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Processing Plant Cost Estimation System: Documentation and User's Guide

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ABSTRACT

A generalized computer model was developed for the purpose of simulating costs and returns for different types of processing plants. This report presents the economic rationale for the model program and the model documentation. An explanation of procedures for using the model is given in general terms with an example of how the model was used to simulate costs and revenues for a cottonseed oil mill.

Key words: Simulation model, costs, returns, processing plants

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Introduction

Simulation models of specific types of processing plants have been developed in recent years to evaluate various economic, technical, and institutional conditions which affect particular types of processing plants (8).[2/] This type of modeling combines economic relationships and engineering coefficients to provide a basis for developing simulated costs and returns for specific processes. A generalized processing plant cost estimation system for determining costs and returns for any type of processing system has not previously been developed. The main problem encountered in developing such a system is the need to incorporate sufficient flexibility to enable the model to handle various types and levels of fixed costs and various technical coefficients which vary among plants within an industry and among industries.

The purpose of this paper is to present the logic and documentation for a generalized model capable of simulating plant processing costs and returns. The term "generalized" refers to the capability of the model in adapting to many different types of processes and/or functions. The model structure is simplified in comparison to simulation models which are structured around specific process functions with defined technical/

1/ The authors are Research Associate, Ag. Economics Dept., Texas Tech University and Economists, USDA, ESCS, Ag. Economics Dept., Texas Tech University, respectively.

2/ Numbers in parentheses refer to the numbers in the List of References.

engineering and/or organizational characteristics in order to have that adaptive capability. This feature necessarily imposes a cost on the user in that it requires a large amount of external data. However, sufficient need for such a model exists to warrant its documentation.

The model presented resulted from a research effort to evaluate alternative technologies in cottonseed oil mills (3). In that context, a simulation system was required which would allow (1) changing number and types of fixed cost items, (2) changing levels of variable costs as capacity utilization of processing plants change, and (3) changing types, levels, and prices of outputs. Due to a time constraint for completing the analysis on cottonseed oil mills, the generalized model described below was developed.

The organization and presentation of the model is as follows: First, the economic basis of the model structure will be discussed. A mathematical specification/explanation of model calculations will then be given. The third section will present a description of the computer program used for model calculation. The last section consists of a sample model run using a selected situation and data set representing a cottonseed oil mill. Many of the technical details are contained in the appendices.

Basis of the Model Structure

Simulation models are mathematical systems which are used to estimate (simulate) a particular process or set of processes--costs and returns in this instance. Economic-engineering simulation models combine economic concepts of costs and returns with engineering concepts or data on physical inputs in a structure to facilitate computations of costs and returns. The primary use of simulation models is as a tool to estimate

costs and/or returns at a plant or firm level when actual data on costs and/or returns do not exist. Such a case might be estimating the cost per unit of product produced with a new or different production process or part of a process. Simulation models may have varying degrees of sophistication or detail with respect to both economic and engineering calculations included within the model structure. However, the more detailed the relationships, the more specific the model to a particular type of process. The model being discussed is simplified in its structure so as to allow application to many different types of processing plants.

The principles for the model calculations are economic; all technical coefficients and price information are inputs to the program. As a prelude to presentation of calculations within the computer model, some economic concepts and terms are discussed in the following paragraphs.

Costs and returns must apply to a specific period of time, the most common basis for this time being a one year production period. In economic terms, total costs can be divided into two types of costs: variable costs and fixed costs. Variable costs are the costs of those resources which are used directly in the production process and vary with the level of output of the plant. The manner in which the amounts and costs of those resources vary with plant output depends on specific technical coefficients and physical factors of machinery and equipment in a plant. Variable costs commonly include such items as production labor, electricity, water, fuel, and repairs.

Fixed costs are those costs to the processing plant which are independent of the level of plant output and do not vary within a production period. These costs are commonly associated with ownership of land,

buildings, machinery, and equipment, and with management and permanent labor. Fixed cost items can be separated into two groups: depreciable and non-depreciable items. Depreciable assets are those items which are subject to a loss of value due to wear and/or obsolescence. Examples are machinery, equipment, and buildings. Fixed costs associated with these items arise from (1) the loss of value due to wear and/or obsolescence (depreciation), and (2) opportunity cost or revenue foregone by not using the funds needed to own the equipment in their next best alternative use. The most common measure of this opportunity cost is the interest rate which applies to a long term capital investment.

Non-depreciable fixed cost items are those which do not vary with the level of output and do not have a cost resulting from wear and/or obsolescence. These items may include costs associated with fixed labor and management, taxes and insurance on depreciable assets, and repair costs on depreciable assets which are independent of the level of plant output. An example of a fixed repair cost is painting of buildings.

