002	86.7
L10	4	740	2.5	444.0	7.9	3507.6	2991	85.3
L11	4	740	2.5	444.0	7.9	3507.6	2887	82.3
L12	4	750	2.5	450.0	8.0	3600.0	3345	92.9
L13	3	750	2.5	337.5	8.0	2700.0	2450	90.7
L14	3	750	2.5	337.5	7.9	2666.3	2399	90.0
L15	3	750	2.5	337.5	8.0	2700.0	2437	90.3
L16	3	750	2.5	337.5	7.9	2666.3	2501	93.8
L17	3	750	2.5	337.5	7.9	2666.3	2329	87.4
Total	63			6949.5	134.8	55098.8	48034	
					Average Labour Efficiency (%) =		87.2	

Table B-17 Production Report for Circular Weaving Department (07/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (07.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	3050	88.3
L2	4	720	2.5	432.0	7.9	3412.8	2783	81.5
L3	4	720	2.5	432.0	7.9	3412.8	2724	79.8
L4	4	720	2.5	432.0	8.0	3456.0	3111	90.0
L5	4	720	2.5	432.0	8.0	3456.0	2987	86.4
L6	4	720	2.5	432.0	7.8	3369.6	2793	82.9
L7	4	740	2.5	444.0	8.0	3552.0	3264	91.9
L8	4	740	2.5	444.0	7.9	3507.6	3029	86.4
L9	4	740	2.5	444.0	8.0	3552.0	2987	84.1
L10	4	740	2.5	444.0	7.9	3507.6	2886	82.3
L11	4	740	2.5	444.0	7.9	3507.6	2991	85.3
L12	4	750	2.5	450.0	8.0	3600.0	3205	89.0
L13	3	750	2.5	337.5	8.0	2700.0	2371	87.8
L14	3	750	2.5	337.5	8.0	2700.0	2389	88.5
L15	3	750	2.5	337.5	7.9	2666.3	2257	84.7
L16	3	750	2.5	337.5	8.0	2700.0	2363	87.5
L17	3	750	2.5	337.5	7.9	2666.3	2386	89.5
Total	63			6949.5	135.1	55222.5	47576	
					Average Labour Efficiency (%) =		86.2	

Table B-18 Production Report for Circular Weaving Department (07/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (07.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.7	3326.4	2788	83.8
L2	4	720	2.5	432.0	7.9	3412.8	2890	84.7
L3	4	720	2.5	432.0	7.8	3369.6	2990	88.7
L4	4	720	2.5	432.0	8.0	3456.0	3015	87.2
L5	4	720	2.5	432.0	8.0	3456.0	3158	91.4
L6	4	720	2.5	432.0	7.9	3412.8	2791	81.8
L7	4	740	2.5	444.0	8.0	3552.0	3209	90.3
L8	4	740	2.5	444.0	8.0	3552.0	3078	86.7
L9	4	740	2.5	444.0	7.9	3507.6	2883	82.2
L10	4	740	2.5	444.0	7.9	3507.6	2975	84.8
L11	4	740	2.5	444.0	7.8	3463.2	2934	84.7
L12	4	750	2.5	450.0	7.9	3555.0	2939	82.7
L13	3	750	2.5	337.5	7.9	2666.3	2425	91.0
L14	3	750	2.5	337.5	8.0	2700.0	2405	89.1
L15	3	750	2.5	337.5	8.0	2700.0	2388	88.4
L16	3	750	2.5	337.5	7.9	2666.3	2418	90.7
L17	3	750	2.5	337.5	8.0	2700.0	2507	92.9
Total	63			6949.5	134.6	55003.5	47793	
					Average Labour Efficiency (%) =			86.9

Table B-19 Production Report for Circular Weaving Department (07/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (07.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2994	86.6
L2	4	720	2.5	432.0	7.9	3412.8	2978	87.3
L3	4	720	2.5	432.0	7.9	3412.8	2876	84.3
L4	4	720	2.5	432.0	7.9	3412.8	2888	84.6
L5	4	720	2.5	432.0	7.9	3412.8	2767	81.1
L6	4	720	2.5	432.0	7.9	3412.8	2893	84.8
L7	4	740	2.5	444.0	8.0	3552.0	3254	91.6
L8	4	740	2.5	444.0	7.9	3507.6	3063	87.3
L9	4	740	2.5	444.0	7.9	3507.6	2765	78.8
L10	4	740	2.5	444.0	8.0	3552.0	2789	78.5
L11	4	740	2.5	444.0	7.9	3507.6	3124	89.1
L12	4	750	2.5	450.0	7.9	3555.0	3111	87.5
L13	3	750	2.5	337.5	8.0	2700.0	2094	77.6
L14	3	750	2.5	337.5	8.0	2700.0	2158	79.9
L15	3	750	2.5	337.5	8.0	2700.0	2467	91.4
L16	3	750	2.5	337.5	7.9	2666.3	2331	87.4
L17	3	750	2.5	337.5	7.9	2666.3	2247	84.3
Total	63			6949.5	134.9	55134.3	46799	
					Average Labour Efficiency (%) =		84.9	

Table B-20 Production Report for Circular Weaving Department (08/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (08.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2980	86.2
L2	4	720	2.5	432.0	8.0	3456.0	2973	86.0
L3	4	720	2.5	432.0	7.9	3412.8	3010	88.2
L4	4	720	2.5	432.0	8.0	3456.0	3058	88.5
L5	4	720	2.5	432.0	8.0	3456.0	3075	89.0
L6	4	720	2.5	432.0	8.0	3456.0	2989	86.5
L7	4	740	2.5	444.0	7.9	3507.6	2861	81.6
L8	4	740	2.5	444.0	7.9	3507.6	3098	88.3
L9	4	740	2.5	444.0	7.9	3507.6	2875	82.0
L10	4	740	2.5	444.0	8.0	3552.0	3108	87.5
L11	4	740	2.5	444.0	7.9	3507.6	2994	85.4
L12	4	750	2.5	450.0	7.9	3555.0	3254	91.5
L13	3	750	2.5	337.5	8.0	2700.0	2365	87.6
L14	3	750	2.5	337.5	8.0	2700.0	2289	84.8
L15	3	750	2.5	337.5	8.0	2700.0	2147	79.5
L16	3	750	2.5	337.5	7.9	2666.3	2163	81.1
L17	3	750	2.5	337.5	7.9	2666.3	2220	83.3
Total	63			6949.5	135.2	55262.7	47459	
					Average Labour Efficiency (%) =			85.9

Table B-21 Production Report for Circular Weaving Department (08/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (08.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	6.5	2808.0	2450	87.3
L2	4	720	2.5	432.0	6.5	2808.0	2512	89.5
L3	4	720	2.5	432.0	6.5	2808.0	2334	83.1
L4	4	720	2.5	432.0	6.5	2808.0	2384	84.9
L5	4	720	2.5	432.0	6.5	2808.0	2378	84.7
L6	4	720	2.5	432.0	6.5	2808.0	2401	85.5
L7	4	740	2.5	444.0	6.5	2886.0	2412	83.6
L8	4	740	2.5	444.0	6.5	2886.0	2529	87.6
L9	4	740	2.5	444.0	6.5	2886.0	2444	84.7
L10	4	740	2.5	444.0	6.5	2886.0	2358	81.7
L11	4	740	2.5	444.0	6.5	2886.0	2349	81.4
L12	4	750	2.5	450.0	6.5	2925.0	2397	81.9
L13	3	750	2.5	337.5	6.5	2193.8	1994	90.9
L14	3	750	2.5	337.5	6.5	2193.8	1907	86.9
L15	3	750	2.5	337.5	6.5	2193.8	1882	85.8
L16	3	750	2.5	337.5	6.5	2193.8	1876	85.5
L17	3	750	2.5	337.5	6.5	2193.8	1934	88.2
Total	63			6949.5	110.5	45171.8	38541	
					Average Labour Efficiency (%) =			85.3

Table B-22 Production Report for Circular Weaving Department (08/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (08.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.5	3240.0	2754	85.0
L2	4	720	2.5	432.0	7.4	3196.8	2777	86.9
L3	4	720	2.5	432.0	7.5	3240.0	2654	81.9
L4	4	720	2.5	432.0	7.5	3240.0	2749	84.8
L5	4	720	2.5	432.0	7.5	3240.0	2651	81.8
L6	4	720	2.5	432.0	7.4	3196.8	2912	91.1
L7	4	740	2.5	444.0	7.4	3285.6	2599	79.1
L8	4	740	2.5	444.0	7.5	3330.0	2975	89.3
L9	4	740	2.5	444.0	7.5	3330.0	2635	79.1
L10	4	740	2.5	444.0	7.5	3330.0	2746	82.5
L11	4	740	2.5	444.0	7.3	3241.2	2850	87.9
L12	4	750	2.5	450.0	7.5	3375.0	3027	89.7
L13	3	750	2.5	337.5	7.5	2531.3	2250	88.9
L14	3	750	2.5	337.5	7.4	2497.5	2225	89.1
L15	3	750	2.5	337.5	7.5	2531.3	2310	91.3
L16	3	750	2.5	337.5	7.5	2531.3	2351	92.9
L17	3	750	2.5	337.5	7.4	2497.5	2150	86.1
Total	63			6949.5	126.8	51834.2	44615	
					Average Labour Efficiency (%) =		86.1	

Table B-23 Production Report for Circular Weaving Department (09/05/1998 - Shift 3)

PRODUCTION REPORT FOR THE FIRM A (Yuvarlak Dokuma)								
SHIFT 3 (09.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2956	85.5
L2	4	720	2.5	432.0	7.9	3412.8	3005	88.1
L3	4	720	2.5	432.0	8.0	3456.0	2879	83.3
L4	4	720	2.5	432.0	8.0	3456.0	2761	79.9
L5	4	720	2.5	432.0	8.0	3456.0	2894	83.7
L6	4	720	2.5	432.0	8.0	3456.0	2991	86.5
L7	4	740	2.5	444.0	8.0	3552.0	2746	77.3
L8	4	740	2.5	444.0	8.0	3552.0	3210	90.4
L9	4	740	2.5	444.0	8.0	3552.0	2995	84.3
L10	4	740	2.5	444.0	7.8	3463.2	2876	83.0
L11	4	740	2.5	444.0	7.9	3507.6	3256	92.8
L12	4	750	2.5	450.0	7.8	3510.0	3148	89.7
L13	3	750	2.5	337.5	8.0	2700.0	2462	91.2
L14	3	750	2.5	337.5	7.9	2666.3	2329	87.4
L15	3	750	2.5	337.5	8.0	2700.0	2357	87.3
L16	3	750	2.5	337.5	8.0	2700.0	1973	73.1
L17	3	750	2.5	337.5	7.9	2666.3	2275	85.3
Total	63			6949.5	135.2	55262.1	47113	
					Average Labour Efficiency (%) =		85.3	

Table B-24 Production Report for Circular Weaving Department (09/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (09.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.9	3412.8	2994	87.7
L2	4	720	2.5	432.0	8.0	3456.0	3012	87.2
L3	4	720	2.5	432.0	8.0	3456.0	2882	83.4
L4	4	720	2.5	432.0	8.0	3456.0	2897	83.8
L5	4	720	2.5	432.0	8.0	3456.0	3152	91.2
L6	4	720	2.5	432.0	8.0	3456.0	2978	86.2
L7	4	740	2.5	444.0	8.0	3552.0	2784	78.4
L8	4	740	2.5	444.0	7.9	3507.6	2789	79.5
L9	4	740	2.5	444.0	7.9	3507.6	3064	87.4
L10	4	740	2.5	444.0	8.0	3552.0	2891	81.4
L11	4	740	2.5	444.0	8.0	3552.0	2993	84.3
L12	4	750	2.5	450.0	8.0	3600.0	3250	90.3
L13	3	750	2.5	337.5	8.0	2700.0	2540	94.1
L14	3	750	2.5	337.5	7.9	2666.3	2444	91.7
L15	3	750	2.5	337.5	8.0	2700.0	2386	88.4
L16	3	750	2.5	337.5	8.0	2700.0	2364	87.6
L17	3	750	2.5	337.5	7.9	2666.3	2128	79.8
Total	63			6949.5	135.5	55396.5	47548	
					Average Labour Efficiency (%) =		85.8	

Table B-25 Production Report for Circular Weaving Department (09/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (09.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.3	3153.6	2750	87.2
L2	4	720	2.5	432.0	7.3	3153.6	2777	88.1
L3	4	720	2.5	432.0	7.3	3153.6	2864	90.8
L4	4	720	2.5	432.0	7.3	3153.6	2549	80.8
L5	4	720	2.5	432.0	4.7	2030.4	1752	86.3
L6	4	720	2.5	432.0	4.6	1987.2	1608	80.9
L7	4	740	2.5	444.0	7.2	3196.8	2980	93.2
L8	4	740	2.5	444.0	7.3	3241.2	2845	87.8
L9	4	740	2.5	444.0	7.3	3241.2	2875	88.7
L10	4	740	2.5	444.0	7.3	3241.2	2765	85.3
L11	4	740	2.5	444.0	7.3	3241.2	2451	75.6
L12	4	750	2.5	450.0	7.2	3240.0	2593	80.0
L13	3	750	2.5	337.5	7.3	2463.8	2267	92.0
L14	3	750	2.5	337.5	7.3	2463.8	2073	84.1
L15	3	750	2.5	337.5	4.6	1552.5	1193	76.8
L16	3	750	2.5	337.5	4.8	1620.0	1433	88.5
L17	3	750	2.5	337.5	7.3	2463.8	2261	91.8
Total	63.00			6949.5	113.4	46597.4	40036	
					Average Labour Efficiency (%) =		85.9	

Table B-26 Production Report for Circular Weaving Department (11/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (11.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	6.0	2592.0	2235	86.2
L2	4	720	2.5	432.0	8.0	3456.0	2884	83.4
L3	4	720	2.5	432.0	7.9	3412.8	2697	79.0
L4	4	720	2.5	432.0	8.0	3456.0	3057	88.5
L5	4	720	2.5	432.0	7.9	3412.8	2791	81.8
L6	4	720	2.5	432.0	8.0	3456.0	2880	83.3
L7	4	740	2.5	444.0	8.0	3552.0	3241	91.2
L8	4	740	2.5	444.0	7.9	3507.6	2862	81.6
L9	4	740	2.5	444.0	8.0	3552.0	2873	80.9
L10	4	740	2.5	444.0	8.0	3552.0	3254	91.6
L11	4	740	2.5	444.0	7.8	3463.2	2976	85.9
L12	4	750	2.5	450.0	8.0	3600.0	3291	91.4
L13	3	750	2.5	337.5	8.0	2700.0	2250	83.3
L14	3	750	2.5	337.5	8.0	2700.0	2177	80.6
L15	3	750	2.5	337.5	7.9	2666.3	2436	91.4
L16	3	750	2.5	337.5	8.0	2700.0	2363	87.5
L17	3	750	2.5	337.5	8.0	2700.0	2184	80.9
Total	63			6949.5	133.4	54478.7	46451	
					Average Labour Efficiency (%) =		85.3	

Table B-27 Production Report for Circular Weaving Department (11/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (11.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.0	3024.0	2635	87.1
L2	4	720	2.5	432.0	7.0	3024.0	2589	85.6
L3	4	720	2.5	432.0	7.0	3024.0	2444	80.8
L4	4	720	2.5	432.0	7.0	3024.0	2543	84.1
L5	4	720	2.5	432.0	6.9	2980.8	2591	86.9
L6	4	720	2.5	432.0	7.0	3024.0	2535	83.8
L7	4	740	2.5	444.0	7.0	3108.0	2694	86.7
L8	4	740	2.5	444.0	7.0	3108.0	2457	79.1
L9	4	740	2.5	444.0	6.9	3063.6	2494	81.4
L10	4	740	2.5	444.0	6.9	3063.6	2398	78.3
L11	4	740	2.5	444.0	7.0	3108.0	2861	92.1
L12	4	750	2.5	450.0	6.9	3105.0	2656	85.5
L13	3	750	2.5	337.5	7.0	2362.5	1894	80.2
L14	3	750	2.5	337.5	7.0	2362.5	2107	89.2
L15	3	750	2.5	337.5	7.0	2362.5	2058	87.1
L16	3	750	2.5	337.5	7.0	2362.5	1947	82.4
L17	3	750	2.5	337.5	7.0	2362.5	1796	76.0
Total	63			6949.5	118.6	48469.5	40699	
					Average Labour Efficiency (%) =		84.0	

Table B-28 Production Report for Circular Weaving Department (11/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (11.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	4.8	2073.6	1874	90.4
L2	4	720	2.5	432.0	4.5	1944.0	1609	82.8
L3	4	720	2.5	432.0	4.5	1944.0	1475	75.9
L4	4	720	2.5	432.0	8.0	3456.0	2987	86.4
L5	4	720	2.5	432.0	8.0	3456.0	2886	83.5
L6	4	720	2.5	432.0	7.9	3412.8	2983	87.4
L7	4	740	2.5	444.0	8.0	3552.0	3105	87.4
L8	4	740	2.5	444.0	7.9	3507.6	3064	87.4
L9	4	740	2.5	444.0	8.0	3552.0	2991	84.2
L10	4	740	2.5	444.0	4.4	1953.6	1572	80.5
L11	4	740	2.5	444.0	4.6	2042.4	1677	82.1
L12	4	750	2.5	450.0	8.0	3600.0	2871	79.8
L13	3	750	2.5	337.5	8.0	2700.0	1998	74.0
L14	3	750	2.5	337.5	8.0	2700.0	2227	82.5
L15	3	750	2.5	337.5	4.6	1552.5	1421	91.5
L16	3	750	2.5	337.5	8.0	2700.0	2295	85.0
L17	3	750	2.5	337.5	7.9	2666.3	2328	87.3
Total	63			6949.5	115.1	46812.8	39363	
					Average Labour Efficiency (%) =		84.1	

