A SYSTEMATIC APPROACH FOR PRODUCTIVITY MEASUREMENT, EVALUATION AND IMPROVEMENT

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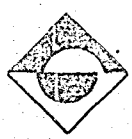

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ABSTRACT

Organizational systems performance measurement is a critical component in the general management process. Being one of the performance measures, productivity has an increasing popularity nowadays. Usage of the term "productivity" should be based on an analytical framework including methodologies and techniques of measurement.

This thesis covers a systematic approach for productivity measurement, evaluation and improvement. A productivity improvement procedure is suggested. The procedure includes a methodology for productivity measurement which is tested on an existing company. Furthermore, ways of specifying dominant factors of productivity and potential factors of productivity improvement were investigated analytically.

ÖZET

Performans ölçümü, organizasyonel sistemlerin genel yönetim sürecinde önemli bir yer tutar. Günümüzde, "üretkenlik" giderek yaygınlaşan bir başarı ölçütü durumuna gelmiştir. Ancak, bu terimin kullanımı, ölçüm yöntem ve tekniklerinin tanımlanmış olduğu bir bilimsel temele dayandırılmalıdır.

Bu çalışma: üretkenlik ölçüm, değerlendirme ve geliştirme faaliyetlerine sistemsel bir yaklaşımı içermektedir. Bu yaklaşım bağlamında, bir üretkenlik geliştirme yöntemi önerilmiş, beraberinde oluşturulan üretkenlik ölçümüne yönelik metod ise bir üretim şirketinde uygulanmıştır. Ayrıca, üretkenliği belirleyen ve arttırılması açısından önem taşıyan faktörlerin saptanma yöntemleri analitik olarak irdelenmiştir.

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I. INTRODUCTION

Usage of the term "productivity", by almost every discipline and profession to promote and market their solutions to the organizational problems, has an increasing trend nowadays. Due to the competition aroused from the implementation of export oriented new monetary policies: "productivity appears to be a term and concept capturing the attention of managers in all types of organizations and at all levels within those organizations". (1)x However, it is still a confused and misused term. Construction of a conceptual framework, including disciplined definitions of related terms and systematic descriptions of related concepts is necessary. Improvement starts with measurement, evaluation and control, which necessitates a sound analyticol framework (including methodologies and techniques of measurement, evaluation and control) based on the above mentioned conceptual framework.

"Organizational systems performance measurement" can be thought as a component in the general management process. Depending upon the definition of boundaries, an organizational system can be, a nation, a region, an industry, a firm, a division, a work group or even an

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(x) Numbers enclosed in brackets refer to the references at the end

individual. By specifying the boundaires we define our "unit of analysis". This allows us to accurately define inputs, transformations, outputs and outcomes from the system. "Once we define major outputs and inputs we can begin to develop measures, ratios and indexes with which to monitor" (2) performance indicators of the organizational system.

We can measure the performance of an organizational system for strategic purposes, for tactical purposes, for planning purposes or for other managerial purposes. Although measurement purposes are common, evaluation criteria change in accordance with the position and the responsibilities of the decision maker in the organizational system. For example, let us take a firm as our unit of analysis. Investors, long range and short range lenders are concerned with strictly financial measures. Classical managerial control ratios, derived on the income statement and the balance sheet are their evaluative criteria. However the operating manager of the firm is concerned with the performance criteria and measures related to the whole conversion process of financial inflow to financial outflow. He has to differentiate between short-term and long-term determinats of aggregate performance and specify internally controlled and externally imposed adjustments. Furthermore he is interested in the extension of the integrated structure of performance criteria to lower levels of the organizational system.

In general, we can classify the measures of organizational system performance in seven distinct but not mutually exclusive categories: effectiveness, efficiency, productivity, quality, profitability, quality of worklife, innovation. Obviously, managers will weigh the measures differently, partly because of their different subjective judgements and partly because of the different organizational characteristics.

Performance measurement system, is a decision support system monitoring the organizational system performance by the indicators of the above mentioned performance measures.

1.1. Basic Concepts and Definitions

Effectiveness is a measure of accoplishment of managerial objectives, i.e. producing the "right things" (quality and quantity) on time. Efficiency is a measure of standardization in consumption of resources, i.e the ratio of expected resource consumption over actual resource consumption. Then,

$$\text{Productivity} = \text{Effectiveness} \times \text{Efficiency}$$

Production is a transformation process of inputs to outputs while productivity is a measure on the relationship of the two and can be expressed in terms of effectiveness and efficiency measures.

From another point of view: a commonly accepted definition is "Productivity is a relationship (usually a ratio or an index) between quantities of outputs (goods and/or services) produced by a given organizational system and quantities of inputs (resources) utilized by that organizational system to produce those same outputs" (3) That is,

$$\text{Productivity} = \frac{\text{Outputs}}{\text{Inputs}}$$

The main problem in quantifying outputs and inputs of an organizational system is the absence of common physical units. This is solved by expressing outputs and inputs by their value in terms of the commonly used monetary unit. However, the decreasing purchasing power of money through time in inflationary economic circumstances leads to extensive usage of various deflators in index calculations. Other problems of productivity analysis which should be pointed out (at

least conceptually) are: dealing with qualitative changes in particular inputs or outputs through time and combining different product (or input) types into meaningful aggregates.

First, there are two major categories of productivity measures: static productivity ratios and dynamic productivity indexes. The ratio of output quantities to input quantities (both referring to the same period of time) is called a static productivity ratio. e.g.

$$\frac{\text{Outputs } 1985}{\text{Inputs } 1985}$$

Dynamic productivity indexes represent ratio of the measurements of two time periods.

For example:

$$\frac{\text{Productivity ratio } 1985}{\text{Productivity ratio } 1984}$$

Furthermore, productivity measures are categorized according to the number of inputs included in the denominator of the productivity equation. If all of the inputs are included, it is called a total factor productivity measure whereas if some of the inputs are included, it is called a multi-factor productivity measure and if only one input is included it is called a partial productivity measure.

All of the outputs are included in total factor, all or some of the outputs are included in multi and partial factor productivity measures.

$$\frac{\text{Total Outputs}}{\text{Total Inputs}}, \quad \frac{\text{Outputs}}{\text{Labor, Capital, Material, Energy}} \text{ and } \frac{\text{Output}}{\text{Labor}}$$

are good examples of total, multi and partial factor productivity measures respectively.

Increasing the number of input/output factors included in the productivity measures results in meeting the managements need "to understand the linkages between partial effects and combined effects in order to identify causes of improvements as well as the factors limiting their benefits". (4)

Profitability is a measure or set of measures of the relationship between financial resources and uses for these financial resources. (e.g. $\frac{\text{Revenues}}{\text{Costs}}$, Return of Assets, Return on Investments)

Profitability is a function of productivity and price recovery. In other words, a firm can increase profit by productivity improvement and/or by price recovery. Productivity, caused by changes in capacity utilization and/or changes in efficiency is thought as the "controllable" element of profitability. Whereas price recovery,

showing the degree to which input cost changes are passed onto output prices, is "uncontrollable" i.e imposed by the market conditions. The relationship between productivity, price recovery and profitability is depicted by the model in Figure 1.1 (American Productivity Center, 1978)

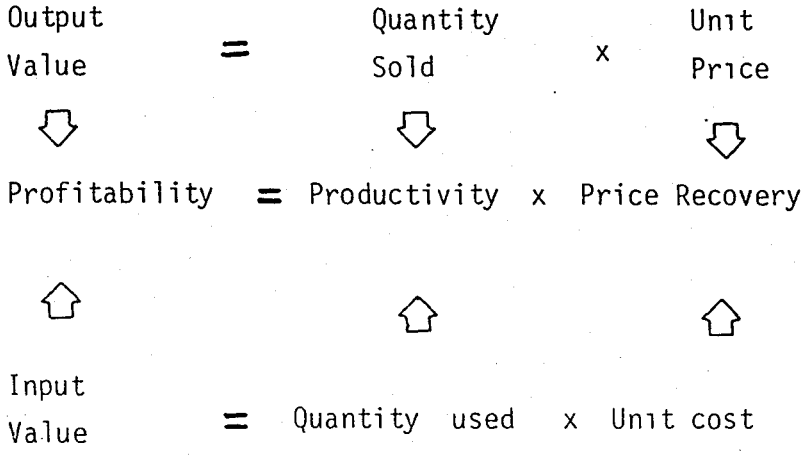


Figure 1.1 : Relationship Between Productivity, Price Recovery and Profitability.

Decomposition of profitability into productivity and price recovery components enables the operations manager to analyse sources of profits. It is obvious that, being a firm generating profit from longterm productivity improvements, should always be preferred to being a firm generating profit from short term price recovery, whereas

traditional financial analysis would not observe any difference between these two cases.

1.2. Prevailing Approaches

This study was started with a literature survey of prevailing approaches to productivity. The approaches, methodologies and measurement techniques available in the productivity related topics can be categorized as follows:

1.2.1. Action-Based Programs and Surrogate Approaches

The common characteristic of these approaches is that they try to achieve productivity improvements without productivity measurement, evaluation and control.

Action based programs are involved in determination of productivity improvement projects in a systematic manner. Completion of each project should solve some of the bottleneck productivity problems and should be followed by the start of a new project determined by going through a prepared checklist (5), (6).

"A surrogate productivity measurement approach is one that does not measure productivity directly but measures something that is highly correlated with productivity" (7) It is assumed that measurement, evaluation, control and improvement of surragate factors will result in productivity improvements.

Some references for surrogate approaches are The Common Staffing Study (8), Benefit/Cost Analysis (9), Managing Productivity by Objectives (10) and Productivity Audits and Checklists (11),(12).

1.2.2. Productivity-Cost-Profitability Approach

The "productivity-cost-profitability" (P-C-P) system is developed under the requirement of "a productivity analysis framework which would facilitate tracing the effects of any productivity-improving innovation on each link in the complex network of interacting relationships being managed." (13) Briefly summarized, it integrates three levels of measurement and analysis the network of productivity relationships, the structure of cost relationships and the managerial control ratios.

By using the model of "network of productivity relationships", this approach emphasizes that, a change in any component such as output per man-hour, can be a result of either changes engendered within that component or passive resultant of changes initiated elsewhere in the network.

The analysis must be extended to include the economic effects of productivity improvement innovations in order to enable management to evaluate the net benefits and give effective decisions. "Structure of costs" is superimposed on to the network of productivity relationships to analyse the cost effects. Taking the importance of the rate of profit on investment in to account, the productivity network and structure of costs are integrated with the "managerial control ratios model".

Managerial control ratios model, facilitates tracing interactions among average product prices, total unit costs, capacity utilization, the productivity of fixed investment and the internal allocation of investment between fixed and working capital and partial effects of variations of each of them on the rate of profit on total investment.

P.C.P. model is depicted in Figure 1.2

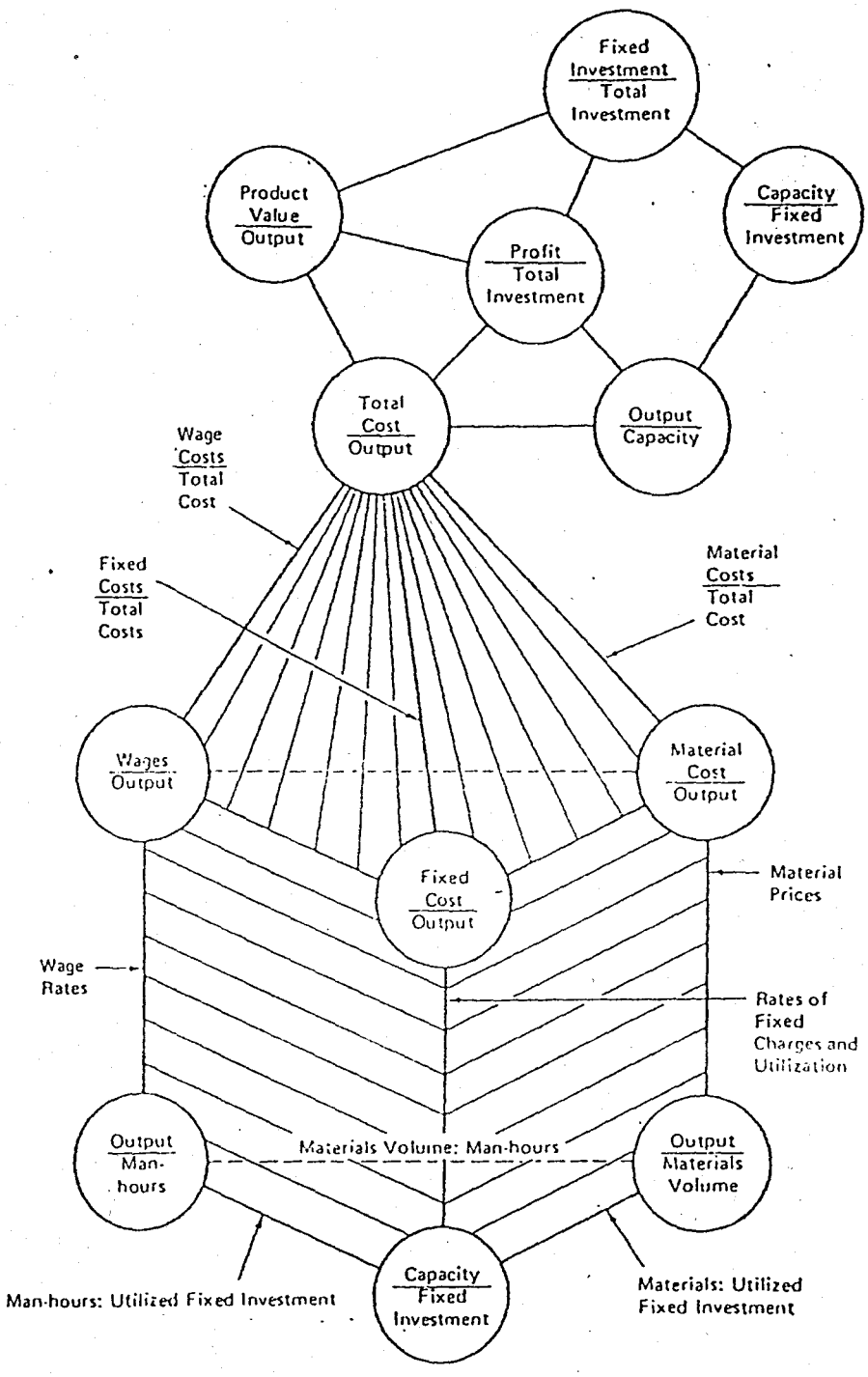


Figure 1.2 : Productivity Network, Cost Structure and Managerial Control Ratios (14)

1.2.3. Normotive Productivity Measurement Methodology and Multi Criteria Performance, Productivity Measurement Technique

This methodology uses structured group processes in the development stage of productivity measures. The implicit assumption is: without support from all levels of management and Labor, productivity improvement can not be achieved. After the generation of a prioritized list of productivity measures by execution of structured group processes such as Nominal Group Technique or Delphi Technique, the "productivity measurement system outline" is constructed by productivity analysts. This is followed by review,discussion, potential revision and approval of the draft by the participants and integration and implementation of the productivity measurement system by the productivity analysts. The final step is continous monitoring of the measurement system and feedback to the participants in hopes of identifying productivity improvement opportunities. For further reference Sink (15) is recommended.

Multi Criteria Performance, Productivity Measurement Technique suggests that, the productivity measures generated by the usage of structured group processes should be aggregated according to the subjective preferences of the operations manager.

Productivity can be defined as "the ratio of performance toward organizational objectives to the totality of input parameters"(16).

The problem is the multi-dimensional goal structure of organizations which is solved by the usage of multi-attribute utility theory (17) to combine performance measures related to each organizational objective in a single aggregate measure.

"This number then represents the perceived value of efforts resulting in performance toward the perceived objectives"(18)

1.2.4. Factorial Productivity Measurement Models

As mentioned in section 1.1 these models are called, partial factor, multi factor or total factor productivity measurement models according to the number of input factors included in the productivity measure.

Partial factor productivity measurement models, including only one of the input factors in the productivity measure are the most primitive of all. Common examples are output per man-hour, value added per man-hour, output per unit material etc.

The main defect of these models is that, they ignore the interaction between partial measures of various inputs which can easily lead to erronious results.

As a typical example, consider a firm increasing outputs by optimizing machine utilization: using output per man-hour as the

only measure, the analyst will observe an increase in productivity, while labor productivity is actually unchanged.

Both multi-factor and total factor productivity measurement models are based on blending the inputs of an organizational system together and comparing the resulting aggregate input with the total output of the same system. The major difference between these approaches is the number of inputs and outputs included in the model.

In multi-factor productivity measurement models (MFPMM) , human, material, capital and energy are taken as inputs and only operational outcomes of the system are taken as outputs of the model. One of the best examples for this type of models is, Sink's MFPMM(15) which is a dynamic, aggregated, indexed and computerized approach. It is based on the premise that profitability is a function of productivity and price recovery.

MFPMM generates a series of ratios and indexes to provide additional insight into the effects of each factor on total productivity, price recovery and profitability. Quantitiy, price and value (or any two) of each output and input in both base and current periods are necessary for the productivity analysis.

For total factor productivity measurement models the starting reference is Craig and Harris (19) and the most up to date references are Sumanth (20), (21), (22). Sumanth's model is a "product-oriented total productivity model, which provides total productivity indices by each product (or at least by each major product), in addition to an aggregate index"(21) and presumably is a more useful tool for a company's management than the aggregate models. This model includes dividents from securities, interest from bonds and other incomes as additional outputs and working capital and other expenses as additional inputs.

Other studies on total factor model building are due to Hamlin (23), Mundel (24),(25), Taylor and Davis (26) and Hines (27).

The MS thesis of Görgüç (28) on productivity measurement and the study of Oral (29) which describes and analyses productivity improvement as a component of competitive power should be mentioned as they've valuable findings of this literature survey.

1.3 Productivity Management

Productivity management is a continous process having four phases, measurement, evaluation, planning and improvement. Measurement

is the first step in this Productivity-Cycle which necessitates construction of a model, based on historical data to explain past behaviour of the system and its performance criteria. Evaluation is interpretation of the factors effecting the system behaviour, by the use of productivity analysis techniques. Planning involves predictive use of the model to see the expected response of the system to certain changes that may be imposed on the system by outside factors or that are due to managerial decisions.

This is followed by the implementation of productivity improvement projects designed in the planning phase. Continous control on implementation is necessary to provide feedback for forth-coming analysis.

1.3.1. Productivity Improvement Procedure (PIP)

Based on the conceptual framework and the above mentioned prevailing approaches a Productivity Improvement Procedure is proposed and the process flowchart is depicted in Figure 1.3

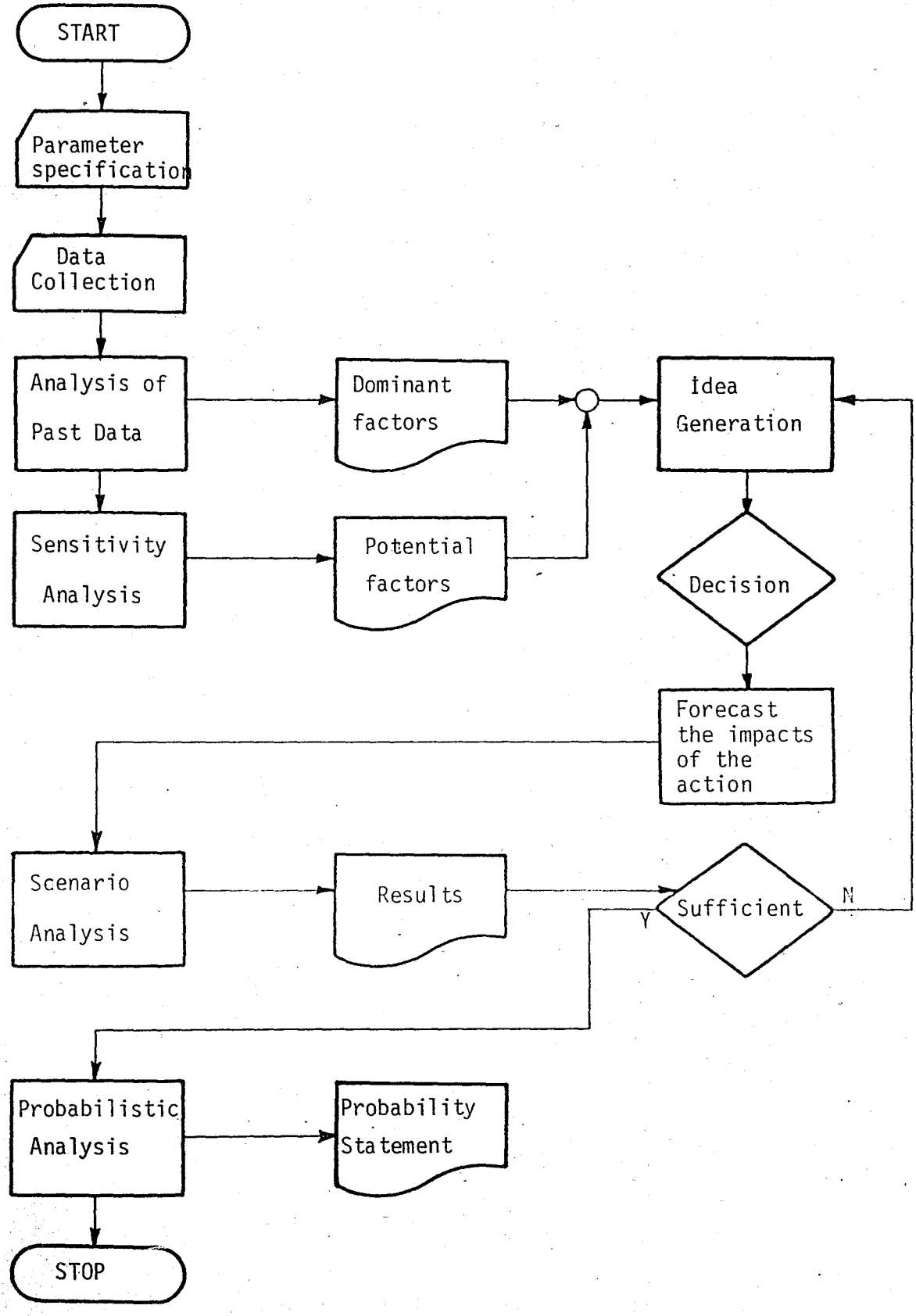


Figure 1.3. Process Flowchart of the Productivity Improvement Procedure

The first step is specification of parameters of the productivity analysis. These parameters are basically the unit of analysis, base period, time length of analysis periods and the number of periods to be analyzed. All productivity measurement models require collection of quantity, price and value (or any two) data for each of the analysis periods.

Analysis of past data will enable the manager to see the sources of profits or losses and dominant factors of bottlenecks. The productivity measurement model involves many variables and interrelationships. Sensitivity analysis, showing to which extent the system and the performance criteria are effected by a given incremental change of each variable, will help in specifying potential factors of improvement. In order to have an idea about the results of productivity improvement projects, management should perform various scenario analysis, where more than one varriable of the productivity model change at a time.

Further the management can obtain a probability statement of the result of the "best" scenario by the use of risk simutation method. This step requires specification of probability distributions of possible changes in the model variables.

Controllable factors of the organizational system can be analyzed by the deterministic appraisal method but the necessity of the usage of probabilistic scenario analysis for uncontrollable factors is quite evident.

1.3.2. Content of the Thesis in Terms of PIP

The thesis involves construction of a productivity measurement and evaluation methodology.

Model building effort was practiced on an existing company. Data processing was simplified via the use of a table handling computer package.

Development of effective means of productivity measurement and tools for the analysis of dominant and potential factors of productivity of an organizational system were the main issue of this study.

The following is suggested to be a useful material in the measurement and evaluation phases of the productivity management process.

II. APPLICATION

It is a commonly accepted fact that,any productivity analysis should be based on a valid productivity measurement model. An existing company was taken as the unit of analysis which obviously was the object of the modeling study.

This chapter covers: description of the company, specification of the parameters of the productivity analysis, data collection and model construction effort.

2.1. Description of the Company

The unit of analysis is a company from the automotive by-product sector, which is established on a 100 decars of land, where the buildings area is 10500 square meters.

The firm produces all kinds of wheels for vehicles (except for automobiles) which are:

i. truck, bus and trailer wheels
ii. tractor and agricultural vehicle wheels and
iii. light commercial vehicle wheels

In brief, wheel manufacturing can be described as combining press formed disc by means of welding or riveting to the wheel-rim which is actually hot-formed steel for trucks and sheet metal for tractors and light commercials.

Production capacity of the firm(300.000 units/year in one shift) is over the domestic demand. The firm started production in 1981 and captured 42% of the domestic market at the end of 1983, by a 63% rise in the sales volume compared to that of the previous year. Besides this, export possibilities are being investigated in order to increase the capacity utilization. The capital base was enlarged after the reorganization and the restructuring in mid 1983.

2.2. Operations Flowchart of the Organizational System

Specification of the unit of analysis brings us to the step of definition of the inputs, transformations, outputs and outcomes of the system. A company can always be taken as an organizational system involved in the transformation of a financial inflow to a presumably (but unfortunately not always) greater financial outflow. In producer firms, the financial inflow is transformed into the inputs of production which arethen corverted to the outputs of the system. Financial outflow

can be realized only by marketing the finished products.