In this processing plant cost estimation system, technical coefficients or methods for changing the levels of the variable cost items with changes in capacity utilization are not developed internally by the model. Such coefficients and adjustments must be provided by the user as input to the model. This aspect of the model makes it more cumbersome for simulating costs for a given type of processing plant, but it allows the model flexibility to handle many types of plants.

Total revenue is defined as the output of a processing plant times the price received for that output. In cases where multiple products are produced, total revenue becomes the summation of the amount of each product produced times the price received for each product.

Plant processing capacity and capacity utilization are central to marginal and average cost and revenue concepts. The processing capacity of individual plants can be expressed either in terms of outputs or inputs. An example of capacity being measured in terms of input is found in the cottonseed oil mill industry where plant capacity is expressed in tons of cottonseed processed per day. This type of specification of plant capacity is useful when multiple products, e.g., cottonseed oil, meal, hulls, and linters, are produced from one major input.

The amount of product processed during a production period depends on the extent of utilization of processing plant capacity. Therefore, capacity utilization refers to the proportion of maximum possible plant capacity which is actually utilized during a production period. Marginal and average costs and returns in this simulation system are developed in terms of plant capacity utilization. If plant capacity is expressed in terms of output (input), average and marginal relationships are expressed per unit of output (input); i.e., average cost refers to cost per unit of output (input) and marginal cost refers to the change in cost associated with a unit change in output (input) (5). Since marginal relationships are based on a unit change in capacity utilization, more than one level of capacity utilization must be examined before the associated marginal relationships can be developed. Also, since the cost estimation system described does not allow product mix or product price changes to occur as capacity utilization changes, marginal revenue is not generated because it equals average revenue.

Model Calculations

Many of the calculations pertinent to the model are placed in subroutines. The results of these basic calculations are then used in the main program.

The subroutine calculations will be defined first.

Fixed Cost Calculations [Subroutine FIX (TFC)]

Fixed costs are divided into two groups as previously discussed--depreciable and non-depreciable items. Items which are depreciable are calculated by the following series of formulas to determine annual equivalency cost, which is the combined depreciation, interest and repair costs of a depreciable item calculated on a yearly basis:

(1) $FOB_i = (FOB \times NUM)(1 + INST)$

where FOB_i = installed cost of a building, machinery, or equipment item i

FOB = FOB cost of one unit (one machine, one square foot of a building, etc.)

NUM = number of units required

INST = installation cost of one unit, based on a percentage of FOB cost (2, pp. 110-113).3/

(2) $$DI_i = FOB_i \left[\frac{R\,(1+R)^{yrs}}{(1+R)^{yrs}-1}\right] - SAL_i \left[\frac{R}{(1+R)^{yrs}-1}\right]$$ (4, p. 44)

where DI_i = annual depreciation and interest cost of item i

R = interest rate

YRS = years of useful life

SAL_i = salvage value of item i in dollars

(3) $REP_i = (FOB)(NUM)(REP)$

where REP_i = fixed repair costs of item i in dollars

REP = fixed repairs as a percentage of FOB cost

(4) $AEC_i = DI_i + REP_i$

where AEC_i = annual equivalency cost of item i

3/ This installation cost may include piping, concrete, electrical instrumentation, paint, engineering, labor, etc.

The formula for determining annual equivalency costs of non-depreciable fixed cost items, including the opportunity cost of the funds required, is:

(5) $AEC_k = (FOB \times NUM)\ (1+R)$

where AEC_k = annual equivalency cost of item k

FOB = annual cost of one non-depreciable fixed cost item.

Each fixed cost item or group of items (more than one item of same kind with same costs, repairs, installation, and/or fixed repairs) are calculated according to one of the two methods previously shown. The annual equivalency costs are then totaled to obtain the total fixed cost for all items which is then used in the main program. The fixed cost subroutine also provides a cost of construction for the plant calculated by totaling the installed cost of all depreciable items (FOB_i as defined in equation 1).

Variable Cost Calculations [Subroutine VAR (TVC)]

Variable cost coefficients at each utilization level must be entered into the model as separate data sets. Variable costs are estimated from these coefficients using an accounting type procedure as follows:

(6) $VC_{ij} = (NUM_j)\ (PR_i)$

where VC_{ij} = variable cost of resource i at capacity utilization j

NUM_j = number of units of the resource required at capacity utilization j

PR_i = cost per unit for resource i.

The technical information required for this procedure must be obtained independently and any decisions on the cost treatment of these items must be made before they are incorporated into the data sets.