Table B-29 Production Report for Circular Weaving Department (12/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (12.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	6.2	2678.4	2378	88.8
L2	4	720	2.5	432.0	6.1	2635.2	2233	84.7
L3	4	720	2.5	432.0	6.2	2678.4	2401	89.6
L4	4	720	2.5	432.0	6.2	2678.4	2459	91.8
L5	4	720	2.5	432.0	6.2	2678.4	2245	83.8
L6	4	720	2.5	432.0	6.1	2635.2	2159	81.9
L7	4	740	2.5	444.0	6.2	2752.8	2512	91.3
L8	4	740	2.5	444.0	6.2	2752.8	2444	88.8
L9	4	740	2.5	444.0	6.2	2752.8	2468	89.7
L10	4	740	2.5	444.0	6.1	2708.4	2294	84.7
L11	4	740	2.5	444.0	6.2	2752.8	2377	86.3
L12	4	750	2.5	450.0	6.2	2790.0	2500	89.6
L13	3	750	2.5	337.5	6.2	2092.5	1794	85.7
L14	3	750	2.5	337.5	6.2	2092.5	1758	84.0
L15	3	750	2.5	337.5	6.1	2058.8	1962	95.3
L16	3	750	2.5	337.5	6.2	2092.5	1905	91.0
L17	3	750	2.5	337.5	6.2	2092.5	1789	85.5
Total	63			6949.5	105.0	42922.4	37678	
					Average Labour Efficiency (%) =		87.8	

Table B-30 Production Report for Circular Weaving Department (12/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (12.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2985	86.4
L2	4	720	2.5	432.0	8.0	3456.0	2889	83.6
L3	4	720	2.5	432.0	8.0	3456.0	2769	80.1
L4	4	720	2.5	432.0	8.0	3456.0	2835	82.0
L5	4	720	2.5	432.0	7.9	3412.8	3025	88.6
L6	4	720	2.5	432.0	8.0	3456.0	3154	91.3
L7	4	740	2.5	444.0	8.0	3552.0	3108	87.5
L8	4	740	2.5	444.0	8.0	3552.0	3142	88.5
L9	4	740	2.5	444.0	7.9	3507.6	2991	85.3
L10	4	740	2.5	444.0	8.0	3552.0	2876	81.0
L11	4	740	2.5	444.0	7.9	3507.6	3065	87.4
L12	4	750	2.5	450.0	8.0	3600.0	3208	89.1
L13	3	750	2.5	337.5	8.0	2700.0	2312	85.6
L14	3	750	2.5	337.5	8.0	2700.0	2519	93.3
L15	3	750	2.5	337.5	8.0	2700.0	2448	90.7
L16	3	750	2.5	337.5	7.9	2666.3	2328	87.3
L17	3	750	2.5	337.5	8.0	2700.0	2350	87.0
Total	63			6949.5	135.6	55430.3	48004	
					Average Labour Efficiency (%) =		86.6	

Table B-31 Production Report for Circular Weaving Department (12/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (12.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.9	3412.8	2965	86.9
L2	4	720	2.5	432.0	8.0	3456.0	2874	83.2
L3	4	720	2.5	432.0	8.0	3456.0	2766	80.0
L4	4	720	2.5	432.0	8.0	3456.0	2948	85.3
L5	4	720	2.5	432.0	8.0	3456.0	3124	90.4
L6	4	720	2.5	432.0	7.8	3369.6	2872	85.2
L7	4	740	2.5	444.0	8.0	3552.0	3108	87.5
L8	4	740	2.5	444.0	8.0	3552.0	2763	77.8
L9	4	740	2.5	444.0	8.0	3552.0	2990	84.2
L10	4	740	2.5	444.0	8.0	3552.0	3082	86.8
L11	4	740	2.5	444.0	8.0	3552.0	3027	85.2
L12	4	750	2.5	450.0	7.0	3150.0	2544	80.8
L13	3	750	2.5	337.5	8.0	2700.0	2259	83.7
L14	3	750	2.5	337.5	7.9	2666.3	2275	85.3
L15	3	750	2.5	337.5	8.0	2700.0	2461	91.1
L16	3	750	2.5	337.5	7.9	2666.3	2450	91.9
L17	3	750	2.5	337.5	7.9	2666.3	2399	90.0
Total	63			6949.5	134.4	54915.2	46907	
					Average Labour Efficiency (%) =		85.4	

Table B-32 Production Report for Circular Weaving Department (13/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (13.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	4.9	2116.8	1711	80.8
L2	4	720	2.5	432.0	5.0	2160.0	1725	79.9
L3	4	720	2.5	432.0	4.9	2116.8	1699	80.3
L4	4	720	2.5	432.0	5.0	2160.0	1800	83.3
L5	4	720	2.5	432.0	4.9	2116.8	1723	81.4
L6	4	720	2.5	432.0	8.0	3456.0	2991	86.5
L7	4	740	2.5	444.0	8.0	3552.0	3128	88.1
L8	4	740	2.5	444.0	8.0	3552.0	3108	87.5
L9	4	740	2.5	444.0	8.0	3552.0	2897	81.6
L10	4	740	2.5	444.0	8.0	3552.0	3106	87.4
L11	4	740	2.5	444.0	7.9	3507.6	3174	90.5
L12	4	750	2.5	450.0	8.0	3600.0	2991	83.1
L13	3	750	2.5	337.5	8.0	2700.0	2451	90.8
L14	3	750	2.5	337.5	7.8	2632.5	2288	86.9
L15	3	750	2.5	337.5	8.0	2700.0	2260	83.7
L16	3	750	2.5	337.5	8.0	2700.0	2350	87.0
L17	3	750	2.5	337.5	8.0	2700.0	2297	85.1
Total	63			6949.5	120.4	48874.5	41699	
					Average Labour Efficiency (%) =		85.3	

Table B-33 Production Report for Circular Weaving Department (13/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (13.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2993	86.6
L2	4	720	2.5	432.0	8.0	3456.0	2985	86.4
L3	4	720	2.5	432.0	8.0	3456.0	3120	90.3
L4	4	720	2.5	432.0	8.0	3456.0	3001	86.8
L5	4	720	2.5	432.0	8.0	3456.0	2894	83.7
L6	4	720	2.5	432.0	7.9	3412.8	2875	84.2
L7	4	740	2.5	444.0	8.0	3552.0	3045	85.7
L8	4	740	2.5	444.0	8.0	3552.0	3268	92.0
L9	4	740	2.5	444.0	8.0	3552.0	2996	84.3
L10	4	740	2.5	444.0	7.8	3463.2	3007	86.8
L11	4	740	2.5	444.0	8.0	3552.0	2878	81.0
L12	4	750	2.5	450.0	8.0	3600.0	2965	82.4
L13	3	750	2.5	337.5	8.0	2700.0	2421	89.7
L14	3	750	2.5	337.5	7.8	2632.5	2290	87.0
L15	3	750	2.5	337.5	7.9	2666.3	2351	88.2
L16	3	750	2.5	337.5	8.0	2700.0	2365	87.6
L17	3	750	2.5	337.5	8.0	2700.0	2345	86.9
Total	63			6949.5	135.4	55362.8	47799	
					Average Labour Efficiency (%) =		86.3	

Table B-34 Production Report for Circular Weaving Department (13/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (13.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.8	3369.6	3056	90.7
L2	4	720	2.5	432.0	8.0	3456.0	2899	83.9
L3	4	720	2.5	432.0	6.5	2808.0	2374	84.5
L4	4	720	2.5	432.0	7.0	3024.0	2606	86.2
L5	4	720	2.5	432.0	8.0	3456.0	3187	92.2
L6	4	720	2.5	432.0	7.9	3412.8	2894	84.8
L7	4	740	2.5	444.0	7.9	3507.6	2994	85.4
L8	4	740	2.5	444.0	8.0	3552.0	3111	87.6
L9	4	740	2.5	444.0	8.0	3552.0	3258	91.7
L10	4	740	2.5	444.0	8.0	3552.0	3345	94.2
L11	4	740	2.5	444.0	8.0	3552.0	2971	83.6
L12	4	750	2.5	450.0	7.5	3375.0	2876	85.2
L13	3	750	2.5	337.5	7.6	2565.0	2133	83.2
L14	3	750	2.5	337.5	8.0	2700.0	2247	83.2
L15	3	750	2.5	337.5	7.9	2666.3	2492	93.5
L16	3	750	2.5	337.5	8.0	2700.0	2437	90.3
L17	3	750	2.5	337.5	8.0	2700.0	2267	84.0
Total	63			6949.5	132.1	53948.3	47147	
					Average Labour Efficiency (%) =		87.4	

Table B-35 Production Report for Circular Weaving Department (14/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (14.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2961	85.7
L2	4	720	2.5	432.0	8.0	3456.0	2885	83.5
L3	4	720	2.5	432.0	8.0	3456.0	2796	80.9
L4	4	720	2.5	432.0	8.0	3456.0	2983	86.3
L5	4	720	2.5	432.0	8.0	3456.0	3205	92.7
L6	4	720	2.5	432.0	4.9	2116.8	1626	76.8
L7	4	740	2.5	444.0	7.9	3507.6	2884	82.2
L8	4	740	2.5	444.0	8.0	3552.0	2993	84.3
L9	4	740	2.5	444.0	8.0	3552.0	2851	80.3
L10	4	740	2.5	444.0	8.0	3552.0	2947	83.0
L11	4	740	2.5	444.0	5.6	2486.4	1886	75.9
L12	4	750	2.5	450.0	4.8	2160.0	1710	79.2
L13	3	750	2.5	337.5	8.0	2700.0	2219	82.2
L14	3	750	2.5	337.5	8.0	2700.0	2245	83.1
L15	3	750	2.5	337.5	8.0	2700.0	2356	87.3
L16	3	750	2.5	337.5	7.9	2666.3	2405	90.2
L17	3	750	2.5	337.5	8.0	2700.0	1992	73.8
Total	63			6949.5	127.1	51673.1	42944	
					Average Labour Efficiency (%) =		83.1	

Table B-36 Production Report for Circular Weaving Department (14/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (14.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2897	83.8
L2	4	720	2.5	432.0	8.0	3456.0	2884	83.4
L3	4	720	2.5	432.0	8.0	3456.0	3125	90.4
L4	4	720	2.5	432.0	8.0	3456.0	3026	87.6
L5	4	720	2.5	432.0	8.0	3456.0	3034	87.8
L6	4	720	2.5	432.0	8.0	3456.0	2872	83.1
L7	4	740	2.5	444.0	8.0	3552.0	2946	82.9
L8	4	740	2.5	444.0	7.9	3507.6	2961	84.4
L9	4	740	2.5	444.0	8.0	3552.0	2764	77.8
L10	4	740	2.5	444.0	8.0	3552.0	2884	81.2
L11	4	740	2.5	444.0	8.0	3552.0	3268	92.0
L12	4	750	2.5	450.0	7.8	3510.0	3060	87.2
L13	3	750	2.5	337.5	7.9	2666.3	2049	76.8
L14	3	750	2.5	337.5	8.0	2700.0	2456	91.0
L15	3	750	2.5	337.5	8.0	2700.0	2555	94.6
L16	3	750	2.5	337.5	8.0	2700.0	2353	87.1
L17	3	750	2.5	337.5	8.0	2700.0	2444	90.5
Total	63			6949.5	135.6	55427.9	47578	
					Average Labour Efficiency (%) =			85.8

Table B-37 Production Report for Circular Weaving Department (14/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (14.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2961	85.7
L2	4	720	2.5	432.0	8.0	3456.0	2975	86.1
L3	4	720	2.5	432.0	8.0	3456.0	2885	83.5
L4	4	720	2.5	432.0	8.0	3456.0	3125	90.4
L5	4	720	2.5	432.0	8.0	3456.0	3256	94.2
L6	4	720	2.5	432.0	8.0	3456.0	2887	83.5
L7	4	740	2.5	444.0	8.0	3552.0	2785	78.4
L8	4	740	2.5	444.0	8.0	3552.0	2864	80.6
L9	4	740	2.5	444.0	7.9	3507.6	3065	87.4
L10	4	740	2.5	444.0	8.0	3552.0	3265	91.9
L11	4	740	2.5	444.0	8.0	3552.0	3120	87.8
L12	4	750	2.5	450.0	8.0	3600.0	3148	87.4
L13	3	750	2.5	337.5	8.0	2700.0	1998	74.0
L14	3	750	2.5	337.5	8.0	2700.0	2537	94.0
L15	3	750	2.5	337.5	7.8	2632.5	2331	88.5
L16	3	750	2.5	337.5	6.0	2025.0	1534	75.8
L17	3	750	2.5	337.5	8.0	2700.0	2333	86.4
Total	63			6949.5	133.7	54809.1	47069	
					Average Labour Efficiency (%) =		85.9	

Table B-38 Production Report for Circular Weaving Department (15/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (15.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2987	86.4
L2	4	720	2.5	432.0	8.0	3456.0	2862	82.8
L3	4	720	2.5	432.0	8.0	3456.0	2994	86.6
L4	4	720	2.5	432.0	8.0	3456.0	3026	87.6
L5	4	720	2.5	432.0	8.0	3456.0	3076	89.0
L6	4	720	2.5	432.0	7.9	3412.8	3158	92.5
L7	4	740	2.5	444.0	7.9	3507.6	2983	85.0
L8	4	740	2.5	444.0	8.0	3552.0	3105	87.4
L9	4	740	2.5	444.0	8.0	3552.0	3100	87.3
L10	4	740	2.5	444.0	4.1	1820.4	1571	86.3
L11	4	740	2.5	444.0	4.4	1953.6	1510	77.3
L12	4	750	2.5	450.0	4.3	1935.0	1612	83.3
L13	3	750	2.5	337.5	8.0	2700.0	2273	84.2
L14	3	750	2.5	337.5	8.0	2700.0	2166	80.2
L15	3	750	2.5	337.5	8.0	2700.0	2507	92.9
L16	3	750	2.5	337.5	8.0	2700.0	2351	87.1
L17	3	750	2.5	337.5	8.0	2700.0	2445	90.6
Total	63			6949.5	124.6	50513.4	43726	
					Average Labour Efficiency (%) =		86.6	

Table B-39 Production Report for Circular Weaving Department (15/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (15.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	6.4	2764.8	2444	88.4
L2	4	720	2.5	432.0	6.5	2808.0	2249	80.1
L3	4	720	2.5	432.0	6.5	2808.0	2512	89.5
L4	4	720	2.5	432.0	6.5	2808.0	2381	84.8
L5	4	720	2.5	432.0	6.5	2808.0	2268	80.8
L6	4	720	2.5	432.0	6.5	2808.0	2473	88.1
L7	4	740	2.5	444.0	6.5	2886.0	2456	85.1
L8	4	740	2.5	444.0	6.4	2841.6	2325	81.8
L9	4	740	2.5	444.0	6.5	2886.0	2491	86.3
L10	4	740	2.5	444.0	6.4	2841.6	2477	87.2
L11	4	740	2.5	444.0	6.5	2886.0	2557	88.6
L12	4	750	2.5	450.0	6.5	2925.0	2604	89.0
L13	3	750	2.5	337.5	6.5	2193.8	2019	92.0
L14	3	750	2.5	337.5	6.3	2126.3	1924	90.5
L15	3	750	2.5	337.5	6.5	2193.8	1876	85.5
L16	3	750	2.5	337.5	6.5	2193.8	1940	88.4
L17	3	750	2.5	337.5	6.5	2193.8	1957	89.2
Total	63			6949.5	110.0	44972.3	38953	
					Average Labour Efficiency (%) =			86.6

Table B-40 Production Report for Circular Weaving Department (15/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (15.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2944	85.2
L2	4	720	2.5	432.0	8.0	3456.0	2896	83.8
L3	4	720	2.5	432.0	8.0	3456.0	2871	83.1
L4	4	720	2.5	432.0	8.0	3456.0	2950	85.4
L5	4	720	2.5	432.0	8.0	3456.0	2977	86.1
L6	4	720	2.5	432.0	8.0	3456.0	2960	85.6
L7	4	740	2.5	444.0	7.0	3108.0	2549	82.0
L8	4	740	2.5	444.0	7.9	3507.6	2883	82.2
L9	4	740	2.5	444.0	8.0	3552.0	3022	85.1
L10	4	740	2.5	444.0	8.0	3552.0	3021	85.1
L11	4	740	2.5	444.0	8.0	3552.0	3184	89.6
L12	4	750	2.5	450.0	8.0	3600.0	3055	84.9
L13	3	750	2.5	337.5	7.8	2632.5	2336	88.7
L14	3	750	2.5	337.5	8.0	2700.0	2451	90.8
L15	3	750	2.5	337.5	8.0	2700.0	2468	91.4
L16	3	750	2.5	337.5	8.0	2700.0	2444	90.5
L17	3	750	2.5	337.5	8.0	2700.0	2308	85.5
Total	63			6949.5	134.7	55040.1	47319	
					Average Labour Efficiency (%) =		86.0	

Table B-41 Production Report for Circular Weaving Department (16/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (16.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.4	3196.8	2634	82.4
L2	4	720	2.5	432.0	7.3	3153.6	2648	84.0
L3	4	720	2.5	432.0	7.5	3240.0	2788	86.0
L4	4	720	2.5	432.0	7.5	3240.0	2816	86.9
L5	4	720	2.5	432.0	7.6	3283.2	2794	85.1
L6	4	720	2.5	432.0	7.4	3196.8	2750	86.0
L7	4	740	2.5	444.0	7.3	3241.2	2666	82.3
L8	4	740	2.5	444.0	7.2	3196.8	2581	80.7
L9	4	740	2.5	444.0	7.8	3463.2	3154	91.1
L10	4	740	2.5	444.0	7.7	3418.8	3008	88.0
L11	4	740	2.5	444.0	7.4	3285.6	2789	84.9
L12	4	750	2.5	450.0	7.7	3465.0	2897	83.6
L13	3	750	2.5	337.5	7.3	2463.8	2241	91.0
L14	3	750	2.5	337.5	7.2	2430.0	2110	86.8
L15	3	750	2.5	337.5	7.4	2497.5	2064	82.6
L16	3	750	2.5	337.5	7.4	2497.5	2076	83.1
L17	3	750	2.5	337.5	7.1	2396.3	1998	83.4
Total	63			6949.5	126.2	51666.0	44014	
					Average Labour Efficiency (%) =		85.2	