Including all the transformations in the organizational system, the departmental operations flowchart can be utilized as:

i. a tool for the definition of inputs and outputs

ii. a checklist for the data collection

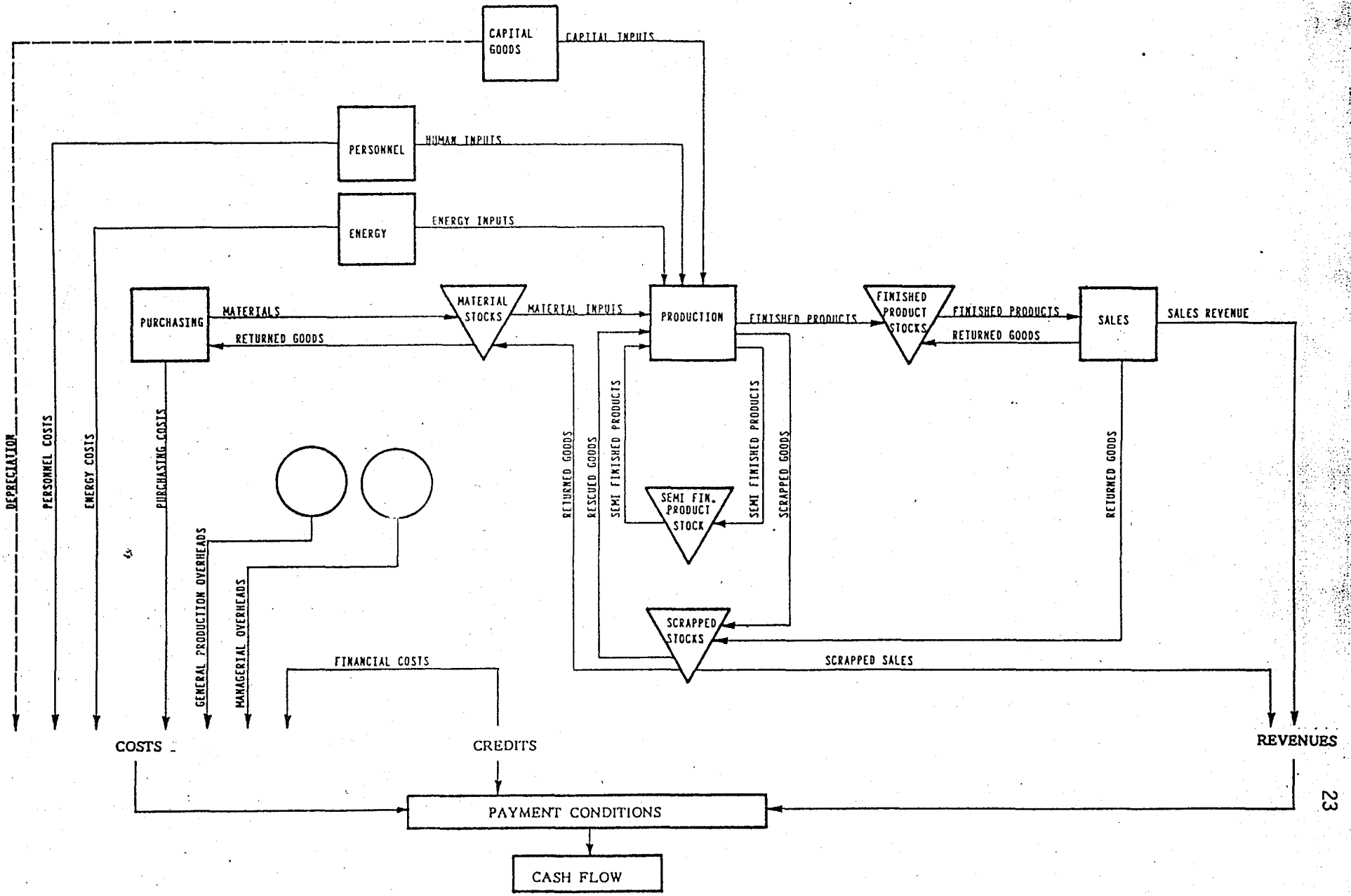
iii. a base for the model construction

Operations flowchart of the unit of analysis is depicted in Figure 2.1.

2.3. Parameters of the Model

Parameters of the model were specified during a productivity related discussion with the assistant general manager of the company. It should be noted that, being the decision maker his preferences played a dominant role in the decision process.

Base period selection was based on the premise that it should represent the "normal" operating conditions as mucs as possible. The years 1981 and 82 were assumed to be the transition period covering the time segment spent on learning the technology and implementation


CAPITAL GOODS
CAPITAL INPUTS
PERSONNEL
HUMAN INPUTS
ENERGY
ENERGY INPUTS
PURCHASING
MATERIALS
RETURNED GOODS
MATERIAL STOCKS
MATERIAL INPUTS
PRODUCTION
FINISHED PRODUCTS
FINISHED PRODUCT STOCKS
FINISHED PRODUCTS
RETURNED GOODS
SALES
SALES REVENUE
DEPRECIATION
PERSONNEL COSTS
ENERGY COSTS
PURCHASING COSTS
GENERAL PRODUCTION OVERHEADS
MANAGERIAL OVERHEADS
FINANCIAL COSTS
RETURNED GOODS
RESCUED GOODS
SEMI FINISHED PRODUCTS
SEMI FIN. PRODUCT STOCK
SEMI FINISHED PRODUCTS
SCRAPPED GOODS
RETURNED GOODS
SCRAPPED STOCKS
SCRAPPED SALES
COSTS
CREDITS
REVENUES
PAYMENT CONDITIONS
CASH FLOW

of new products.

Although 1983 seemed suitable for a yearly analysis, lack of an effective management information system before the reorganization made data collection impossible for the first five months of the year.

January 1984 was selected to be the base period of the productivity analysis covering the first half of 1984. Data availability for the six,monthly periods was verified on the operations flowchart.

2.4. Data Collection

Determination of the unit of analysis and specification of the model parameters were followed by the definition of the outputs and inputs of the organizational system. Finished and semi-finished goods were defined to be the outputs and human, capital, material and energy were defined to be the inputs of the multi-factor productivity measurement model. As it is obvious from the operations flowchart scrappes, general managerial costs, production overheads and financial costs were not included in the model. Inputs and outputs were further disaggregated by class, type and level hierarchy. Lack of reliable

periodic data for some levels of inputs or outputs resulted in the exclusion of these variables from the model. It was suggested by the prevailing approaches that, the accounting records usually cover the necessary data for productivity analysis. Although this was not the case, accounting systems of the company had been investigated to provide a sound background for model construction.

2.4.1. Data Classification

Quantitiy, price and value (or any two) of each input and output in each of the analysis periods are the necessary data for productivity analysis.

Stages of the data collection can be summarized follows:

2.4.1.1. Sales

Only finished product sales were included in the model. That is, component sales and scrap sales were disregarded because of the

lack of reliable data.

Finished product sales were first decomposed into " types " according to the wheel types: tractor, tractor disc, truck and light commercial. These classes were than disaggregated into "levels" according to wheel models.

Reports of the production department including the amount of products sent to the customers, annual sales reports and accounting records are available for data collection.

Net sales is defined to be the sold minus returned amount of goods.

Unit selling prices change with time in retail sales while they seem to be constant in whole sales. The constant selling price of whole sales is caused by the reflection of price increases made in June 1984, to the previous sales made after January 1984.

2.4.1.2. Finished Product Stocks

The hierarchical decomposition applied to sales items is also

valid for finished product stocks.

Stock reports annually prepared by the production department, include stock amounts of finished products. Total stock values are available in the proforma income statements prepared at the end of every two months. Finished product stocks are evaluated by their unit industrial costs calculated using the cost accounting system of the company. Costing study is performed by the accounting department once in every two months.

2.4.1.3. Semi-Finished Product Stocks

Production of wheel consits of 15-20 operations. The production process was decomposed into three or four phases depending on type, each covering production of a major component of the finishing product.

These sub-levels formed a data collection frame for the semi-finished product stocks.

Stock amounts are available in the stock reports. An extra work on these reports is necessary to obtain stock figures in terms of sub-levels of the model. Total stock value of the semi-finished goods is calculated during the periodic costing study.

The accounting department bases the costing studies on their own countings. Differences between the production and accounting departments in categorizing a scrapped item(whether it can be rescued or not) lead to some practical problems in the specification of the stock amounts.

2.4.1.4. Purchasing

The items included in the model cover approximately 90% of the total material cost. These are sheet irons, profiles and purchased parts, items such as paint, oil, electrodes, etc were disregarded. Sheet irons were decomposed into levels of plate sheets an rolled sheets which include sub-levels of different models. Profiles which are basically imported, were levelized according to their parent truck wheels of model. The important components of a wheel are flanj, segman and combring were included in the model as purchased parts.

Accounting records are the only reference for the amounts and values of purchased items. Interests paid depending on the payment programmes are embedded in the value of purchased items.

2.4.1.5. Material Stocks

The hierarchical decomposition applied to purchased items is also valid for material stocks. Sheet irons are sent to a by-producer for a cutting operation after the purchase. Cutting and transportation costs are included in the value of a stocked item.

Accounting records are again the only reference for material stocks. Unit cost of an item, given to the production department is defined to be the average unit value of the same item in the stocks.

In the case of material bottlenecks model conversion of sheet irons by specific cutting operations is possible, but this solution brings up practical problems both in costing study and in data collection for productivity analysis.

2.4.1.6. Capital Inputs

Capital is commonly decomposed into fixed capital and working capital components. Fixed capital is composed of land and buildings, plants and machinery, tools and fixtures, vehicles and inventories. Accounting records were used as a reference for book values and depreciation amounts of fixed capital.

Only stock data for working capital was collected whereas cash was assumed to be negligable.

2.4.1.7. Energy Inputs

Although the firm utilizes various kinds of energy resources, the engineering department was capable of giving only the electric consumption.

Lack of reliable data made it impossible to include other energy resources in the model.

2.4.1.8. Human Inputs

Human factors consist of personnel both in the general management's building and in the factory plant. The second was further decomposed into salaried and waged personnel.

Quantity of human inputs are the amount of man-months for the salaried personnel (both in the factory and general management) and the amount of man-hours for the waged personnel.

Work of the waged personnel was disaggregated into "normal work" and "overtime work" both consisting the sub-levels according to the work centers in the factory.

Annual reports prepared by the personnel relations department are available for both the amounth of work and the cost of personnel. It is possible to notice the periodic jumps in the total personnel costs curve by a rough investigation. These are caused by the bonusses paid at the end of every three months, bairam and fuel payments.

Actual values of the human resource consumption were calculated by equally distributing the above mentioned payments to the related analysis periods.

2.4.2. Accounting Systems of the Company

Accounting systems of the company were investigated in order to provide a sound background for model construction These are: the costing system, depreciation system and income statement preparation.

2.4.2.1. Costing System

Periodic costing studies are performed by the accounting department to provide reliable data to the proforma income statements prepared at the end of each two months.

Total costs of a production period are distributed according to some dispatching keys and added on to the industrial costs of the stocks and sales.

Total material costs are distributed by weighing the products according to their gross material consumption standards. Whereas total labor, capital and production overhead costs are distributed by weighing the products according to their man-hour and machine-hour technical grades. These technical grades are calculated on the basis

of a time study of the production process of each product.

2.4.2.2. Depreciation System

The firm utilizes the straight line depreciation method which provides for the uniform write-off of an asset. The depreciation amounts allowed at the end of each year are constant throughout the asset's economic life. For some of the capital goods, depreciation rates are specified by law e.g land and buildings should be depreciated by 2 % rate.

Total yearly depreciation is the sum of the constant depreciation allowed for the capital goods transferred from the previous year (which can be calculated at the beginning of the year) and the depreciations allowed for the new investments.

The amount of capital resource consumption is defined to be the starting value of the assets minus their accumulated depreciations which actually is the "book-value" of those assets. Whereas the total depreciation allowed at the end of a year is considered to be the value of the capital resource consumption.

There is an additional amount of depreciation allowed for the investment period overhead costs. The overhead of the investment period (300 million TL for our company) should be amortized in the first five years after the establishment of a firm. Initial investment depreciation (60 million TL per year) is excluded from the industrial costs and from our model as well.

The firm's assets are "revaluated" at the end of 1983.

2.4.2.3. Income Statement Preparation System

Proforma income statements are prepared by the accounting department at the end of each two months in order to inform the general management about the aggregate performance of the company. February is an exception because the accounting department is always overloaded by the preparation of previous year's balance sheet and income statement during that period. The associated part of the yearly plan is taken as a base for the proforma income statement of february, assuming the deviations from the plan are negligable.

Sales figures are based to the annual sales reports, stock evaulation and industrial costs of sold items covering the labor, material, amortization and production overhead costs are based to the above mentioned costing study. The profit/loss is calculated by the addition of the managerial overhead costs, financial costs and the initial investment depreciation to the industrial costs.

Covering the periodic data, proforma income statements could be a valuable data-base for the productivity analysis if they were prepared in a monthly basis.

2.5. Modeling

On the basis of the prevailing approaches an aggregated hierarchical, dynamic, multi-factor productivity measurement model was constructed to represent the unit of analysis. Sink's MFPMM was taken as a prototype and adopted to cover the above mentioned data. The general framework of the database of the model is depicted in Figure 2.2.

	Period I			...	Period VI		
Outputs/Inputs	Quantity	Unit Value	Total Value	...	Quantity	Unit Value	Total Value
Outputs							
Classes							
Types							
Levels							
Sub-levels							
⋮							
Inputs							
Classes							
Types							
Levels							
Sub-levels							
⋮							

Figure 2.2 Framework of the Database of the Model

Modeling environment is described before the brief summary of the data-base construction effort.

2.5.1. Modeling environment

Ease of computer usage in model building is obvious. Structural characteristics of the productivity measurement model resulted in the use of a table handling package. MULTIPLAN table handling package of B20 series of the Burroughs computers was the modeling tool used.

Basically, Multiplan is a work-sheet simulator,allowing 64K active memory. It enables the user to construct a data structure in an intuitive manner and provides hierarchical relationships between "sheets".

As an aid for both businnes and personal needs Multiplan is one of the powerful modeling and planning tools.

2.5.2. Data sheets

First step of model construction was preparation of "data sheets" to provide an analytical framework for productivity measurement and analysis. Seperate data sheets were prepared for each data type because of dimensional constraints. General model

framework depicted in Figure 2.2 was taken as a basic structure in all the following sheets.

A preceeding note about the fixed capital and stock sheets is that, they have a minor discrepancy from the general framework. This is because, we can't talk about fixed capital or stock values "during" an analysis period but we can only talk about fixed capital or stock values "at" a specific time point in an analysis period. The above mentioned data sheets cover the necassary data at the beginning and at the end of each analysis period.

Data sheets are given in Appendix A.

2.5.2.1. Sales Sheet

Sales sheet was prepared on the basis of the general model framework to cover the sales data (Appendix A.1)

Negative sale figures were used to represent returned products. Absence of a sale was represented by a blank cell on the sheet. Unit selling prices are the average selling price of the associated period. Effects of the price changes made at the end of June 1984 were embedded in those unitprices. Cells associated with undetermined unit

prices were left blank.

2.5.2.2. Finished Product Stocks Sheet

Finished product stocks sheet was prepared on the basis of the general model framework to cover the finished product stocks data (Appendix A.2)

Null stocks were represented by blank cells. Product stocks are evaluated by their industrial costs in the income statement. The same procedure was applied during evaluation of the finished product stocks in the model:

i. Stocks at the beginning of 1984 were evaluated by the average industrial costs of 1983.
ii. Stocks at the end of January and February were evaluated by the industrial cost forecasts in the 1984 yearly plan.
iii. Stocks at the end of March and April were evaluated by the average industrial costs depicted in the proforma income statement released at the end of April 1984.

iv. Stocks at the end of May and June were evaluated by the average industrial costs depicted in the proforma income statement of June 1984. The implicit assumption was that, the monthly avenages would not deviate much from the average industrial costs calculated for two months.

Cells associated with the unit costs which had not been calculated were left blank. Only the average industrial cost of the 8.0 x 20 model in 1983 (which was implemented in 1984) was estimated by assumming that it would follow a trend similar to that of the 7.0 x 20 model.

2.5.2.3. Semi-finished Product Stock Sheets

Two seperate data sheets were prepared in order to cover the semi-finished product stocks data. First one is the semi-finished product costing sheet which includes decomposition of finished product stocks into their components' costs. (Appendix A.3.1) This sheet transfers unit value information to the second sheet covering the periodic quantity, unit value and total value data for semi-finished

product stocks. (Appendix A.3.2)

To simplify both the data collection and the model construction, production processes consisting of 15-20 operations (depending on the model), were disaggregated into 3-4 major operation groups. Lack of unit value data for the outputs of these operation groups, necessitated an extra costing study for the semi-finished products. Semi-finished product costing sheet was prepared for the above-mentioned purposes. The costing study due to June 1984 was taken as a source for labor, overhead and depreciation data for finished products, in addition to the technical grades and material consumption data for both finished and semi-finished products.

Summation of the unit labor, overhead and depreciation costs of a finished product was distributed to the related semi-finished products by making use of the technical grades. Adding these onto the unit material costs, total unit costs in other words unit values of the semi-finished products were obtained.

Percentage distributions of component costs in their finished product costs were assumed to be constant throughout the six analysis periods. This enabled decomposition of the unit finished product costs according to the percentage distributions of June 1984 costs. Second it was assumed that monthly average costs were constant in two months periods.

Semi-finished product stocks sheet covering the quantity, unit value and total value data was prepared according to the general model framework. Null stocks were represented by blank cells. Finished product equivalents of semi-finished product stocks were calculated by making use of the above mentioned percentage distributions.

2.5.2.4. Purchasing Sheet

Purchasing sheet was prepared according to the general model framework. (Appendix A.4) For sheet metals and wheel components, interests were included in total purchasing values. However, TL equivalent of the foreign currency paid in profile imports consisted the values of these purchases.

2.5.2.5. Metarial Stocks Sheet

Material stocks sheet was prepared according to the general model framework (Appendix A.5) Null stocks were represented by blank cells. Stocks were evaluated by their average unit costs, including unit purchasing, cutting and transportation costs. Cutting and transportation costs were added on the stock value after the cutting

operation. Sheet metal stocks which converted into other types of sheet metal by specific cutting operations, were considered to be the stocks of these new types at the beginning of the productivity analysis.

2.5.2.6. Fixed Capital Sheet

Fixed capital sheet was prepared according to the general model framework. (Appendix A.6)

Value of usage, should be represented by the depreciation allowed for that fixed asset. In order to be consistent with the firm's accounts, allowed depreciations were not decreased from the values of fixed assets. In general, depreciations are assumed to be allowed at the end of each year.

The following formulas were applied in the generation of fixed capital data:

Quantity of a fixed capital input during a period	=	Cummulative value of that asset at the end of the period	− Accumulated depreciation of that asset at the beginning of 1984

Value a fixed capital resource consumption during a periad = Cummulative value of that asset at the end of June 1984 x Yearly deprecia rate of that asset

Average depreciation rate of a period = Value of the fixed capital resource consumption / Quantity of the fixed capital input

2.5.2.7. Energy Sheet

Energy sheet was prepared according to the general model framework (Appendix A.7)

2.4.2.8. Personnel Sheet

Personnel sheet was prepared according to the general model framework. (Appendix A.8) Quantities of human input consumed were evaulated by their average unit costs including social aids, bairam and fuel payments. Decomposition of the total values of normal and overtime labor work into work centers, was performed by weighing the quantity of labor input consumption of these work centers by their

average hourly wages respectively. Values of labor input consumption were calculated by distributing the above mentioned weighted sum to the work centers. Average hourly wages of January 1984 were assumed to be the weights valid for the first three months and that of April were assumed to be the weights valid for the last three months of the analysis.

III. PRODUCTIVITY MEASUREMENT SYSTEM (PMS)

Productivity measures should be based on a valid model of the unit of analysis. Data base construction for the hierarchical, aggregate and dynamic multi-factor productivity measurement model was described in the previous chapter This chapter covers: productivity measurement formulas, data refinement for productivity measurement, information flow in the productivity measurement system and the productivity measurement model (analysis sheets).

3.1. Productivity Measurement Formulas

A total productivity index can be expressed either as a ratio of total productivity values of two periods (Sumanth) or as a ratio of aggregate changes of outputs to aggregate changes of inputs (Sink). Regardless of the total productivity expression and the number of factors included in the model, aggregation of inputs and outputs to get the total input and total output figures is the basic problem in factorial productivity measurement. Selection of an appropriate method is a must in model construction. This aggregation method

will enable the productivity analyst to calculate total change ratios for input/output classes composed of levels having different units.

Let Q_{i0}, P_{i0} and V_{i0} represent quantity, price and value of output in base period and Q_{it}, P_{it} and V_{it} represent that of the same output in current period. Some of the available indexing methods to find the "weighted change ratio of outputs" (represented by q_{0T}) are given in the following table:

Name	Weight	Formula of q_{0T}
Laspeyres index	Base year prices(P_{i0})	$q_{0T} = \frac{\sum_i P_{i0} Q_{it}}{\sum_i P_{i0} Q_{i0}}$
Passche index	Current year prices(P_{it})	$q_{0T} = \frac{\sum_i P_{it} Q_{it}}{\sum_i P_{it} Q_{i0}}$
Edgeworth index	Arithmetic means of the base and current year prices. $(\overline{P_{it}} = \frac{1}{2}(P_{it}+P_{i0}))$	$q_{0T} = \frac{\sum_i \overline{P_{it}} Q_{it}}{\sum_i \overline{P_{it}} Q_{i0}}$
Fabricent index	Geometric means of the base and current year prices $(\overline{\overline{P}}_{it} = \sqrt{P_{it} \times P_{i0}})$	$q_{0T} = \frac{\sum_i \overline{\overline{P}}_{it} Q_{it}}{\sum_i \overline{\overline{P}}_{it} Q_{i0}}$

Table 3.1 Indexing methods

Sink's MFPMM was taken as a starting prototype in this study of productivity analysis to provide additional performance measures such as price recovery and profitability. This enables the decision maker to trace the effects of productivity improvement projects both on total productivity and profitability of the firm.

Three of the four stages Sink pointed out were adopted to construct the basic model.

These are:

i. Calculation of weighted change ratios,

ii. Calculation of monetary changes,

iii. Calculation of performans indexes:

productivity, price recovery and profitability for all the classes types, levels and sub-levels of inputs and outputs. Whereas MFPMM of Sink covers performance index calculation for only inputs.

The fourth-step is expressing the effects of performance changes on profits in monetary terms which outstands the domain of this thesis.

Laspeyres index was utilized in the calculation of weighted quantity change ratios whereas Paasche index was utilized in the calculation of weighted price change ratios. This enabled maintaining the product relationship between quantity, price and value change ratios in the higher levels of the hierarchical model.

Besides being the product of weighted quantity and price change ratios a weighted value change ratio is the ratio of total value in current period to total value in base period. This is because any group of inputs/outputs have a common value unit in monetary terms. Calculation of change ratios results in the drop of units.

Monetary effects of changes were calculated to provide additional insight to factorial changes. Monetary effects of quantity changes were calculated by fixing the prices to their base year level and moving the quantities to their current year level. While monetary effects of price changes were calculated by fixing the quantities to their current year level and moving the prices to their current year level. Summation of monetary effects of these two changes gave the monetary effects of value changes. Calculation of monetary effects of changes is depicted in Figure 3.1

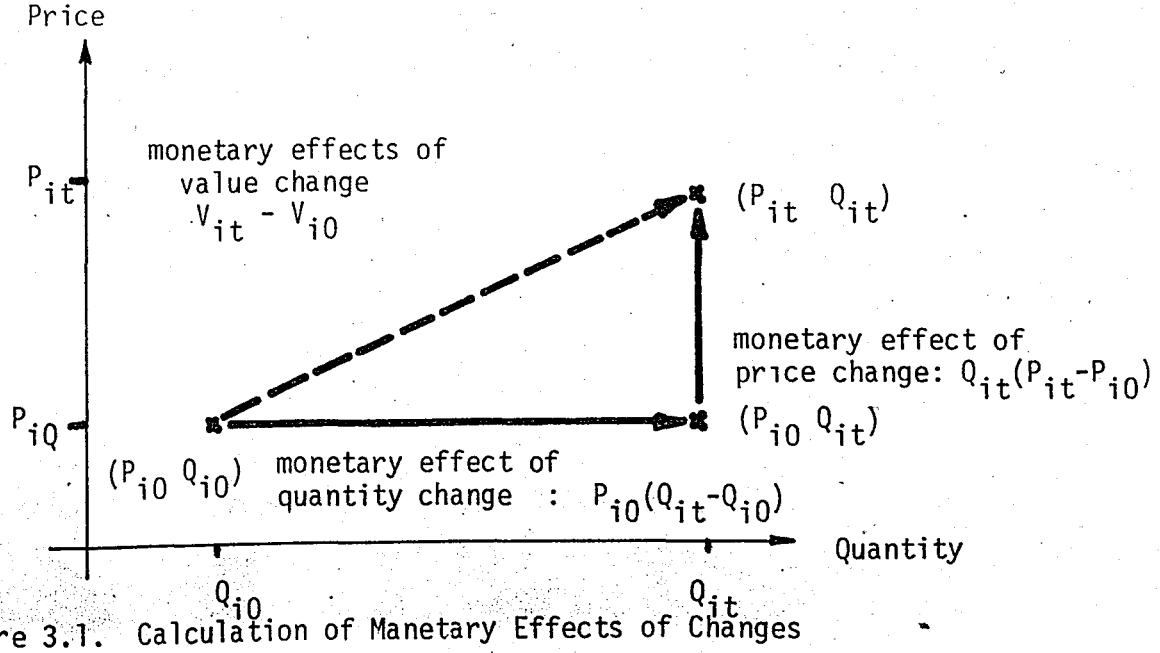


Figure 3.1. Calculation of Manetary Effects of Changes (for output "i")

Performance indexes (productivity, price recovery and productivity) of an input were calculated by dividing the weighted quantity, price and value change ratio of total outputs to quantity, price and value change ratio of that input respectively.

In the calculation of performance indexes of an output, change ratios of that output took place in the numerator while weighted change ratios of total inputs were put in the denominator of the performance index expression. By this, product relationships between productivity, price recovery and profitability indexes were maintained at all levels of the model.