If the variable cost items are placed in the data sets by production stages, the model will sum these requirements by production stage. The totals of all production stages will then be totaled to obtain a total

variable cost at the level of capacity stipulated for the data set ($TVC_j = \sum_i VC_{ij}$). This total variable cost can then be used to calculate the interest on operating capital by the following formula:

(7) $CO_j = TVC_j(R)$

R = interest rate

The total variable cost at this capacity level becomes:

(8) $TVC_j^* = TVC_j + CO_j$

where TVC_j^* = total variable cost at capacity utilization j.

The model does not require the computation of variable costs by production stages. Cost figures for variable cost items can be placed in the model using a strict accounting type approach to determine variable costs. However, if the production stage approach to determining variable costs is used, the model does have the ability to give dollar amounts of variable resources used. The resources for which requirements are totaled by the program are electricity, labor, fuel, repairs, and water. With minor reprogramming of the model the number of items in this group could be increased, decreased, or otherwise modified.

Total Revenue Calculations [Subroutine NR (TR)]

In an effort to cover all processing plants, the model needed flexibility in handling multiple products, combinations of products, and different product prices. For this reason, the model uses the following equation to calculate the revenue from each separate product produced and to sum the results.

(9) $TR = \sum_{i=1}^{n} (Q_i \times P_i)$

where TR = total revenue generated

Q_i = quantity produced of product i

P_i = price of product i

n = number of products.

Main Program Calculations

The main program uses the total fixed and variable costs and revenue generated in the subroutines along with control information to calculate the following information at each level of capacity specified: total cost, average fixed cost, average variable cost, average total cost, average revenue, average net revenue, total net revenue, and marginal cost.

Total fixed cost is the same at each level of capacity utilization or annual volume processed. Average fixed cost is the fixed cost per unit of output and varies as output varies. Average fixed cost at 100 percent utilization is total cost divided by total capacity of the plant for the production period. Average fixed cost at the other levels of capacity is the total fixed cost of the plant divided by the output of the plant at the specific capacity utilization, or:

$$(10) \quad AFC_j = \frac{TFC}{(X)(CP_j)}$$

where AFC_j = average fixed cost at the j^{th} level of capacity utilization

X = plant output (or input) at 100 percent capacity utilization

CP_j = percent of total plant capacity utilization at the j^{th} level of capacity utilization (100 percent = 1.00).

Total variable cost changes from one utilization level to the next and is calculated at each level of capacity utilization specified to the model. Total variable cost for each capacity utilization level is needed to calculate average variable cost for that level. This equation is:

$$(11) \quad AVC_j = \frac{TVC_j^*}{(X)(CP_j)}$$

where AVC_j = average variable cost at the j^{th} level of capacity utilization

TVC_j^* = total variable cost at the j^{th} level of capacity utilization.

Total cost at each level of capacity utilization is generated by adding total fixed and total variable costs. The average cost at each level of capacity utilization can be obtained either by dividing total cost by output or by adding average variable and average fixed costs. The model uses the first method as shown in the following equation:

$$(12) \quad AC_j = \frac{TFC + TVC_j^*}{(X)(CP_j)}$$

where AC_j = average cost at the j^{th} level of capacity utilization.

When the total revenue at 100 percent capacity utilization is transferred to the main program, it is used in generating total revenue at the varying levels of capacity utilization by multiplying total revenue by the percent of capacity utilization according to the formula:

$$(13) \quad TR_j = TR \times CP_j$$

where TR_j = total revenue at the j^{th} level of capacity utilization

TR = total revenue at 100 percent capacity utilization.

The model then calculates average revenue by the following formula:

$$(14) \quad AR = \frac{TR}{(X)}$$

where AR = revenue per unit of plant output (or input).

Total net revenue is defined as total revenue less total cost. By this definition, total net revenue is calculated as:

$$(15) \quad TNR_j = TR_j - TC_j$$

where TNR_j = total net revenue at the j^{th} level of capacity utilization

TC_j = total cost at the j^{th} level of capacity utilization.

Total net revenue is calculated for each level of capacity utilization. The average net revenue can be calculated by either subtracting total cost from total revenue and dividing by the capacity of plant times the percent of capacity utilization or by subtracting average cost from average revenue. The first method is used by the model and is mathematically defined as:

$$(16) \quad ANR_j = \frac{TR_j - TC_j}{(X)(CP_j)}$$

where ANR_j = average net revenue at the j^{th} level of capacity utilization.

The last calculation for each level of capacity utilization is the marginal cost. The equation for marginal cost used in the program is:

$$(17) \quad MC_j = \frac{TC_j - TC_{j-1}}{(X)(\Delta CP)}$$

where MC_j = marginal cost of producing at capacity utilization j

ΔCP = change in capacity utilization between the j^{th} level of capacity utilization and the previous level of capacity utilization.