Table B-42 Production Report for Circular Weaving Department (16/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (16.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2986	86.4
L2	4	720	2.5	432.0	8.0	3456.0	2887	83.5
L3	4	720	2.5	432.0	8.0	3456.0	3125	90.4
L4	4	720	2.5	432.0	8.0	3456.0	3055	88.4
L5	4	720	2.5	432.0	8.0	3456.0	3013	87.2
L6	4	720	2.5	432.0	8.0	3456.0	2982	86.3
L7	4	740	2.5	444.0	8.0	3552.0	2894	81.5
L8	4	740	2.5	444.0	8.0	3552.0	3250	91.5
L9	4	740	2.5	444.0	7.9	3507.6	3049	86.9
L10	4	740	2.5	444.0	7.8	3463.2	2897	83.7
L11	4	740	2.5	444.0	8.0	3552.0	3261	91.8
L12	4	750	2.5	450.0	8.0	3600.0	3122	86.7
L13	3	750	2.5	337.5	8.0	2700.0	2253	83.4
L14	3	750	2.5	337.5	8.0	2700.0	2173	80.5
L15	3	750	2.5	337.5	7.9	2666.3	2318	86.9
L16	3	750	2.5	337.5	8.0	2700.0	2284	84.6
L17	3	750	2.5	337.5	8.0	2700.0	2475	91.7
Total	63			6949.5	135.6	55429.1	48024	
					Average Labour Efficiency (%) =		86.6	

Table B-43 Production Report for Circular Weaving Department (16/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (16.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2887	83.5
L2	4	720	2.5	432.0	8.0	3456.0	2866	82.9
L3	4	720	2.5	432.0	8.0	3456.0	2943	85.2
L4	4	720	2.5	432.0	8.0	3456.0	3127	90.5
L5	4	720	2.5	432.0	8.0	3456.0	2765	80.0
L6	4	720	2.5	432.0	8.0	3456.0	2749	79.5
L7	4	740	2.5	444.0	8.0	3552.0	3084	86.8
L8	4	740	2.5	444.0	8.0	3552.0	3061	86.2
L9	4	740	2.5	444.0	7.9	3507.6	2996	85.4
L10	4	740	2.5	444.0	8.0	3552.0	3205	90.2
L11	4	740	2.5	444.0	8.0	3552.0	3146	88.6
L12	4	750	2.5	450.0	8.0	3600.0	2980	82.8
L13	3	750	2.5	337.5	8.0	2700.0	2253	83.4
L14	3	750	2.5	337.5	7.9	2666.3	2333	87.5
L15	3	750	2.5	337.5	8.0	2700.0	2391	88.6
L16	3	750	2.5	337.5	7.8	2632.5	2109	80.1
L17	3	750	2.5	337.5	8.0	2700.0	2219	82.2
Total	63			6949.5	135.6	55450.4	47114	
					Average Labour Efficiency (%) =		85.0	

Table B-44 Production Report for Circular Weaving Department (18/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (18.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.0	3024.0	2538	83.9
L2	4	720	2.5	432.0	7.0	3024.0	2555	84.5
L3	4	720	2.5	432.0	7.0	3024.0	2678	88.6
L4	4	720	2.5	432.0	7.0	3024.0	2497	82.6
L5	4	720	2.5	432.0	7.0	3024.0	2634	87.1
L6	4	720	2.5	432.0	7.9	3412.8	2880	84.4
L7	4	740	2.5	444.0	7.0	3108.0	2597	83.6
L8	4	740	2.5	444.0	7.0	3108.0	2665	85.7
L9	4	740	2.5	444.0	7.0	3108.0	2660	85.6
L10	4	740	2.5	444.0	6.8	3019.2	2492	82.5
L11	4	740	2.5	444.0	6.4	2841.6	2256	79.4
L12	4	750	2.5	450.0	7.0	3150.0	2700	85.7
L13	3	750	2.5	337.5	7.0	2362.5	1894	80.2
L14	3	750	2.5	337.5	7.0	2362.5	1905	80.6
L15	3	750	2.5	337.5	7.0	2362.5	2033	86.1
L16	3	750	2.5	337.5	6.9	2328.8	1986	85.3
L17	3	750	2.5	337.5	7.0	2362.5	2025	85.7
Total	63			6949.5	119.0	48646.4	40995	
					Average Labour Efficiency (%) =		84.3	

Table B-45 Production Report for Circular Weaving Department (18/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (18.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.9	3412.8	2881	84.4
L2	4	720	2.5	432.0	8.0	3456.0	3105	89.8
L3	4	720	2.5	432.0	8.0	3456.0	2976	86.1
L4	4	720	2.5	432.0	8.0	3456.0	2838	82.1
L5	4	720	2.5	432.0	7.9	3412.8	2990	87.6
L6	4	720	2.5	432.0	7.9	3412.8	2890	84.7
L7	4	740	2.5	444.0	8.0	3552.0	3072	86.5
L8	4	740	2.5	444.0	8.0	3552.0	3143	88.5
L9	4	740	2.5	444.0	8.0	3552.0	2974	83.7
L10	4	740	2.5	444.0	7.9	3507.6	3055	87.1
L11	4	740	2.5	444.0	8.0	3552.0	2916	82.1
L12	4	750	2.5	450.0	8.0	3600.0	3229	89.7
L13	3	750	2.5	337.5	7.9	2666.3	2300	86.3
L14	3	750	2.5	337.5	8.0	2700.0	2357	87.3
L15	3	750	2.5	337.5	8.0	2700.0	2176	80.6
L16	3	750	2.5	337.5	7.9	2666.3	2263	84.9
L17	3	750	2.5	337.5	8.0	2700.0	2106	78.0
Total	63			6949.5	135.4	55354.5	47271	
					Average Labour Efficiency (%) =		85.4	

Table B-46 Production Report for Circular Weaving Department (18/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (18.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2988	86.5
L2	4	720	2.5	432.0	8.0	3456.0	2873	83.1
L3	4	720	2.5	432.0	8.0	3456.0	2765	80.0
L4	4	720	2.5	432.0	8.0	3456.0	3108	89.9
L5	4	720	2.5	432.0	8.0	3456.0	3077	89.0
L6	4	720	2.5	432.0	8.0	3456.0	3018	87.3
L7	4	740	2.5	444.0	7.9	3507.6	3020	86.1
L8	4	740	2.5	444.0	8.0	3552.0	2894	81.5
L9	4	740	2.5	444.0	8.0	3552.0	2973	83.7
L10	4	740	2.5	444.0	8.0	3552.0	2834	79.8
L11	4	740	2.5	444.0	7.9	3507.6	3249	92.6
L12	4	750	2.5	450.0	4.2	1890.0	1582	83.7
L13	3	750	2.5	337.5	4.4	1485.0	1251	84.2
L14	3	750	2.5	337.5	4.3	1451.3	1110	76.5
L15	3	750	2.5	337.5	4.3	1451.3	1326	91.4
L16	3	750	2.5	337.5	4.2	1417.5	1157	81.6
L17	3	750	2.5	337.5	4.4	1485.0	1219	82.1
Total	63			6949.5	113.6	47587.2	40444	
					Average Labour Efficiency (%) =		85.0	

Table B-47 Production Report for Circular Weaving Department (19/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (19.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2875	83.2
L2	4	720	2.5	432.0	8.0	3456.0	3003	86.9
L3	4	720	2.5	432.0	8.0	3456.0	2876	83.2
L4	4	720	2.5	432.0	8.0	3456.0	2943	85.2
L5	4	720	2.5	432.0	8.0	3456.0	2965	85.8
L6	4	720	2.5	432.0	7.9	3412.8	2792	81.8
L7	4	740	2.5	444.0	7.9	3507.6	3107	88.6
L8	4	740	2.5	444.0	8.0	3552.0	3231	91.0
L9	4	740	2.5	444.0	8.0	3552.0	2990	84.2
L10	4	740	2.5	444.0	8.0	3552.0	2964	83.4
L11	4	740	2.5	444.0	6.4	2841.6	2297	80.8
L12	4	750	2.5	450.0	8.0	3600.0	3100	86.1
L13	3	750	2.5	337.5	8.0	2700.0	2256	83.6
L14	3	750	2.5	337.5	7.9	2666.3	2454	92.0
L15	3	750	2.5	337.5	8.0	2700.0	2561	94.9
L16	3	750	2.5	337.5	8.0	2700.0	2218	82.1
L17	3	750	2.5	337.5	7.1	2396.3	1895	79.1
Total	63			6949.5	133.2	54460.5	46527	
					Average Labour Efficiency (%) =			85.4

Table B-48 Production Report for Circular Weaving Department (19/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (19.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2987	86.4
L2	4	720	2.5	432.0	8.0	3456.0	2972	86.0
L3	4	720	2.5	432.0	8.0	3456.0	2864	82.9
L4	4	720	2.5	432.0	8.0	3456.0	2871	83.1
L5	4	720	2.5	432.0	8.0	3456.0	2788	80.7
L6	4	720	2.5	432.0	7.9	3412.8	2757	80.8
L7	4	740	2.5	444.0	7.9	3507.6	2942	83.9
L8	4	740	2.5	444.0	8.0	3552.0	3076	86.6
L9	4	740	2.5	444.0	8.0	3552.0	3064	86.3
L10	4	740	2.5	444.0	8.0	3552.0	3073	86.5
L11	4	740	2.5	444.0	8.0	3552.0	3104	87.4
L12	4	750	2.5	450.0	8.0	3600.0	3083	85.6
L13	3	750	2.5	337.5	7.3	2463.8	1975	80.2
L14	3	750	2.5	337.5	8.0	2700.0	2259	83.7
L15	3	750	2.5	337.5	8.0	2700.0	2268	84.0
L16	3	750	2.5	337.5	8.0	2700.0	2363	87.5
L17	3	750	2.5	337.5	8.0	2700.0	2450	90.7
Total	63			6949.5	135.1	55272.2	46896	
					Average Labour Efficiency (%) =		84.8	

Table B-49 Production Report for Circular Weaving Department (19/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (19.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2990	86.5
L2	4	720	2.5	432.0	8.0	3456.0	2876	83.2
L3	4	720	2.5	432.0	8.0	3456.0	2995	86.7
L4	4	720	2.5	432.0	8.0	3456.0	2900	83.9
L5	4	720	2.5	432.0	8.0	3456.0	3158	91.4
L6	4	720	2.5	432.0	7.9	3412.8	3001	87.9
L7	4	740	2.5	444.0	8.0	3552.0	3084	86.8
L8	4	740	2.5	444.0	8.0	3552.0	3072	86.5
L9	4	740	2.5	444.0	8.0	3552.0	3121	87.9
L10	4	740	2.5	444.0	7.8	3463.2	3033	87.6
L11	4	740	2.5	444.0	8.0	3552.0	3021	85.1
L12	4	750	2.5	450.0	8.0	3600.0	2888	80.2
L13	3	750	2.5	337.5	8.0	2700.0	2519	93.3
L14	3	750	2.5	337.5	8.0	2700.0	2446	90.6
L15	3	750	2.5	337.5	8.0	2700.0	2386	88.4
L16	3	750	2.5	337.5	8.0	2700.0	2297	85.1
L17	3	750	2.5	337.5	8.0	2700.0	2184	80.9
Total	63			6949.5	135.7	55464.0	47971	
					Average Labour Efficiency (%) =		86.5	

Table B-50 Production Report for Circular Weaving Department (20/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (20.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	3046	88.1
L2	4	720	2.5	432.0	8.0	3456.0	2986	86.4
L3	4	720	2.5	432.0	8.0	3456.0	2873	83.1
L4	4	720	2.5	432.0	8.0	3456.0	2992	86.6
L5	4	720	2.5	432.0	8.0	3456.0	3123	90.4
L6	4	720	2.5	432.0	8.0	3456.0	3009	87.1
L7	4	740	2.5	444.0	8.0	3552.0	3246	91.4
L8	4	740	2.5	444.0	7.9	3507.6	3084	87.9
L9	4	740	2.5	444.0	7.9	3507.6	2877	82.0
L10	4	740	2.5	444.0	8.0	3552.0	3135	88.3
L11	4	740	2.5	444.0	7.8	3463.2	3040	87.8
L12	4	750	2.5	450.0	8.0	3600.0	3208	89.1
L13	3	750	2.5	337.5	8.0	2700.0	2479	91.8
L14	3	750	2.5	337.5	8.0	2700.0	2364	87.6
L15	3	750	2.5	337.5	8.0	2700.0	2357	87.3
L16	3	750	2.5	337.5	8.0	2700.0	2371	87.8
L17	3	750	2.5	337.5	8.0	2700.0	2111	78.2
Total	63			6949.5	135.6	55418.4	48301	
					Average Labour Efficiency (%) =		87.2	

Table B-51 Production Report for Circular Weaving Department (20/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (20.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	6.6	2851.2	2527	88.6
L2	4	720	2.5	432.0	6.6	2851.2	2450	85.9
L3	4	720	2.5	432.0	6.5	2808.0	2265	80.7
L4	4	720	2.5	432.0	6.5	2808.0	2531	90.1
L5	4	720	2.5	432.0	6.6	2851.2	2374	83.3
L6	4	720	2.5	432.0	6.6	2851.2	2468	86.6
L7	4	740	2.5	444.0	6.6	2930.4	2601	88.8
L8	4	740	2.5	444.0	6.0	2664.0	2331	87.5
L9	4	740	2.5	444.0	6.0	2664.0	2264	85.0
L10	4	740	2.5	444.0	6.0	2664.0	2192	82.3
L11	4	740	2.5	444.0	6.6	2930.4	2258	77.1
L12	4	750	2.5	450.0	6.6	2970.0	2659	89.5
L13	3	750	2.5	337.5	6.6	2227.5	1978	88.8
L14	3	750	2.5	337.5	6.6	2227.5	1893	85.0
L15	3	750	2.5	337.5	6.6	2227.5	1772	79.6
L16	3	750	2.5	337.5	6.6	2227.5	1973	88.6
L17	3	750	2.5	337.5	6.6	2227.5	2021	90.7
Total	63			6949.5	110.2	44981.1	38557	
					Average Labour Efficiency (%) =		85.7	

Table B-52 Production Report for Circular Weaving Department (20/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (20.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2998	86.7
L2	4	720	2.5	432.0	8.0	3456.0	3027	87.6
L3	4	720	2.5	432.0	8.0	3456.0	2862	82.8
L4	4	720	2.5	432.0	8.0	3456.0	2943	85.2
L5	4	720	2.5	432.0	8.0	3456.0	2876	83.2
L6	4	720	2.5	432.0	8.0	3456.0	2894	83.7
L7	4	740	2.5	444.0	8.0	3552.0	2934	82.6
L8	4	740	2.5	444.0	8.0	3552.0	3152	88.7
L9	4	740	2.5	444.0	8.0	3552.0	3050	85.9
L10	4	740	2.5	444.0	8.0	3552.0	3026	85.2
L11	4	740	2.5	444.0	8.0	3552.0	3261	91.8
L12	4	750	2.5	450.0	8.0	3600.0	3149	87.5
L13	3	750	2.5	337.5	8.0	2700.0	2275	84.3
L14	3	750	2.5	337.5	8.0	2700.0	2339	86.6
L15	3	750	2.5	337.5	8.0	2700.0	2358	87.3
L16	3	750	2.5	337.5	8.0	2700.0	2544	94.2
L17	3	750	2.5	337.5	8.0	2700.0	2486	92.1
Total	63			6949.5	136.0	55596.0	48174	
					Average Labour Efficiency (%) =		86.7	

Table B-53 Production Report for Circular Weaving Department (21/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (21.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2976	86.1
L2	4	720	2.5	432.0	8.0	3456.0	2839	82.1
L3	4	720	2.5	432.0	8.0	3456.0	3152	91.2
L4	4	720	2.5	432.0	8.0	3456.0	3025	87.5
L5	4	720	2.5	432.0	8.0	3456.0	2984	86.3
L6	4	720	2.5	432.0	8.0	3456.0	3072	88.9
L7	4	740	2.5	444.0	8.0	3552.0	2965	83.5
L8	4	740	2.5	444.0	8.0	3552.0	3111	87.6
L9	4	740	2.5	444.0	8.0	3552.0	3089	87.0
L10	4	740	2.5	444.0	7.9	3507.6	2954	84.2
L11	4	740	2.5	444.0	8.0	3552.0	3214	90.5
L12	4	750	2.5	450.0	8.0	3600.0	3165	87.9
L13	3	750	2.5	337.5	8.0	2700.0	2214	82.0
L14	3	750	2.5	337.5	8.0	2700.0	2345	86.9
L15	3	750	2.5	337.5	7.9	2666.3	2378	89.2
L16	3	750	2.5	337.5	8.0	2700.0	2286	84.7
L17	3	750	2.5	337.5	8.0	2700.0	2357	87.3
Total	63			6949.5	135.8	55517.9	48126	
					Average Labour Efficiency (%) =		86.7	

Table B-54 Production Report for Circular Weaving Department (21/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (21.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2952	85.4
L2	4	720	2.5	432.0	8.0	3456.0	2873	83.1
L3	4	720	2.5	432.0	8.0	3456.0	2946	85.2
L4	4	720	2.5	432.0	8.0	3456.0	3051	88.3
L5	4	720	2.5	432.0	8.0	3456.0	3128	90.5
L6	4	720	2.5	432.0	8.0	3456.0	3005	87.0
L7	4	740	2.5	444.0	8.0	3552.0	2886	81.3
L8	4	740	2.5	444.0	8.0	3552.0	3110	87.6
L9	4	740	2.5	444.0	8.0	3552.0	3261	91.8
L10	4	740	2.5	444.0	7.9	3507.6	2994	85.4
L11	4	740	2.5	444.0	8.0	3552.0	2876	81.0
L12	4	750	2.5	450.0	8.0	3600.0	3263	90.6
L13	3	750	2.5	337.5	8.0	2700.0	2275	84.3
L14	3	750	2.5	337.5	8.0	2700.0	2330	86.3
L15	3	750	2.5	337.5	7.9	2666.3	2392	89.7
L16	3	750	2.5	337.5	8.0	2700.0	2347	86.9
L17	3	750	2.5	337.5	8.0	2700.0	2561	94.9
Total	63			6949.5	135.8	55517.9	48250	
					Average Labour Efficiency (%) =		86.9	