Productivity measurement formulas are given in Table 3.2

	BASE PERIOD			CURRENT PERIOD			WEIGHTED CHANGE RATIOS			MONETARY CHANGES			PERFORMANCE INDEXES		
	Quantity	Unit Val	Value	Quantity	Unit Val	Value	Quantity	Unit Volue	Value	Quantity	Unit Value	Value	Produc-tivity	Price Recovery	Prof bili
TOTAL OUTPUT							$q_{OT} = \frac{\sum_i P_{i\phi} Q_{it}}{\sum_i P_{i\phi} Q_{i\phi}}$	$P_{OT} = \frac{\sum_i P_{it} Q_{it}}{\sum_i P_{i\phi} Q_{it}}$	$V_{OT} = \frac{\sum_i P_{it} Q_{it}}{\sum_i P_{i\phi} Q_{i\phi}}$	$q_{OT}^{TL} = \sum_i q_i^{TL}$	$P_{OT}^{TL} = \sum_i P_i^{TL}$	$V_{OT}^{TL} = \sum_i V_i^{TL}$	$\frac{q_{OT}}{q_{IT}}$	$\frac{P_{OT}}{P_{IT}}$	$\frac{V_O}{V_I}$
OUTPUT$_i$	$Q_{i\phi}$	$P_{i\phi}$	$V_{i\phi}$	Q_{it}	P_{it}	V_{it}	$q_i = Q_{it}/Q_{i\phi}$	$P_i = P_{it}/P_{i\phi}$	$V_i = V_{it}/V_{i\phi}$	$q_i^{TL} = (Q_{it} - Q_{i\phi})P_{i\phi}$	$P_i^{TL} = (P_{it} - P_{i\phi})Q_{it}$	$V_i^{TL} = V_{it} - V_{i\phi}$	$\frac{q_i}{q_{IT}}$	$\frac{P_i}{P_{IT}}$	$\frac{V}{V}$
TOTAL INPUT							$q_{IT} = \frac{\sum_j P_{j\phi} Q_{jt}}{\sum_j P_{j\phi} Q_{j\phi}}$	$P_{IT} = \frac{\sum_j P_{jt} Q_{jt}}{\sum_j P_{j\phi} Q_{jt}}$	$V_{IT} = \frac{\sum_j P_{jt} Q_{jt}}{\sum_j P_{j\phi} Q_{j\phi}}$	$q_{IT}^{TL} = \sum_j q_j^{TL}$	$P_{IT}^{TL} = \sum_j P_j^{TL}$	$V_{IT}^{TL} = \sum_j J_j^{TL}$	$\frac{q_{OT}}{q_{IT}}$	$\frac{P_{OT}}{P_{IT}}$	$\frac{V_{OT}}{V_{IT}}$
INPUT$_j$	$Q_{j\phi}$	$P_{j\phi}$	$V_{i\phi}$	Q_{jt}	P_{jt}	V_{jt}	$q_j = Q_{jt}/Q_{j\phi}$	$P_j = P_{jt}/P_{j\phi}$	$V_j = V_{jt}/V_{j\phi}$	$q_j^{TL} = (Q_{jt} - Q_{j\phi})P_{j\phi}$	$P_j^{TL} = (P_{jt} - P_{j\phi})Q_{jt}$	$V_j^{TL} = V_{jt} - V_{j\phi}$	$\frac{q_{OT}}{q_j}$	$\frac{P_{OT}}{P_j}$	$\frac{V_O}{V}$

Table 3.2 Productivity Measurement System Formulas

3.2. Data Refinement

Although data collection and data base construction phases of this study went down to sub-level details, productivity measurement model was decided to be bounded by class and type categories of data. This was to simplfy both the measurement and analysis of productivity. Refinement of the collected data was necessary before feeding them into the measurement model. "Data Refinement Sheet" is given in Appendix A.9.

3.2.1. Generation of Interval Data

Dynamic productivity indexes involve comparison of productivity ratios of two time periods which necessitates quantity, unit price and value (or any two) of outputs produced and inputs consumed during both of those periods. As mentioned above, fixed capital and stock data represent the necessary figures at the beginning and at the end of the analysis periods. The "interval data" were obtained from the type total (each representing sum of the figures in the associated levels/sub-levels) of the data base.

The following formula was applied for outputs of the model.

Production = Sales + Starting Finished, Semi-finished product stocks − Ending Finished, Semi-finished product stocks

It should be noted that, finished and semi-finished production amounts were expressed as a sum in terms of their finished product equivalents for each wheel type.

Material consumption during the analysis periods were calculated as follows:

Material Consumption = Purchases + Starting Material Stocks − Ending Material Stocks

Fixed capital is the "least changing" one of all inputs. So, it was assumed that, starting book value of a fixed asset would represent the related quantity of fixed capital input during an analysis period.

Energy consumption and human inputs data didn't necessitate any extra operation.

3.2.2. Scaling of Data

Proforma income statements are prepared by the accounting department to inform the top management at the end of every two months. In the case of June, inventory was counted on the twenthyfifth to make the income statement ready on the first of July. Thus it was necessary to scale the sixth period's data except fixed capital and human inputs.

Quantities and values of production, material and energy consumption were increased by 4/3. Unit values were not changed assuming the monthly average would be near to the first three weeks's average.

3.3 Information Flow in PMS

After the refinement,data. were available for the productivity measurement and analysis. Information flow (between the sheets) in PMS is depicted in Figure 3.2. File names, sheet functions and the level of information flow between sheets are shown in the figure. Analysis sheets will be explained in the following sections.

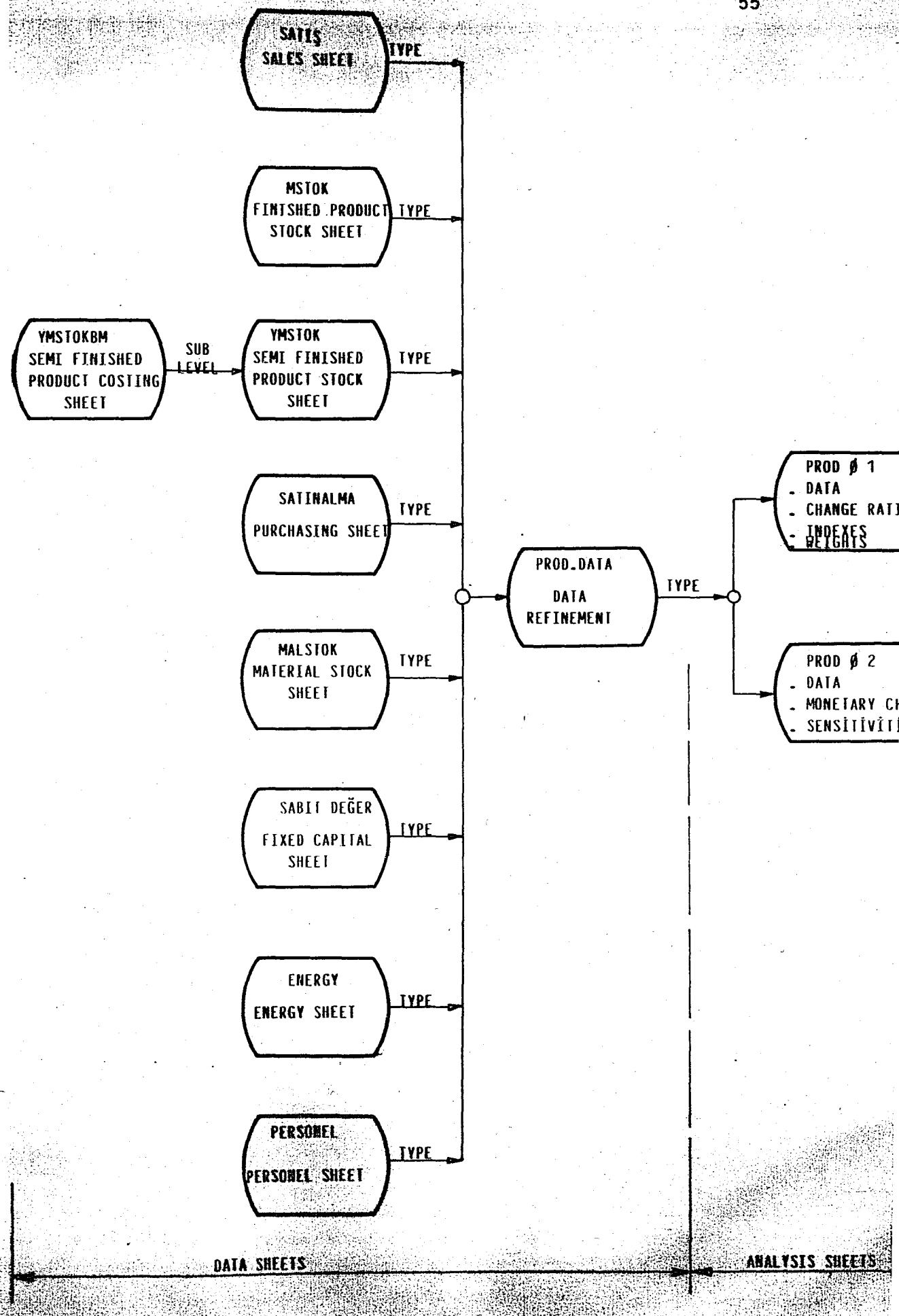


FIGURE 3.2 : INFORMATION FLOW IN PRODUCTIVITY MEASUREMENT SYSTEM

3.4. Analysis Sheets

Completing data preparation and construction of the general model framework, brought us to the step of productivity measurement and analysis. Two seperate "analysis sheets", based on the general model framework were prepared for measurement and analysis purposes. Contents of these sheets are given in Appendix B . As shown in Figure 3.2 both of these sheets were linked to the Data Refinement Sheet to transfer the "Productivity Data Table" (given in Appendix B.1) In addition to the Productivity Data Table the first analysis sheet covers:

i. Change Ratios Table,
ii. Performance Indexes Table and
iii. Productivity Weights Table

while the second analysis sheet covers:

i. Monetary Changes Table and
ii. Relative Sensitivities Table

Being basically related to productivity measurement, three of the above: Change Ratios Table, Monetary Changes Table and Performance Indexes Table will be described in this section.

3.4.1. Change Ratios Table

Change Ratios Table (given Appendix B.2) was prepared by utilizing the "Weighted change ratios" formulas depicted in Table 3.2. This table covers, change ratios of quantity, unit price and value of each item at the six analysis periods. Change ratios represent changes with respect to the base period so, change ratios of the base period are obviously equal to 1.0.

Hierarchical structure of the model was also maintained in this sheet. Change ratios of type category items were calculated by simple ratios. Whereas change ratios of class totals, total inputs and total outputs were calculated by weighted ratios.

3.4.2. Monetary Changes Table

Monetary Changes Table (given in Appendix B.3) was prepared by utilizing the "monetary changes" formulas depicted in Table 3.2. This table covers, decomposition of monetary effects of value changes to quantity change and unit price change based components, for each

item in each of the six analysis periods. Monetary changes represent monetary effects of changes with respect to the base period. Thus, monetary changes of base period are obviously equal to zero.

Hierarchical structure of the model was also maintained in this sheet. Monetary changes of type category items were calculated by the above mentioned formulas. Monetary changes of class totals are the sum of monetary changes of related types, whereas that of inputs and outputs are the sum of class totals.

3.4.2. Monetary Changes Table

Performance Indexes Table (given in Appendix B.4)was prepared by utilizing the "performance indexes" formulas depicted in Table 3.2. This table covers productivity, price recovery and profitability indexes of each item at the six analysis periods. Since those indexes represent performance compared to that of the base period, base period performance indexes are assigned the value 1.0. Hierarchical structure of the model was maintained by taking the appropriate simple change ratio or weighted change ratio into the performance index expression.

Productivity measurement was completed by the preparation of the above mentioned three tables. Furthermore,two additional tables: Productivity Weights Table and Relative Sensitivities Table were prepared to provide insight in evaluation and analysis of the productivity measores. These two tables will be described later, but self-control facilities in the productivity measurement system should be pointed out as a final note of this section.

Extensive linkage between data and analysis sheets and hierarchical, aggregated and indexed structure of the model enables the analyst to observe data declaration, data handling or punching errors easily. The following errors were detected after a rough inspection of the measurement tables:

i. A data declaration error in "SDC Combring" stocks

Date	Declared Stock	Actual Stock
December 31, 1983	16500	6500
January 31, 1984	10166	4166

ii. A punching error in "SDC Göbek" stocks

Date	False	True
May 31 , 1984	58880	5888

iii. A data handling error in factory personnel costs at June 1984. The fuel payments (4.450.000 TL) and the holidays payments (1.090.000 TL) made at the end of the sixth month were equally distributed to the six analysis periods.

The above errors were basically noticed from the abnormal jumps in change ratios or performance indexes.

IV. THEORETICAL ISSUES

Preceeding three chapters cover conceptual framework, data base construction and basic productivity measurement model of the unit of analysis. It is possible to monitor performance of the organizational system by the ease of this model. However, interpretation, evaluation and analysis of these measures are necessary for generation, implementation and control of productivity improvement projects. This chapter will cover the construction of an analytical framework and some theoretical contributions to constitute a base for the productivity analysis.

Total productivity can be defined as the "ratio of total tangible output (in value terms) to the sum of all tangible inputs (in cost terms)." (21) Product-oriented total productivity model of Sumanth and Multi-factor productivity measurement model of Sink were decided to be the alternative prototypes for this study. Total productivity index is expressed as a ratio of total productivity values of two periods in the first model, whereas multi-factor productivity index is expressed as a ratio of aggregate changes of outputs to that of inputs in the second.

However the similarity of these approaches is obvious from the following equivalence.

$$\text{Productivity index}(j) = \frac{\frac{\text{Output}(j)}{\text{Input}(j)}}{\frac{\text{Output}(j)}{\text{Input}(j)}} = \frac{\frac{\text{Output}(j)}{\text{Output}(i)}}{\frac{\text{Input}(j)}{\text{Input}(j)}}$$

$$= \frac{\text{Productivity value}(j)}{\text{Productivity value}(i)} = \frac{\text{Change of outputs}}{\text{Change of inputs}}$$

where (i) represents the base period and (j) represents the current period. Furthermore, Sumanth's example (21) was analyzed by Sink's approach and the Same results were obtained for total and partial productivities of inputs.

Sink's model seemed to be more advantageous since it provides additional performance measures. Although lack of past data disabled construction of a product-oriented total productivity model, Sumath's paper was used as a basic reference throughout this study.

4.1. Productivity Matrix

Let us consider a firm consuming five inputs: human,material, capital, energy and others and producing "N" types of outputs. The following table can be prepared for the base period (period Ø) (Table 4.1)

The above table is called "Productivity Values Matrix" for the base period in which

O_{i0} : base period value of product "i"

OF_0 : base period value of total outputs of the firm,

I_{ij0} : base period value of consumption of input "$_j$" for product "i"

I_{j0} : base period value of total consumption of input "j".

I_{i0} : base period value of total input consumption of product "i".

IF_0 : base period value of total input consumption of the firm

A similar Productivity Values Matrix can also be prepared for the current period (period t) (Table 4.2)

The previous notation applies to the above table and all terms represent current year values in base period terms.

	Outputs	INPUTS		PRODUCTIVITY VALUES	
		Human (H), Material (M), Capital (C), Energy (E), Other (x)	Total	Human (H) ---------- Other (x)	Total
PRODUCT 1	O_{10}	I_{1HO} -------- I_{1XO}	I_{10}	O_{10}/I_{1HO} ---------- O_{10}/I_{1XO}	O_{10}/I_{10}
⋮	⋮	⋮	⋮	⋮	⋮
PRODUCT N	O_{NO}	I_{NHO} ---------- I_{NXO}	I_{NO}	O_{NO}/I_{NHO} ---------- O_{NO}/I_{NXO}	O_{NO}/I_{NO}
TOTAL	OF_O	I_{HO} ---------- I_{XO}	IF_O	OF_O/I_{HO} ---------- OF_O/I_{XO}	OF_O/IF_O

Table 4.1. Productivity Values Matrix for the Base Period

	Outputs	INPUTS		PRODUCTIVITY VALUES	
		Human (H) Material(M) Capital(C) Energy(E) Other (X)	Total	Human(H) ---------- Other(X)	Total
$PRODUCT_1$	O_{1t}	I_{1Ht} -------- I_{1Xt}	I_{1t}	O_{1t}/I_{1Ht} ------- O_{1t}/I_{1Xt}	O_{1t}/I_{1t}
⋮	⋮	⋮	⋮	⋮	⋮
$PRODUCT_N$	O_{Nt}	I_{NHt} -------- I_{NXt}	I_{Nt}	O_{Nt}/I_{NHt} ------- O_{Nt}/I_{NXt}	O_{Nt}/I_{Nt}
TOTAL	OF_t	I_{Ht} ---------- I_{Xt}	IF_t	OF_t/I_{Ht} -------- OF_t/I_{Xt}	OF_t/IF_t

Table 4.2. Productivity Values Matrix for the Current Period

Productivity indexes of the current period are defined to be the ratio of productivity values of the current period to that of the base period. So, "Productivity Indexes Matrix" of the current period can be obtained by diving all terms of the later value matrix by the related terms of the former. (Table 4.3).

The above table is consistent with the previous notation and all terms represent changes in input/output values (in base period terms) respectively.

It is obvious from the above table that, the productivity indexes of the current period can be obtained either from the ratio of productivity values or from the ratio of output changes to input changes.

For the sake of simplicity "productivity indexes" part of Table 4.3 are represented in Table 4.4.

The above table covers the productivity indexes of the current period in which:

PP'_{ijt} : partial productivity index of input "j" with respect to product "i" in period "t"

PPF'_{jt}: partial productivity index of input "j" in period "t",

TP'_{it}: total productivity index of product "i" in period "t" and

TPF'_{t} : total productivity index of firm in period "t".

	Output Changes	INPUT CHANGES						PRODUCTIVITY INDEXES		
		Human(H)	Material (M)	Capital (C)	Energy (E)	Other (X)	Total	Human (H)	Other (X)	Total
PRODUCT 1	O'_{1t}	I'_{1Ht}				I'_{1Xt}	I'_{1t}	O'_{1t}/I'_{1Ht}	O'_{1t}/I'_{1Xt}	O'_{1t}/I'_{1t}
⋮	⋮	⋮				⋮	⋮	⋮	⋮	⋮
PRODUCT N	O'_{Nt}	I'_{NHt}				I'_{NXt}	I'_{Nt}	O'_{Nt}/I'_{NHt}	O'_{Nt}/I'_{NXt}	O'_{Nt}/I'_{Nt}
TOTAL	OF'_t	I'_{Ht}				I'_{Xt}	IF'_t	OF'_t/I'_{Ht}	OF'_t/I'_{Xt}	OF'_t/IF'_t

Table 4.3. Productivity Indexes Matrix for the Current Period

INPUT / OUTPUT	Human (H)	Material (M)	Capital (C)	Energy (E)	Other (X)	TOTAL
$PRODUCT_1$	PP'_{1Ht}				PP'_{1Xt}	TP'_{1t}
$PRODUCT_N$	PP_{NHt}				PP_{NXt}	TP_{Nt}
TOTAL	PPF'_{Ht}				PPF'_{xt}	TPF'_{t}

Table 4.4 Productivity Indexes of the Current Period

Aggregate productivity measurement models deal only with the last row of the Productivity Indexes Matrix i.e partial productivities of inputs and total productivity of firm. Whereas, product-oriented productivity measurement models focus on the whole matrix that is they are additionally interested in partial productivities of inputs with respect to individual products and total productivities of products.

Partial productivity of an input with respect to a specific product is related to the consumption of the former during the production of the later. Total productivity of a product is related to the total input consumption of that product whereas partial productivity of the firm of an input is related to the consumption of that input during the whole production process. Total productivity of the firm is related to the totality of inputs consumed to produce the totality of outputs.

Total productivity value of a product represents the value of that product (in base period terms) produced by consuming one unit of the associated inputs mix. Whereas total productivity index of a product represents the change of the above mentioned value compared to that of the base period. Now, total outputs can be considered as the $(n+1)$ st product produced by consuming the total inputs mix. Then, total productivity value of the firm

represents the value of that hypothetical product i.e total outputs (in base period terms) per a unit "total inputs mix" consumption while total productivity index of the firm represents the change of the above mentioned value compared to that of the base period. Partial productivity value of an input with respect to a specific product represents the value of that product (in base period terms) and partial productivity value of an input represents the value of the "total product" (in base period terms) both produced by consuming one unit of that input. Obviously the indexes represent changes of these values compared to those of the base period. An important note about these partial productivity values is that while focusing on the value of the output produced by the consumption of a unit of the associated input, they ignore the necessity of the usage of other inputs during production. Assuming all inputs have the same significance in production (i.e they are all necessary) these partial productivity values should be divided by the number of inputs to obtain better indicators of performance.

Being an aggregate model, the productivity measurement model of this study focases on the partial productivity of inputs and the total productivity of firm. The relationship between the partial productivities of inputs and the total productivity of the firm is covered in the next section. Furthermore, the relationship between output productivity formulation of the model (Table 3.2) and the total prproductivity of product formulation in the Productivity Indexes Matrix (Table 4.4) will be investigated.

4.2. Productivity Weights

It can easily be verified that, "total productivity of a product is the weighted sum of its partial productivities and the total productivity of firm is a weighted sum of the partial productivities (of inputs) of the firm" (21) The above statement is true for both productivity values and productivity indexes.

Let us take productivity values first. Total productivity value of product "i" in period "t" (TP_{it}) satisfies the following equivalence (for every product "i" and time period "t"):

$$TP_{it} = \sum_{j} W_{ijt} \; PP_{ijt} \quad \text{where}$$

$$PP_{ijt} = \frac{\text{Partial productivity value of input "j" wrt product "i" in period "t"}}{\text{number of inputs}} \quad \text{and}$$

"Productivity value weights" are:

$$W_{ijt} = \frac{I_{ijt}}{I_{it}} \quad \text{for } i = 1,2, \ldots n \text{ and } j \in (H,M,C,E,X)$$

Obviously:

$$\sum_j W_{ijt} = 1 \qquad \text{for } i = 1,2,\ldots.n$$

Whereas, total productivity value of firm in period "t" (TPF_t) satisfies the following equivalence (for every time period "t"):

$$TPF_t = \sum_j W_{jt} \; PPF_{jt} \quad \text{where}$$

$$PPF_{jt} = \frac{\text{Partial productivity value of input "j" in period "t"}}{\text{number of inputs}} \quad \text{and}$$

"productivity value weights" are:

$$W_{jt} = \frac{I_{jt}}{IF_t} \qquad \text{for } j \notin (H,M,C,E,X)$$

Obviously:

$$\sum_j W_{jt} = 1$$

Next, let us consider productivity indexes. Total productivity index of product "i" in period "t" (TP'_{it}) satisfies the following equivalence (for every product "i" and time period "t").

$$TP'_{it} = \sum_j W'_{ijt} \; PP'_{ijt} \quad \text{where}$$

"productivity index weights" are:

$$W'_{ijt} = \frac{I_{ij0}}{I_{i0}} \quad \frac{I'_{ijt}}{I_{it}'} = \frac{I_{ijt}}{I_{it}} \qquad \text{for } i = 1,2..n \text{ and } j \neq (M,M,C,E,X)$$

and obviously,

$$\sum_j W'_{ijt} = 1 \quad \text{for } i = 1,2,.... n$$

Whereas total productivity index of a firm in period "t" (TPF'_t) satisfies the following equivalence (for every time period "t"):

$$TPF'_t = \sum_j W'_{jt} \; PPF'_{jt} \qquad \text{where}$$

"productivity index weights" are:

$$W'_{jt} = \frac{I_{j0}}{IF_0} \quad \frac{I'_{jt}}{IF'_t} = \frac{I_{jt}}{IF_t} \qquad \text{for } j \neq (H,M,C,E,X)$$

and obviously,

$$\sum_j W'_{jt} = 1$$

Then, being a weighted sum of the partial productivity indexes of inputs, total productivity index of firm is always between the above mentioned partial productivities. Similar rules hold for the three other cases.

Furthermore, if current period value (in base period terms) of an input consumption is zero then, productivity index weight of that input will be zero which will prevent total productivity index of firm from being infinity while the partial productivity of that input is infinity.

If base period value of an input consumption is zero then it will be impossible to monitor partial productivities of the following periods. It is necessary to shift the base period.

4.3. Total Productivity of Products

It is a commonly aceepted fact that a product-oriented total productivity model, providing total productivity indexes of each product in addition to the aggregate indexes, will be a more useful tool to a manager than an aggregate model. The challenging disadvantage of product-oriented-models is that, they involve a considerable amount of record keeping and computations. The later can be overcame by the ease of computers but the former necessitates an effective management information system. Lack of detailed past data disabled construction of a product-oriented total productivity model in this study. However, an output productivity formulation (on the data base of the aggreqate model) is proposed to obtain reliable "estimates"

of total productivity indexes of products in certain circumstances.

Output productivity formulation involves decomposition of total productivity of firm into output components and the relationship between this formulation and total productivity indexes of products will be investigated in this section.