The model is designed to calculate costs and returns of a processing plant at various levels of capacity when plant utilization is increasing. The reasoning behind increasing capacity utilization levels is to simplify the method of calculating marginal cost. The marginal cost concept applies only when two or more levels of capacity utilization are used. With no previous level of capacity utilization, a given level of capacity utilization has no marginal cost associated with it.

The Computer Model

The computer program, shown in Appendix I, was programmed in Fortran IV, level G and has been run on the ITEL AS/6 computer system at Texas Tech University. The card reader input unit is 5, the line printer output unit

is 6, and the temporary disk storage, needed for the Statistical Analysis System (SAS) portion of the program, input unit is 4.

The computer model is divided into a main program and four sub-routines. The calculations performed in all segments of the model with the exception of Subroutine Title were previously discussed. Subroutine Title is simply a method of printing appropriate division titles from the data sets (such as Fixed Cost). This was intended to save programming time and performs no mathematical calculations. To aid in understanding the input and output of the Fortran program, a list of terms and their definitions are shown in Appendix II.

The basis operation of the model program is as follows:

1. The main program reads the input information specifying the plant situation(s) to be run.

2. The fixed cost subroutine is called, fixed cost input data are read, and fixed costs are computed and printed.

3. Variable cost input data for a single plant capacity utilization level are read and variable costs are computed by the variable cost subroutine, by production stage if specified, and printed.

4. Revenue input data are read and revenue at 100 percent capacity utilization are computed in the revenue subroutine.

5. Step 3 is repeated for each additional level of plant capacity utilization specified.

6. Total, average, and marginal costs and revenues are calculated and printed for each level of plant capacity utilization specified.

A more detailed outline of the operation of the program is shown in Appendix III.

When processing plant costs are developed at more than one capacity utilization level, cost curves for various levels of output can be developed. A simple method of plotting the information generated by the Fortran program was to use SAS (1). This software package, which must be available to the

computer system used, takes a limited number of commands to operate. A discussion of the SAS statements and the output of the SAS program is presented in Appendix IV.

Developing Input Data for the Computer Model

There are some general procedures for using the model irrespective of the type of plant being simulated. The purpose of this section is to discuss some of those procedures. The section which follows discusses the application of the model to a specific problem.

The first step is to define the characteristics of the plant being modeled. This requires a working knowledge of the process under study, particularly with respect to plant size (processing capacity), operating procedures, machinery used and associated processing rates, and labor requirements. Thus, at least a general knowledge of the operation of a plant or industry is required. If the user does not already have that knowledge, discussions with plant managers and visits to processing plants are usually productive. If the process is an experimental one, researchers knowledgeable of the process may be the only reliable source of information.

Data collecting starts with a determination of plant size and capacity utilization. The plant's operating capacity in terms of major output (or input) per some specific unit of time multiplied by the number of units of time the plant will operate at 100 percent capacity utilization yields the amount of output (or input) to be processed. This is inserted as N(1) in control card no. 3, Appendix V. The next step is to determine the number of capacity utilization levels which are to be computed by the model. If the first level is 50 percent (N(2)) and the last level is 100 percent changing by incremental increases of 10 percent (N(6)), then 6 (N(5))

levels of capacity utilization will be computed and a variable cost data set is needed at each utilization level.

Depreciable Fixed Costs

Once the processing plant has been defined in general terms, plant configuration in terms of buildings, machinery, equipment, land, etc., must be developed. If the plant actually exists and records are available, values for these depreciable items and estimated years of useful life, salvage value, and fixed repairs can be estimated from records. If the plant is to represent a hypothetical situation, determining the number, capacity, cost and installation requirements for equipment may be more difficult. In a hypothetical situation, using new cost of machinery and equipment is often the best approach. Equipment manufacturers can give estimates of the number, processing capacity, FOB cost, years of useful life, salvage value, installation cost, and fixed repairs of the machinery and equipment needed. An alternative method of obtaining this information would be to contact plant managers. The installed cost of an item can be used instead of FOB cost; i.e., installation cost can be entered into the model as a zero. The model is capable of handling zero values for all fixed cost information except the interest rate, FOB cost, and years of useful life.

The information on equipment sizes and estimates of storage facilities can then be used to develop building sizes and land requirements. The information for each depreciable fixed cost item is placed on a data card following the format of card 5 in Appendix V. One card for each depreciable fixed cost item is needed.