Table B-55 Production Report for Circular Weaving Department (21/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (21.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.5	3240.0	2876	88.8
L2	4	720	2.5	432.0	7.5	3240.0	2861	88.3
L3	4	720	2.5	432.0	7.5	3240.0	2830	87.3
L4	4	720	2.5	432.0	7.4	3196.8	2905	90.9
L5	4	720	2.5	432.0	7.5	3240.0	2993	92.4
L6	4	720	2.5	432.0	7.5	3240.0	2764	85.3
L7	4	740	2.5	444.0	7.4	3285.6	2887	87.9
L8	4	740	2.5	444.0	7.5	3330.0	2931	88.0
L9	4	740	2.5	444.0	7.4	3285.6	2769	84.3
L10	4	740	2.5	444.0	7.5	3330.0	3034	91.1
L11	4	740	2.5	444.0	7.5	3330.0	2941	88.3
L12	4	750	2.5	450.0	7.5	3375.0	3038	90.0
L13	3	750	2.5	337.5	7.5	2531.3	2326	91.9
L14	3	750	2.5	337.5	7.5	2531.3	2229	88.1
L15	3	750	2.5	337.5	7.4	2497.5	2206	88.3
L16	3	750	2.5	337.5	7.5	2531.3	2264	89.4
L17	3	750	2.5	337.5	7.4	2497.5	1990	79.7
Total	63			6949.5	127.0	51921.8	45844	
					Average Labour Efficiency (%) =		88.3	

Table B-56 Production Report for Circular Weaving Department (22/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (22.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	3025	87.5
L2	4	720	2.5	432.0	8.0	3456.0	2963	85.7
L3	4	720	2.5	432.0	8.0	3456.0	2889	83.6
L4	4	720	2.5	432.0	8.0	3456.0	3125	90.4
L5	4	720	2.5	432.0	8.0	3456.0	3144	91.0
L6	4	720	2.5	432.0	8.0	3456.0	2916	84.4
L7	4	740	2.5	444.0	7.9	3507.6	3054	87.1
L8	4	740	2.5	444.0	7.9	3507.6	3046	86.8
L9	4	740	2.5	444.0	8.0	3552.0	2751	77.4
L10	4	740	2.5	444.0	8.0	3552.0	3207	90.3
L11	4	740	2.5	444.0	8.0	3552.0	3111	87.6
L12	4	750	2.5	450.0	7.9	3555.0	3090	86.9
L13	3	750	2.5	337.5	8.0	2700.0	2461	91.1
L14	3	750	2.5	337.5	7.0	2362.5	2026	85.8
L15	3	750	2.5	337.5	7.4	2497.5	2137	85.6
L16	3	750	2.5	337.5	7.5	2531.3	1990	78.6
L17	3	750	2.5	337.5	8.0	2700.0	2483	92.0
Total	63			6949.5	133.6	54753.5	47418	
					Average Labour Efficiency (%) =			86.6

Table B-57 Production Report for Circular Weaving Department (22/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (22.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	6.5	2808.0	2431	86.6
L2	4	720	2.5	432.0	6.5	2808.0	2375	84.6
L3	4	720	2.5	432.0	6.5	2808.0	2456	87.5
L4	4	720	2.5	432.0	6.5	2808.0	2476	88.2
L5	4	720	2.5	432.0	6.4	2764.8	2469	89.3
L6	4	720	2.5	432.0	6.4	2764.8	2504	90.6
L7	4	740	2.5	444.0	6.5	2886.0	2387	82.7
L8	4	740	2.5	444.0	6.5	2886.0	2269	78.6
L9	4	740	2.5	444.0	6.4	2841.6	2391	84.1
L10	4	740	2.5	444.0	6.5	2886.0	2562	88.8
L11	4	740	2.5	444.0	6.5	2886.0	2681	92.9
L12	4	750	2.5	450.0	6.4	2880.0	2482	86.2
L13	3	750	2.5	337.5	6.5	2193.8	1938	88.3
L14	3	750	2.5	337.5	6.5	2193.8	1887	86.0
L15	3	750	2.5	337.5	6.5	2193.8	1799	82.0
L16	3	750	2.5	337.5	6.5	2193.8	1861	84.8
L17	3	750	2.5	337.5	6.4	2160.0	1873	86.7
Total	63			6949.5	110.0	44962.2	38841	
					Average Labour Efficiency (%) =		86.4	

Table B-58 Production Report for Circular Weaving Department (22/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (22.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2970	85.9
L2	4	720	2.5	432.0	8.0	3456.0	2931	84.8
L3	4	720	2.5	432.0	8.0	3456.0	3042	88.0
L4	4	720	2.5	432.0	8.0	3456.0	3033	87.8
L5	4	720	2.5	432.0	8.0	3456.0	3173	91.8
L6	4	720	2.5	432.0	7.9	3412.8	2886	84.6
L7	4	740	2.5	444.0	8.0	3552.0	3267	92.0
L8	4	740	2.5	444.0	8.0	3552.0	3111	87.6
L9	4	740	2.5	444.0	8.0	3552.0	2895	81.5
L10	4	740	2.5	444.0	8.0	3552.0	3100	87.3
L11	4	740	2.5	444.0	7.9	3507.6	2887	82.3
L12	4	750	2.5	450.0	8.0	3600.0	3261	90.6
L13	3	750	2.5	337.5	8.0	2700.0	2462	91.2
L14	3	750	2.5	337.5	8.0	2700.0	2189	81.1
L15	3	750	2.5	337.5	7.9	2666.3	2228	83.6
L16	3	750	2.5	337.5	7.8	2632.5	2190	83.2
L17	3	750	2.5	337.5	8.0	2700.0	2271	84.1
Total	63			6949.5	135.5	55407.2	47896	
					Average Labour Efficiency (%) =			86.4

Table B-59 Production Report for Circular Weaving Department (23/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (23.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	5.2	2246.4	1912	85.1
L2	4	720	2.5	432.0	5.1	2203.2	1874	85.1
L3	4	720	2.5	432.0	8.0	3456.0	2963	85.7
L4	4	720	2.5	432.0	8.0	3456.0	3025	87.5
L5	4	720	2.5	432.0	4.9	2116.8	1730	81.7
L6	4	720	2.5	432.0	5.2	2246.4	1894	84.3
L7	4	740	2.5	444.0	5.3	2353.2	1956	83.1
L8	4	740	2.5	444.0	7.9	3507.6	3082	87.9
L9	4	740	2.5	444.0	8.0	3552.0	3157	88.9
L10	4	740	2.5	444.0	8.0	3552.0	3206	90.3
L11	4	740	2.5	444.0	8.0	3552.0	2886	81.3
L12	4	750	2.5	450.0	5.2	2340.0	2012	86.0
L13	3	750	2.5	337.5	4.9	1653.8	1575	95.2
L14	3	750	2.5	337.5	8.0	2700.0	2370	87.8
L15	3	750	2.5	337.5	8.0	2700.0	2332	86.4
L16	3	750	2.5	337.5	8.0	2700.0	2451	90.8
L17	3	750	2.5	337.5	4.3	1451.3	1326	91.4
Total	63			6949.5	112.0	45786.6	39751	
					Average Labour Efficiency (%) =		86.8	

Table B-60 Production Report for Circular Weaving Department (23/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (23.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2990	86.5
L2	4	720	2.5	432.0	8.0	3456.0	2876	83.2
L3	4	720	2.5	432.0	8.0	3456.0	2934	84.9
L4	4	720	2.5	432.0	8.0	3456.0	2783	80.5
L5	4	720	2.5	432.0	8.0	3456.0	3015	87.2
L6	4	720	2.5	432.0	8.0	3456.0	2991	86.5
L7	4	740	2.5	444.0	7.9	3507.6	3152	89.9
L8	4	740	2.5	444.0	8.0	3552.0	3260	91.8
L9	4	740	2.5	444.0	8.0	3552.0	2976	83.8
L10	4	740	2.5	444.0	8.0	3552.0	2881	81.1
L11	4	740	2.5	444.0	8.0	3552.0	3078	86.7
L12	4	750	2.5	450.0	7.9	3555.0	3129	88.0
L13	3	750	2.5	337.5	7.9	2666.3	2468	92.6
L14	3	750	2.5	337.5	8.0	2700.0	2349	87.0
L15	3	750	2.5	337.5	8.0	2700.0	2447	90.6
L16	3	750	2.5	337.5	7.9	2666.3	2450	91.9
L17	3	750	2.5	337.5	8.0	2700.0	2342	86.7
Total	63			6949.5	135.6	55439.1	48121	
					Average Labour Efficiency (%) =		86.8	

Table B-61 Production Report for Circular Weaving Department (23/05/1998 - Shift 3)

PRODUCTION REPORT FOR THE FIRM A (Yuvarlak Dokuma)								
SHIFT 3 (23.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2987	86.4
L2	4	720	2.5	432.0	8.0	3456.0	2895	83.8
L3	4	720	2.5	432.0	8.0	3456.0	2943	85.2
L4	4	720	2.5	432.0	8.0	3456.0	2978	86.2
L5	4	720	2.5	432.0	8.0	3456.0	2990	86.5
L6	4	720	2.5	432.0	8.0	3456.0	2891	83.7
L7	4	740	2.5	444.0	7.9	3507.6	3063	87.3
L8	4	740	2.5	444.0	8.0	3552.0	3088	86.9
L9	4	740	2.5	444.0	8.0	3552.0	2879	81.1
L10	4	740	2.5	444.0	8.0	3552.0	2943	82.9
L11	4	740	2.5	444.0	7.9	3507.6	3264	93.1
L12	4	750	2.5	450.0	8.0	3600.0	3070	85.3
L13	3	750	2.5	337.5	7.9	2666.3	2361	88.6
L14	3	750	2.5	337.5	8.0	2700.0	2279	84.4
L15	3	750	2.5	337.5	8.0	2700.0	2339	86.6
L16	3	750	2.5	337.5	7.9	2666.3	2297	86.2
L17	3	750	2.5	337.5	8.0	2700.0	2361	87.4
Total	63			6949.5	135.6	55439.7	47628	
					Average Labour Efficiency (%) =		85.9	

Table B-62 Production Report for Circular Weaving Department (25/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (25.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2885	83.5
L2	4	720	2.5	432.0	8.0	3456.0	2793	80.8
L3	4	720	2.5	432.0	8.0	3456.0	2964	85.8
L4	4	720	2.5	432.0	8.0	3456.0	2933	84.9
L5	4	720	2.5	432.0	8.0	3456.0	3021	87.4
L6	4	720	2.5	432.0	7.9	3412.8	3049	89.3
L7	4	740	2.5	444.0	8.0	3552.0	3057	86.1
L8	4	740	2.5	444.0	8.0	3552.0	3159	88.9
L9	4	740	2.5	444.0	8.0	3552.0	3178	89.5
L10	4	740	2.5	444.0	8.0	3552.0	3086	86.9
L11	4	740	2.5	444.0	8.0	3552.0	3099	87.2
L12	4	750	2.5	450.0	8.0	3600.0	3260	90.6
L13	3	750	2.5	337.5	8.0	2700.0	2375	88.0
L14	3	750	2.5	337.5	7.9	2666.3	2249	84.4
L15	3	750	2.5	337.5	8.0	2700.0	2391	88.6
L16	3	750	2.5	337.5	8.0	2700.0	2340	86.7
L17	3	750	2.5	337.5	7.8	2632.5	2116	80.4
Total	63			6949.5	135.6	55451.6	47955	
					Average Labour Efficiency (%) =		86.5	

Table B-63 Production Report for Circular Weaving Department (25/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (25.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2993	86.6
L2	4	720	2.5	432.0	8.0	3456.0	2996	86.7
L3	4	720	2.5	432.0	8.0	3456.0	2995	86.7
L4	4	720	2.5	432.0	8.0	3456.0	3012	87.2
L5	4	720	2.5	432.0	7.9	3412.8	2876	84.3
L6	4	720	2.5	432.0	8.0	3456.0	2791	80.8
L7	4	740	2.5	444.0	8.0	3552.0	3124	88.0
L8	4	740	2.5	444.0	8.0	3552.0	3027	85.2
L9	4	740	2.5	444.0	8.0	3552.0	3062	86.2
L10	4	740	2.5	444.0	6.9	3063.6	2569	83.9
L11	4	740	2.5	444.0	8.0	3552.0	2878	81.0
L12	4	750	2.5	450.0	8.0	3600.0	3269	90.8
L13	3	750	2.5	337.5	8.0	2700.0	2340	86.7
L14	3	750	2.5	337.5	8.0	2700.0	2290	84.8
L15	3	750	2.5	337.5	7.8	2632.5	2072	78.7
L16	3	750	2.5	337.5	8.0	2700.0	2461	91.1
L17	3	750	2.5	337.5	8.0	2700.0	2348	87.0
Total	63			6949.5	134.6	54996.9	47103	
					Average Labour Efficiency (%) =		85.6	

Table B-64 Production Report for Circular Weaving Department (25/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (25.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.2	3110.4	2662	85.6
L2	4	720	2.5	432.0	7.2	3110.4	2697	86.7
L3	4	720	2.5	432.0	7.2	3110.4	2469	79.4
L4	4	720	2.5	432.0	7.2	3110.4	2331	74.9
L5	4	720	2.5	432.0	7.1	3067.2	2579	84.1
L6	4	720	2.5	432.0	7.0	3024.0	2629	86.9
L7	4	740	2.5	444.0	7.2	3196.8	2770	86.6
L8	4	740	2.5	444.0	7.2	3196.8	2791	87.3
L9	4	740	2.5	444.0	7.2	3196.8	2642	82.6
L10	4	740	2.5	444.0	7.1	3152.4	2630	83.4
L11	4	740	2.5	444.0	7.2	3196.8	2792	87.3
L12	4	750	2.5	450.0	7.0	3150.0	2886	91.6
L13	3	750	2.5	337.5	7.1	2396.3	1994	83.2
L14	3	750	2.5	337.5	7.2	2430.0	2104	86.6
L15	3	750	2.5	337.5	7.2	2430.0	2208	90.9
L16	3	750	2.5	337.5	7.2	2430.0	1986	81.7
L17	3	750	2.5	337.5	7.2	2430.0	1892	77.9
Total	63			6949.5	121.7	49738.7	42062	
					Average Labour Efficiency (%) =		84.6	

Table B-65 Production Report for Circular Weaving Department (26/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (26.05.1998 / 00 pm to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2994	86.6
L2	4	720	2.5	432.0	8.0	3456.0	3005	87.0
L3	4	720	2.5	432.0	8.0	3456.0	3120	90.3
L4	4	720	2.5	432.0	8.0	3456.0	3059	88.5
L5	4	720	2.5	432.0	8.0	3456.0	2894	83.7
L6	4	720	2.5	432.0	8.0	3456.0	2992	86.6
L7	4	740	2.5	444.0	8.0	3552.0	3173	89.3
L8	4	740	2.5	444.0	8.0	3552.0	3076	86.6
L9	4	740	2.5	444.0	8.0	3552.0	2976	83.8
L10	4	740	2.5	444.0	8.0	3552.0	2883	81.2
L11	4	740	2.5	444.0	8.0	3552.0	3022	85.1
L12	4	750	2.5	450.0	7.9	3555.0	3123	87.8
L13	3	750	2.5	337.5	8.0	2700.0	2273	84.2
L14	3	750	2.5	337.5	8.0	2700.0	2347	86.9
L15	3	750	2.5	337.5	8.0	2700.0	2298	85.1
L16	3	750	2.5	337.5	7.8	2632.5	2280	86.6
L17	3	750	2.5	337.5	7.3	2463.8	1992	80.9
Total	63			6949.5	135.0	55247.3	47507	
					Average Labour Efficiency (%) =		86.0	

Table B-66 Production Report for Circular Weaving Department (26/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (26.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2783	80.5
L2	4	720	2.5	432.0	8.0	3456.0	2994	86.6
L3	4	720	2.5	432.0	8.0	3456.0	3056	88.4
L4	4	720	2.5	432.0	7.9	3412.8	2973	87.1
L5	4	720	2.5	432.0	7.9	3412.8	2994	87.7
L6	4	720	2.5	432.0	8.0	3456.0	3012	87.2
L7	4	740	2.5	444.0	8.0	3552.0	3087	86.9
L8	4	740	2.5	444.0	8.0	3552.0	3154	88.8
L9	4	740	2.5	444.0	8.0	3552.0	3127	88.0
L10	4	740	2.5	444.0	7.9	3507.6	3051	87.0
L11	4	740	2.5	444.0	8.0	3552.0	3092	87.0
L12	4	750	2.5	450.0	8.0	3600.0	3126	86.8
L13	3	750	2.5	337.5	8.0	2700.0	2286	84.7
L14	3	750	2.5	337.5	8.0	2700.0	2460	91.1
L15	3	750	2.5	337.5	7.9	2666.3	2300	86.3
L16	3	750	2.5	337.5	8.0	2700.0	2276	84.3
L17	3	750	2.5	337.5	8.0	2700.0	2461	91.1
Total	63			6949.5	135.6	55431.5	48232	
					Average Labour Efficiency (%) =		87.0	

Table B-67 Production Report for Circular Weaving Department (26/05/1998 - Shift 2

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (26.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2900	83.9
L2	4	720	2.5	432.0	8.0	3456.0	2994	86.6
L3	4	720	2.5	432.0	8.0	3456.0	2935	84.9
L4	4	720	2.5	432.0	8.0	3456.0	2886	83.5
L5	4	720	2.5	432.0	8.0	3456.0	2786	80.6
L6	4	720	2.5	432.0	8.0	3456.0	2781	80.5
L7	4	740	2.5	444.0	8.0	3552.0	3088	86.9
L8	4	740	2.5	444.0	8.0	3552.0	2983	84.0
L9	4	740	2.5	444.0	8.0	3552.0	3079	86.7
L10	4	740	2.5	444.0	7.9	3507.6	3268	93.2
L11	4	740	2.5	444.0	8.0	3552.0	3071	86.5
L12	4	750	2.5	450.0	8.0	3600.0	2975	82.6
L13	3	750	2.5	337.5	7.8	2632.5	2365	89.8
L14	3	750	2.5	337.5	8.0	2700.0	2341	86.7
L15	3	750	2.5	337.5	8.0	2700.0	2290	84.8
L16	3	750	2.5	337.5	8.0	2700.0	2516	93.2
L17	3	750	2.5	337.5	7.9	2666.3	2319	87.0
Total	63			6949.5	135.6	55450.4	47577	
					Average Labour Efficiency (%) =		85.8	