Let $(\underline{X}_t')$ denote output productivity vector of the model in period "t" and $(\underline{TP}_t')$ denote total productivity index of products vector in period "t" Then, using the previous notation:

$$\underline{TP}_t' = \begin{bmatrix} 0_{1t}' & & I_{1t}' \\ \vdots & & \vdots \\ 0_{nt}' & & I_{nt}' \end{bmatrix} \quad \underline{X}_t' = \begin{bmatrix} 0_{1t}' & / & IF_t' \\ \vdots & & \vdots \\ 0_{nt}' & / & IF_t' \end{bmatrix} \quad \text{where}$$

$$IF_t' = \sum_i \frac{I_{i0}}{IF_0} I_{it}'$$

We can continue as follows:

$$\underline{TP}_t' = \underline{X}_t' \quad \text{iff} \quad IF_t' = I_{it}' \quad \text{for } i = 1 \ldots n$$

$$IF_t' = I_{it}' \quad \text{iff}$$

i) $\overline{I}_t' = I_{it}'$ for $i = 1 \ldots n$ and

ii) $\overline{I}_0 = I_{i0}$ for $i = 1 \ldots n$

Furthermore, $I'_{it} = \dfrac{I_{it}}{I_{i0}}$ that is

$$\bar{I}'_t = I_{it} \quad \text{for } i = 1 \ldots n$$

where $\bar{I}_0$, $\bar{I}_t$ and $\bar{I}'_t$ are the arithmetic means.

To state it in words, the above mentioned two vectors are equal if and only if both the base period input consumption of products and the current period input consumption of products are equal to their arithmetic means respectively. Next, the current period conditions are changed and discrepancy between the two vectors is analyzed.

Let

$$I^*_{it} = I_{it} + \varepsilon_i \quad \text{for } i = 1 \ldots n \text{ while}$$

$$\sum_i \varepsilon_i = \emptyset$$

Then $IF'^*_t = IF'_t$ and the vector $\underline{X}'_t$ is unaffected. But,

$$TP'^*_t : \begin{bmatrix} 0'_{1t} / (\bar{I}'_t + \dfrac{\varepsilon_1}{\bar{I}_0}) \\ \vdots \\ 0'_{nt} / (\bar{I}'_t + \dfrac{\varepsilon_n}{\bar{I}_0}) \end{bmatrix} \quad \text{and}$$

$$\Delta TP'_{it} = TP'^*_{it} - TP'_{it}$$

$$= \frac{0'_{it}}{\bar{I}'_t + \frac{\varepsilon_i}{\bar{I}_0}} - TP'_{it} = - \frac{n\,\varepsilon_i}{IF_t} \; TP'_{it}$$

Relative sensitivity of the total productiorty index of products vector with respect to percentage changes in current period value of a product is

$$\frac{\Delta TP'_{it} / TP'_{it}}{\Delta I_{it} / I_{it}} = -1 \quad \text{and}$$

$$\frac{TP'_{it} - X'_{it}}{TP'_{it}} = - \frac{\varepsilon_i}{\bar{I}_t}$$

That is, percentage error occur during the use of the output productivity vector is bounded by the percentage difference of the current period product value (in base period terms) from the arithmetic mean.

Productivity index weights of the output productivities should be added to complete the list of productivity weights. Total productivity index of a firm in period "t" (TPF'_t) satisfies the following equivalence (for every time period "t"):

$$TPF'_t = \sum_i W'_{it} \; X'_{it} \quad \text{where}$$

"productivity index weights" are:

$$W'_{it} = \frac{O_{i0}}{OF_0} \quad \text{for } i = 1 \ldots n$$

and obviously,

$$\sum_i W'_{it} = 1$$

Then, being a weighted sum of the output productivity indexes, total productivity index of firm is always between these output productivities.

Furthermore, if the base period production of an output is zero the productivity index weight of that output in the following periods will be zero.

4.4 Relative Sensitivity

The above mentioned "productivity weights" point out dominant factors of total productivity of a firm. Relative sensitivities of total productivity of a firm due to percentage changes in input

consumption show the potential factors of productivity improvement. This section covers formulation of relative sensitivities of productivity, price recovery and profitability indexes of inputs and profit of a firm due to percentage changes in quantities and unit prices of all the outputs and inputs.

An illustrative example will be given before the relative sensitivity formulation: Profit of a firm in period "t" (V_t) is defined to be:

$$V_t = \sum_i P_{it} \; Q_{it} - \sum_j P_{jt} \; Q_{jt}$$

where (P_{it}) and (Q_{it}) represent unit price and quantity of product "i" in period "t" and (P_{jt}) and (Q_{jt}) represent unit price and quantity of input "j" in period "t" respectively. Let us analyze percentage change in the profit due to a percent change in the quantity of input "A" in period "t". Relative sensitivity of profit due to percentage changes in input quantity is defined to be:

$$R_{Q_{At}} = \frac{\partial V_t/V_t}{\partial Q_{At}/Q_{At}} = -\frac{P_{At} \; Q_{At}}{V_t}$$

Relative sensitivity formulas are depicted in Table 4.5

	PRODUCTIVITY		PRICE RECOVERY		PROFITABILITY		PROFIT
OUTPUT	ANY INPUT	TOTAL INPUTS	ANY INPUT	TOTAL INPUTS	ANY INPUT	TOTAL INPUTS	
P_{At}	——	——	$\frac{P_{At}\ Q_{At}}{\sum_i P_{it}\ Q_{it}}$	$\frac{P_{At}\ Q_{At}}{\sum_i P_{it}\ Q_{it}}$	$\frac{P_{At}\ Q_{At}}{\sum_i P_{it}\ Q_{it}}$	$\frac{P_{At}\ Q_{At}}{\sum_i P_{it}\ Q_{it}}$	$\frac{P_{At}\ Q_{At}}{V_t}$
Q_{At}	$\frac{P_{A0}\ Q_{At}}{\sum_i P_{i0}\ Q_{it}}$	$\frac{P_{A0}\ Q_{At}}{\sum_i P_{i0}\ Q_{it}}$	——	——	$\frac{P_{At}\ Q_{At}}{\sum_i P_{it}\ Q_{it}}$	$\frac{P_{At}\ Q_{At}}{\sum_i P_{it}\ Q_{it}}$	$\frac{P_{At}\ Q_{At}}{V_t}$
INPUT B	INPUT B	TOTAL INPUTS	INPUT B	TOTAL INPUTS	INPUT B	TOTAL INPUTS	
P_{Bt}	——	——	- 1	$\frac{-P_{Bt}\ Q_{Bt}}{\sum_j P_{jt}\ Q_{jt}}$	- 1	$-\frac{P_{Bt}\ Q_{Bt}}{\sum_j P_{jt}\ Q_{jt}}$	$-\frac{P_{Bt}\ Q_{Bt}}{V_t}$
Q_{Bt}	- 1	$-\frac{P_{B0}\ Q_{Bt}}{\sum_j P_{j0}\ Q_{jt}}$	——	——	- 1	$-\frac{P_{Bt}\ Q_{Bt}}{\sum_j P_{jt}\ Q_{jt}}$	$-\frac{P_{Bt}\ Q_{Bt}}{V_t}$

Table 4.5 Relative Sensitivity Formulas

Although changes in quantity or unit price of an output affect performance indexes of all the inputs, price changes in quantity or unit price of an input has no effect on the performance indexes of other inputs. It is obvious from Table 4.5 that

$$\sum_i R_{P_{it}} + \sum_j R_{P_{jt}} = 1 \quad \text{and}$$

$$\sum_i R_{Q_{it}} + \sum_j R_{Q_{jt}} = 1$$

where (R) denotes relative sensitivity of profit.

It should be pointed out that, relative sensitivity of total productivity of a firm due to percentage changes in quantity of input "A" is equal to productivity index weight of the partial productivity of that input. That is

$$\left| - \frac{P_{A0} \quad Q_{At}}{\sum_j P_{j_0} \quad Q_{jt}} \right| = \frac{I_{At}}{IF_t} = W'_{At}$$

This is because dominant factors of productivity are obviously the potential factors of short term improvements i.e they do not loose their dominance against incremental changes.

V. PRODUCTIVITY ANALYSIS

Evaluation and analysis of the productivity measures are necessary for the generation of productivity improvement projects. Other performance measures (price recovery and profitability) provided by the productivity measurement model were considered to be out of the domain of this study so analysis effort was focused only on productivity measures. The necessity of model validation before the analysis is quite evident. This is followed by determination of dominant and potential factors of productivity by the ease of the analytical framework described in the preceeding chapter.

5.1. Model Validation

Hierarchical productivity measurement model of this study is based on a detailed data base. Accounting records of the company do not cover all the necessary data contradicting the suggestions of prevailing approaches. However, proforma income statements which are prepared by the accounting department at the end of every two months were used as basic references for validation of the measurement model.

That is, model validation was performed via a comparison of related records of the model and the proforma income statements. Table 5.1 covers comparison of the accumulated figures of the model with related records of the proforma income statements in a two monthly basis.

MODEL (M)	INCOME STATEMENT (IS)	Jan-Feb		Jan-April		Jan-June	
		M	IS	M	IS	M	IS
Total outputs	Sales revenue	367	334	791	680	1131	1107
Total inputs	Total costs	273.3	302	597.9	597	859.7	844
Material	Material+BS-ES	163	196	376	380	525	509
Fixed capital	Depreciations	60	52	120	105	180	166
Energy	Energy	3.3	4	6.9	7	9.7	10
Personnel	Labor+ Personnel +Social aids	47	50	95	105	145	159

Table 5.1 Comparison of Related Records of the Model and the Proforma Income Statements (million TL)

The figures in the above table do not point out any significant discrepancies between the model and the income statements. Values

of the beginning (BS) and ending (ES) stocks of finished and semifinished goods in terms of their raw material equivalents are embedded in the material costs while the depreciations allowed for the investment overheads are embedded in the depreciations in the proforma income statements. Stock values were not depicted in the proforma income statement of February.

The above analysis was followed by a comparison of the stock figures of the model with that of the income statements. Table 5.2 depicts comparison of the stock values

	Jan 1 st		June 30 th	
Stock type	M	IS	M	IS
Finished and semi finished goods	97	142	172	172
Material	202	206	140	135
Total Stocks	299	348	312	307

Table 5.2 Stock values (Million TL) of the Model and the Proforma Income Statements

The 45 million discrepancy in the starting finished and semi-finished product stocks of 1984 arises from the inconsistency between the production and accounting departments in the classification of scrapped items.

Being indirectly related with the operations, the following items were excluded from the measurement model:

	Jan-Feb	Jan-April	Jan-June
Other production costs	20	49	70
Managerial overheads	11	33	43
Financial costs	61	128	197
Total	92	210	310

Table 5.3 Items Excluded from the Model (million TL)

The above mentioned expenses could be equally distributed to the related time periods and added to the model (for the sake of completeness). Base period value of the expense should be taken as the "quantity" while current period value consists the "value" of that item. It is obvious that an appropriate deflator should be taken as the "unit value", to maintain the relationship between quantity, unit value and value of the item. These expenses were not added to the model assuming they would have negligable effect on the performance indexes.

5.2. Determination of Dominant Factors

It is possible to point out the dominant factors of productivity by graphical analysis of productivity indexes and evaluation of productivity weights.

5.2.1. Graphical Analysis of Productivity Indexes

Graphical analysis is a common way of identifying trends of the indicators through time. Providing additional insight to the development of organizational performance, productivity graphics are valuable tools of an operations manager. Productivity graphics covering the productivity indexes obtained from the productivity measurement system for the six analysis periods are given in Appendix C. The hierarchical decomposition strategy was also followed during the analysis of the following graphics:

i. Input factors productivity indexes (AppendixC.1)

ii. Material productivity indexes (Appendix C.2)

iii. Fixed capital productivity indexes (Appendix C.3)

iv. Personnel productivity indexes (Appendix C.4)

v. Output productivity indexes (Appendip C.5)

Since, the company did not implement any productivity improvement programs the indexes show the trend in the operational performance other than the degree of success of a productivity improvement project. So. no variations were expected in fixed capital, personnel and energy consumptions during a six months period.

Productivity indexes of fixed capital, energy and personnel inputs follows similar trends. Further analysis shows that fluctuations in the change ratios of these input factors are negligable in accordance with the expectations. Thus, productivity indexes of fixed capital, energy and personnel inputs can be considered as a function of output change ratios.

However, it can intuitively be stated that material productivity is dominant during the determination of total productivity of the firm. But,being a function of fluctuating productivity indexes of the three types, material productivity index does not follow a similar trend to that of the other inputs. Further analysis shows the inconsistency

between change ratios of outputs and material consumption. It is found that profile consumption during truck wheel production varies from 17 kg/wheel (in May 1984) to 39 kg/wheel (in March 1984). However, profile consumption standarts very from 22 kg/wheel to 29 kg/wheel depending on the model of the wheel. The role of nonstandard material consumption in the above mentioned variation is obvious. Unfortunately, bounding the measurement model by the class and type categories of data for decision support purposes can have an accelareting effect on this fluctuation.

Note that, change ratios of type category data were calculated to be simple ratios of type totals (representing sum of associated levels) other then weighted total change ratio of associated levels. By this, characteristical differences within both the output levels and the material levels were assumed to be negligable.

5.2.2. Productivity Weights Table

Productivity weights table given in Appendix B.5 was prepared by using the formulas developed in section 4.2.

It was stated that, total productivity of a firm was a weighted sum of the partial productivities of inputs. Productivity index weights of these partial productivities are defined to be the current period input consumption percentages defined in terms of the base period. Furthermore, these weights are found to be the product of base period consumption percentages and current period change percentages. Whereas, the latter is defined to be the ratio of value change of the input to that of total inputs, while all values are expressed in base period terms. This is summarized by the following formula:

$$W'_{jt} = \frac{I_{jt}}{IF_t} = \frac{I_{j0}}{IF_0} \cdot \frac{I'_{jt}}{IF'_t}$$

Productivity index weights were computed by multiplying the base period consumption percentages by the current period change percentages. Current period consumption percentages in current period terms are additionally provided in the table. Note that, productivity index weights of outputs are constant and equal to base period production percentage of outputs. Hierarchical structure of the model is again maintained in this table, productivity index weights of classes add up to one while that of types add up to the related class weight. It can easily be seen from the following table that, truck wheels are the dominant factor in total productivity of outputs (with 51 percent weight) while, material consumption is the dominant factor in total productivity of inputs (with 56 percent weight)

Outputs - Tractor wheels 22%

- TTF Disc 16%
- Truck wheels 51%
- Light Commercial wheels....11%

Inputs - Material 56%

- Sheet Metals 16%
- Profiles..... 31%
- Segman,Flanj,Combring 9%

- Fixed Capital 25%

- Plant and Machinery 13%
- Tools and factores 11%
- Others 1%

- Energy 1%
- Personnel 18%

- General Management 4%
- Salaried 5%
- Waged 9%

Table 5.4 Productivity Weights of June 1984

It is interesting to point out the 31 percent weight of profiles which is over all the other input classes. The dominating role of technological input (fixed capital) with a 25 percent weight on human inputs with 18 percent weight should be noticed.

Graphics of productvitity index weights of input factors and outputs are also included in Appendixes C.1 and C.5 respectively.

5.3. Determination of Potential Factors

It is possible to point out the potential factors of productivity by evaluating the relative sensitivity of total productivity of firm due to percentage changes in input quantities.

5.3.1. Relative Sensitivities Table

Relative sensitivities table given in Appendix B.6 was prepared by using the formulas depicted in Table 4.5. The table covers relative sensitivity figures at the end of June 1984.

Relative sensitivities of performance indexes due to percentage changes in inputs were represented by negative numbers indicating the opposing effects of these changes.

Figures in the table denote the expected percentage change in the performance indexes due to a percent change of any input or output factor.

Hierarchical structure of the model exists in this table also. That is,relative sensitivities of classes add up to one while that of types add up to the related class sensitivity. As explained before, profit is an exception of this rule. However, sum of relative sensitivities of profit due to output and input factors add up to one.

Relative sensitivity vector of total productivity is equal to productivity index weights vector of June 1984 as it was proved in Section 4.4.

VI. CONCLUSION

Organizational systems performance measurement is a critical component in the general management process. Reliable measurement systems constitute a sound basis for continous monitoring and control of organizational performance. It is obvious that, reliability of a performance measurement system depends on effectiveness of the management information system and validity of the performance measurement model. Continous monitoring and control of organizational performance enables the manager to point out bottlenecks of improvement, notice potential factors of improvement and evaluate success of implemented improvement projects. In this context, performance measurement systems can be thought as decision support systems.

Productivity is one of the performance measures of an organizational system. Simplification of complex structure of organizational systems is necessary to construct a measurement model. This is done by defining productivity as a ratio of total tangible outputs to total tangible inputs. That is intangible input and output. factors such as noice, sun light, psychological motivation of workers will not be explicitly stated in the measurement model.

Since classification of inputs and outputs depends on the organizational structure, it is impossible to construct a general purpose productivity measurement model for every organizational system.

Prevailing approaches to productivity related topics are investigated and an iterative productivity improvement procedure is suggested. Briefly, the procedure includes measurement and analysis of productivity, generation of productivity improvement projects and a decision concerning the project to be implemented for productivity improvement.

This thesis covers application of the first step of productivity improvement procedure to an existing company. Construction of the productivity measurement model and the analytical framework for productivity analysis was performed in a systematic manner. It was stated that, profitability is a function of price recovery and productivity. In addition to productivity measures, price recovery and profitability measures of the unit of analysis were also provided by the same measurement model. But analysis was focused only on productivity measures.

Lack of an effective management information system was onee of the main obstacles throughout this study of past data. It caused exclusion of some factors from the analysis and disabled construction of a product-oriented measurement model. Data base of the model was

constructed by the ease of a table handling package. Productivity measurement formulas were adopted to perform the calculations on the data base by the same package.

This enables automatic information flow from the lowest to highest levels of the model. It was interesting to observe the above mentioned self control facilities and the sensitivity of high level results due to changes in low levels of this hierarchical structure.

Main theoretical issues of this study are productivity weights defined on the productivity matrix in order to help in analyzing the dominant factors of productivity and relative sensitivities defined in order to point out the potential factors of productivity improvement. It was found out that, dominant factors do not loose their dominance in short term (as could be expected) and are the potential factors of productivity improvement at the same time.

Estimation possibilities of total productivities of products with the same data of an aggregate measurement model were investigated. Fortunately, it is possible to estimate total productivities of products by an aggregate measurement model in certain conditions. Importance of this fact can easily be understood by comparing data volumes of product-oriented models with that of aggregate models. Further investigation of estimation possibilities of total productivities of products by aggregate models is suggested for the forth comings.

The factors amount of which are not directly related to the operations were not included in the model and the model was bounded by type and class categories of data for simplification purposes. But, it is possible to extend the analysis to level category data end include the unoperational factors in the model. Covering a similar data, income statements are good references for model validation. It should be obvious at this point that productivity measurement systems make use of the same data in a more illustrative way than the classical managerial control ratios.

Finally, productivity measurement and analysis applications will gradually increase and a sound theory of productivity will be developed. This study should be treated succesfull if it contains any useful material for the future.

APPENDICES

APPENDICES

APPENDIX A

DATA SHEETS

1984 YILI SATIŞ BİLGİLERİ

MÜŞTERİLER/JANT EBADI		OCAK			ŞUBAT			MART			NİSAN			MAYIS			HAZİRAN		
		ADET	BİRİM FİYAT	TUTAR (000)TL	ADET	BİRİM FİYAT	TUTAR (000)TL	ADET	BİRİM FİYAT	TUTAR (000)TL	ADET	BİRİM FİYAT	TUTAR (000)TL	ADET	BİRİM FİYAT	TUTAR (000)TL	ADET	BİRİM FİYAT	TUTAR (000)TL
GENEL TOPLAM		15406	12437	171808	14169	13067	185175	16745	11541	193250	14773	11853	177714	15345	11758	180432	7261	11511	83577
GENEL TOPLAM (Tiff Gobek Haric)		12304	13392	164776	11239	14221	159830	14706	11942	175613	14163	12041	170535	12544	12452	156203	6190	12006	74315
TRAKTÖR TOPLAMI		6604	7819	51634	4804	6964	33453	6068	7804	47356	4944	8015	39624	5279	9031	47674	3229	5739	18531
Turk Traktor	5.00x19	1375	4060	5583	1384	4060	5619	1476	4060	5993	1860	4060	7552	382	4060	3581	1440	4060	5846
	5.5fX16	768	4620	3548	650	4620	3003		4620	0	745	4620	3442	642	4620	2966	359	4620	1659
	13X28	1029	8430	8674	1871	8430	15773	1653	8430	13935	785	8430	6618	1023	8430	8624	1067	8430	8995
	13X30	849	9050	7683	655	9050	5928	237	9050	2145	260	9050	2353	792	9050	7168	33	9050	299
Cumitas	5.5fx16	1070	3750	4013	41	3750	154		3750	0		3750	0	-41	3750	-154		3750	0
	15x30		15000	0	6	15000	90	-1	15000	-15		15000	0	-5	15000	-75		15000	0
Burtrak	4.0x16		2500	0		2500	0	-20	2500	-50		2500	0		2500	0	-7	2500	-18
	11x28	130	9500	1235	-1	9500	-10	335	9500	3183	168	9500	1596	152	9500	1444	-1	9500	-10
FZOK	5.5fx16		2500	0		2500	0	1011	2500	2528	-6	2500	-15	92	2500	230		2500	0
	11X36	1273	16060	20444	161	16060	2586	1174	16060	18854	1104	16060	17730	1367	16060	21954	25	16060	402
Iltor	5.5x16	100	4070	407		4070	0	-4	4070	-16		4070	0	300	4070	1221	300	4070	1221
Piyasa	OR	8	3750	30	21	3857	81	205	3702	759	20	3300	66	16	4438	71	1	5000	5
	ARKA	2	8500	17	16	14375	230	2	21000	42	8	35375	283	59	10915	644	12	11000	132
Turk Traktor	GOBEK	3102	8650	26832	2930	8650	25345	2039	8650	17637	639	8650	7180	2801	8650	24229	1071	8650	9264
KAMYON TOPLAMI		4263	21925	93467	6112	20050	122545	4645	15747	73146	3298	14747	48636	3203	16578	53100	2689	19357	52051
Otosan	6.5X20	2153	27000	58131	2786	27000	75222	798	27000	21546		27000	0		27000	0	845	27000	22815
	7.0X20/10		27000	0		27000	0		27000	0		27000	0	27	27000	729		27000	0
Otoyol	8.0x20*		21300	0		21300	0	241	21300	5133	359	21300	7647	592	21300	12610		21300	0
Bebiaot	6.5x20	1112	21400	23797	683	21400	14723		21400	0	545	21400	11663	600	21400	12840		21400	0
Chrysler	7.0x20*	500	10900	5450	900	10900	9810	1000	10900	10900	1000	10900	10900	548	10900	5973	500	10900	5450
BMC	7.0X20/10		15000	0	488	15000	7320	1069	15000	16035	223	15000	3345	540	15000	8100	503	15000	7545
Piyasa	6.5x20	35	16229	568	119	16143	1921	29	16690	484	16	17611	317	20	17600	352	50	17600	880
	7.0x20*	394	10749	4314	1049	11548	12114	1071	11692	12756	948	12263	11625	383	12251	4692	10	12756	130
	7.0x20/8	3	17667	53	28	17500	490	30	17900	537	6	25000	150			0	564	20250	11421
	7.0x20/10	5	17200	86	18	17500	315			0	2	18500	37			0	10	20300	203
	7.5x20	61	17508	1068	36	17500	630	147	17517	2575	55	17745	976	228	17750	4047	153	18098	2769
	8.0x20			0			0	230	13000	2990	122	13000	1586	217	13000	2821	34	13000	442
	8.0x20*			0			0	10	19000	190	20	19500	390	48	19500	936	20	19835	397
HAFIF TICARI TOPLAMI		1437	13691	19675	323	11863	3832	3973	13802	55110	5721	13895	82274	4062	13646	55430	272	13724	3733
Otoyol	5.5x16SDC	1395	13900	19391	231	13900	3211	3937	13900	54724	5917	13900	82246	3913	13900	54391	265	13900	3684
Piyasa	5.5x16SDC	42	6762	284	92	6750	621	56	6873	386	4	7000	28	149	6973	1039	7	7077	50