Non-depreciable Fixed Costs

Property taxes are an example of a non-depreciable fixed cost item. The

actual tax cost can be entered in the model or the assessed value times the tax rate can be entered. The method of entering the data, shown as card number 6 in Appendix V, requires one card for each non-depreciable item.

Costs Which Contain Fixed and Variable Components

Once depreciable fixed cost items have been determined and placed in the computer model, the remaining cost items should be examined for fixed and variable components. Many cost components may not fall neatly into non-depreciable fixed costs or variable cost items. Labor costs can be divided into fixed and variable components by determining the basis on which employees are paid. Employees who receive a set annual salary or wage regardless of the level of processing capacity utilization are considered fixed. The fixed employee category will generally include management and office personnel. Other job categories which may remain fixed are sales, purchasing, accounting, engineering, supervisory, and laboratory personnel. Those individuals who receive an hourly or production base wage and whose hours of work vary directly with plant production are placed in the variable labor category. Data on these employees are entered in the data set following the format of card 10, Appendix V.

The labor component includes salary, benefits (insurance, bonuses, workmen's compensation, social security, etc.) for each individual employee. The fixed labor component is entered as a non-depreciable fixed cost item (card 6, Appendix V). The variable labor component is entered in each production stage in the variable cost sections.

Insurance may also have a fixed and a variable component. Insurance on buildings, machinery, and equipment are a cost to the plant regardless of the level of capacity utilization achieved. Therefore, insurance on these

items are a fixed cost to the plant and is entered in the data set as a non-depreciable fixed cost item (card 6, Appendix V). Many firms carry insurance on major inputs to a process and on output which is stored before sales transactions and shipping of the output are accomplished. Insurance on products needed for or produced by a processing plant which vary according to the level of production achieved are considered variable costs and are entered in the data set following the format of card 10, Appendix V.

Variable Costs

The variable costs which are needed at various levels of capacity utilization must be determined outside the model. The electricity, natural gas, fuel oil, water, and other fuel and utility usage levels must be determined for each specific level of capacity utilization. The usage rate and the appropriate unit cost of the item can then be entered in the model to determine the variable cost of that item at each level of capacity utilization. These items are inserted as shown by card 10, Appendix V. One card is required for each variable cost item at each level of capacity utilization.

Revenue

Revenue for the plant is based on the amount of each product produced and the price received for each output. These output values and prices received are placed in the model for the 100 percent capacity utilization level. The model calculates total revenue at 100 percent capacity utilization, then generates total revenue at alternative levels of capacity utilization based on a percent of total output. One card (number 13 in Appendix V) for each product produced in the model situation is required.

Completing the Data Set

Total fixed costs by definition are constant regardless of the capacity

utilization level. Total revenue at each level of utilization is that percentage of the 100 percent capacity utilization revenue. Therefore, the fixed cost and revenue data are only entered once. Since variable costs change as capacity utilization changes, the data set must include the variable cost data associated with each level of capacity utilization. Thus, if one wished to calculate costs and returns for 60, 70, . . , 100 percent plant utilization, the data set for 60 percent utilization variable costs would be entered first (prior to the total revenue entries). Then the variable cost data sets (cards 8-11) for 70, 80, 90, and 100 percent utilization levels would be added following card 14, Appendix V.

Example Model Run

The purpose of this section is to illustrate the use of the computer model in a specific example. In terms of model input, both card input data and card location in the data deck will be discussed. Model output is shown in Appendix VII.

General Plant Specifications

The example is a hypothetical cottonseed oil mill with a daily processing capacity of 600 tons-per-day (TPD) of raw cottonseed and using pre-press solvent extraction technology (3). Since the example consists of one model to be run, the value of P(1) on card 1 is one for this example. The title card (card 2) should give some descriptive information as basis for identification. The title chosen was "600 TPD Pre-press Solvent Cottonseed Oil Mill Model" and is also printed on the output (see Appendix VII).

Cottonseed oil mill size or plant capacity is normally expressed in tons of seed it can process during a 24 hour day. Therefore, the capacity of the

plant and the average cost and returns are based on the major input, cottonseed. It was assumed, based on information from mill managers, that the mill at 100 percent capacity utilization operates 330 days per year with the remaining 35 days necessary for major repair and maintenance. Thus, the volume of seed which can be processed at 100 percent capacity utilization is 198,000 tons per year. Thus N(1) on the control card (card 3, Appendix V) is 198,000.

It was decided to compute oil mill costs and returns from 30 percent (N(2) on card 3=30) to 100 percent by 10 percent increments (N(6)=10). Thus, eight levels of capacity utilization were simulated (N(5)=8). Cottonseed was assumed to cost $109 per ton (N(4)=109) and the interest rate was assumed to be 10 percent (N(3)=10). These specifications are also printed on the first page of the computer output, Appendix VII.