Table B-68 Production Report for Circular Weaving Department (27/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (27.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	3012	87.2
L2	4	720	2.5	432.0	8.0	3456.0	3056	88.4
L3	4	720	2.5	432.0	8.0	3456.0	2984	86.3
L4	4	720	2.5	432.0	8.0	3456.0	2883	83.4
L5	4	720	2.5	432.0	8.0	3456.0	2791	80.8
L6	4	720	2.5	432.0	8.0	3456.0	2994	86.6
L7	4	740	2.5	444.0	8.0	3552.0	3074	86.5
L8	4	740	2.5	444.0	8.0	3552.0	2891	81.4
L9	4	740	2.5	444.0	8.0	3552.0	3154	88.8
L10	4	740	2.5	444.0	8.0	3552.0	3222	90.7
L11	4	740	2.5	444.0	8.0	3552.0	2876	81.0
L12	4	750	2.5	450.0	8.0	3600.0	3226	89.6
L13	3	750	2.5	337.5	8.0	2700.0	2246	83.2
L14	3	750	2.5	337.5	8.0	2700.0	2467	91.4
L15	3	750	2.5	337.5	8.0	2700.0	2458	91.0
L16	3	750	2.5	337.5	8.0	2700.0	2246	83.2
L17	3	750	2.5	337.5	8.0	2700.0	2415	89.4
Total	63			6949.5	136.0	55596.0	47995	
					Average Labour Efficiency (%) =		86.3	

Table B-69 Production Report for Circular Weaving Department (27/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (27.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	3012	87.2
L2	4	720	2.5	432.0	8.0	3456.0	2994	86.6
L3	4	720	2.5	432.0	8.0	3456.0	2846	82.3
L4	4	720	2.5	432.0	8.0	3456.0	2760	79.9
L5	4	720	2.5	432.0	8.0	3456.0	3051	88.3
L6	4	720	2.5	432.0	8.0	3456.0	3005	87.0
L7	4	740	2.5	444.0	8.0	3552.0	3108	87.5
L8	4	740	2.5	444.0	8.0	3552.0	3079	86.7
L9	4	740	2.5	444.0	8.0	3552.0	3046	85.8
L10	4	740	2.5	444.0	8.0	3552.0	3157	88.9
L11	4	740	2.5	444.0	8.0	3552.0	2976	83.8
L12	4	750	2.5	450.0	8.0	3600.0	3272	90.9
L13	3	750	2.5	337.5	8.0	2700.0	2345	86.9
L14	3	750	2.5	337.5	8.0	2700.0	2461	91.1
L15	3	750	2.5	337.5	8.0	2700.0	2177	80.6
L16	3	750	2.5	337.5	8.0	2700.0	2332	86.4
L17	3	750	2.5	337.5	8.0	2700.0	2384	88.3
Total	63			6949.5	136.0	55596.0	48005	
					Average Labour Efficiency (%) =		86.3	

Table B-70 Production Report for Circular Weaving Department (27/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (27.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	3001	86.8
L2	4	720	2.5	432.0	8.0	3456.0	2976	86.1
L3	4	720	2.5	432.0	8.0	3456.0	2743	79.4
L4	4	720	2.5	432.0	8.0	3456.0	2891	83.7
L5	4	720	2.5	432.0	6.5	2808.0	2354	83.8
L6	4	720	2.5	432.0	8.0	3456.0	3108	89.9
L7	4	740	2.5	444.0	8.0	3552.0	3094	87.1
L8	4	740	2.5	444.0	8.0	3552.0	3049	85.8
L9	4	740	2.5	444.0	8.0	3552.0	3105	87.4
L10	4	740	2.5	444.0	7.9	3507.6	2876	82.0
L11	4	740	2.5	444.0	8.0	3552.0	2993	84.3
L12	4	750	2.5	450.0	8.0	3600.0	3075	85.4
L13	3	750	2.5	337.5	8.0	2700.0	2431	90.0
L14	3	750	2.5	337.5	8.0	2700.0	2367	87.7
L15	3	750	2.5	337.5	8.0	2700.0	2333	86.4
L16	3	750	2.5	337.5	8.0	2700.0	2546	94.3
L17	3	750	2.5	337.5	8.0	2700.0	2492	92.3
Total	63			6949.5	134.4	54903.6	47434	
					Average Labour Efficiency (%) =		86.4	

Table B-71 Production Report for Circular Weaving Department (28/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (28.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.9	3412.8	2861	83.8
L2	4	720	2.5	432.0	7.8	3369.6	2794	82.9
L3	4	720	2.5	432.0	8.0	3456.0	2946	85.2
L4	4	720	2.5	432.0	8.0	3456.0	3068	88.8
L5	4	720	2.5	432.0	8.0	3456.0	3025	87.5
L6	4	720	2.5	432.0	7.8	3369.6	2920	86.7
L7	4	740	2.5	444.0	7.1	3152.4	2662	84.4
L8	4	740	2.5	444.0	8.0	3552.0	2983	84.0
L9	4	740	2.5	444.0	8.0	3552.0	3079	86.7
L10	4	740	2.5	444.0	8.0	3552.0	2991	84.2
L11	4	740	2.5	444.0	8.0	3552.0	3080	86.7
L12	4	750	2.5	450.0	6.5	2925.0	2470	84.4
L13	3	750	2.5	337.5	8.0	2700.0	2277	84.3
L14	3	750	2.5	337.5	8.0	2700.0	2342	86.7
L15	3	750	2.5	337.5	8.0	2700.0	2286	84.7
L16	3	750	2.5	337.5	8.0	2700.0	2249	83.3
L17	3	750	2.5	337.5	8.0	2700.0	2404	89.0
Total	63			6949.5	133.1	54305.4	46437	
					Average Labour Efficiency (%) =		85.5	

Table B-72 Production Report for Circular Weaving Department (28/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (28.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.8	3369.6	2876	85.4
L2	4	720	2.5	432.0	7.9	3412.8	3015	88.3
L3	4	720	2.5	432.0	8.0	3456.0	2992	86.6
L4	4	720	2.5	432.0	8.0	3456.0	2873	83.1
L5	4	720	2.5	432.0	8.0	3456.0	3126	90.5
L6	4	720	2.5	432.0	8.0	3456.0	3079	89.1
L7	4	740	2.5	444.0	8.0	3552.0	2891	81.4
L8	4	740	2.5	444.0	8.0	3552.0	3085	86.9
L9	4	740	2.5	444.0	7.0	3108.0	2584	83.1
L10	4	740	2.5	444.0	8.0	3552.0	3129	88.1
L11	4	740	2.5	444.0	8.0	3552.0	3088	86.9
L12	4	750	2.5	450.0	8.0	3600.0	3264	90.7
L13	3	750	2.5	337.5	8.0	2700.0	2449	90.7
L14	3	750	2.5	337.5	8.0	2700.0	2277	84.3
L15	3	750	2.5	337.5	8.0	2700.0	2468	91.4
L16	3	750	2.5	337.5	7.9	2666.3	2216	83.1
L17	3	750	2.5	337.5	8.0	2700.0	2331	86.3
Total	63			6949.5	134.6	54988.7	47743	
					Average Labour Efficiency (%) =			86.8

Table B-73 Production Report for Circular Weaving Department (28/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (28.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2876	83.2
L2	4	720	2.5	432.0	8.0	3456.0	2942	85.1
L3	4	720	2.5	432.0	8.0	3456.0	2946	85.2
L4	4	720	2.5	432.0	8.0	3456.0	2861	82.8
L5	4	720	2.5	432.0	8.0	3456.0	2769	80.1
L6	4	720	2.5	432.0	8.0	3456.0	3013	87.2
L7	4	740	2.5	444.0	8.0	3552.0	3194	89.9
L8	4	740	2.5	444.0	8.0	3552.0	2979	83.9
L9	4	740	2.5	444.0	8.0	3552.0	3154	88.8
L10	4	740	2.5	444.0	8.0	3552.0	3077	86.6
L11	4	740	2.5	444.0	8.0	3552.0	2948	83.0
L12	4	750	2.5	450.0	8.0	3600.0	3209	89.1
L13	3	750	2.5	337.5	8.0	2700.0	2334	86.4
L14	3	750	2.5	337.5	7.9	2666.3	2426	91.0
L15	3	750	2.5	337.5	8.0	2700.0	2194	81.3
L16	3	750	2.5	337.5	8.0	2700.0	2413	89.4
L17	3	750	2.5	337.5	8.0	2700.0	2349	87.0
Total	63			6949.5	135.9	55562.3	47684	
					Average Labour Efficiency (%) =		85.8	

Table B-74 Production Report for Circular Weaving Department (29/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (29.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2796	80.9
L2	4	720	2.5	432.0	8.0	3456.0	3015	87.2
L3	4	720	2.5	432.0	8.0	3456.0	3026	87.6
L4	4	720	2.5	432.0	8.0	3456.0	2973	86.0
L5	4	720	2.5	432.0	8.0	3456.0	2991	86.5
L6	4	720	2.5	432.0	8.0	3456.0	2878	83.3
L7	4	740	2.5	444.0	8.0	3552.0	2896	81.5
L8	4	740	2.5	444.0	8.0	3552.0	2790	78.5
L9	4	740	2.5	444.0	8.0	3552.0	3049	85.8
L10	4	740	2.5	444.0	8.0	3552.0	3033	85.4
L11	4	740	2.5	444.0	8.0	3552.0	3170	89.2
L12	4	750	2.5	450.0	8.0	3600.0	3000	83.3
L13	3	750	2.5	337.5	8.0	2700.0	2310	85.6
L14	3	750	2.5	337.5	8.0	2700.0	2442	90.4
L15	3	750	2.5	337.5	8.0	2700.0	2332	86.4
L16	3	750	2.5	337.5	8.0	2700.0	2372	87.9
L17	3	750	2.5	337.5	8.0	2700.0	2339	86.6
Total	63			6949.5	136.0	55596.0	47412	
					Average Labour Efficiency (%) =		85.3	

Table B-75 Production Report for Circular Weaving Department (29/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (29.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	6.5	2808.0	2400	85.5
L2	4	720	2.5	432.0	6.5	2808.0	2364	84.2
L3	4	720	2.5	432.0	6.5	2808.0	2381	84.8
L4	4	720	2.5	432.0	6.4	2764.8	2391	86.5
L5	4	720	2.5	432.0	6.5	2808.0	2264	80.6
L6	4	720	2.5	432.0	6.5	2808.0	2556	91.0
L7	4	740	2.5	444.0	6.5	2886.0	2559	88.7
L8	4	740	2.5	444.0	6.5	2886.0	2418	83.8
L9	4	740	2.5	444.0	6.5	2886.0	2338	81.0
L10	4	740	2.5	444.0	6.5	2886.0	2497	86.5
L11	4	740	2.5	444.0	6.5	2886.0	2303	79.8
L12	4	750	2.5	450.0	6.5	2925.0	2568	87.8
L13	3	750	2.5	337.5	6.5	2193.8	1876	85.5
L14	3	750	2.5	337.5	6.5	2193.8	1994	90.9
L15	3	750	2.5	337.5	6.5	2193.8	1880	85.7
L16	3	750	2.5	337.5	6.5	2193.8	1977	90.1
L17	3	750	2.5	337.5	6.5	2193.8	2059	93.9
Total	63			6949.5	110.4	45128.6	38825	
					Average Labour Efficiency (%) =		86.0	

Table B-76 Production Report for Circular Weaving Department (29/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (29.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	3005	87.0
L2	4	720	2.5	432.0	8.0	3456.0	2896	83.8
L3	4	720	2.5	432.0	8.0	3456.0	2784	80.6
L4	4	720	2.5	432.0	8.0	3456.0	3000	86.8
L5	4	720	2.5	432.0	8.0	3456.0	2994	86.6
L6	4	720	2.5	432.0	8.0	3456.0	2876	83.2
L7	4	740	2.5	444.0	8.0	3552.0	2780	78.3
L8	4	740	2.5	444.0	8.0	3552.0	3265	91.9
L9	4	740	2.5	444.0	8.0	3552.0	3079	86.7
L10	4	740	2.5	444.0	8.0	3552.0	2974	83.7
L11	4	740	2.5	444.0	8.0	3552.0	3172	89.3
L12	4	750	2.5	450.0	8.0	3600.0	2976	82.7
L13	3	750	2.5	337.5	8.0	2700.0	2444	90.5
L14	3	750	2.5	337.5	8.0	2700.0	2268	84.0
L15	3	750	2.5	337.5	8.0	2700.0	2366	87.6
L16	3	750	2.5	337.5	8.0	2700.0	2401	88.9
L17	3	750	2.5	337.5	8.0	2700.0	2211	81.9
Total	63			6949.5	136.0	55596.0	47491	
					Average Labour Efficiency (%) =		85.4	

Table B-77 Production Report for Circular Weaving Department (30/05/1998 - Shift 3)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 3 (30.05.1998 / 00 am to 08 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2786	80.6
L2	4	720	2.5	432.0	8.0	3456.0	2993	86.6
L3	4	720	2.5	432.0	8.0	3456.0	3024	87.5
L4	4	720	2.5	432.0	8.0	3456.0	3100	89.7
L5	4	720	2.5	432.0	8.0	3456.0	2889	83.6
L6	4	720	2.5	432.0	8.0	3456.0	2873	83.1
L7	4	740	2.5	444.0	8.0	3552.0	2884	81.2
L8	4	740	2.5	444.0	8.0	3552.0	2972	83.7
L9	4	740	2.5	444.0	8.0	3552.0	2775	78.1
L10	4	740	2.5	444.0	8.0	3552.0	3045	85.7
L11	4	740	2.5	444.0	8.0	3552.0	3111	87.6
L12	4	750	2.5	450.0	8.0	3600.0	3264	90.7
L13	3	750	2.5	337.5	8.0	2700.0	2456	91.0
L14	3	750	2.5	337.5	8.0	2700.0	2355	87.2
L15	3	750	2.5	337.5	8.0	2700.0	2417	89.5
L16	3	750	2.5	337.5	8.0	2700.0	2397	88.8
L17	3	750	2.5	337.5	8.0	2700.0	2348	87.0
Total	63			6949.5	136.0	55596.0	47689	
					Average Labour Efficiency (%) =		85.8	

Table B-78 Production Report for Circular Weaving Department (30/05/1998 - Shift 1)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 1 (30.05.1998 / 08 am to 04 pm)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	7.6	3283.2	2886	87.9
L2	4	720	2.5	432.0	7.6	3283.2	2792	85.0
L3	4	720	2.5	432.0	7.6	3283.2	2903	88.4
L4	4	720	2.5	432.0	7.5	3240.0	2846	87.8
L5	4	720	2.5	432.0	7.6	3283.2	2875	87.6
L6	4	720	2.5	432.0	7.6	3283.2	2852	86.9
L7	4	740	2.5	444.0	7.6	3374.4	2993	88.7
L8	4	740	2.5	444.0	7.5	3330.0	3047	91.5
L9	4	740	2.5	444.0	7.5	3330.0	3125	93.8
L10	4	740	2.5	444.0	7.5	3330.0	2976	89.4
L11	4	740	2.5	444.0	7.6	3374.4	3015	89.3
L12	4	750	2.5	450.0	7.6	3420.0	2889	84.5
L13	3	750	2.5	337.5	7.6	2565.0	2358	91.9
L14	3	750	2.5	337.5	7.6	2565.0	2246	87.6
L15	3	750	2.5	337.5	7.6	2565.0	2313	90.2
L16	3	750	2.5	337.5	7.7	2585.3	2246	86.9
L17	3	750	2.5	337.5	7.6	2565.0	2220	86.5
Total	63			6949.5	128.9	52660.1	46582	
					Average Labour Efficiency (%) =		88.5	

Table B-79 Production Report for Circular Weaving Department (30/05/1998 - Shift 2)

PRODUCTION REPORT FOR CIRCULAR WEAVING DEPARTMENT								
SHIFT 2 (30.05.1998 / 04 pm to 00 am)								
Labour Code	# of Machine	Pick / min	Width (mm)	Standard Production (m/hour)	Effective Working Time (Ave) (hr/shift)	Standard Production (m/shift)	Actual Production (m/shift)	Labour Efficiency (%)
L1	4	720	2.5	432.0	8.0	3456.0	2896	83.8
L2	4	720	2.5	432.0	8.0	3456.0	2972	86.0
L3	4	720	2.5	432.0	8.0	3456.0	2946	85.2
L4	4	720	2.5	432.0	8.0	3456.0	2912	84.3
L5	4	720	2.5	432.0	8.0	3456.0	2970	85.9
L6	4	720	2.5	432.0	7.1	3067.2	2678	87.3
L7	4	740	2.5	444.0	8.0	3552.0	2883	81.2
L8	4	740	2.5	444.0	8.0	3552.0	3105	87.4
L9	4	740	2.5	444.0	8.0	3552.0	3128	88.1
L10	4	740	2.5	444.0	8.0	3552.0	2999	84.4
L11	4	740	2.5	444.0	8.0	3552.0	3064	86.3
L12	4	750	2.5	450.0	8.0	3600.0	3019	83.9
L13	3	750	2.5	337.5	8.0	2700.0	2266	83.9
L14	3	750	2.5	337.5	8.0	2700.0	2348	87.0
L15	3	750	2.5	337.5	8.0	2700.0	2473	91.6
L16	3	750	2.5	337.5	8.0	2700.0	2293	84.9
L17	3	750	2.5	337.5	8.0	2700.0	2364	87.6
Total	63			6949.5	135.1	55207.2	47316	
					Average Labour Efficiency (%) =		85.7	