1984 YILI MAMUL STOK BILGILERI (Ay Sonu)

MUSTERILER/JANT ERADI		DONEM BASI			OCAK			SUBAT			MART			NISAN			MAYIS			HAZIRAN		
		ADET	BIRIM MAL.	TUTAR (000)TL	ADET	BIRIM MAL.	TUTAR (000)TL	ADET	BIRIM MAL.	TUTAR (000)TL	ADET	BIRIM MAL.	TUTAR (000)TL	ADET	BIRIM MAL.	TUTAR (000)TL	ADET	BIRIM MAL.	TUTAR (000)TL	ADET	BIRIM MAL.	TUTAR (000)TL
GENEL TOPLAM		410	11098	4549	1470	7075	10400	752	4709	3671	447	4123	1843	1747	6764	13183	1213	11148	13521	6154	6646	40879
GENEL TOPLAM (TIF Gobek Haric)		222	15929	3536	481	9526	4582	378	3945	1491	378	3829	1447	666	8746	5825	1079	11729	12656	3758	6770	25440
TRAKTOR TOPLAMI		222	15929	3536	274	3832	1050	378	3945	1491	378	3829	1447	274	3764	1031	472	5222	2465	3212	5087	16339
Turk Traktor	3.62x19		3382	0		4172	0		4172	0		4107	0		4107	0	118	4878	576	1358	4878	7600
	5.5IX16	3	3060	9		4241	0	104	4241	441	104	3999	416		3999	0		4744	0	943	4744	4474
	13X28		5559	0		6569	0		6569	0		6435	0		6435	0	44	7225	318	393	7225	2839
	13X30		7387	0		8689	0		8689	0		8481	0		8481	0	36	9510	342		9510	0
Cualtas	5.5fx16	11	2645	27	274	3832	1050	274	3832	1050	274	3764	1031	274	3764	1031	274	4485	1227	318	4485	1426
	15x30		15833	0		18300	0		18300	0		17497	0		17497	0		19782	0		19782	0
Burtrak	4.0x16			0			0			0			0			0			0			0
	11x28		10591	0		11557	0		11557	0		11468	0		11468	0		12029	0		12029	0
T/DK	5.5fx16		3060	0		3765	0		3765	0		3701	0		3701	0		4583	0		4583	0
	11X36	208	16817	3498		19204	0		19204	0		19142	0		19142	0		19073	0		19073	0
Iltor	5.5x16		3060	0		4031	0		4031	0		4031	0		4031	0		4835	0		4835	0
Piyasa	ON			0			0			0			0			0			0			0
	ARKA			0			0			0			0			0			0			0
Turk Traktor	GOBEK	188	5308	1013	989	5883	5818	374	5883	2200	69	5735	396	1283	5735	7358	134	6452	865	2396	6452	15459
KAMYON TOPLAMI		0	13703	0	207	17063	3532	0	17063	0	0	16380	0	372	12229	4774	459	19740	9060	402	19702	8000
Otosan	6.5X20		13903	0		17063	0		17063	0		16880	0		16880	0		18688	0		18688	0
	7.0X20/10		15719	0		17782	0		17782	0		18146	0		18146	0		19919	0		19919	0
Otoyol	8.0x20x		11105	0		12063	0		12063	0		12511	0		12511	0		13583	0		13583	0
Sehiaot	6.5x20		13903	0	207	17063	3532		17063	0		16380	0		16380	0		18688	0		18688	0
Chrysler	7.0x20x		10913	0		11548	0		11548	0		12209	0		12209	0		12928	0		12928	0
GMC	7.0X20/10		15719	0		17782	0		17782	0		18146	0		18146	0		19919	0	27	17719	533
Piyasa	6.5x20		13903	0		17063	0		17063	0		16880	0		16880	0	27	18688	505		18688	0
	7.0x20x		10713	0		11548	0		11548	0		12207	0	368	12207	4488	2	12728	26	1	12728	13
	7.0x20/8		15919	0		17982	0		17982	0		18146	0		18146	0		19919	0		19919	0
	7.0x20/10		15717	0		17782	0		17782	0		18146	0		18146	0	384	17719	7647	374	17719	7450
	7.5x20		14314	0		17314	0		17314	0		17330	0		17330	0	46	19155	881		19155	0
	8.0x20		16331	0		18454	0		18454	0		18693	0		18693	0		20526	0		20526	0
	8.0x20x		11105	0		12063	0		12063	0		12511	0	26	12511	325		13583	0		13583	0
HAFIF TICARI TOPLAMI		0	4829	0	0	5957	0	0	5957	0	0	6370	0	0	6370	0	148	7641	1131	144	7641	1100
Otoyol	5.5x16SDC		4829	0		5957	0		5957	0		6370	0		6370	0		7641	0		7641	0
Piyasa	5.5x16SDC		4829	0		5957	0		5957	0		6370	0		6370	0	148	7641	1131	144	7641	1100

BIRIM MALIYETLER (22/6/84)

		NAMUL	ISCILIK	GIG	AMORTISMAN	I+G+A	TEKNIK PUAN	MALZEME	22/6/84 SINAI MAL.	22/6/84 SINAI MAL. %	31/12/83 SINAI MAL.	29/2/84 SINAI MAL.	30/4/84 SINAI MAL.
TRAKTOR ÖN JANTI													
3.62X19	TTF	KOMPLE	1041	632	1059	2732	0.7335	2146	4878	100.00%	3362	4172	4107
		CEMBER				419	0.1125	735	1154	23.66%	795	987	972
		GOBEK				806	0.2170	1103	1911	39.18%	1317	1635	1609
		CEMBER+GOBEK				2087	0.5550	2148	4213	86.37%	2704	3603	3547
5.5X16	TTF	KOMPLE	1008	612	1025	2645	0.7105	2099	4744	100.00%	3060	4241	3999
		CEMBER				419	0.1125	937	1356	28.58%	875	1212	1143
		GOBEK				860	0.2310	864	1724	36.34%	1112	1541	1453
		CEMBER+GOBEK				2118	0.5690	2099	4217	88.90%	2720	3770	3555
5.5X16	JV	KOMPLE	1008	612	1025	2645	0.7105	1840	4485	100.00%	2645	3832	3764
		CEMBER				419	0.1125	933	1352	30.14%	797	1155	1134
		GOBEK				860	0.2310	609	1469	32.75%	866	1255	1233
		CEMBER+GOBEK				2118	0.5690	1840	3958	88.25%	2334	3382	3322
5.5X16	IL.	KOMPLE	1008	612	1025	2645	0.7105	1990	4635	100.00%	3060	4081	4081
		CEMBER				419	0.1125	877	1316	28.39%	869	1159	1157
		GOBEK				860	0.2310	795	1655	35.71%	1093	1457	1457
		CEMBER+GOBEK				2118	0.5690	1770	4108	88.64%	2712	3617	3617
5.5X16	TZDK	KOMPLE	1008	612	1025	2645	0.7105	1938	4583	100.00%	3060	3965	3901
		CEMBER				419	0.1125	886	1305	28.47%	871	1129	1111
		GOBEK				860	0.2310	754	1614	35.22%	1078	1396	1374
		CEMBER+GOBEK				2118	0.5690	1938	4056	88.51%	2708	3509	3453
TRAKTOR ARKA JANTI													
11X28	BT.	KOMPLE	1988	1206	2020	5214	1.3993	6815	12029	100.00%	10591	11557	11468
		CEMBER				1006	0.2700	2803	3809	31.67%	3354	3660	3631
		GOBEK				503	0.1350	3052	3555	29.55%	3130	3416	3389
		KULAK				52	0.0139	373	425	3.53%	374	408	405
		CEMBER+KULAK				2077	0.5573	3763	5840	48.55%	5141	5610	5567
11X38	TZDK	KOMPLE	2720	1772	2768	7260	2.0581	11413	19073	100.00%	16317	19204	19142
		CEMBER				1256	0.3375	3203	4459	23.38%	3932	4490	4475
		GOBEK				2410	0.6475	5880	8290	43.46%	7309	8347	8320
		KULAK				179	0.0481	477	656	3.44%	578	661	658
		CEMBER+KULAK				2831	0.7606	5533	8364	43.85%	7375	8421	8394
13X28	TTF	KOMPLE	1267	768	1267	3322	0.8914	3903	7225	100.00%	5559	6569	6435
		CEMBER				1006	0.2700	3176	4182	57.89%	3218	3802	3725
		KULAK				152	0.0409	353	505	7.00%	389	460	450
		CEMBER+KULAK				2158	0.5790	3903	6061	83.89%	4663	5510	5398
13X30	TTF	KOMPLE	1640	995	1667	4302	1.1550	5208	9510	100.00%	7387	8689	8481
		CEMBER				1006	0.2700	3401	4407	46.34%	3423	4026	3930
		KULAK				207	0.0557	1322	1529	16.08%	1188	1397	1364

15X30	JD	KOMPLE	3271	1984	3324	8579	2.3052	11203	19782	100.00%	15833	18300	17497
		CENGER				1258	0.3375	3658	4912	24.83%	3931	4544	4345
		GOBEK				2940	0.7900	4369	7309	36.95%	5850	6761	6465
		KULAK				196	0.0527	872	1068	5.40%	871	1007	962
		CENGER+KULAK				2848	0.7652	6834	9682	48.94%	7749	8956	8563
KAMYON		JANTI											
6.5X20		KOMPLE	2554	1543	2585	6682	1.7926	12006	18688	100.00%	13903	17063	16860
		CENGER				1342	0.3600	5820	7162	38.32%	5328	6539	6469
		GOBEK				1355	0.3636	2635	3990	21.35%	2969	3643	3604
		CENGER+GOBEK				5739	1.5396	7207	14946	79.98%	11119	13646	13500
		SEGMAN				362	0.0972	2519	2881	15.42%	2144	2631	2603
		FLANS				394	0.1058	280	674	3.61%	502	616	607
7.0X20		KOMPLE	2544	1543	2585	6672	1.7926	13246	19918	100.00%	15919	17982	18146
		CENGER				1340	0.3600	7003	8343	41.89%	6688	7552	7601
		GOBEK				1353	0.3636	2689	4042	20.29%	3231	3649	3683
		CENGER+GOBEK				5730	1.5396	10444	16174	81.20%	12927	14602	14735
		SEGMAN				362	0.0972	2522	2884	14.48%	2305	2603	2627
		FLANS				394	0.1058	280	674	3.38%	539	608	614
7.5X20		KOMPLE	2544	1543	2585	6672	1.7926	12483	19155	100.00%	14314	17314	17330
		CENGER				1340	0.3600	6132	7472	39.01%	5584	6754	6760
		GOBEK				1353	0.3636	2650	4003	20.90%	2992	3619	3622
		CENGER+GOBEK				5730	1.5396	7534	15264	79.69%	11407	13797	13810
		SEGMAN				362	0.0972	2654	3016	15.74%	2254	2726	2728
		FLANS				394	0.1058	295	689	3.60%	515	623	623
8.0X20		KOMPLE	2544	1543	2585	6672	1.7926	13854	20526	100.00%	16331	18454	18693
		CENGER				1340	0.3600	7328	8668	42.23%	6878	7773	7874
		GOBEK				1353	0.3636	2641	3994	19.46%	3178	3591	3638
		CENGER+GOBEK				5730	1.5396	10721	16451	80.15%	13089	14791	14982
		SEGMAN				362	0.0972	2820	3182	15.50%	2532	2861	2898
		FLANS				394	0.1058	313	707	3.44%	562	635	644
HAFIF	TICARI	JANTI											
5.5X16	SDC	KOMPLE	1374	834	1397	3405	0.9685	4036	7641	100.00%	4829	5957	6370
		CENGER				752	0.2020	1109	1861	24.35%	1176	1451	1551
		GOBEK				910	0.2445	944	1854	24.27%	1172	1445	1546
		CENGER+GOBEK				3002	0.8065	2459	5461	71.47%	3451	4257	4553
		KOMBRING				491	0.1320	1577	2068	27.07%	1307	1612	1724

1984 YILI YARI MAMUL STOK BILGILERI (Ay Sonu)

MUSTERILER/JANT EBADI		DONEM BASI			OCAK			SUBAT			MART			NISAN			MAYIS			HAZIRAN			22/6/84
		ADET	BIRIM MAL.(000)TL	TUTAR	ADET	BIRIM MAL.(000)TL	TUTAR	ADET	BIRIM MAL. (000)TL	TUTAR	ADET	BIRIM MAL.(000)TL	TUTAR	ADET	BIRIM MAL. (000)TL	TUTAR	ADET	BIRIM MAL.(000)TL	TUTAR	ADET	BIRIM MAL. (000)TL	TUTAR	SINAI MAL. Z
GENEL TOPLAM		8701	10413	92870	7678	11878	91443	8100	10365	83959	9086	11113	97384	11013	11600	127840	8776	12256	110257	10007	13193	132022	
TRAKTOR TOPLAMI		3860	9571	36948	3107	8964	27847	4298	9319	40054	2644	10226	27040	4758	8957	42615	3829	7898	30244	3240	9461	30653	
KAMYON TOPLAMI		3257	14468	47129	3176	17367	55166	1845	17478	32248	2559	17372	44464	4137	17339	71730	3442	17415	59945	4332	19104	82765	
HAFIF TICARI TOPLAMI		1784	4829	8613	1415	5957	8431	1957	5957	11656	2082	6370	18361	2119	6370	13495	1725	7641	13179	2435	7641	18604	
TRAKTOR ON JANTI																							
3.6ZX19	TTF	KOMPLE	462	3362	1553	602	4172	2512	893	4172	3724	237	4107	974	469	4107	1928	1921	4878	9373	263	4878	1281	100.00Z
		CEMBER	216	775	172		787	0		787	0	611	772	374	98	772	95	2597	1154	2997	287	1154	333	25.66Z
		GOBEK	740	1317	975	1537	1635	2512	2278	1635	3724	3	1609	5	1009	1609	1624	3206	1911	6127	357	1911	682	35.18Z
		CEMBER+GOBEK	140	2704	407		3603	0		3603	0	106	3547	376	59	3547	209	59	4213	249	69	4213	291	38.37Z
5.5X16	TTF	KOMPLE	293	3060	897	665	4241	2821	551	4241	2339	214	3999	856	813	3999	3252	25	4744	119	389	4744	1843	100.00Z
		CEMBER		875	0	1024	1212	1241	813	1212	985	683	1143	781	715	1143	817	10	1356	14	234	1356	317	28.50Z
		GOBEK	782	1112	870	1025	1541	1580		1541	0	3	1453	4	572	1453	831		1724	0	7	1724	12	36.34Z
		CEMBER+GOBEK	10	2720	27		3770	0	359	3770	1353	20	3555	71	451	3555	1603	25	4217	105	359	4217	1514	88.70Z
5.5X16	JD	KOMPLE	685	2645	1812	0	3832	0	0	3832	0	0	3764	0	0	3764	0	96	4485	431	157	4485	706	100.00Z
		CEMBER	375	777	315		1155	0		1155	0		1134	0		1134	0		1352	0		1352	0	30.14Z
		GOBEK	1394	866	1208		1255	0		1255	0		1233	0		1233	0	5	1469	7	36	1469	53	32.75Z
		CEMBER+GOBEK	124	2334	287		3382	0		3382	0		3322	0		3322	0	107	3958	424	165	3958	653	88.25Z
5.5X16	IL.	KOMPLE		3060	0		4081	0		4081	0		4081	0		4081	0		4635	0		4635	0	100.00Z
		CEMBER		867	0		1159	0		1159	0		1159	0		1159	0		1316	0		1316	0	28.39Z
		GOBEK		1093	0		1457	0		1457	0		1457	0		1457	0		1655	0		1655	0	35.71Z
		CEMBER+GOBEK		2712	0		3617	0		3617	0		3617	0		3617	0		4108	0		4108	0	88.64Z
5.5X16	TZOK	KOMPLE	28	3060	87	301	3965	1193	809	3965	3208	457	3901	1784	447	3901	1743	434	4583	1991	493	4583	2261	100.00Z
		CEMBER		871	0		1129	0		1129	0	181	1111	201		1111	0		1305	0		1305	0	28.47Z
		GOBEK		1078	0		1396	0	923	1396	1289	64	1374	88	25	1374	34	2	1614	3	26	1614	42	35.22Z
		CEMBER+GOBEK	32	2708	87	340	3509	1193	547	3507	1920	433	3453	1495	425	3453	1709	470	4056	1938	547	4056	2219	88.51Z
TRAKTOR ARKA JANTI																							
11X28	BT.	KOMPLE	350	10591	3709	350	11557	4047	551	11557	6364	205	11468	2352	94	11468	1080	94	12029	1134	111	12029	1334	100.00Z
		CEMBER	477	3354	1603	479	3680	1753	479	3680	1753	376	3631	1365	77	3631	280	27	3809	103	18	3809	69	31.67Z
		GOBEK	370	3130	1158	370	3416	1264	774	3416	2644	137	3389	464	94	3389	319	125	3555	444	119	3555	423	29.55Z
		KULAK	572	374	214	572	408	233	779	408	318	1180	405	478	360	405	348	360	425	385	342	425	358	3.53Z
		CEMBER+KULAK	142	5141	730	142	5610	797	294	5610	1649	8	5567	45	24	5567	134	38	5840	222	83	5840	485	48.55Z
11X38	TZOK	KOMPLE	1036	16817	18269	301	17204	5784	724	17204	13911	436	19142	9307	769	19142	14717	151	19073	2872	242	19073	4611	100.00Z
		CEMBER	780	3932	3067		4490	0	183	4490	822	156	4475	698	207	4475	926	277	4459	1235	113	4459	504	25.38Z
		GOBEK	1253	7309	9012	800	8347	5008	1224	8347	10217	816	8320	6789	1209	8320	10059	51	8290	423	250	8290	2072	43.46Z
		KULAK	642	578	371	1175	661	776	1672	661	1104	1132	658	745	1831	658	1206	371	656	243	768	656	504	3.44Z
		CEMBER+KULAK	789	7375	5817		8421	0	210	8421	1768	128	8376	1074	301	8394	2527	113	8364	970	193	8361	1551	43.85Z

		CEMBER	63	3218	203		3802	0	159	3802	605	231	3725	860	257	3725	957	493	4182	2062	124	4182	519	57.87%
		KULAK	3481	389	1354	2900	460	1333	667	460	307	5500	450	2476	1360	450	621		505	0	6372	505	3221	7.00%
		CEMBER+KULAK	1	4863	5	240	5510	1323	98	5510	540	30	5378	162	1277	5378	6893	165	6061	1000	124	6061	752	85.87%
13X30	TTF	KOMPLE	192	7387	1418	0	8689	0	103	8689	895	55	8481	464	381	8481	3227	220	9510	2091	481	9510	4574	100.00%
		CEMBER		3423	0		4026	0	13	4026	52		3730	0	50	3730	176	75	4407	330	556	4407	2450	46.34%
		KULAK	1183	1188	1405		1397	0	603	1397	843	340	1364	464	1836	1364	2504	1000	1529	1529	1034	1529	1581	16.08%
		CEMBER+KULAK	2	8175	12		7237	0		7237	0		7112	0	74	7112	526	29	7975	231	68	7975	542	83.86%
15X30	JU	KOMPLE	483	15833	7643	483	18300	8834	446	18300	8162	446	17497	7804	468	17497	8196	464	19782	9171	483	19782	9553	100.00%
		CEMBER	499	3731	1962	499	4544	2267	440	4544	1799	440	4345	1912	493	4345	2142	493	4912	2422	445	4912	2186	24.83%
		GOBEK	619	5850	3621	619	6761	4185	579	6761	3915	579	6465	3743	592	6465	3827	579	7309	4232	584	7309	4268	36.95%
		KULAK	319	871	278	319	1007	321	267	1007	269	267	962	257	267	962	257	267	1038	291	267	1038	291	5.50%
		CEMBER+KULAK	230	7749	1782	230	8956	2060	221	8956	1979	221	8563	1893	230	8563	1970	230	9682	2227	290	9682	2808	48.94%
KANYON		JANTI																						
6.5X20		KOMPLE	1057	13903	14698	1057	17063	18039	805	17063	13743	1511	16880	25502	2461	16880	41537	1712	18688	32000	2776	18688	51849	100.00%
		CEMBER	573	5328	3160	573	6339	3878	494	6537	3230	1480	6469	9574	1349	6469	8727	1282	7162	7152	2284	7162	16350	38.32%
		GOBEK	1928	2969	5724	1928	3643	7024	1803	3643	6569	1719	3604	6196	4114	3604	14828	3635	3990	14505	2103	3990	8392	21.35%
		CEMBER+GOBEK	523	11119	5815	523	13546	7137	287	13546	3944	298	13500	4023	676	13500	9126	175	14946	2616	935	14946	13227	79.58%
		SEGMAN		2144	0		2631	0		2631	0	2182	2603	5679	2840	2603	7391	1925	2881	5547	3249	2881	9361	15.42%
		PLANO		502	0		616	0		616	0	50	607	30	2405	607	1455	224	674	151	6719	674	4531	3.61%
7.0X20		KOMPLE	466	15919	7418	650	17982	11684	494	17982	8887	686	18146	12444	633	18146	11483	881	19918	17552	822	19918	16365	100.00%
		CEMBER	43	6668	287	900	7532	6026	618	7532	5148	335	7601	2928	185	7601	1254	668	8343	5573	1169	8343	9252	41.89%
		GOBEK	1007	3231	3253	350	3649	1277	312	3649	1139	589	3683	2169	349	3683	1285	300	4042	1213	608	4042	2458	20.29%
		CEMBER+GOBEK	300	12927	3878	300	14602	4381	315	14602	4600	461	14735	6773	217	14735	3178	407	16174	6615	180	16174	2911	81.20%
		SEGMAN		2305	0		2603	0		2603	0	37	2627	97	2153	2627	5656	1074	2884	3097	490	2884	1413	14.48%
		PLANO		539	0		603	0		603	0	748	814	458	148	814	90	1564	874	1054	490	874	430	3.38%
7.5X20		KOMPLE	1641	14314	23482	1470	17314	25443	393	17314	6802	195	17330	3382	582	17330	10080	103	19155	1964	409	19155	7833	100.00%
		CEMBER	760	5584	4243	760	6754	5133	326	6754	2302	151	6760	1021	255	6760	1724		7472	0	307	7472	2274	39.01%
		GOBEK	652	2992	1950	652	3619	2359	652	3619	2359	652	3622	2361	998	3622	3615	15	4003	60	656	4003	2626	20.90%
		CEMBER+GOBEK	924	11407	10540	924	13797	12749		13777	0		13810	0	328	13810	4502	55	15284	840	15	15284	229	79.69%
		SEGMAN	2623	2254	5911	1531	2726	4173	439	2726	1197		2728	0	77	2728	210	330	3016	995	890	3016	2684	15.74%
		PLANO	1627	515	837	1653	623	1029	1678	623	1045		623	0	47	623	29	100	689	69		689	0	3.60%
8.0X20		KOMPLE	94	16331	1530	0	18454	0	153	18454	2816	168	18693	3136	462	18693	8630	746	20526	15319	326	20526	6698	100.00%
		CEMBER		6893	0		7793	0	148	7793	1138	78	7874	758	173	7874	1368	544	8668	4715	473	8668	4100	42.23%
		GOBEK	119	3178	378		3591	0	2	3591	7	2	3638	7	10	3638	36	59	3994	236		3994	0	17.46%
		CEMBER+GOBEK	88	13089	1152		14791	0	113	14791	1671	102	14982	1528	434	14982	6502	431	16451	7713	75	16451	1234	80.15%
		SEGMAN		2532	0		2861	0		2861	0	224	2898	649	52	2898	151	496	3182	1578	99	3182	315	15.50%
		PLANO		562	0		635	0		635	0	301	644	194	893	644	575	1241	707	877	1485	707	1050	3.44%
HAFIF		TICARI JANTI																						
5.5X16	SDC	KOMPLE	1784	4829	8613	1415	5957	8431	1957	5957	11656	2882	6370	18361	2119	6370	13495	1725	7641	13179	2435	7641	18604	100.00%
		CEMBER	2003	1176	2450		1451	0		1451	0	1005	1551	1557	422	1551	655		1881	0	420	1881	752	24.35%
		GOBEK	898	1172	1052	2112	1445	3053	3789	1445	5477	6715	1546	10379	3926	1546	6068	5888	1854	10917	5886	1854	10913	24.27%
		CEMBER+GOBEK	486	3451	1401		4257	0		4257	0	1355	4553	8169	307	4553	1393	190	5461	1033	338	5461	1346	71.47%
		KOMBRING	2838	1307	3710	3335	1612	5378	3832	1612	6179	147	1724	253	3117	1724	5375	592	2066	1224	2448	2068	5063	27.07%

	ADET	BIRIM HAL.	TUTAR (000)TL	ADET	BIRIM HAL.	TUTAR (000)TL	ADET	BIRIM HAL.	TUTAR (000)TL	ADET	BIRIM HAL.	TUTAR (000)TL	ADET	BIRIM HAL.	TUTAR (000)TL	ADET	BIRIM HAL.	TUTAR (000)TL
GENEL TOPLAM	720170	187.75	135350	194535	181.93	35392	742447	134.10	99580	268847	114.28	30702	481431	148.15	67447	335206	215.37	72192
SACLAR	327760	108.42	35535	144144	103.45	14911	659804	103.74	68449	256687	104.68	26871	372180	104.27	38806	212069	149.88	31785
LEVHA SACLAR	287420	103.75	29815	116020	103.04	12037	482224	103.59	47385	156878	104.77	16439	271660	103.84	28209	126872	130.89	16573
4X462X2275																		
6X1500X4700																		
6X1500X4550																		
6X1200X4555																		
7X1200X2240													22000	101.59	2235			
8X1200X2400	33510	102.30	3428	11060	102.35	1132	21570	102.32	2207				33590	109.26	3670			
8X1500X2250	41530	103.20	4286				41590	103.20	4292				68770	103.20	7097	13860	155.70	2158
7X1500X2750	81410	103.21	8402	96460	103.19	9954	87240	103.20	9007	55050	103.22	5682	119300	103.20	12312	74380	130.09	9676
10X9300X2580	68680	105.65	7256				108280	104.25	11288									
10X1500X2250																		
10X1500X6000																		
11X1100X2200	62290	103.40	6441				145800	103.40	15076	90380	103.40	9345	28000	103.39	2895	38310	120.26	4607
9X10000X4000				9300	102.26	951												
8X1100X2400							28794	102.31	2946	11540	111.79	1290						
10X740X2550							33950	105.66	3587									
RULO SACLAR	20494	104.91	2150	27324	105.18	2874	197580	104.09	20566	99789	104.24	10402	100520	105.42	10597	85447	178.03	15212
2.5X178XR																		
3.2X165XR							18486	105.86	1955									
3.7X460XR																		
4X110XR																		
4X130XR																		
4X174XR																		
4X205XR																		
4X207XR																		
4X360XR							60710	104.89	6368				25970	104.89	2724			
4X410XR	20494	104.91	2150	20074	104.91	2106	54210	101.37	5507	31826	104.97	3685	20750	104.92	2198	42730	173.82	3282
4X462XR																		
5X320XR																		
5.5X160XR							54192	105.81	5734				29380	105.79	3108	59820	126.55	7570
3.2X160XR				7250	105.73	766				20360	106.04	2213	24220	105.79	2561			
4X120XR																		
LAMA SAC 43XB	19846	179.99	3572															
PROFILLER	369932	244.04	90278										51640	276.76	14347	59680	283.23	16903
6.5X20 1159	244591	239.37	59026															
7.0X20 1160	79359	253.38	20108										51640	276.76	14347	59680	283.23	16903
7.5X20 2860																		
8.0X20 1161	43982	253.38	11144															
SEGMAN-FLANS-COMBRINO	22478	424.62	9544.6	50391	406.44	20481	82645	376.45	31111	11960	320.32	3831	37481	381.57	14294	63457	370.39	23504
SEGMAN	22478	424.62	9544.6	41687	424.62	17701	31925	424.62	13556	107	424.62	45.434	5375	424.62	2290.8	11754	424.62	4991
FLANS		319.38		8704	319.38	2779.9	40360	319.38	12890	11853	319.38	3785.6	18610	319.38	5943.7	36428	319.38	11634
COMBRINO		450.32			450.32		10360	450.32	4665.3		450.32		13456	450.32	6057.5	152/5	450.32	6873.8