The values assigned to variables N(9), N(10), N(11) and N(12) were 1's. This instructs the computer to print input data, fixed costs, variable costs, and revenues by item. The value assigned to N(7) was 1; this instructed the computer to plot the associated average and marginal costs and average revenue curves for the cottonseed oil mill specified. The value of N(8) was 1, which instructs the computer to sort the variable cost items of labor, electricity, natural gas, water, and repairs and total these items from all production stages at each level of capacity utilization. All the N(I) values are inputed in the data set on the control card (card 3, Appendix V). These specifications can also be seen on the first page of the computer printout, Appendix VII.

Fixed Costs

New equipment cost, operating capacities, years of useful life, sizing,

and types were obtained from equipment manufacturers and from discussions with mill managers. The numbers of machines in each production stage were determined with reference to the capacities of the individual machines in relationship to the total capacity of plant. For example, the number of hullers needed by the mill was calculated as follows: The type of huller specified had a processing capacity of 80 tons of cottonseed per day per machine, and the total processing capacity of the mill was 600 TPD. The number of machines needed was 8 (or 600 TPD ÷ 80 TPD = 7.5, rounded to 8 machines since fractions of a machine cannot be used and most plants prefer some excess processing capacity if requirements cannot be matched). Based on machine requirements and sizes and normal space requirements (industry data), building sizes for the processing plant were determined. Storage requirements were based on maximum unprocessed seed storage, and one month storage requirements for products for a 600 TPD plant under typical operating conditions.

Installation costs (as a fraction of FOB cost) for machinery were developed from information published by Guthrie (2), where installation charges for piping, concrete, and electrical work were estimated on the basis of industry surveys. The installed cost for buildings was entered in the model as FOB cost. Therefore, installation cost as a fraction of FOB cost was entered as a zero.

The cottonseed processing industry in the more recent past has experienced little need for changes in equipment as a result of technological advancement. Replacement of existing equipment has come largely from wear. Equipment in the model was assumed to have a relatively long useful life with the cost of removing old equipment equal to the scrap value, leaving a net salvage value of zero. Fixed repair costs as a fraction of FOB cost

inserted in the data set were determined from industry data. The depreciable fixed cost data--the name, number, years of useful life, cost, annual fixed repair rate, and salvage value for each item--were entered in the program on 56 cards, each in the format of card 5, Appendix V. The computer output, Appendix VII, prints the input information as well as the calculated annual equivalency cost for each item.

Fixed costs of labor were based on discussions with oil mill managers. All salaries shown consist of a base salary plus 25 percent of base salary for workmen's compensation, social security, insurance, and other benefits. Property taxes and insurance were estimated as a function of the value of the mill as determined by cost of new plant. The rates applied were: taxes--$1.40 per $100 valuation at 50 percent of assessed value, where assessed value equals cost of construction a new plant; insurance--$6 per $1000 of value. The non-depreciable fixed cost data--name, number, and annual cost for each item--were entered on 9 data cards, each in the format of card 6, Appendix V. The input data and computed annual cost for each cost item are shown as the last 9 items of the fixed cost output, Appendix VII.

Variable Costs

For the cottonseed oil mill situation examined, plant operations were divided into eleven production stages; these include (a) cottonseed buying and transportation to the mill and (b) miscellaneous costs as production stages. Labor units per production stage were based on the number of production workers required for 3 shifts. Cost per unit at each level of production assumes an 8 hour day, 7 days a week work schedule, and includes wages, fringe benefits and overtime pay. Electricity consumption was based

on the connected horsepower of the production stage and converted to kilowatt hours assuming a 24 hour-per-day schedule. A cost of $.04 per kilowatt hour was assumed to develop daily electricity costs. For the unloading storage production stage daily cost were converted to a per ton electricity cost due to its seasonal nature.

Repair costs per ton of seed for each production stage were derived from industry data. Other variable costs included were specialized costs of bagging and ties for baling linters (based on the amount of linters produced at each percent utilization divided by 660 lbs. of linters per bale and a cost of $1.85 per pattern), the cost of hexane (hexane loss was assumed to be 1 gallon per ton of raw cottonseed processed at a price of $.68 per gallon), lab analysis (based on industry data), and office variable expenses (based on industry data).

The variable cost data--item name, number, and unit cost--for the eleven production stages at 30 percent capacity utilization were entered on 65 data cards in the format of cards 9 and 10, Appendix V. These are preceeded by a title card 8 and included the production stage heading cards. Each variable cost data set must conclude with an end card 11.