APPENDIX - C

Some Views from the Running Computer Program

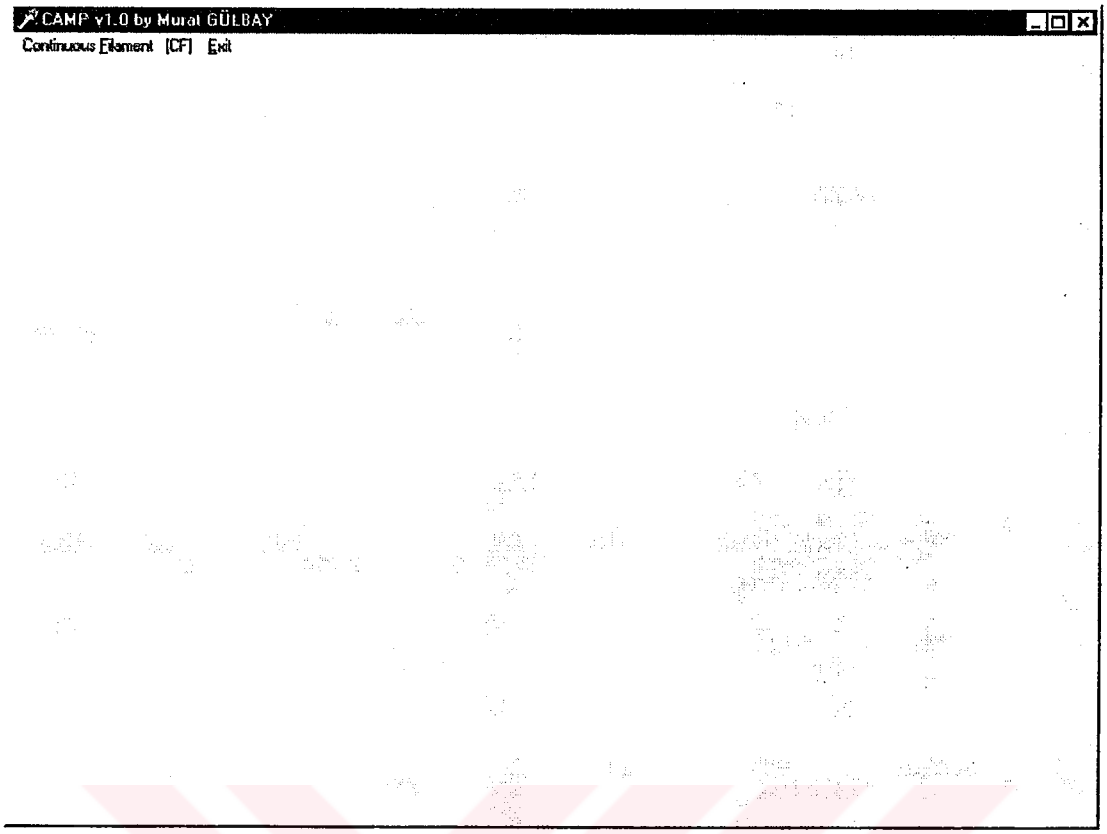

Figure C-1 Main Menu of the Program "CAMPCF"

Figure C-2 "Continuous Filament (CF)" Submenu of the Program "CAMPCF"

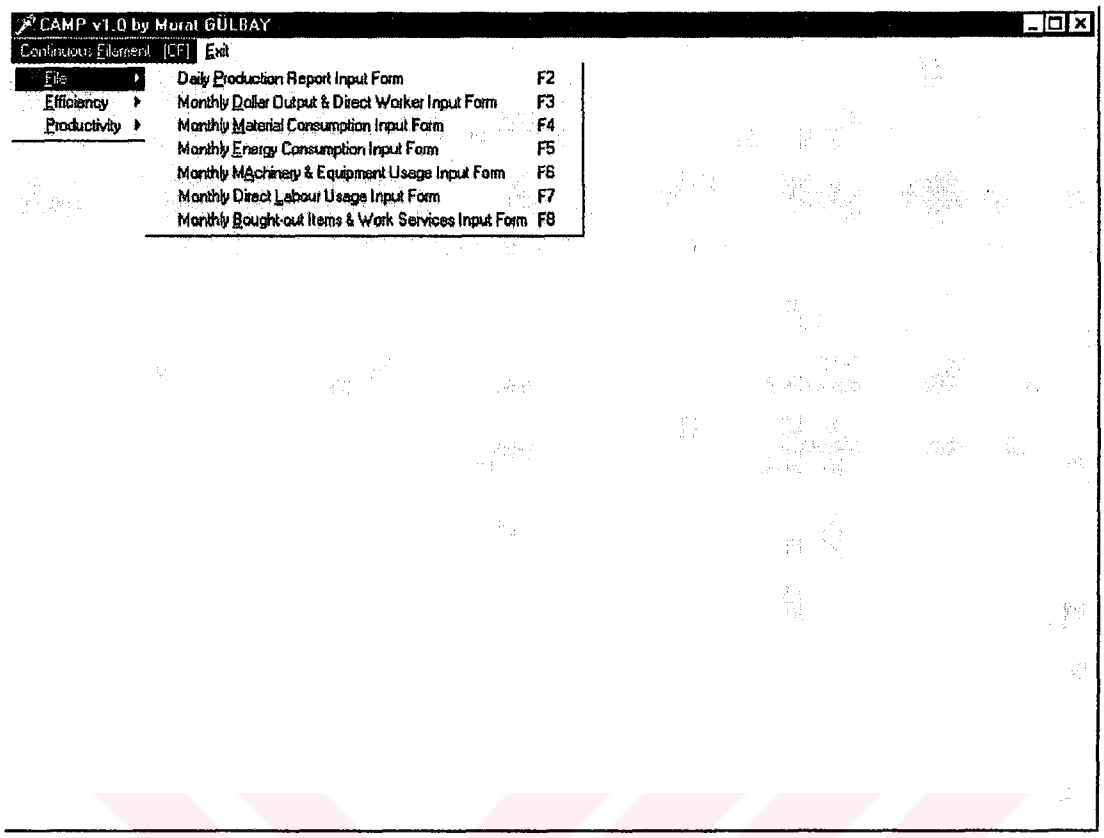

Figure C-3 "File" Submenu of "CF" Menu of the Program "CAMPCF"

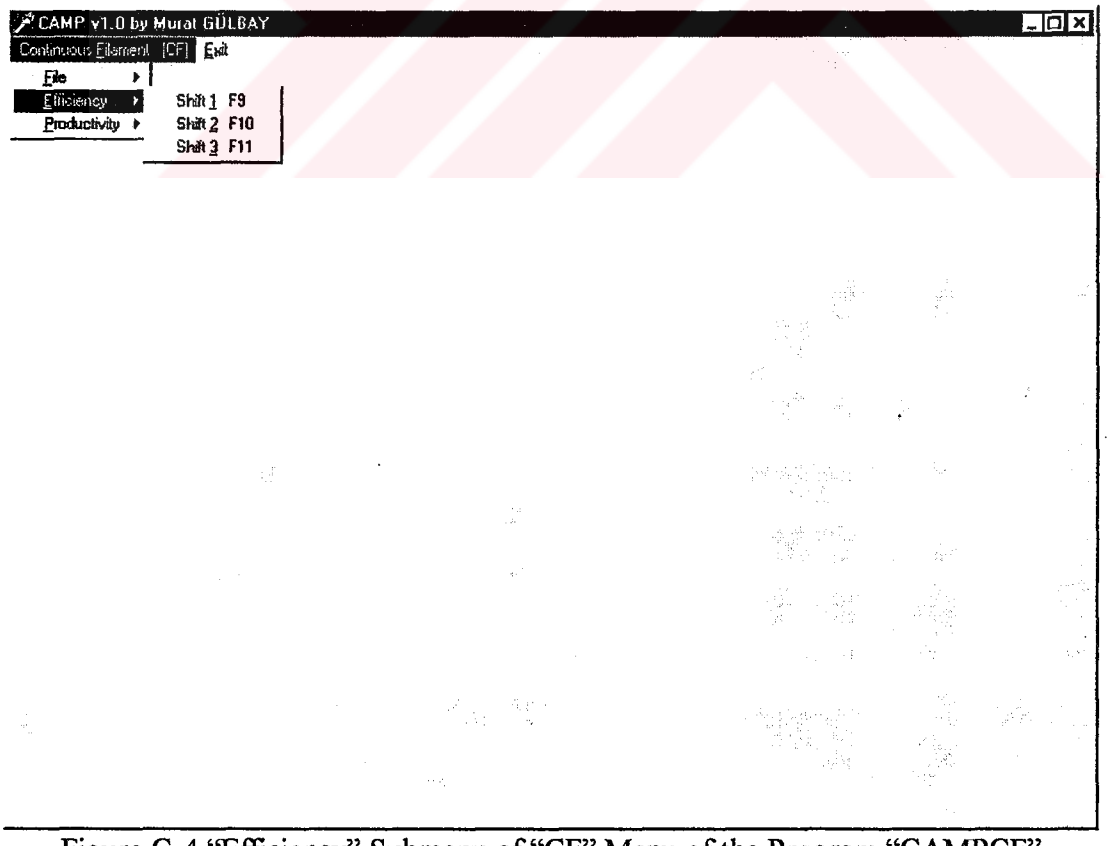

Figure C-4 "Efficiency" Submenu of "CF" Menu of the Program "CAMPCF"

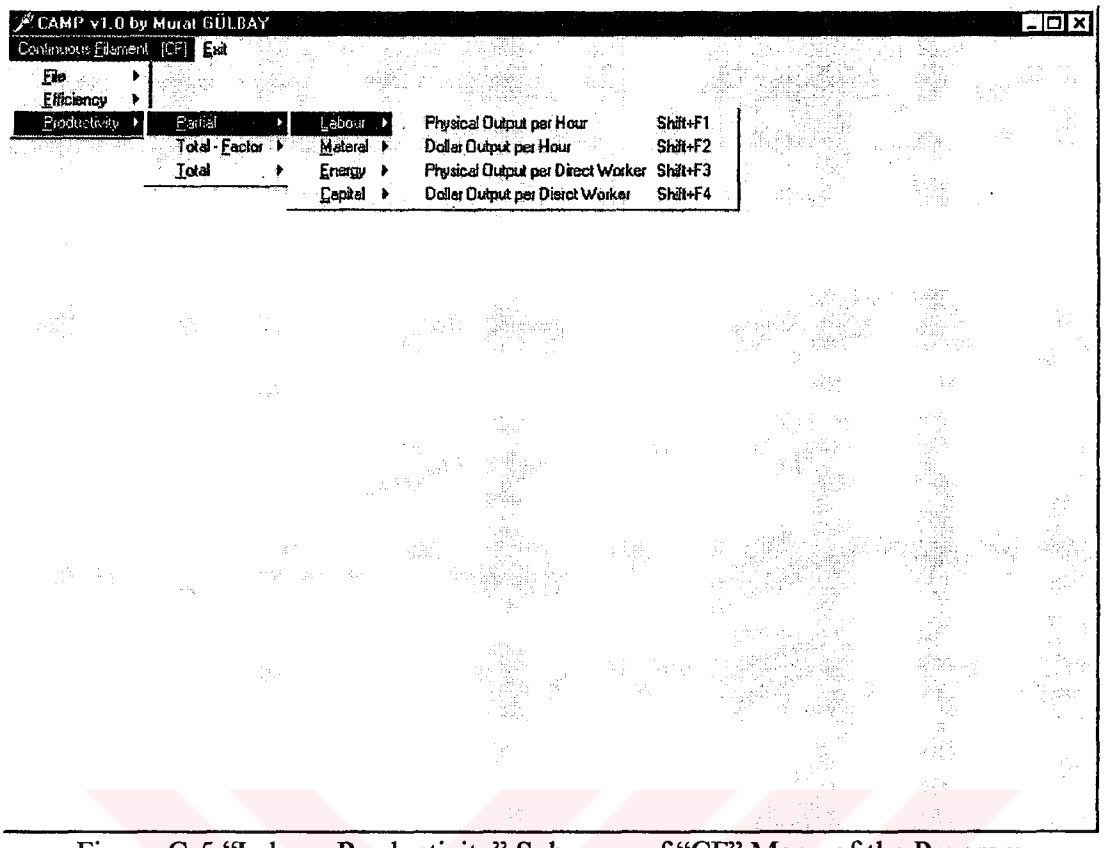

Figure C-5 "Labour Productivity" Submenu of "CF" Menu of the Program "CAMPCF"

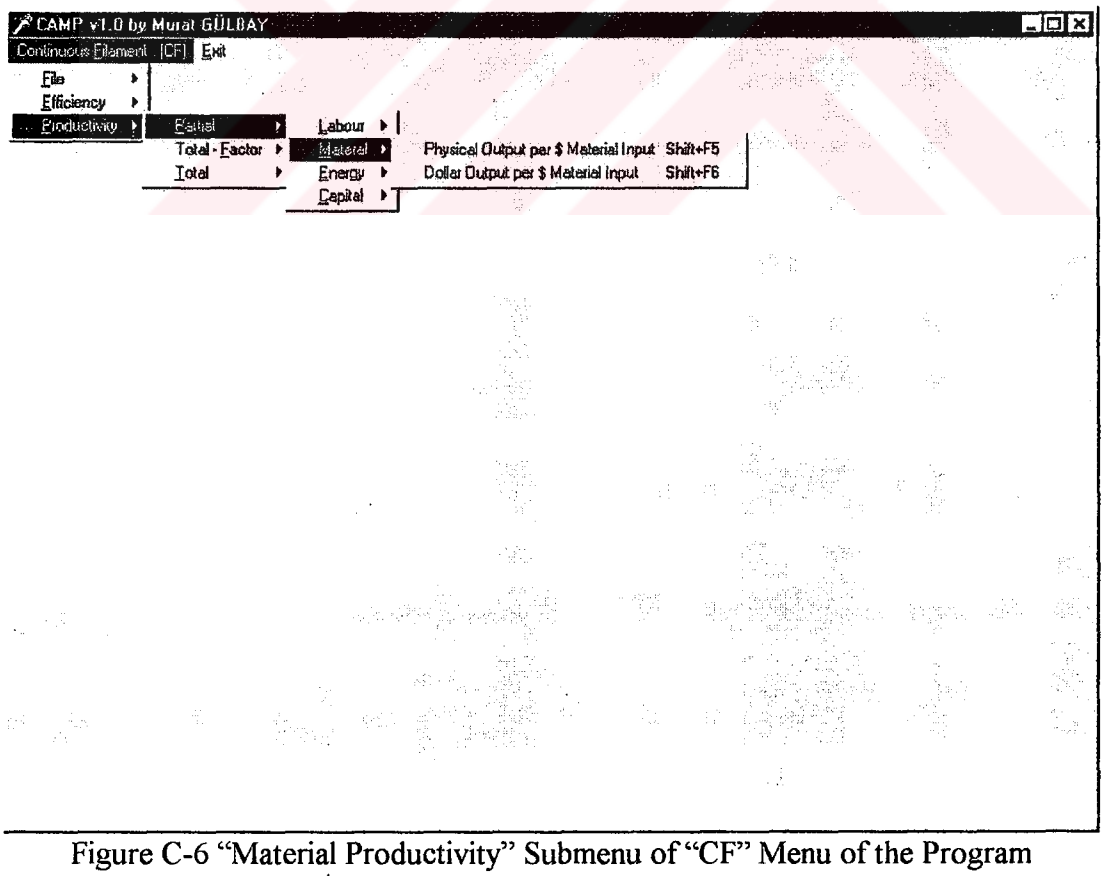

Figure C-6 "Material Productivity" Submenu of "CF" Menu of the Program "CAMPCF"

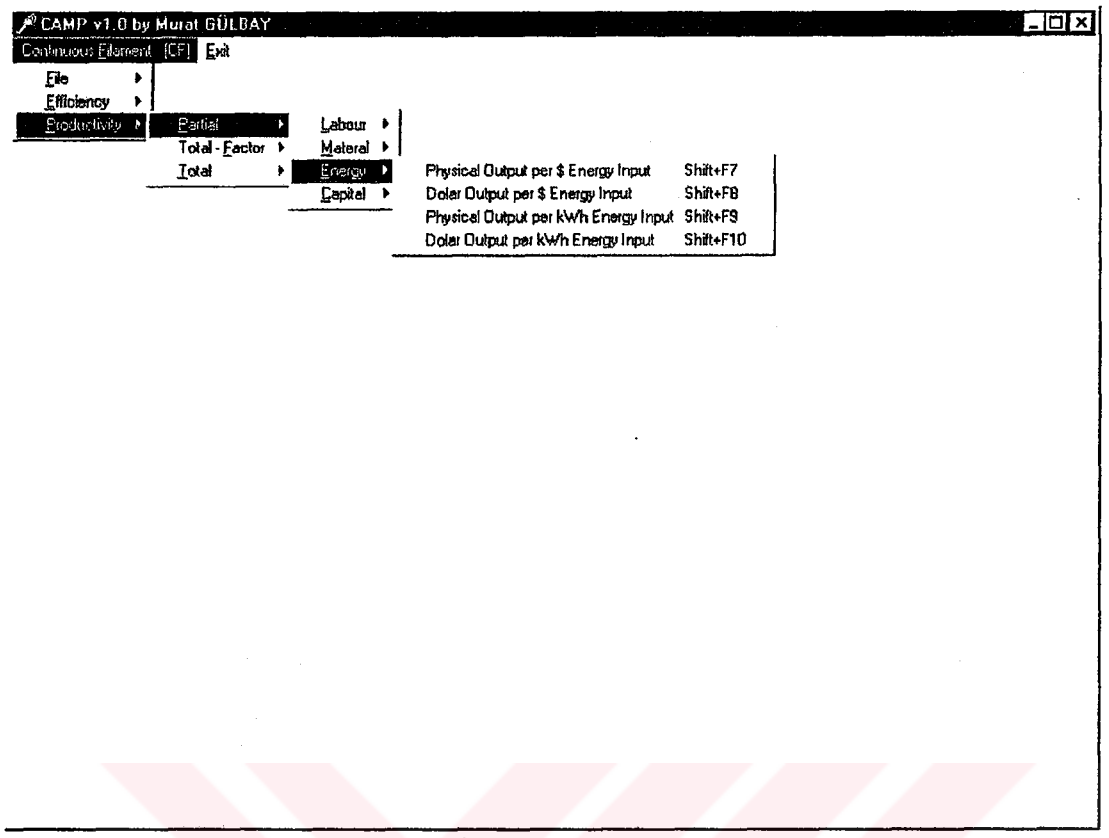

Figure C-7 "Energy Productivity" Submenu of "CF" Menu of the Program "CAMPCF"