1984 YILI HALZEME STOK BILGILERI (Ay Sonu)

HALZEME	DÖNEM BASI			OCAK			SUBAT			MART			NISAN			MAYIS			HAZIRAN		
	ADET	BIRIM HAL.	TUTAR (000)TL	ADET	BIRIM HAL.	TUTAR (000)TL	ADET	BIRIM HAL.	TUTAR (000)TL	ADET	BIRIM HAL.	TUTAR (000)TL	ADET	BIRIM HAL.	TUTAR (000)TL	ADET	BIRIM HAL.	TUTAR (000)TL	ADET	BIRIM HAL.	TUTAR (000)TL
GENEL TOPLAM	1410706	143.20	202040	1446810	168.84	243953	1194501	175.03	209151	1122812	158.67	178120	783282	165.83	129900	817282	164.83	134709	854811	164.38	140484
SACLAR	806065	89.41	72247	815693	91.13	56111	471712	89.60	42264	590310	93.72	55324	351413	88.58	31127	409061	90.51	37024	474466	94.71	44936
LEVHA SACLAR	334350	71.07	32276	217122	90.10	19563	132457	85.45	11318	337737	97.13	32797	149855	92.33	13843	224727	97.92	22006	218388	98.85	21587
4X462X2275	21979	89.18	1960	21979	89.18	1960	21979	89.18	1960	21979	89.18	1960	21979	89.18	1960	21847	89.17	1948	21648	99.18	2147
6X1300X4700	332	72.29	24	332	72.29	24	332	72.29	24	332	72.29	24	332	72.29	24	332	72.29	24			
6X1500X4550	9322	71.66	668	9322	71.66	668	9322	71.66	668	9322	71.66	668									
6X1200X4550	17216	57.54	1025	17216	57.54	1025	17216	57.54	1025	17216	57.54	1025	17216	57.54	1025	16888	57.50	973	13384	57.56	796
7X1200X2240	57150	86.03	5031	47100	88.05	4147	38100	86.03	3354	35100	88.03	3090	11100	88.02	977	30100	97.94	2948	29841	95.27	2843
8X1200X2400				17870	102.29	1828	4070	102.20	416	25660	102.30	2625									
8X1500X2250	29692	93.37	2791	17134	99.10	1698	30	100.00	3	5980	103.18	617	30	100.00	3	10480	103.15	1081	9222	104.97	968
7X1500X2750	27300	95.09	2615													50170	103.21	5178	12718	106.48	1354
10X930X2580	17320	99.19	1718							65580	105.66	6929									
10X1500X2250	27318	90.84	2527	27818	90.84	2527	27818	90.84	2527	27818	90.84	2527	27818	90.84	2527						
10X1500X6000	4270	90.87	388	4270	90.87	388	4270	90.87	388	4270	90.87	388	4270	90.87	388						
11X1160X2260	141351	95.58	13527	54031	97.96	5290				33230	103.40	3436	87110	103.40	9737	95110	103.40	9834	129575	102.48	13279
9X1000X4000							9300	102.26	951	9300	102.26	951									
8X1100X2400																					
10X940X2580										33950	105.66	3587									
RULO SACLAR	453715	98.10	39771	378725	87.07	32776	319409	85.70	27374	243934	86.63	21132	174919	82.54	14089	184534	81.47	15018	258100	91.24	23547
2.5X178XR	39257	51.25	2012	39257	51.25	2012	39257	51.25	2012	39257	51.25	2012	39257	51.25	2012	39257	51.25	2012	39257	51.25	2012
3.2X165XR	10314	78.22	1615							8154	105.97	850									
3.9X460XR	21271	62.24	1324	21271	62.24	1324	21271	62.24	1324	21271	62.24	1324	21271	62.24	1324	21271	62.24	1324	21271	62.24	1324
4X118XR	750	47.33	37	750	47.33	37	750	47.33	37	750	47.33	37	750	47.33	37	750	47.33	37	750	47.33	37
4X130XR	3140	50.00	157	3140	50.00	157	3140	50.00	157	3140	50.00	157	3140	50.00	157	3140	62.42	196	3140	62.42	196
4X174XR	27332	77.27	2112	27332	77.27	2112	27332	77.27	2112	27332	77.27	2112	27332	77.27	2112	27332	77.27	2112	27332	77.56	2120
4X265XR	20230	97.68	1976	20230	97.68	1976	20230	97.68	1976	20230	97.68	1976	20230	97.68	1976	20230	97.68	1976	20230	97.92	1981
4X207XR	53448	91.23	4876	26990	91.22	2463	18170	91.20	1659	16296	91.25	1487	14402	91.24	1314	14402	91.24	1314	1552	92.78	144
4X360XR	43676	87.58	3825	43676	87.58	3825	43676	87.58	3825	60710	104.89	6368	22840	104.90	2396	11690	104.88	1226	11690	102.22	1195
4X410XR	133072	75.22	13147	99954	75.92	7588	47338	74.87	4872	7250	101.38	735	7035	104.92	1035	9050	104.86	949	36020	110.97	3977
4X462XR	6912	95.49	660	6912	95.49	660	6912	111.11	768	6912	111.11	768	6912	111.11	768	6912	111.11	768	6912	111.11	768
3X320XR	7406	97.70	919	7406	97.70	919	7406	97.70	919	7406	97.70	919	7406	97.70	919	7406	97.70	919	7406	97.70	919
5.5X180XR	62604	94.68	5946	62604	94.68	5946	62604	94.68	5946	18168	105.64	1883							59820	108.43	6486
3.2X160XR													15020	105.99	1572	16400	105.98	1738	16400	114.21	1873
4X210XR	17103	115.01	1967	17103	115.01	1967	17103	115.01	1967	7078	99.46	704	4494	99.47	447	4494	99.47	447	4320	115.05	497
LAMA SAC 43X0				19848	179.99	3572	19848	179.99	3572	6639	180.00	1195	6639	180.00	1195						
PROFILLER	494921	214.51	106166	739723	223.99	165693	646201	222.52	143795	439822	209.92	92329	341862	209.65	71671	349350	219.75	76770	286202	210.57	60265
6.5X20 1159	15165	238.77	3621	190000	237.33	45073	112205	239.33	26854	43521	239.31	10415	43521	239.31	10415	43521	239.31	10415	133	233.08	31
7.0X20 1160	179564	238.78	42876	205549	240.37	49407	205549	240.37	49407	67854	211.93	14380				51840	276.76	14347	33496	254.39	8521
7.5X20 2650	58616	170.58	10770	58616	170.58	10770	58616	170.58	10770	58616	170.58	10770	58616	170.58	10770	58616	170.58	10770	58616	170.58	10770
8.0X20 1161	243576	200.67	48879	287558	208.75	60023	271831	208.75	56744	271831	208.75	56744	241725	208.77	50466	197373	208.83	41218	195957	208.84	40923
SEGMAN-FLANS-COMBRING	107920	218.93	23627	91194	242.88	22147	76660	301.20	23072	92480	327.44	30467	71787	334.81	24102	58871	355.27	20715	93943	375.58	35283
SEGMAN	11804	253.81	2996	11948	365.81	4371	24376	411.52	10031	24493	418.95	10261	21524	418.97	9018	15367	420.10	6456	27121	422.06	11447
FLANS	42066	189.08	8127	31196	189.08	5275	9367	201.37	1971	14704	297.24	4371	9790	307.12	2977	4781	315.45	1571	14750	318.91	4706
COMBRING	48050	260.23	12504	48050	260.23	12504	42923	260.23	11170	53283	297.19	15835	41683	297.19	12388	38523	334.56	12888	52064	367.43	19130

1984 YILI ENERJI KULLANIM BILGILERI

ENERJI	OCAK			SUBAT			MART			NISAN			MAYIS			HAZIRAN		
	KWH	BIRIM FIYAT	TUTAR (000)TL	KWH	BIRIM FIYAT	TUTAR (000)TL	KWH	BIRIM FIYAT	TUTAR (000)TL	KWH	BIRIM FIYAT	TUTAR (000)TL	KWH	BIRIM FIYAT	TUTAR (000)TL	KWH	BIRIM FIYAT	TUTAR (000)TL
ELEKTRIK	119280	13.010	1552	124800	13.343	1665	137760	13.510	1861	122640	13.510	1657	105360	14.999	1580	60960	14.999	914

1984 YILI SABIT DEGER BILGILERI

SABIT DEGER	DÖNEM BASI			OCAK			SUBAT			MART			NISAN			MAYIS			HAZIRAN		
	MIKTAR (000 TL)	BIRIM HAL.	TUTAR (000)TL	MIKTAR (000 TL)	BIRIM HAL.	TUTAR (000)TL	MIKTAR (000 TL)	BIRIM HAL.	TUTAR (000)TL	MIKTAR (000 TL)	BIRIM HAL.	TUTAR (000)TL	MIKTAR (000 TL)	BIRIM HAL.	TUTAR (000)TL	MIKTAR (000 TL)	BIRIM HAL.	TUTAR (000)TL	MIKTAR (000 TL)	BIRIM HAL.	TUTAR (000)TL
GENEL TOPLAM	2611963	1.15%	30156	2620757	1.15%	30156	2634390	1.14%	30156	2640674	1.14%	30156	2647031	1.14%	30156	2652730	1.14%	30156	2654073	1.14%	30156
BINA VE ARAZI	234887	0.18%	435	234887	0.18%	435	234887	0.18%	435	234887	0.18%	435	234887	0.18%	435	234887	0.18%	435	234887	0.18%	435
MAKINA TESISLER	2064002	0.77%	15992	2072002	0.77%	15992	2077435	0.77%	15992	2081815	0.77%	15992	2081688	0.77%	15992	2082025	0.77%	15992	2085516	0.77%	15992
KALIP MODEL VE APARAT	269330	4.92%	13252	269330	4.92%	13252	274020	4.84%	13252	274208	4.83%	13252	281608	4.71%	13252	281608	4.71%	13252	281420	4.71%	13252
KARA NAKIL VASITALARI	13351	1.01%	135	13351	1.01%	135	13351	1.01%	135	13351	1.01%	135	13351	1.01%	135	13351	1.01%	135	13351	1.01%	135
DEMIRBAS MEFRUSAT	30393	1.12%	342	31189	1.10%	342	34847	0.98%	342	37213	0.92%	342	38319	0.89%	342	40859	0.84%	342	38899	0.88%	342

1984 YILI PERSONEL BILGILERI

PERSONEL	OCAK			SUBAT			MART			NISAN			MAYIS			HAZIRAN		
	MIKTAR	BIRIM MAL.	TUTAR (000)TL	MIKTAR	BIRIM MAL.	TUTAR (000)TL	MIKTAR	BIRIM MAL.	TUTAR (000)TL	MIKTAR	BIRIM MAL.	TUTAR (000)TL	MIKTAR	BIRIM MAL.	TUTAR (000)TL	MIKTAR	BIRIM MAL.	TUTAR (000)TL
GENEL MUDURLUK (Adam/Ay)	19	227316	4319	19	226316	4300	19	229368	4358	22	217071	4776	21	233905	4912	21	256095	5378
F A B R I K A (Adam/Ay)	43	153419	6593	42	176119	7397	42	166071	6975	41	156951	6435	41	146683	6014	40	193325	7733
F A B R I K A (Adam/Saat)	44984	273	12280	46001	276	12713	46291	278	13420	39630	307	12262	41331	292	12074	41093	330	13548
NORMAL CALISMA TOPLAMI	40496.8	277	11204	38062.4	287	10919	40513.9	288	11672	36610.3	314	11489	40266.6	293	11808	37386.1	337	12615
Kesme Pres	4516.6	284	1283	4274.7	274	1265	4478.2	294	1323	4152.7	312	1295	4789.7	291	1394	4475.7	335	1500
Torna Matkap	4640.5	255	1183	4660.5	264	1232	4572.5	264	1213	4364.2	301	1314	4734.4	281	1330	4568.0	324	1478
Traktor	2983.5	252	746	2773.5	261	729	2561.7	261	667	2148.7	293	640	2151.2	278	599	2205.2	321	707
Segman Flans	662.2	305	208	697.7	316	221	1281.0	316	405	1379.2	311	428	1968.0	290	570	1436.0	334	479
Kanyon	4056.5	295	1197	3827.2	306	1171	3767.5	306	1151	3574.5	317	1132	3934.5	295	1162	3502.5	340	1192
Kaynak	6461.9	266	1718	6117.0	276	1686	6588.0	275	1813	6113.2	309	1889	5543.5	288	1599	5186.5	332	1723
Boya	4730.0	285	1361	4299.7	295	1270	4883.9	295	1382	4304.2	313	1345	4471.5	292	1310	4420.0	336	1485
Montaj	1957.0	197	385	1683.0	204	343	1697.0	204	346	1479.2	293	434	1655.5	274	453	1687.5	315	532
Kalite Kontrol	770.7	253	195	716.2	262	187	734.7	261	192	670.2	276	185	1002.5	276	277	849.7	318	270
Forklift Amhar	1987.9	290	577	1815.7	301	546	1829.4	300	550	1488.2	324	482	1829.2	302	553	1634.4	348	569
Yardimci Isletme	2088.5	298	616	1783.0	309	613	1754.4	307	603	1673.5	338	573	2059.0	315	650	2009.5	363	730
Kaliphane	2003.8	317	636	1878.2	329	618	2557.7	329	840	2187.0	348	761	2614.7	325	849	2370.7	374	887
Yemek	750.2	314	293	838.0	325	289	788.2	325	315	877.5	333	293	1001.7	311	311	842.7	358	302
Idari	1264.5	287	363	1230.5	298	367	1389.7	298	414	1030.5	312	321	1159.2	291	337	1275.2	335	427
Koruma	1375.0	314	433	1177.5	325	383	1410.0	325	458	1147.5	333	382	1532.0	311	476	722.5	458	330
FAZLA CALISMA TOPLAMI	4487.5	235	1056	7938.9	226	1794	7777.5	225	1748	3020.0	256	773	1114.5	257	286	3706.5	252	933
Kesme Pres	624.0	239	149	985.0	231	228	897.0	230	180	270.0	248	67	80.0	247	15	670.5	250	93
Torna Matkap	196.5	215	42	580.5	208	121	614.0	206	127	98.0	240	23	26.5	238	6	136.5	241	33
Traktor	473.0	212	100	867.5	205	178	835.5	203	169	127.0	237	30	55.0	236	13	381.0	237	91
Segman Flans	105.5	257	27	152.0	249	38	224.0	247	55	39.0	247	10	20.0	246	5	32.5	249	8
Kanyon	248.5	248	62	744.0	240	179	701.5	239	167	248.0	252	62	36.5	250	9	35.0	254	9
Kaynak	515.5	224	115	1089.5	217	236	1177.5	215	253	135.0	246	33	12.0	244	3	732.0	248	181
Boya	507.0	240	122	835.0	232	194	1088.5	230	250	352.0	247	88	25.0	247	6	734.5	250	184
Montaj	241.5	165	40	377.5	160	61	357.0	159	57	169.0	233	39	10.5	232	2	142.5	235	33
Kalite Kontrol	107.0	212	23	224.0	206	46	203.0	204	41	97.0	236	23	45.2	234	11	152.5	237	36
Forklift Amhar	305.0	244	74	468.0	237	111	459.0	235	108	198.0	258	51	170.8	256	44	210.5	260	55
Yardimci Isletme	303.5	251	76	431.0	243	105	376.0	241	91	460.0	269	124	121.0	267	32	318.0	271	86
Kaliphane	470.5	267	126	501.5	259	130	513.5	257	132	458.0	277	127	129.5	275	36	159.0	279	44
Yemek	259.0	264	68	421.5	256	108	374.5	254	100	250.0	265	66	285.0	263	75	234.5	267	63
Idari	129.0	242	31	261.9	234	61	304.5	232	71	117.0	248	29	116.5	247	29	69.5	250	17

1/1/1984 - 22/6/1984 G I R D I / C I K T I F A K T O R L E R I

	DONEM BASI			OCAK			SUBAT			MART			NISAN			MAYIS			HAZIRAN		
G I R D I / C I K I I	MIKTAR	BIRIM MAL.	TUTAR (000)TL	MIKTAR	BIRIM MAL.	TUTAR (000)TL	MIKTAR	BIRIM MAL.	TUTAR (000)TL	MIKTAR	BIRIM MAL.	TUTAR (000)TL	MIKTAR	BIRIM MAL.	TUTAR (000)TL	MIKTAR	BIRIM MAL.	TUTAR (000)TL	MIKTAR	BIRIM MAL.	TUTAR (000)TL
H A M U L STOKLARI																					
G E N E L T O P L A M	410	11096	4549	1470	7075	10400	752	4909	3691	447	4123	1843	1949	6764	13183	1213	11146	13521	6154	6646	40899
T R A K T O R TOPLAMI	222	15929	3536	274	3832	1050	378	3745	1471	378	3829	1447	274	3764	1031	472	5222	2465	3212	5087	16339
Turk Traktor GOSEK	168	5388	1013	989	5883	5818	374	5883	2200	69	5735	396	1283	5735	7358	134	6452	865	2396	6452	15459
K A M Y O N TOPLAMI	0	13703	0	207	17033	3532	0	17033	0	0	18300	0	392	12229	4794	459	17740	7960	402	19702	8000
H A F I F TICARI TOPLAMI	0	4829	0	0	5957	0	0	5957	0	0	6370	0	0	6370	0	148	7641	1131	144	7641	1100
YARI M A M U L STOKLARI																					
G E N E L T O P L A M	8901	10413	92690	7698	11878	91443	8100	10365	83959	8086	11113	89864	11013	11608	127840	8996	12256	110257	10007	13193	132022
T R A K T O R TOPLAMI	3380	9371	31648	3107	8964	27847	4278	7319	40054	2644	10226	27040	4758	8957	42615	3829	7898	30244	3240	9461	30653
K A M Y O N TOPLAMI	3257	14468	47129	3176	17367	55166	1845	17478	32248	2559	17372	44464	4137	17339	71730	3442	19415	66835	4332	19104	82765
H A F I F TICARI TOPLAM	1784	4829	8613	1415	5957	8431	1957	5957	11656	2882	6370	18361	2119	6370	13495	1725	7641	13179	2435	7641	18604
M A L Z E M E STOKLARI																					
G E N E L T O P L A M	1410906	143	202040	1446610	169	243953	1194581	175	209151	1122612	159	178120	765262	166	126900	817282	165	134709	854611	164	140484
S A C L A R	508065	89	72247	615693	91	56111	471712	90	42264	590310	94	55324	351413	89	31127	407061	91	37024	474486	95	44936
P R O F I L L E R	494921	215	106166	739723	224	165693	646201	223	143795	439822	210	92329	341862	210	71671	349350	220	76770	286202	211	60265
SEGMAN-FLANS-CONDRING	107920	219	23627	91194	243	22149	76868	301	23092	72400	329	30467	71987	335	24102	58871	355	20915	73963	376	35283

1/1/1984 - 22/6/1984 G I R D I / C I K T I F A K T Ö R L E R İ

G I R D I / C I K T I	O C A K			Ş U B A T			M A R T			N I S A N			M A Y I S			H A Z I R A N		
	MIKTAR	BIRIM NAL.	TUTAR (000)TL	MIKTAR	BIRIM NAL.	TUTAR (000)TL	MIKTAR	BIRIM NAL.	TUTAR (000)TL	MIKTAR	BIRIM NAL.	TUTAR (000)TL	MIKTAR	BIRIM NAL.	TUTAR (000)TL	MIKTAR	BIRIM NAL.	TUTAR (000)TL
S A T I S L A R																		
G E N E L T O P L A M	15406	12437	191608	14169	13069	185175	16745	11541	193250	14993	11853	177714	15345	11758	180432	7261	11511	83579
T R A K T Ö R T O P L A M I	6604	7817	51634	4304	6764	33453	6068	7304	47358	4744	8015	38024	5279	9031	47674	3227	5739	18531
Turk Traktor GÖDEK	3102	8650	26832	2930	8650	25345	2039	8650	17637	830	8650	7180	2801	8650	24229	1071	8650	9264
K A M Y O N T O P L A M I	4283	21725	93467	3112	20050	122545	4845	15747	73148	3278	14747	48336	3203	16578	53100	2687	19357	52051
H A F I F T I C A R I T O P L A M I	1437	13691	19675	323	11863	3832	3993	13802	55110	5921	13895	82274	4062	13646	55430	272	13724	3733
S A T I N A L M A																		
G E N E L T O P L A M	720170	188	135358	194535	182	35392	742449	134	99560	268647	114	30702	461481	146	67447	335206	215	72192
S A Ç L A R	327760	108	35365	144144	103	14911	687804	104	68449	256687	105	26871	372180	104	38806	212087	150	31785
P R O F I L L E R	369932	244	90278										51840	277	14347	59680	283	16903
SEGMAN-FLANŞ-CUMBRING	22478	425	9545	50391	406	20481	82845	378	31111	11780	320	3831	37461	382	14294	63457	370	23504
S A B I T D E G E R L E R																		
G E N E L T O P L A M	2611963	1.15%	30156	2620759	1.15%	30156	2634590	1.14%	30156	2640674	1.14%	30156	2649831	1.14%	30156	2652730	1.14%	30156
B I N A V E A R A Z I	234087	0.18%	435	234087	0.18%	435	234087	0.18%	435	234087	0.18%	435	234087	0.18%	435	234087	0.18%	435
M A K I N A T E S I S L E R	2064002	0.77%	15992	2072002	0.77%	15992	2077485	0.77%	15992	2081015	0.77%	15992	2081666	0.77%	15992	2082025	0.77%	15992
K A L I P M O D E L V E A P A R A T	267330	4.72%	13252	267330	4.72%	13252	274020	4.84%	13252	274200	4.83%	13252	281603	4.71%	13252	281600	4.71%	13252
K A R A N A K I L V A S I T A L A R I	13351	1.01%	135	13351	1.01%	135	13351	1.01%	135	13351	1.01%	135	13351	1.01%	135	13351	1.01%	135
D E N I Z A S I N E F R U S A T	30393	1.12%	342	31189	1.10%	342	34847	0.98%	342	37213	0.92%	342	38319	0.89%	342	40859	0.84%	342
E N E R J I																		
E L E K T R I K	119280	13	1552	124800	13	1665	137760	14	1861	122640	14	1657	105360	15	1580	60960	15	914
P E R S O N E L																		
GENEL MÜDÜRLÜK (Adam/Ay)	19	227316	4319	19	226316	4300	19	229368	4358	22	217091	4776	21	233905	4912	21	256095	5378
F A B R I K A (Adam/Ay)	43	155417	6683	42	176119	7377	42	166071	6975	41	136751	5605	41	146683	6014	40	173325	7733
F A B R I K A (Adam/Saat)	44984	273	12260	46001	276	12713	48291	278	13420	39630	309	12262	41381	292	12094	41093	330	13548

1/1/1984 - 30/6/1984 G I R D I / C I K T I F A K T O R L E R I

G I R D I / C I K T I	OCAK			SUBAT			MART			NISAN			MAYIS			HAZIRAN (22/6)			HAZIRAN (30/6)		
	MIKTAR	BIRIM MAL.	TUTAR (000)TL	MIKTAR	BIRIM MAL.	TUTAR (000)TL	MIKTAR	BIRIM MAL.	TUTAR (000)TL	MIKTAR	BIRIM MAL.	TUTAR (000)TL	MIKTAR	BIRIM MAL.	TUTAR (000)TL	MIKTAR	BIRIM MAL.	TUTAR (000)TL	MIKTAR	BIRIM MAL.	TUTAR (000)TL
CIKTILAR			196212			170981			197307			227030			163187			132722			176963
MAMUL URETIMI (ADET)																					
GENEL TOPLAM	15263	12856	196212	13853	12345	170981	16426	12012	197307	19422	11689	227030	12592	12960	163187	13213	10045	132722	17617	10045	176963
TRAKTOR TOPLAMI	5702	6785	40047	6100	7558	46102	4414	7770	34278	6754	7878	54704	4548	8077	36736	6380	6100	32815	7173	6100	43753
Turk Traktor GÖBEK	3903	8106	31638	2315	9385	21726	1734	9131	15833	2044	6919	14142	1652	10736	17735	3333	7158	23859	4444	7158	31811
KAMYON TOPLAMI	4387	23751	105036	4574	21011	76075	5357	13723	65362	5267	13320	80673	2376	20573	52472	3522	17001	58722	4896	17001	87227
HAFIF TICARI TOPLAMI	1069	18240	19492	864	8164	7057	4919	12567	61815	5157	15010	77409	3816	14738	56244	978	9333	9127	1304	9333	12170
GIRDILER			141731			119028			130388			130773			108300			116413			133857
HALZEME KULLANIMI (KG)			93444			70194			130592			81922			59638			66417			88556
GENEL TOPLAM	684466	137	93444	446564	157	70194	814418	160	130592	625997	131	81922	409461	146	59638	297877	223	66417	397169	223	88556
SACLAR	520132	77	51671	238125	100	23758	541206	102	55389	475384	103	31083	314532	105	32907	146664	163	23873	175552	163	31831
PROFILLER	125130	246	30751	93522	234	21898	206379	249	51466	97960	211	20658	44352	209	9248	122828	272	33408	163771	272	44544
SEDDAN PLANS-CONBRING	39204	281	11022	84917	301	25538	66833	355	23737	32453	314	10176	50577	348	17481	28305	322	9136	37847	322	12182
SABIT DEGERLER (000 TL)			30156			30156			30156			30156			30156			30156			30156
GENEL TOPLAM	2611963	1.15%	30156	2620759	1.15%	30156	2634590	1.14%	30156	2640674	1.14%	30156	2649831	1.14%	30156	2652730	1.14%	30156	2652730	1.14%	30156
BINA VE ARAZI	234887	0.18%	435	234887	0.18%	435	234887	0.18%	435	234887	0.18%	435	234887	0.18%	435	234887	0.18%	435	234887	0.18%	435
MAKINA TESISLER	2064002	0.77%	15992	2072002	0.77%	15992	2077485	0.77%	15992	2081015	0.77%	15992	2081666	0.77%	15992	2082025	0.77%	15992	2082025	0.77%	15992
KALIP MOBEL VE APARAT	267330	4.92%	13252	267330	4.92%	13252	274020	4.84%	13252	274208	4.83%	13252	281608	4.71%	13252	281608	4.71%	13252	281608	4.71%	13252
KARA NAKIL VASITALARI	13351	1.01%	135	13351	1.01%	135	13351	1.01%	135	13351	1.01%	135	13351	1.01%	135	13351	1.01%	135	13351	1.01%	135
DEMIRBAS MUFRUSAT	30373	1.12%	342	31107	1.10%	342	34847	0.98%	342	37213	0.92%	342	38317	0.89%	342	40357	0.84%	342	40357	0.84%	342
ENERJI (KWH)			1552			1665			1861			1657			1580			914			1219
ELEKTRIK	119280	13	1552	124800	13	1665	137760	14	1861	122640	14	1657	105360	15	1580	60960	15	914	81280	15	1219
PERSONEL			16577			17013			17773			17030			17006			18726			18726
GENEL MUDURLUK (Adam/Ay)	19	227316	4319	19	226316	4300	19	229368	4358	22	217091	4776	21	233905	4912	21	256095	5378	21	256095	5378
FABRIKA (Adam/Ay)	43	135419	5823	42	176119	7377	42	166071	6975	41	156751	6425	41	146683	6014	40	193325	7733	40	193325	7733
FABRIKA (Adam/Saat)	44984	273	12260	46001	276	12713	48291	278	13420	39630	309	12262	41381	292	12094	41093	330	13548	41093	330	13548