The number of units and cost per unit are used to calculate variable cost for each item. The program computes and prints total variable cost for each production stage and for the plant at 30 percent capacity utilization. Also, since the program was instructed to calculate variable input requirements (N(8)), these were computed and printed. Program output of variable costs for 30 percent capacity utilization are shown on pages 48-50, Appendix VII.

Revenue

The mill used produces four products for sale: oil, meal, hulls, and linters. To determine the output of the mill, data on the average production of each of the products from one ton of cottonseed were used. Thus, the following figures were calculated and entered in the model: 347 lbs./ton x 198,000 tons = 68,706,000 lbs. of oil; 923 lbs./ton x 198,000 tons ÷ 2000 lbs. = 91,377 tons of meal; 449 lbs./ton x 198,000 tons ÷ 2000 lbs. = 44,451 tons of hulls; 190 lbs./ton x 198,000 tons = 37,620,000 lbs. of linters. The conversion of meal and hulls to tons was needed to obtain the quantity measurements on which prices for those products are based. The associated prices are then placed in the data set on the appropriate per unit basis. Each product in the revenue section is inserted on a separate data card in the format of card 13, Appendix V. Results of the revenue calculations are shown on page 50, Appendix VII.

The main program calculations are performed using the information described above. The main program then calculated total and average costs and revenues for the 600 TPD mill operating at 30 percent capacity utilization. The results are shown in Appendix VII under "Results of the Model at 30% capacity". The only calculation missing is marginal cost, which can only be calculated with two or more levels of capacity utilization.

Capacity Utilization at 40 Percent Through 100 Percent

A new variable cost data set was compiled for each of the remaining levels of capacity utilization. Total fixed costs remain the same and all other calculations on total revenue and average and marginal cost and returns are internally generated by the model. The variable costs for each additional capacity utilization level were inserted and results of the model at each level of utilization are shown in Appendix VII.

SAS Subroutines

The output of the SAS program is shown in the last part of Appendix VII. The first output is a table showing the variables to be plotted. These variables are: A--capacity utilization (as a percent), B--average fixed cost, C--average variable cost, D--average total cost, E--marginal cost, and F--average revenue.

Each variable in the table is plotted on the following graph where the horizontal axis shows capacity utilization percentage and the vertical axis measures dollars per ton of raw cottonseed processed. The second graph merely plots dots (•) to designate points so that appropriate curves can be drawn; the first graph with letters designating plotted points must be used as a guide.

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(7) Murrill, Paul W. and Cecil L. Smith, Fortran IV Programming, Intext Educational Publishers, New York, 1973, Second Edition.

(8) Shaw, Dale L., "Economic-Engineering Simulation of Cotton Ginning Costs, GINMODEL: Program Documentation and User's Guide," USDA, Economic Research Service and Texas Tech University, College of Agricultural Sciences, Publication No. T-1-174, August, 1978.