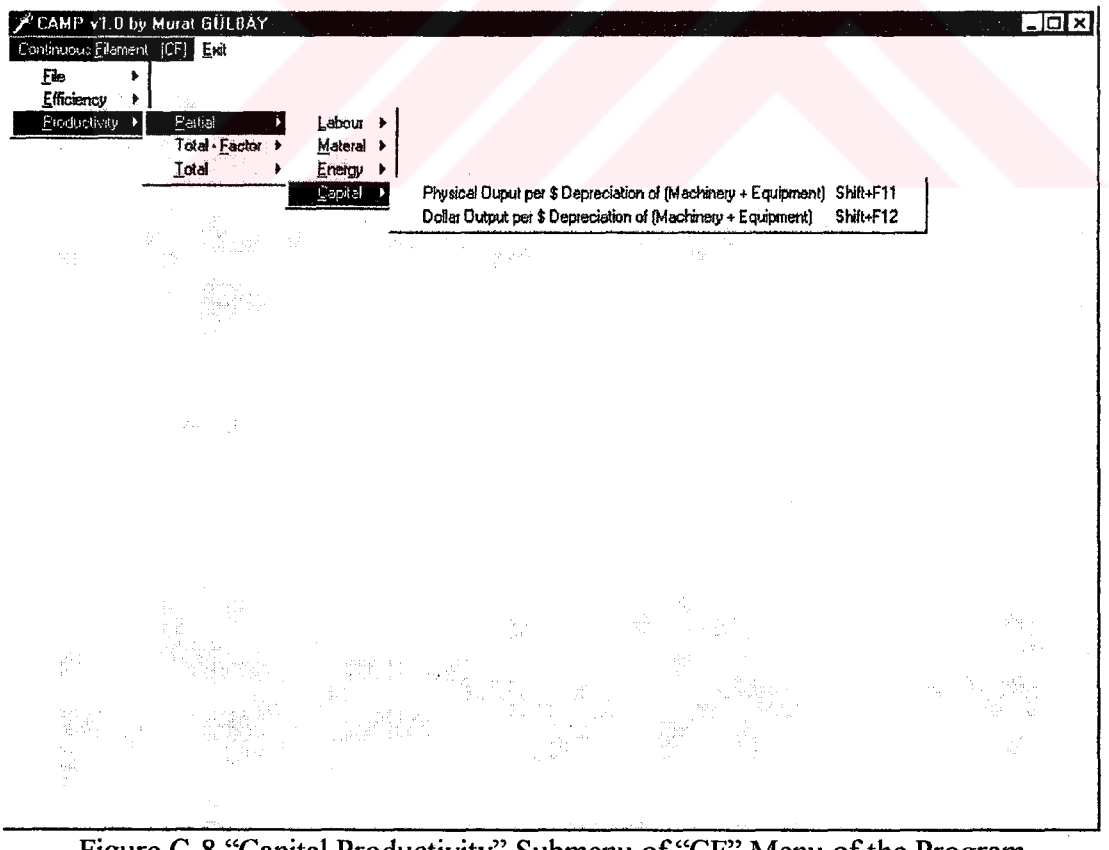

Figure C-8 "Capital Productivity" Submenu of "CF" Menu of the Program "CAMPCF"

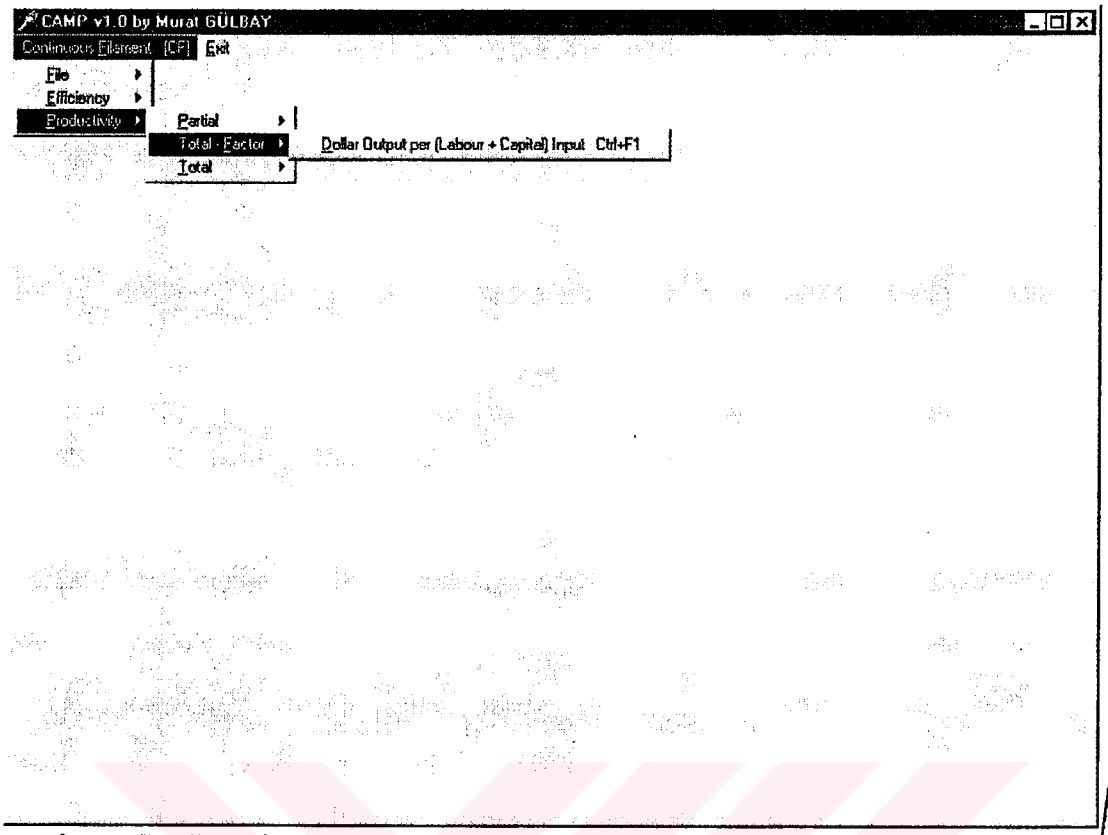

Figure C-9 "Total-Factor Productivity" Submenu of "CF" Menu of the Program "CAMPCF"

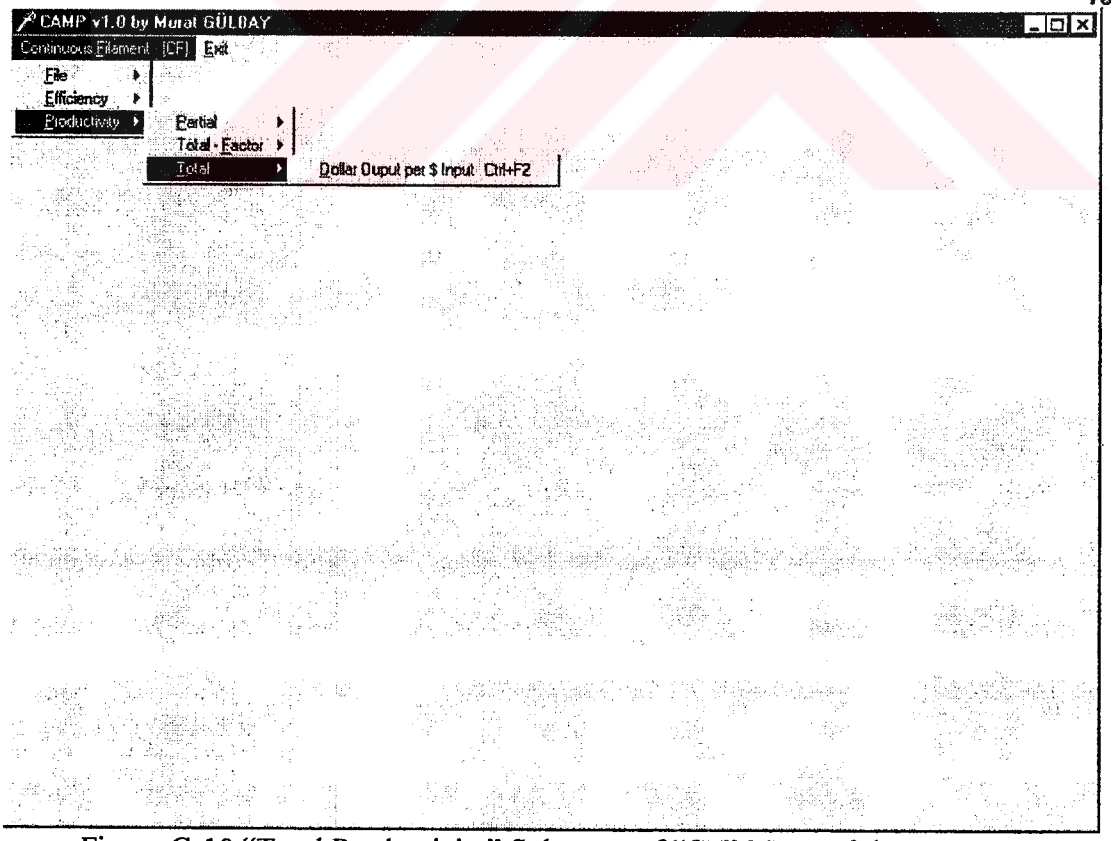

Figure C-10 "Total Productivity" Submenu of "CF" Menu of the Program "CAMPCF"

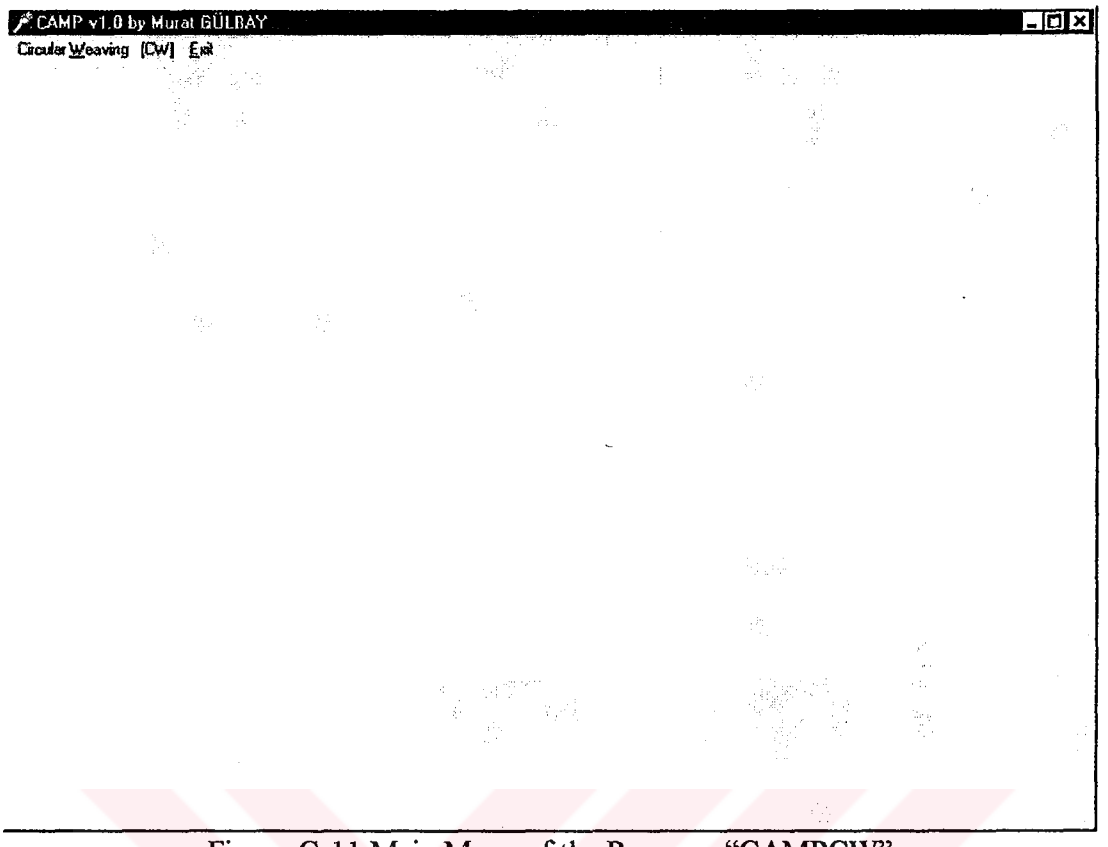

Figure C-11 Main Menu of the Program "CAMPCW"

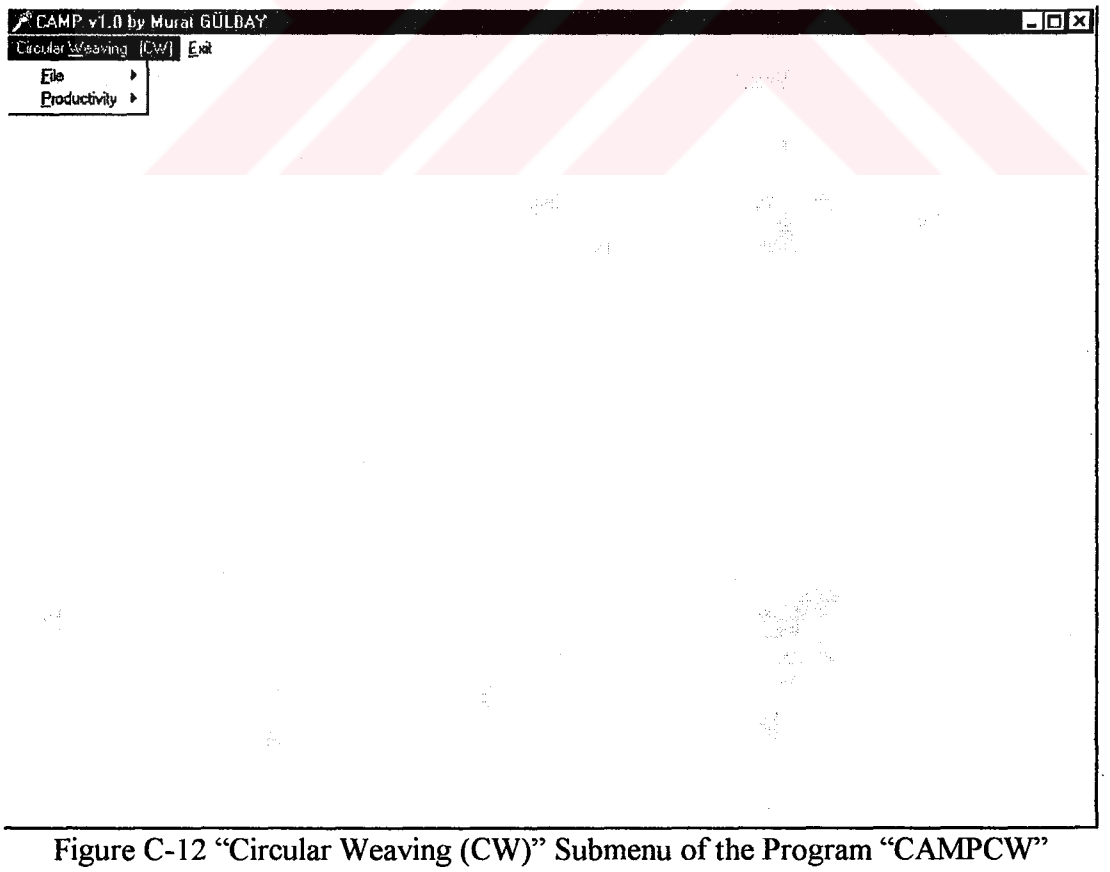

Figure C-12 "Circular Weaving (CW)" Submenu of the Program "CAMPCW"

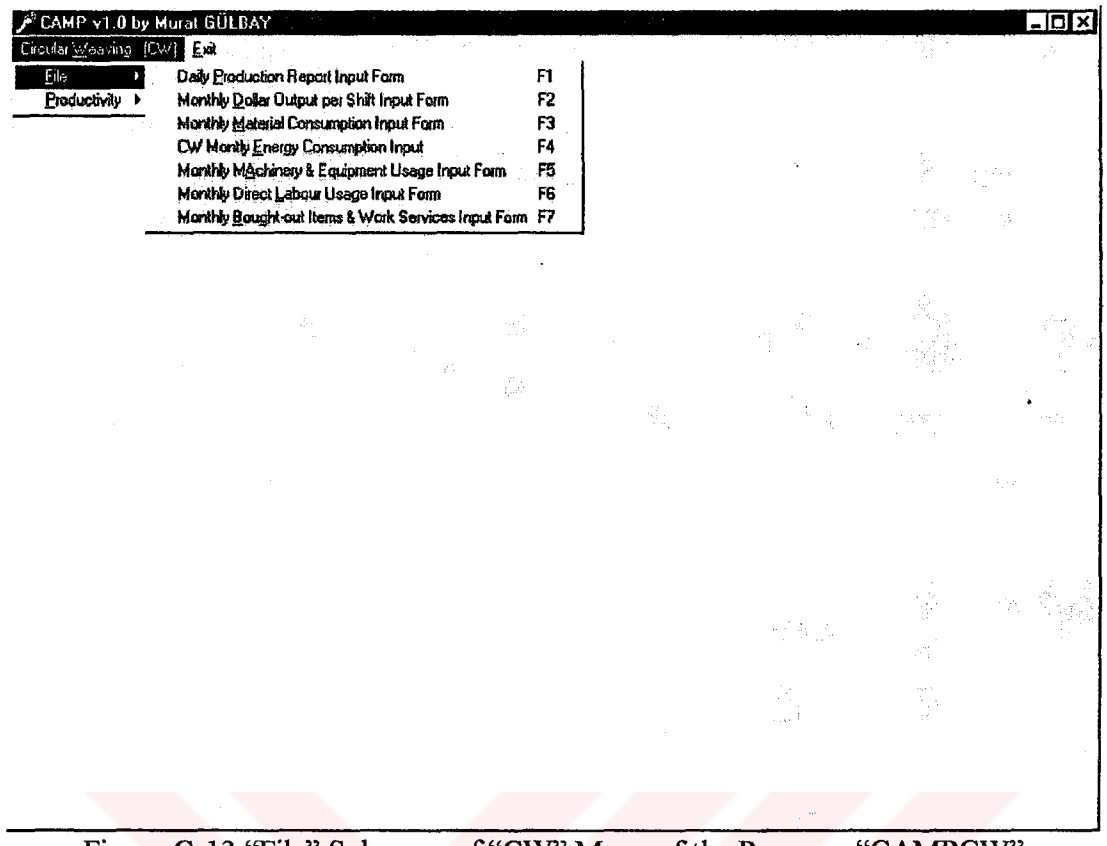

Figure C-13 "File" Submenu of "CW" Menu of the Program "CAMPCW"