APPENDIX B

ANALYSIS TABLES

1/1/1984 - 30/6/1984 G I R D I / C I K T I   F A K T O R L E R I

G I R D I / C I K T I	ÜCAK HIKTAR	ÜCAK BIRIM HAL.	ÜCAK TUTAR (000)TL	SUBAT HIKTAR	SUBAT BIRIM HAL.	SUBAT TUTAR (000)TL	MART HIKTAR	MART BIRIM HAL.	MART TUTAR (000)TL	NISAN HIKTAR	NISAN BIRIM HAL.	NISAN TUTAR (000)TL	MAYIS HIKTAR	MAYIS BIRIM HAL.	MAYIS TUTAR (000)TL	HAZIRAN(30/6) HIKTAR	HAZIRAN(30/6) BIRIM HAL.	HAZIRAN(30/6) TUTAR (000)TL
** C I K T I L A R **			196212			170981			197307			227030			163187			176963
H A M U L URETIMI (ADET)																		
G E N E L T O P L A M	15263	12856	196212	13853	12343	170981	16426	12012	197307	19422	11689	227030	12592	12960	163187	17617	10045	176963
T R A K T O R TOPLAMI	5902	6785	40047	5100	7553	45102	4414	7770	34293	6754	7373	54784	4543	8077	35736	7173	6100	43753
Turk Traktor GOBEK	3903	8106	31638	2315	9385	21726	1734	9131	15833	2044	6919	14142	1652	10736	17735	4444	7158	31811
K A M Y O N TOPLAMI	4387	23931	105038	4374	21011	76075	5559	15723	85352	5267	15320	80675	2575	20373	52472	4595	17001	87229
H A F I F TICARI TOPLAMI	1069	18240	19492	864	8164	7057	4919	12567	61815	5157	15010	77409	3816	14738	56244	1304	9333	12170
** G I R D I L E R **			141731			119028			180300			150772			108300			138857
M A L Z E M E KULLANIMI (KG)			93444			70194			130592			81922			59638			88556
G E N E L T O P L A M	684466	137	93444	446564	157	70194	814418	160	130592	625997	131	81922	409461	146	59638	397169	223	88556
S A C L A R	520132	99	51671	238125	100	23753	541206	102	55337	475534	103	51068	314532	105	32707	175552	183	31831
P R O F I L L E R	125130	246	30751	93522	234	21898	206379	249	51466	97960	211	20658	44352	209	9248	163771	272	44544
SEGMAN-FLANS-COMBRING	37204	201	11022	64717	301	19538	68833	355	23737	32453	314	10176	50377	346	17431	37847	322	12182
S A B I T DEGERLER (000 TL)			30156			30156			30156			30156			30156			30156
G E N E L T O P L A M	2611963	1.15%	30156	2620759	1.15%	30156	2634590	1.14%	30156	2640674	1.14%	30156	2649831	1.14%	30156	2652730	1.14%	30156
-BINA VE ARAZI	234887	0.18%	435	234887	0.18%	435	234887	0.18%	435	234887	0.18%	435	234887	0.18%	435	234887	0.18%	435
MAKINA TESISLER	2064002	0.77%	15992	2072002	0.77%	15992	2077485	0.77%	15992	2081015	0.77%	15992	2081666	0.77%	15992	2082025	0.77%	15992
KALIP MODEL VE APARAT	287330	4.72%	13252	287330	4.72%	13252	274020	4.84%	13252	274203	4.83%	13252	281603	4.71%	13252	281603	4.71%	13252
KARA NAKIL VASITALARI	13351	1.01%	135	13351	1.01%	135	13351	1.01%	135	13351	1.01%	135	13351	1.01%	135	13351	1.01%	135
DEMIRBAS MEFRUSAT	30373	1.12%	342	31137	1.10%	342	34847	0.98%	342	37213	0.92%	342	38319	0.89%	342	40357	0.84%	342
E N E R J I (KWH)			1552			1665			1861			1657			1580			1219
ELEKTRIK	119280	13	1552	124800	13	1665	137760	14	1861	127640	14	1657	105360	15	1580	81280	15	1219
P E R S O N E L			16579			17015			17778			17038			17006			18926
GENEL MUDURLUK (Adam/Ay)	19	227316	4319	19	226316	4300	19	229368	4358	22	217091	4776	21	233905	4912	21	256095	5378
F A B R I K A (Adam/Ay)	43	155419	6683	42	175119	7377	42	166071	6975	41	156951	6435	41	146683	6014	40	173325	7733
F A B R I K A (Adam/Saat)	44984	273	12260	46001	276	12713	48291	278	13420	39630	309	12262	41381	292	12094	41093	330	13548

B.1.

1/1/1984 - 30/6/1984 GİRDİ/ÇIKTI FAKTÖRLERİ DEĞİŞİM ORANLARI

GİRDİ/ÇIKTI	OCAK			ŞUBAT			MART			NİSAN			MAYIS			HAZİRAN(30/6)		
	MİKTAR	BİRİM HAL.	TUTAR (000)TL	MİKTAR	BİRİM HAL.	TUTAR (000)TL	MİKTAR	BİRİM HAL.	TUTAR (000)TL	MİKTAR	BİRİM HAL.	TUTAR (000)TL	MİKTAR	BİRİM HAL.	TUTAR (000)TL	MİKTAR	BİRİM HAL.	TUTAR (000)TL
ÇIKTILAR	1.0000	1.0000	1.0000	0.9448	0.9224	0.8714	1.3352	0.7531	1.0056	1.4468	0.7998	1.1571	0.8944	0.9299	0.8317	1.1256	0.8013	0.9019
MAMUL ÜRETİMİ																		
GENEL TOPLAM	1.0000	1.0000	1.0000	0.9448	0.9274	0.8714	1.3352	0.7531	1.0056	1.4468	0.7998	1.1571	0.8944	0.9299	0.8317	1.1256	0.8013	0.9019
TRAKTÖR TOPLAMI	1.0000	1.0000	1.0000	1.0335	1.1137	1.1512	0.7477	1.1452	0.8564	1.1782	1.1611	1.3680	0.7706	1.1704	0.9173	1.2153	0.8770	1.0726
Turk Traktor GÖBEK	1.0000	1.0000	1.0000	0.5931	1.1578	0.6867	0.4443	1.1264	0.5004	0.5237	0.8535	0.4470	0.4233	1.3244	0.5606	1.1386	0.8831	1.0055
KAMYON TOPLAMI	1.0000	1.0000	1.0000	1.0421	0.8700	0.9149	1.2211	0.6838	0.8127	1.2001	0.6402	0.7683	0.8388	0.8513	0.4778	1.0677	0.7940	0.8475
HAFİF TİCARİ TOPLAMI	1.0000	1.0000	1.0000	0.8089	0.4476	0.3621	4.6027	0.6890	3.1713	4.8259	0.8229	3.9713	3.5711	0.8080	2.8855	1.2202	0.5117	0.6243
GİRDİLER	1.0000	1.0000	1.0000	0.8427	1.0107	0.8518	1.2102	1.0431	1.2624	0.7218	1.0027	0.7245	0.7487	1.0292	0.7708	0.8374	1.1767	0.7877
MALZEME KULLANIMI																		
GENEL TOPLAM	1.0000	1.0000	1.0000	0.7476	1.0048	0.7512	1.3192	1.0594	1.3975	0.8821	0.9938	0.8767	0.6032	1.0581	0.6382	0.7525	1.2594	0.9477
SAÇLAR	1.0000	1.0000	1.0000	0.8337	1.0047	0.8376	1.0405	1.0302	1.0720	0.7528	1.0373	0.7808	0.8047	1.0332	0.8317	0.8750	1.0385	0.9168
PROFİLLER	1.0000	1.0000	1.0000	0.7474	0.9528	0.7121	1.6493	1.0147	1.6736	0.7829	0.8581	0.6718	0.3544	0.8485	0.3007	1.3088	1.1068	1.4485
SOĞUMA-FLANŞ-CÖVÜRİNG	1.0000	1.0000	1.0000	1.6359	1.0705	1.7726	1.7047	1.2832	2.1885	0.8278	1.1174	0.9250	1.2701	1.2273	1.5588	0.7634	1.1448	1.1052
SABİT DEĞERLER																		
GENEL TOPLAM	1.0000	1.0000	1.0000	1.0024	0.9977	1.0000	1.0128	0.9874	1.0000	1.0149	0.9853	1.0000	1.0275	0.9732	1.0000	1.0286	0.9722	1.0000
BİNA VE ARAZİ	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
MAKİNA TESİSLER	1.0000	1.0000	1.0000	1.0039	0.9961	1.0000	1.0065	0.9935	1.0000	1.0082	0.9918	1.0000	1.0086	0.9915	1.0000	1.0087	0.9913	1.0000
MALİP MÜDT. VE APARAT	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0174	0.9827	1.0000	1.0181	0.9822	1.0000	1.0456	0.9564	1.0000	1.0456	0.9564	1.0000
KARA NAKİL VASITALARI	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
DEMİRBAŞ MEFRUŞAT	1.0000	1.0000	1.0000	1.0262	0.9745	1.0000	1.1485	0.8722	1.0000	1.2244	0.8167	1.0000	1.2603	0.7932	1.0000	1.3444	0.7437	1.0000
ENERJİ																		
ELEKTRİK	1.0000	1.0000	1.0000	1.0463	1.0256	1.0731	1.1549	1.0384	1.1993	1.0282	1.0384	1.0677	0.8833	1.1529	1.0183	0.8814	1.1529	0.7856
PERSONEL																		
GENEL TOPLAM	1.0000	1.0000	1.0000	1.0052	1.0439	1.0494	1.0321	1.0310	1.0641	0.9532	1.0586	1.0091	0.9640	1.0266	0.9896	0.9539	1.2014	1.1460
GENEL MÜDÜRLÜK (Adam/Ay)	1.0000	1.0000	1.0000	1.0000	0.7756	0.7756	1.0000	1.0070	1.0070	1.1377	0.7550	1.1053	1.1053	1.0270	1.1373	1.1053	1.1266	1.2452
FABRİKA (Adam/Ay)	1.0000	1.0000	1.0000	0.9767	1.1332	1.1068	0.9767	1.0685	1.0437	0.9535	1.0099	0.9629	0.9535	0.9438	0.8999	0.9302	1.2439	1.1571
FABRİKA (Adam/Saat)	1.0000	1.0000	1.0000	1.0228	1.0140	1.0367	1.0735	1.0177	1.0748	0.9810	1.1353	1.0002	0.7177	1.0724	0.7695	0.7145	1.2077	1.1051

1/1/1984 - 30/6/1984 GİRDİ/ÇIKTI FAKTÖRLERİ (000) TL DEĞİŞİMLERİ

	OCAK			ŞUBAT			MART			NİSAN			MAYIS			HAZİRAN		
GİRDİ/ÇIKTI	MİKTAR	BİRİM MAL.	TUTAR (000)TL	MİKTAR	BİRİM MAL.	TUTAR (000)TL	MİKTAR	BİRİM MAL.	TUTAR (000)TL	MİKTAR	BİRİM MAL.	TUTAR (000)TL	MİKTAR	BİRİM MAL.	TUTAR (000)TL	MİKTAR	BİRİM MAL.	TUTAR (000)TL
ÇIKTILAR	0	0	0	-10839	-14392	-25231	65766	-64671	1095	87660	-56842	30818	-20718	-12308	-33026	24646	-43895	-19249
MAMUL ÜRETİMİ																		
GENEL TOPLAM	0	0	0	-10839	-14392	-25231	65766	-64671	1095	87660	-56842	30818	-20718	-12308	-33026	24646	-43895	-19249
TRAKTÖR TOPLAMI	0	0	0	1340	4716	6056	-10076	4348	-5749	7135	7602	14737	-7137	5376	-3311	3623	-4717	-1094
Turk Traktor GÖBEK	0	0	0	-12872	2961	-9911	-17582	1777	-15805	-13069	-2427	-17496	-18247	4344	-13902	4385	-4212	174
KAMYON TOPLAMI	0	0	0	4418	-13353	-8940	23720	-42374	-17674	21017	-43357	-24341	-43400	-7184	-52584	7346	-23153	-15807
HAFİF TİCARİ TOPLAMI	0	0	0	-3724	-8710	-12435	70224	-27902	42323	74525	-16658	57917	50115	-13363	36752	4292	-11614	-7322
GİRDİLER	0	0	0	-23322	1533	-21787	51290	7747	59038	-11610	403	-11208	-57268	5248	-52020	-23335	22012	-1324
HAMMADDE KULLANIMI																		
GENEL TOPLAM	0	0	0	-23587	336	-23250	29829	7319	37147	-11014	-509	-11522	-37079	3272	-33806	-23130	18242	-4888
SAÇLAR	0	0	0	-23048	135	-22713	2074	1824	3718	-2437	1833	-603	-20425	1663	-18762	-32244	12404	-17840
PROFİLLER	0	0	0	-7768	-1085	-8853	19967	748	20715	-6677	-3416	-10093	-19851	-1652	-21503	9496	4297	13793
SOĞUK PLANG-CONDARING	0	0	0	7229	1286	8515	7788	4746	12714	-1373	1072	-326	3178	3261	6439	-332	1541	1159
SABİT DEĞERLER																		
GENEL TOPLAM	0	0	0	71	-71	0	385	-385	0	449	-449	0	830	-830	0	862	-862	0
BİNA VE ARAZİ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MAKİNA TESİSLER	0	0	0	62	-62	0	104	-104	0	132	-132	0	137	-137	0	140	-140	0
KALIP KÜÇÜ VE APARAT	0	0	0	0	0	0	231	-231	0	240	-240	0	504	-504	0	504	-504	0
KARA NAKİL VASITALARI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DEMİRBAŞ MÜFRUŞAT	0	0	0	7	-7	0	50	-50	0	77	-77	0	87	-87	0	118	-118	0
ENERJİ																		
ELEKTRİK	0	0	0	72	42	113	240	69	309	44	61	105	-181	210	28	-494	162	-333
PERSONEL																		
GENEL TOPLAM	0	0	0	122	1026	1148	746	745	1491	-1088	1299	211	-838	596	-242	-1072	4469	3397
ÜRÜN NÜVÜKLÜK (Adam/Ay)	0	0	0	0	-17	-17	0	37	37	632	-225	457	455	138	593	455	604	1059
FABRİKA (Adam/Ay)	0	0	0	-155	869	714	-155	447	292	-311	63	-248	-311	-358	-669	-466	1516	1050
FABRİKA (Adam/Saat)	0	0	0	277	176	453	701	257	1160	-1457	1481	2	-782	816	-186	-1061	2347	1286

1/1/1984 - 30/6/1984 GİRDİ/ÇIKTI FAKTÖRLERİ - ÜRETKENLİK ORANLARI

GİRDİ/ÇIKTI	OCAK			ŞUBAT			MART			NİSAN			MAYIS			HAZİRAN(30/6)		
	MİKTAR	BİRİM MAL.	TUTAR (000)TL	MİKTAR	BİRİM MAL.	TUTAR (000)TL	MİKTAR	BİRİM MAL.	TUTAR (000)TL	MİKTAR	BİRİM MAL.	TUTAR (000)TL	MİKTAR	BİRİM MAL.	TUTAR (000)TL	MİKTAR	BİRİM MAL.	TUTAR (000)TL
ÇIKTILAR	1.0000	1.0000	1.0000	1.1207	0.7126	1.0230	1.1032	0.7220	0.7965	1.5695	0.7974	1.2516	1.1943	0.7035	1.0770	1.3410	0.6807	0.7131
HAMUL ÜRETİMİ																		
GENEL TOPLAM	1.0000	1.0000	1.0000	1.1209	0.9126	1.0230	1.1032	0.7220	0.7965	1.5695	0.7974	1.2516	1.1943	0.9035	1.0790	1.3410	0.6809	0.9131
TRAKTÖR TOPLAMI	1.0000	1.0000	1.0000	1.2261	1.1022	1.3514	0.8180	1.0778	0.8784	1.2781	1.1577	1.4797	1.0270	1.1585	1.1901	1.4478	0.7840	1.1061
Turk Traktor GÖBEK	1.0000	1.0000	1.0000	0.7037	1.1456	0.8062	0.3671	1.0799	0.3964	0.5681	0.8510	0.4835	0.5652	1.2868	0.7273	1.3565	0.7505	1.0180
KANYON TOPLAMI	1.0000	1.0000	1.0000	1.2383	0.8687	1.0760	1.0070	0.8380	0.8438	1.3020	0.8383	0.8310	0.7836	0.8271	0.8481	1.2748	0.8740	0.8801
HAFİF TİCARİ TOPLAMI	1.0000	1.0000	1.0000	0.9597	0.4429	0.4250	3.8032	0.6605	2.5121	5.2355	0.8205	4.2957	4.7684	0.7851	3.7436	1.4537	0.4348	0.6321
GİRDİLER	1.0000	1.0000	1.0000	1.1207	0.7126	1.0230	1.1032	0.7220	0.7965	1.5695	0.7974	1.2516	1.1943	0.7035	1.0770	1.3410	0.6807	0.7131
HALZEME KULLANIMI																		
GENEL TOPLAM	1.0000	1.0000	1.0000	1.2637	0.9179	1.1600	1.0121	0.7109	0.7195	1.6401	0.8047	1.3198	1.4828	0.8788	1.3031	1.4959	0.6362	0.9517
SACLAR	1.0000	1.0000	1.0000	1.7055	0.7130	1.3557	1.2332	0.7311	0.7331	1.5134	0.7710	1.1707	1.4771	0.8327	1.3058	2.7737	0.4370	1.4641
PROFİLLER	1.0000	1.0000	1.0000	1.2641	0.9681	1.2237	0.8095	0.7422	0.6008	1.8480	0.9320	1.7224	2.5234	1.0959	2.7655	0.8600	0.7240	0.6226
SEDAN-FLANŞ CİVARING	1.0000	1.0000	1.0000	0.5705	0.3818	0.4718	0.7832	0.5782	0.4669	1.7477	0.7137	1.2507	0.6733	0.7564	0.5244	1.1660	0.5777	0.8161
SABİT DEĞERLER																		
GENEL TOPLAM	1.0000	1.0000	1.0000	0.9425	0.9245	0.8714	1.3183	0.7628	1.0056	1.4256	0.8117	1.1571	0.8704	0.9555	0.8317	1.0743	0.8241	0.9019
DİNA VE ARAZİ	1.0000	1.0000	1.0000	0.7448	0.7224	0.3714	1.3352	0.7531	1.0056	1.4468	0.7778	1.1571	0.8744	0.7277	0.8317	1.1256	0.8013	0.9017
MAKİNA TESİSLER	1.0000	1.0000	1.0000	0.9411	0.9259	0.8714	1.3265	0.7581	1.0056	1.4349	0.8064	1.1571	0.8868	0.9378	0.8317	1.1159	0.8082	0.9019
KAMYON MODEL VE APARAT	1.0000	1.0000	1.0000	0.7448	0.7224	0.3714	1.3123	0.7503	1.0056	1.4210	0.8142	1.1571	0.8354	0.9723	0.8317	1.0765	0.8370	0.9017
KARA NAKİL VASITALARI	1.0000	1.0000	1.0000	0.9448	0.9224	0.8714	1.3352	0.7531	1.0056	1.4468	0.7998	1.1571	0.8944	0.9299	0.8317	1.1256	0.8013	0.9019
DEMİRBAŞ MALZEMESİ	1.0000	1.0000	1.0000	0.7206	0.7465	0.3714	1.1845	0.8635	1.0056	1.1816	0.7772	1.1571	0.7074	1.1724	0.8317	0.8573	1.0772	0.9017
ENERJİ																		
ELEKTRİK	1.0000	1.0000	1.0000	0.9030	0.8993	0.8121	1.1561	0.7253	0.8385	1.4071	0.7702	1.0837	1.0126	0.8066	0.8167	1.6519	0.6950	1.1480
PERSONEL																		
GENEL TOPLAM	1.0000	1.0000	1.0000	0.9398	0.8836	0.8304	1.2937	0.7305	0.9450	1.5178	0.7555	1.1467	0.9278	0.9058	0.8404	1.1800	0.6667	0.7870
GENEL MÜDÜRLÜK (Adam/Ay)	1.0000	1.0000	1.0000	0.7448	0.7224	0.3753	1.3352	0.7464	0.7788	1.2475	0.8374	1.0463	0.8072	0.9037	0.7313	1.0104	0.7112	0.7243
FABRİKA (Adam/Ay)	1.0000	1.0000	1.0000	0.9675	0.8140	0.7875	1.3670	0.7048	0.9635	1.5173	0.7920	1.2017	0.9380	0.9852	0.9242	1.2100	0.6441	0.7794
FABRİKA (Adam/Saat)	1.0000	1.0000	1.0000	0.7237	0.7076	0.3404	1.2437	0.7386	0.7187	1.3422	0.7045	1.1567	0.7723	0.8671	0.8431	1.2322	0.6823	0.8162