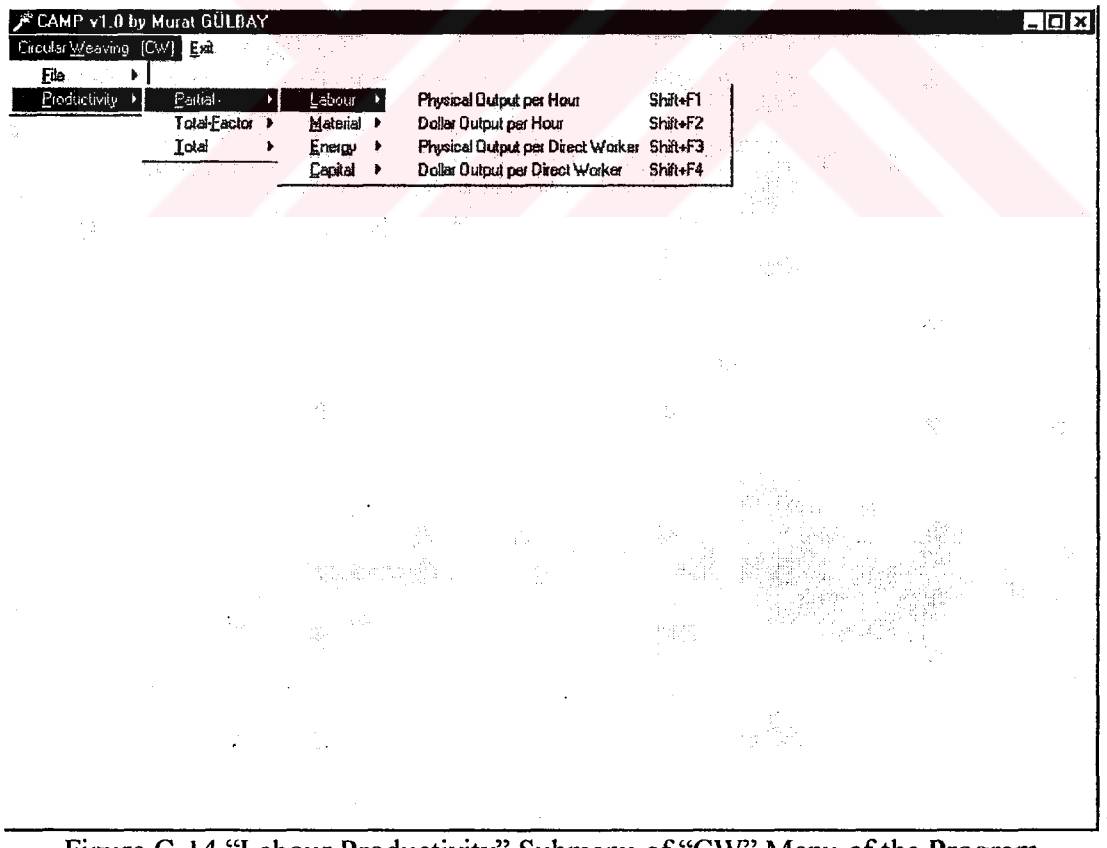

Figure C-14 "Labour Productivity" Submenu of "CW" Menu of the Program "CAMPCW"

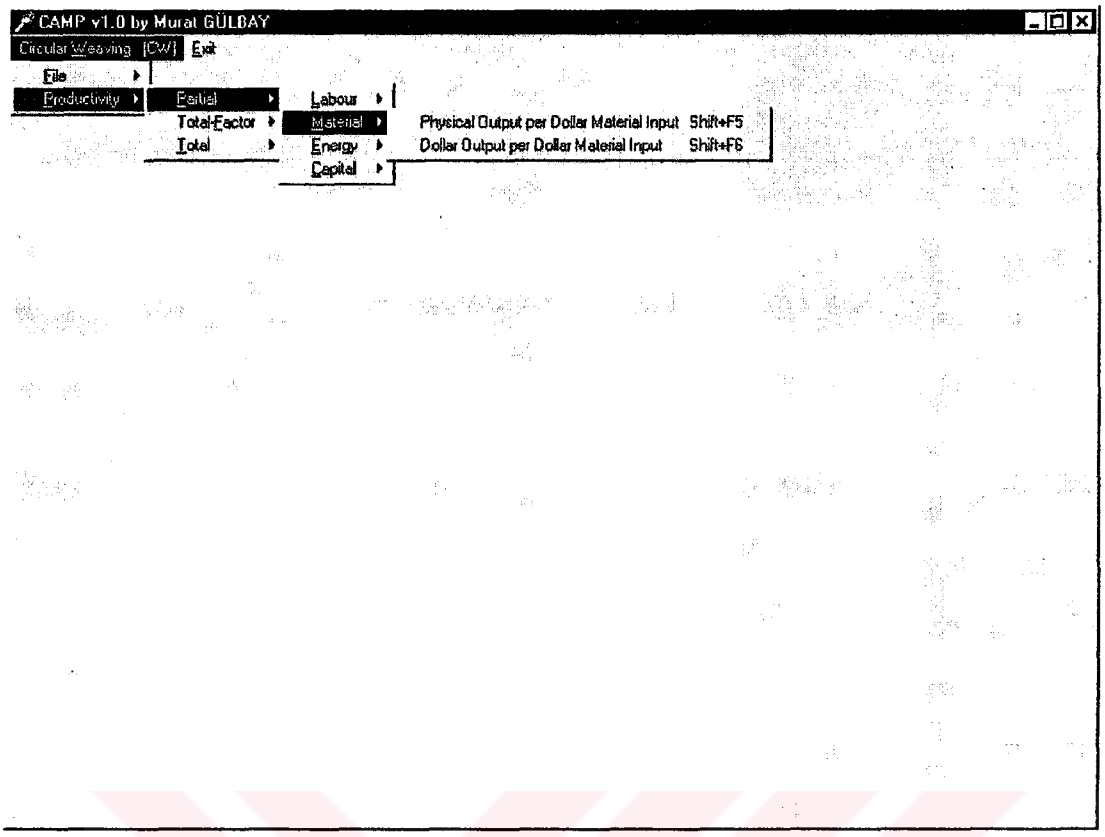

Figure C-15 "Material Productivity" Submenu of "CW" Menu of the Program "CAMPCW"

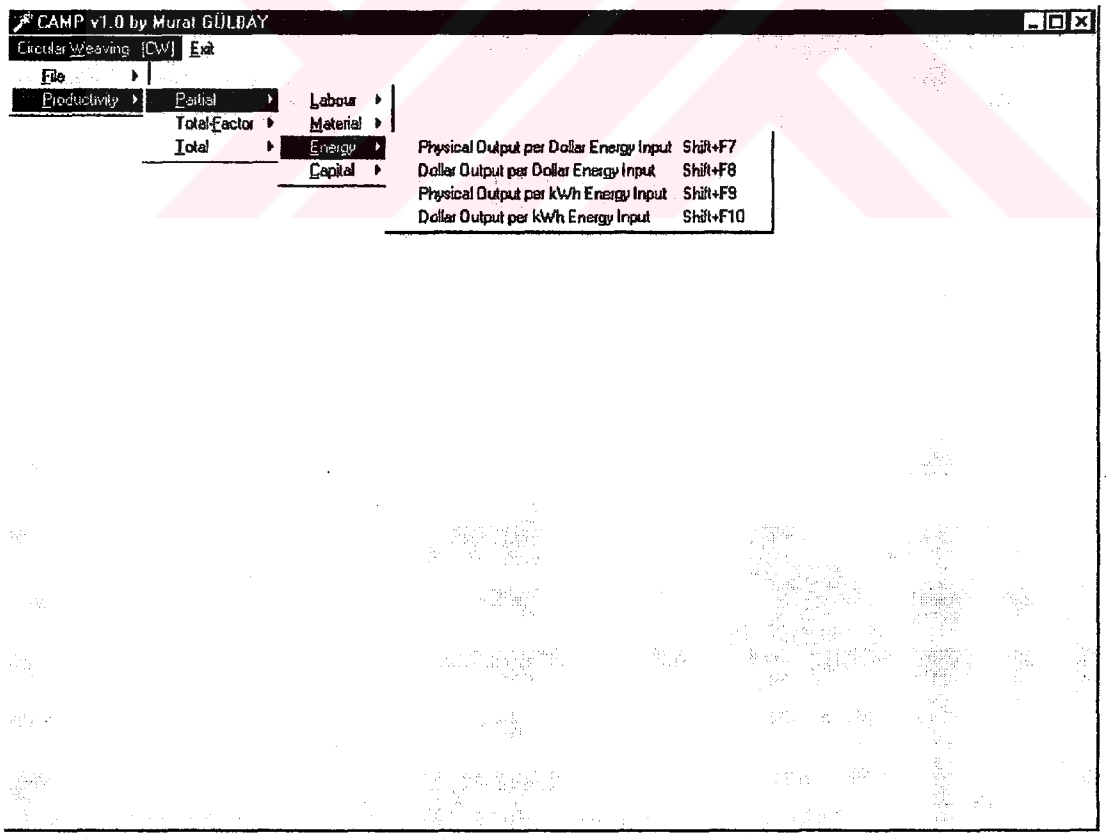

Figure C-16 "Energy Productivity" Submenu of "CW" Menu of the Program "CAMPCW"

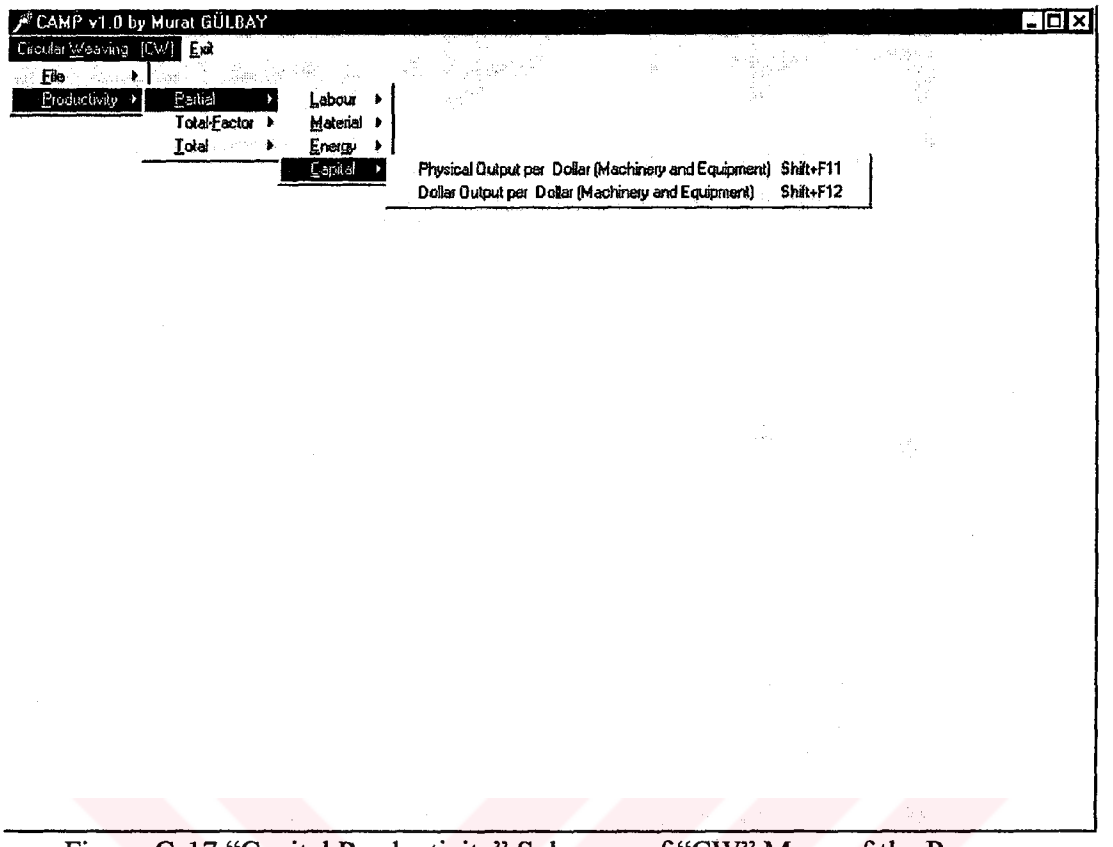

Figure C-17 "Capital Productivity" Submenu of "CW" Menu of the Program "CAMPCW"

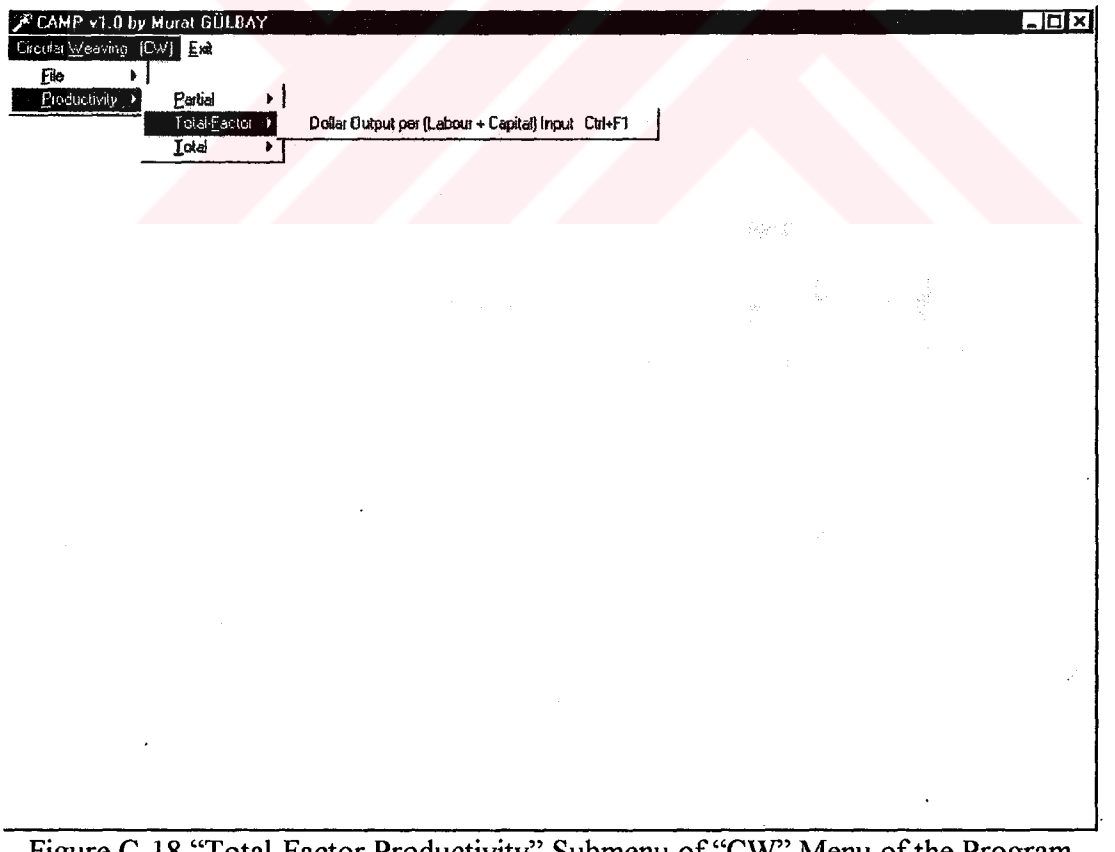

Figure C-18 "Total-Factor Productivity" Submenu of "CW" Menu of the Program "CAMPCW"

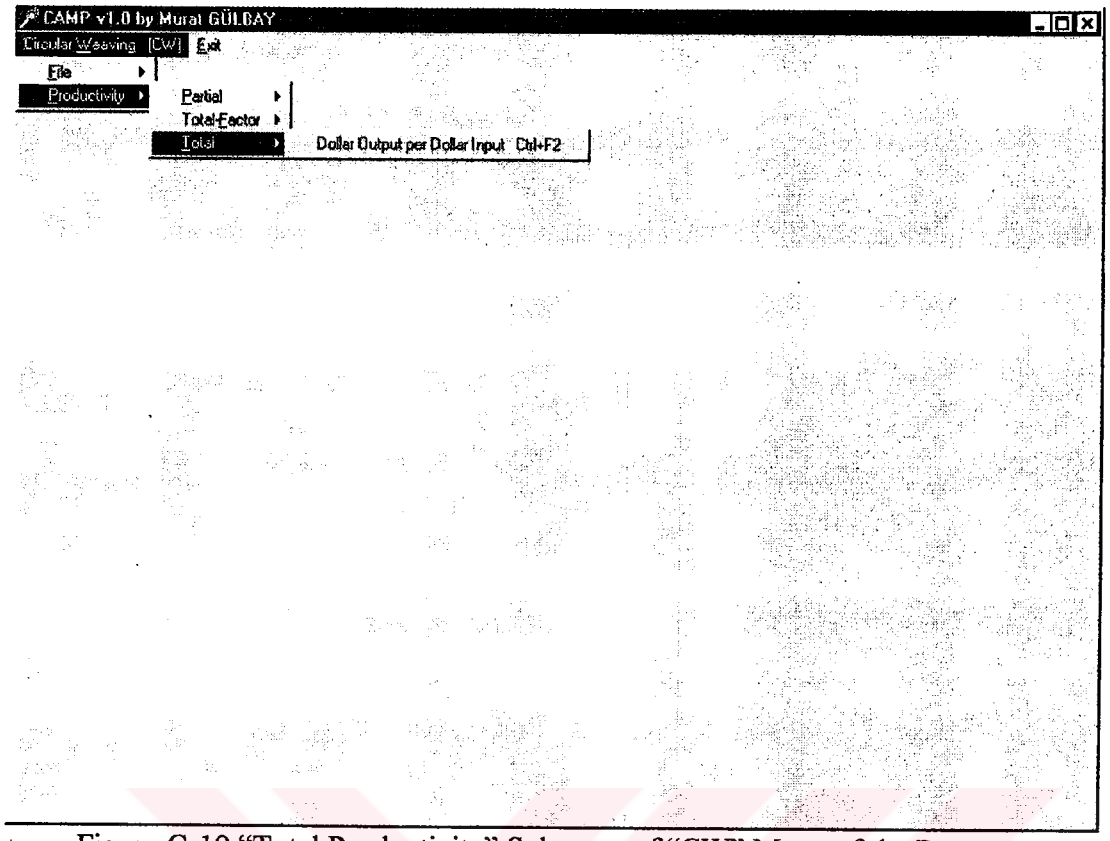

Figure C-19 "Total Productivity" Submenu of "CW" Menu of the Program "CAMPCW"