1/1/1984 - 30/6/1984 GİRDİ/ÇIKTI FAKTÖRLERİ ÜRETKENLİK AĞIRLIKLARI

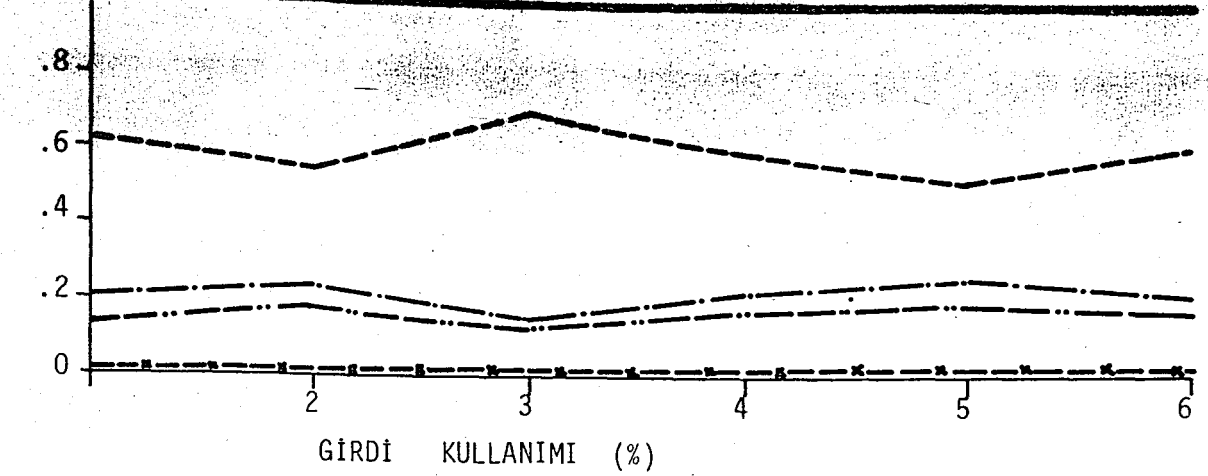
GİRDİ/ÇIKTI	OCAK			ŞUBAT			MART			NİSAN			MAYIS			HAZİRAN(30/6)		
	KULLANIM Z	DEĞİŞİM Z	AĞIRLIK	KULLANIM Z	DEĞİŞİM Z	AĞIRLIK	KULLANIM Z	DEĞİŞİM Z	AĞIRLIK	KULLANIM Z	DEĞİŞİM Z	AĞIRLIK	KULLANIM Z	DEĞİŞİM Z	AĞIRLIK	KULLANIM Z	DEĞİŞİM Z	AĞIRLIK
ÇIKTILAR	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
MAMUL ÜRETİMİ																		
GENEL TOPLAM	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
TRAKTÖR TOPLAMI	0.2041	1.0000	0.2041	0.2076	1.0737	0.2233	0.1738	0.8301	0.1143	0.2413	0.8143	0.1662	0.2251	0.8816	0.1750	0.2472	1.0797	0.2204
Turk Traktor GÖBEK	0.1612	1.0000	0.1612	0.1771	0.6278	0.1012	0.0802	0.3327	0.0537	0.0623	0.3620	0.0584	0.1087	0.4732	0.0763	0.1798	1.0115	0.1631
KAMYON TOPLAMI	0.3333	1.0000	0.3333	0.3620	1.1030	0.3704	0.4328	0.7145	0.4076	0.3334	0.8295	0.4441	0.3215	0.8581	0.3512	0.3042	0.7505	0.3033
HAFİF TİCARİ TOPLAMI	0.0993	1.0000	0.0993	0.0413	0.8562	0.0851	0.3133	3.4473	0.3425	0.3410	3.3357	0.3314	0.3447	3.9926	0.3966	0.0688	1.0840	0.1077
GİRDİLER	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
HALZEME KULLANIMI																		
GENEL TOPLAM	0.6296	1.0000	0.6296	0.5552	0.8870	0.5585	0.6970	1.0901	0.6863	0.5971	0.9570	0.6025	0.5213	0.8055	0.5071	0.6041	0.8964	0.5644
SAÇLAR	0.3402	1.0000	0.3402	0.2275	0.6572	0.2288	0.2756	0.3573	0.2773	0.3722	1.0337	0.3577	0.2377	0.8075	0.2311	0.2171	0.4477	0.1557
PROFİLLER	0.2072	1.0000	0.2072	0.1732	0.8867	0.1837	0.2747	1.3628	0.2824	0.1506	0.8493	0.1760	0.0808	0.4733	0.0981	0.3039	1.5592	0.3231
SOĞUK-PLAKA-LEVHALAR	0.0743	1.0000	0.0743	0.1545	1.7646	0.1437	0.1267	1.4056	0.1046	0.0743	0.8700	0.0667	0.1528	1.7227	0.1277	0.0831	1.1501	0.0854
SABİT DEĞERLER																		
GENEL TOPLAM	0.2032	1.0000	0.2032	0.2385	1.1892	0.2416	0.1607	0.8369	0.1700	0.2198	1.1010	0.2237	0.2636	1.3721	0.2788	0.2057	1.2254	0.2490
BİNA VE ARAZİ	0.0027	1.0000	0.0027	0.0034	1.1364	0.0035	0.0023	0.8235	0.0024	0.0032	1.0947	0.0032	0.0030	1.3333	0.0037	0.0030	1.1713	0.0035
MAKİNA TESİSLER	0.1078	1.0000	0.1078	0.1265	1.1910	0.1283	0.0854	0.8317	0.0896	0.1166	1.0938	0.1179	0.1398	1.3467	0.1451	0.1091	1.2017	0.1295
KALIP MÜHÜ. VE APARAT	0.0373	1.0000	0.0373	0.1043	1.1364	0.1057	0.0707	0.8407	0.0731	0.0788	1.1045	0.0788	0.1158	1.3762	0.1247	0.0784	1.2435	0.1112
KARA NAKİL VASITALARI	0.0009	1.0000	0.0009	0.0011	1.1864	0.0011	0.0007	0.8263	0.0008	0.0010	1.0849	0.0010	0.0012	1.3333	0.0012	0.0009	1.1913	0.0011
DEMİRBAŞ MOBİLYA	0.0023	1.0000	0.0023	0.0027	1.2175	0.0028	0.0018	0.7474	0.0022	0.0025	1.3203	0.0031	0.0030	1.6335	0.0037	0.0023	1.6018	0.0037
ENERJİ																		
ELEKTRİK	0.0105	1.0000	0.0105	0.0132	1.2413	0.0130	0.0099	0.9543	0.0100	0.0121	1.1154	0.0117	0.0138	1.1795	0.0123	0.0083	0.8118	0.0085
PERSONEL																		
GENEL TOPLAM	0.1567	1.0000	0.1567	0.1931	1.1926	0.1869	0.1321	0.8528	0.1337	0.1711	1.0341	0.1621	0.2012	1.2872	0.2018	0.1819	1.1364	0.1781
GENEL MÜDÜRLÜK (Adam/Ay)	0.0291	1.0000	0.0291	0.0340	1.1364	0.0345	0.0253	0.8235	0.0240	0.0340	1.2562	0.0355	0.0427	1.4757	0.0427	0.0367	1.3137	0.0383
FABRİKA (Adam/Ay)	0.0450	1.0000	0.0450	0.0585	1.1588	0.0522	0.0372	0.8071	0.0363	0.0469	1.0344	0.0466	0.0526	1.2732	0.0573	0.0528	1.1082	0.0499
FABRİKA (Adam/Saat)	0.0826	1.0000	0.0826	0.1006	1.2133	0.1002	0.0716	0.8870	0.0733	0.0874	0.9557	0.0770	0.1057	1.2283	0.1015	0.0724	1.0333	0.0377

30/6/84 GİRDİ GÖSTERGELERİ GÖRECE DUYARLILIKLARI

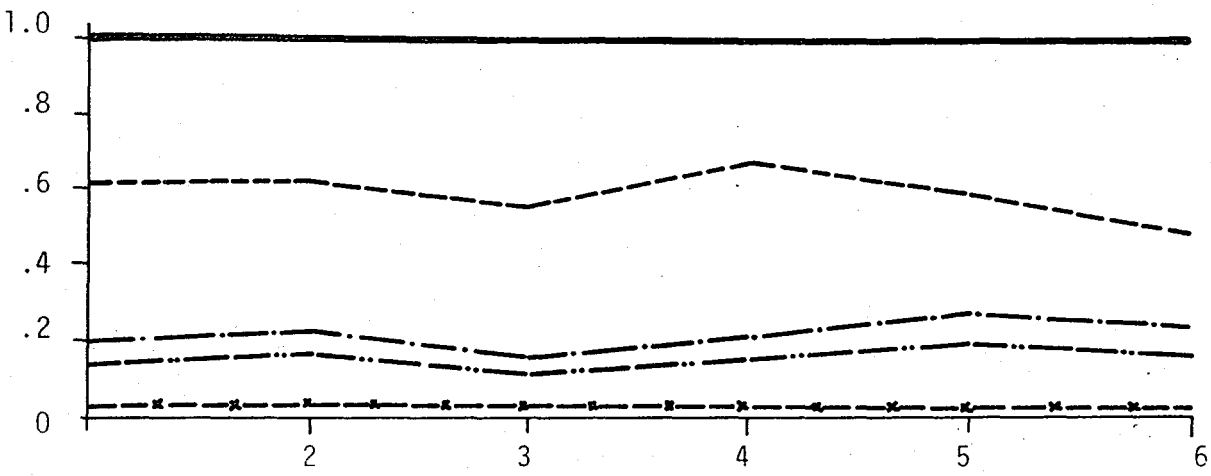
GİRDİ / ÇIKTI BİRİM FİYAT	FİYAT ÜSTÜNLÜĞÜ KARLILIK (1)	FİYAT ÜSTÜNLÜĞÜ KARLILIK TOPLAM GİRDİ	KAR (1)	KAR TOPLAM GİRDİ	GİRDİ / ÇIKTI MİKTAR	ÜRETKENLİK (1)	ÜRETKENLİK TOPLAM GİRDİ	KARLILIK (1)	KARLILIK TOPLAM GİRDİ	KAR
ÇIKTILAR					**ÇIKTILAR**					
MAMUL ÜRETİMİ					MAMUL ÜRETİMİ					
GENEL TOPLAM	1.000	1.000	1.000	1.000	5.826	GENEL TOPLAM	1.000	1.000	1.000	1.000	5.826
TRAKTÖR TOPLAMI	0.247	0.247	0.247	0.247	1.441	TRAKTÖR TOPLAMI	0.220	0.220	0.247	0.247	1.441
Türk Traktör GÖDEK	0.180	0.180	0.180	0.180	1.047	Türk Traktör GÖDEK	0.163	0.163	0.180	0.180	1.047
KAMYON TOPLAMI	0.504	0.504	0.504	0.504	2.938	KAMYON TOPLAMI	0.509	0.509	0.504	0.504	2.938
HAFİF TİCARİ TOPLAMI	0.069	0.069	0.069	0.069	0.401	HAFİF TİCARİ TOPLAMI	0.108	0.108	0.069	0.069	0.401
GİRDİLER					**GİRDİLER**					
HALİÇME KURLANIMI					HALİÇME KURLANIMI					
GENEL TOPLAM	-1.000	-0.604	-1.000	-0.604	-2.916	GENEL TOPLAM	-1.000	-0.564	-1.000	-0.604	-2.916
SAÇLAR	-1.000	-0.217	-1.000	-0.217	-1.048	SAÇLAR	-1.000	-0.155	-1.000	-0.217	-1.048
PROFİLLER	-1.000	-0.304	-1.000	-0.304	-1.467	PROFİLLER	-1.000	-0.323	-1.000	-0.304	-1.467
SEÇMAN-FİANS-CÜMBRİNG	-1.000	-0.083	-1.000	-0.083	-0.401	SEÇMAN-FİANS-CÜMBRİNG	-1.000	-0.085	-1.000	-0.083	-0.401
SABİT DEĞERLER					SABİT DEĞERLER					
GENEL TOPLAM	-1.000	-0.206	-1.000	-0.206	-0.773	GENEL TOPLAM	-1.000	-0.247	-1.000	-0.206	-0.773
BİNA VE ARAZİ	-1.000	-0.003	-1.000	-0.003	-0.014	BİNA VE ARAZİ	-1.000	-0.003	-1.000	-0.003	-0.014
MAKİNA TESİSLER	-1.000	-0.107	-1.000	-0.107	-0.527	MAKİNA TESİSLER	-1.000	-0.127	-1.000	-0.107	-0.527
KALİP MODEL VE APARAT	-1.000	-0.090	-1.000	-0.090	-0.436	KALİP MODEL VE APARAT	-1.000	-0.111	-1.000	-0.090	-0.436
KARA NAKİL VASITALARI	-1.000	-0.001	-1.000	-0.001	-0.004	KARA NAKİL VASITALARI	-1.000	-0.001	-1.000	-0.001	-0.004
DEMİRBAŞ MEFRUSAT	-1.000	-0.002	-1.000	-0.002	-0.011	DEMİRBAŞ MEFRUSAT	-1.000	-0.004	-1.000	-0.002	-0.011
ENERJİ					ENERJİ					
ELEKTRİK	-1.000	-0.008	-1.000	-0.008	-0.040	ELEKTRİK	-1.000	-0.008	-1.000	-0.008	-0.040
PERSONEL					PERSONEL					
GENEL TOPLAM	-1.000	-0.182	-1.000	-0.182	-0.878	GENEL TOPLAM	-1.000	-0.178	-1.000	-0.182	-0.878
GENEL MÜDÜRLÜK (Adam/Ay)	-1.000	-0.037	-1.000	-0.037	-0.177	GENEL MÜDÜRLÜK (Adam/Ay)	-1.000	-0.038	-1.000	-0.037	-0.177
FABRİKA (Adam/Ay)	-1.000	-0.053	-1.000	-0.053	-0.255	FABRİKA (Adam/Ay)	-1.000	-0.050	-1.000	-0.053	-0.255
FABRİKA (Adam/Saat)	-1.000	-0.072	-1.000	-0.072	-0.446	FABRİKA (Adam/Saat)	-1.000	-0.070	-1.000	-0.072	-0.446

(1)GİRDİ : ÇIKTILAR'DA HERHANGİ BİR GİRDİ , GİRDİLER'DE KENDİSİ (DİĞER GİRDİ GÖSTERGE DUYARLILIKLARI = 0)

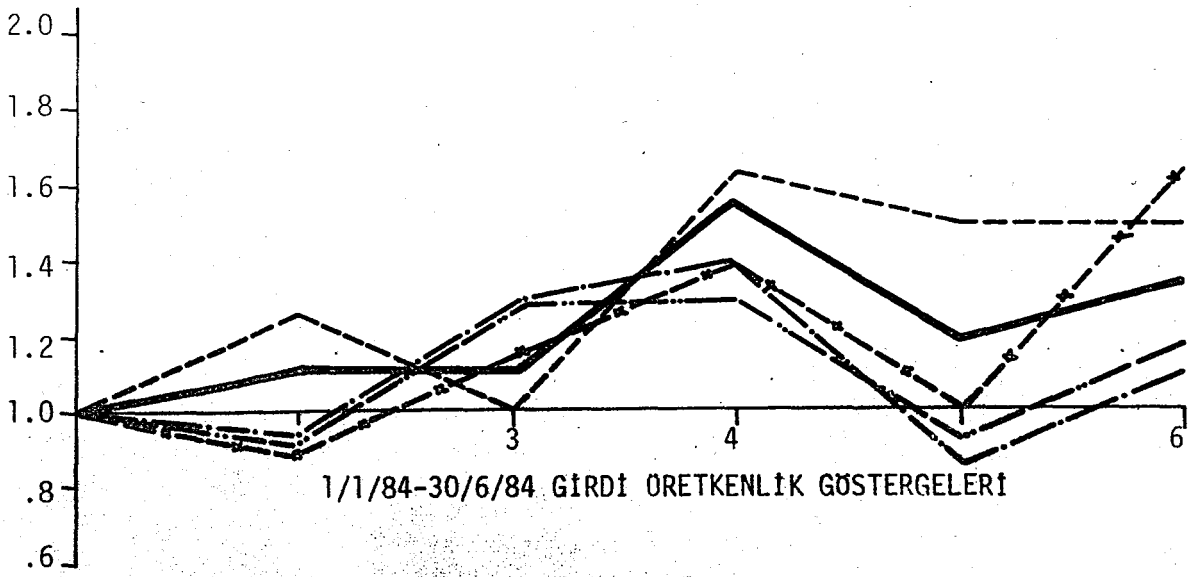
APPENDIX C
PRODUCTIVITY GRAPHICS



GİRDİ KULLANIMI (%)

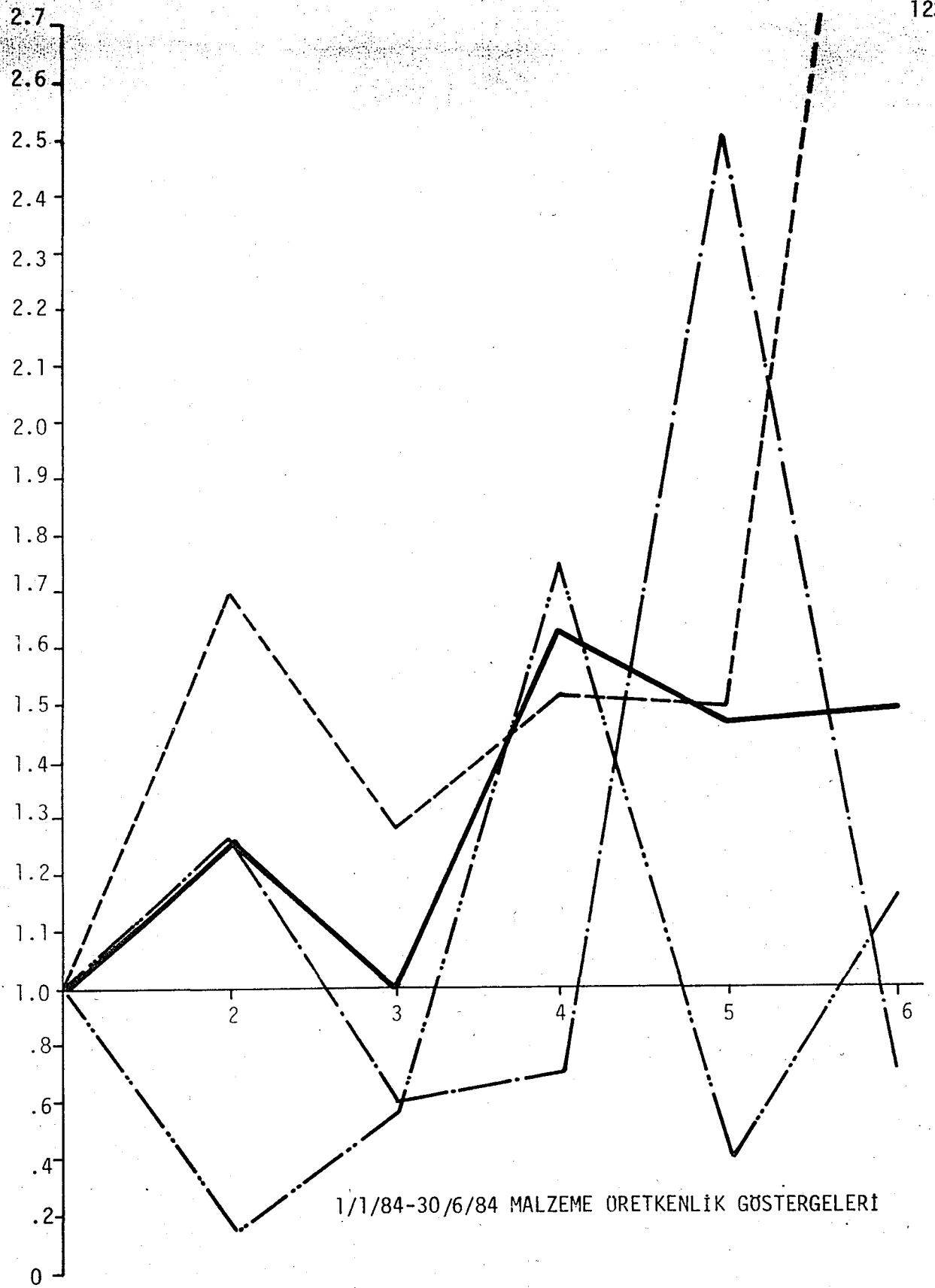


ÜRETKENLİK AĞIRLIKLARI



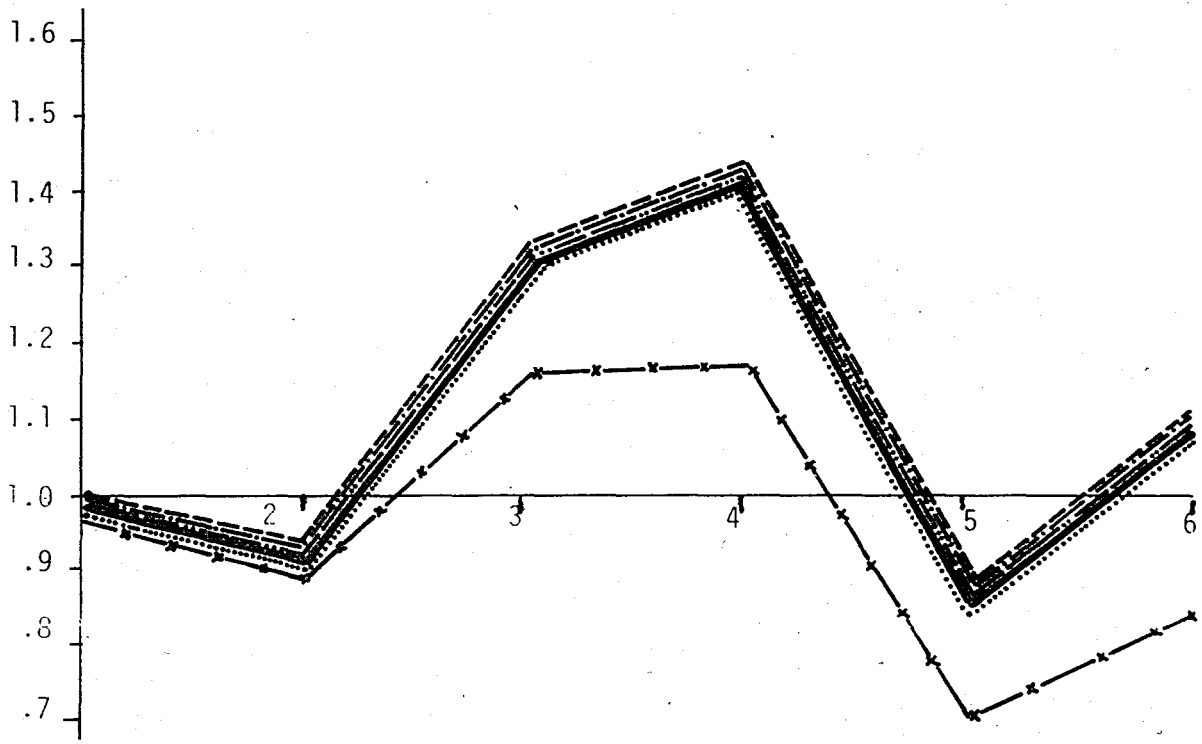
1/1/84-30/6/84 GİRDİ ÜRETKENLİK GÖSTERGELERİ

GENEL TOPLAM
MALZEME
SABİT DEĞER
PERSONEL
ELEKTRİK



1/1/84-30/6/84 MALZEME ÜRETKENLİK GÖSTERGELERİ

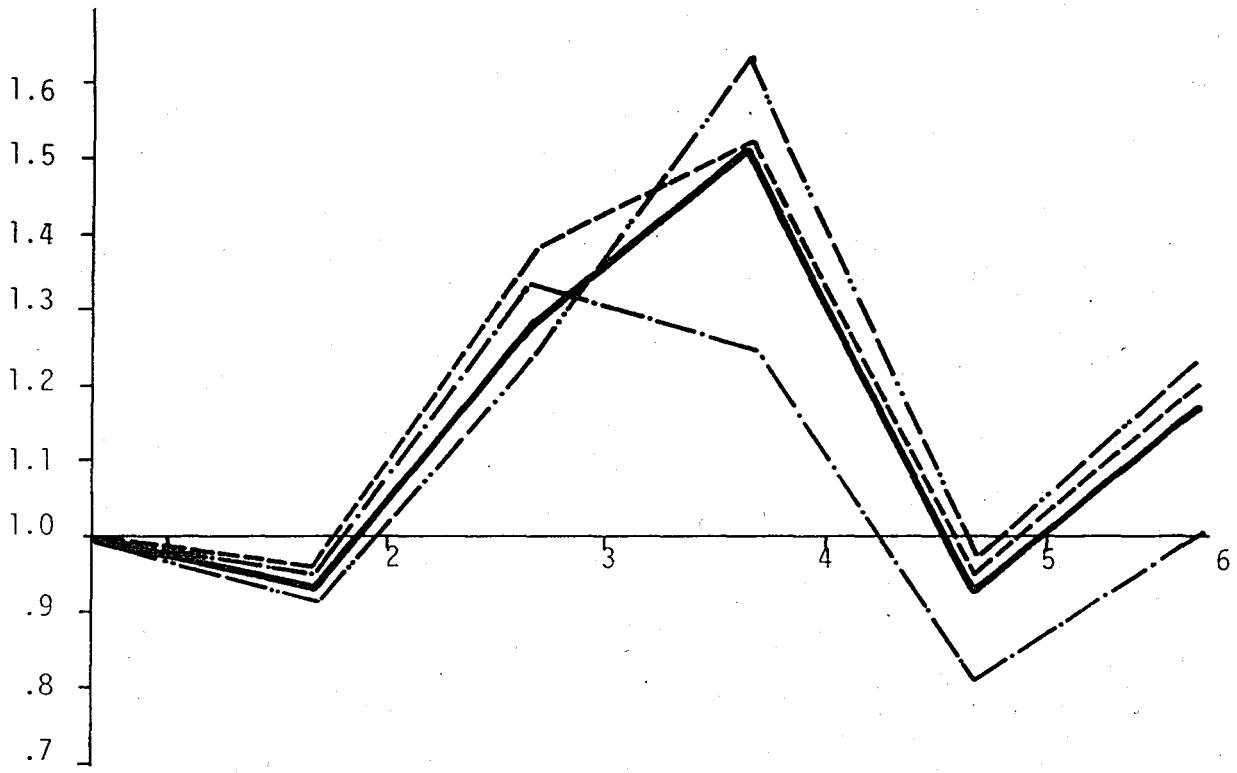
GENEL TOPLAM
SAC
PROFİL
SEGMAN, FLANJ, COMBRING



1/1/84-30/6/84 SABİT DEĞER ÜRETKENLİK GÖSTERGELERİ

GENEL TOPLAM
KARA NAKİL VASITALARI
BİNA VE ARAZİ
MAKİNA VE TESİSLER
KALIP MODEL APARAT
DEMİRBAŞ MEFRUŞAT

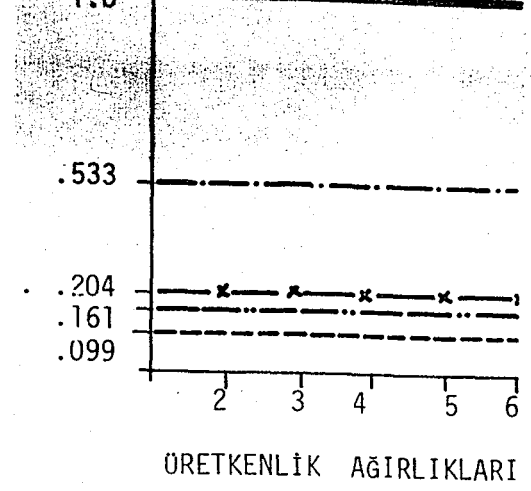
C.3



1/1/84-30/6/84 PERSONEL ÜRETKENLİK GÖSTERGELERİ

GENEL TOPLAM
FABRİKA AYLIKLI
GENEL MODORLOK
FABRİKA SAAT OCRETLİ

C.4



ÜRETKENLİK AĞIRLIKLARI

1/1/84-30/6/84 ÇIKTI ÜRETKENLİK GÖSTERGELERİ

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