Appendix I

Computer Program

```
C N IS CONTROL VECTOR
      COMMON /A1/N
      INTEGER N(30),P(1)
      REAL C(20,10)
      WRITE(6,31)
   31 FORMAT('1',+1X,'****PROCESSING PLANT COST ESTIMATION SYSTEM****'/
     *43X,'ECONOMICS, STATISTICS, AND COOPERATIVES SERVICE'/
     *51X,'USDA AND TEXAS TECH UNIVERSITY')
      READ (5,2) P(1)
    2 FORMAT(I5)
      NP=P(1)
      DO 20 J=1,NP
      CALL TITLE
      READ (5,1) (N(I),I=1,30)
    1 FORMAT (I10,2I2,I6,I2,I3,I1,5I1,I4,17I1)
      WRITE (6,21) (N(I),I=1,12),P(1)
   21 FORMAT(///5X,'CAPACITY OF PLANT',20X,I8,'TONS'/5X,'CAPACITY UTILIZ
     *ATION',23X,I2,'%'/5X,'INTEREST RATE',30X,I2,'%'/5X,'COST OF RAW MA
     *TERIAL',21X,I4/5X,'NUMBER OF VARIABLE DATA SETS',15X,I2,/5X,
     *'ADDITION TO CAPACITY UTILIZATION',11X,I2,'%'/5X,
     *'GENERATE COST CURVES',24X,I1,5X,'1=YES'/5X,'SORT VARIABLE REQUIRE
     *MENTS AND TOTAL',8X,I1,5X,'0=NO'/5X,'PRINT OUT INPUT',29X,I1/5X,
     * 'PRINT OUT TOTAL FIXED COST BY ITEM',10X,I1/5X,
     * 'PRINT OUT TOTAL VARIABLE COST BY ITEM',7X,I1/5X,
     * 'PRINT OUT TOTAL REVENUE BY ITEM',13X,I1/5X,
     *'NUMBER OF PROBLEMS',25X,I2)
      TFC=0.0
      TCL=0.0
      CALL FIX(TFC)
      NI=N(5)
      DO 10 I=1,NI
      TVC=0.0
      IF (N(11).EQ.1) CALL TITLE
      IF (I.GT.1) N(2)=N(2)+N(6)
      CALL VAR(TVC)
      TC=TVC+TFC
      IF (I.EQ.1) CALL NR(TR)
      N1=N(4)
      N2=N(1)
      N3=N(2)
      N6=N(6)
      R1=FLOAT(N1)
      R2=FLOAT(N2)
      R3=FLOAT(N3)
      R4=FLOAT(N6)
      TR1=TR*(R3/100)
      PROF=TR1-TC
      AVC=TVC/(R2*(R3/100))
      AFC=TFC/(R2*(R3/100))
      ATC=AVC+AFC
      AR=TR1/(R2*(R3/100))
      APROF=PROF/(R2*(R3/100))
      WRITE (6,14) N(2)
   14 FORMAT('1'//10X,'RESULTS OF THE MODEL AT',1X,I3,'% CAPACITY')
      WRITE (6,12) TFC,TVC,TC,TR1,PROF
   12 FORMAT(///5X,'TOTAL FIXED COST',9X,F20.2
     *//5X,'TOTAL VARIABLE COST',6X,F20.2
     *//5X,'TOTAL COST',15X,F20.2
     *//5X,'TOTAL REVENUE',12X,F20.2
     *//5X,'TOTAL NET REVENUE',8X,F20.2)
      WRITE (6,13) AFC,AVC,ATC,AR,APROF
   13 FORMAT(//5X,'AVERAGE FIXED COST',7X,F20.2
     *//5X,'AVERAGE VARIABLE COST',4X,F20.2
     *//5X,'AVERAGE TOTAL COST',7X,F20.2
     *//5X,'AVERAGE REVENUE',10X,F20.2
     *//5X,'AVERAGE NET REVENUE',6X,F20.2)
      C(I,1)=R3
      C(I,2)=AFC
      C(I,3)=AVC
      C(I,4)=ATC
      C(I,6)=AR
      IF (I.EQ.1) C(I,5)=0.0
      IF (I.EQ.1) GO TO 30
      C(I,5)=(TC-TCL)/(R2*(R4/100))
   30 TCL=TC
      IF (I.GT.1) WRITE (6,15) C(I,5)
   15 FORMAT(//5X,'MARGINAL COST',12X,F20.2)
   10 CONTINUE
      WRITE (4,16) ((C(I,K),K=1,6),I=1,NI)
   16 FORMAT(5X,F5.0,2X,F7.2,2X,F7.2,2X,F7.2,2X,F7.2,2X,F7.2)
   20 CONTINUE
      STOP
      END
```

TITLE

```
      SUBROUTINE TITLE
      COMMON /A2/T(20)
      READ (5,2) (T(I),I=1,20)
    2 FORMAT (20A4)
      WRITE (6,1) (T(I),I=1,15)
    1 FORMAT('1',20X,15A4//)
      RETURN
      END
```

FIX

```
      SUBROUTINE FIX(TFC)
      INTEGER F/'F'/,E/'E'/,C/'C'/
      COMMON /A1/N(30)/A2/T(20)
      INTEGER NAME(5),NUM,YRS
      REAL FOB,INST,REP,SAL
      TFC=0.0
      CCP=0.0
      REP1=0.0
      READ (5,15) (T(I),I=1,20)
   15 FORMAT (20A4)
      IF (N(10).EQ.1) WRITE (6,13) (T(I),I=1,11)
   13 FORMAT('1',36X,11A4)
      IF (N(10).EQ.1) WRITE (6,14)
   14 FORMAT(///73X,'ANNUAL'/32X,'FOB',25X,'SALVAGE',6X,'EQUIV.'/5X,
     *'ITEM NAME',17X,'COST',3X,'NUM',3X,'YRS',2X,'INST',3X,'REP',2X,
     *'VALUE',8X,'COSTS')
      N3=N(3)
      R=FLOAT(N3)
      R=R/100
   10 AEC=0.0
      READ (5,1) ID,(NAME(I),I=1,5),FOB,NUM,YRS,INST,REP,SAL
    1 FORMAT(A1,5A4,F9.0,2I5,2F5.0,F10.0)
      IF (ID.EQ.E) GO TO 2
      IF (ID.EQ.C) GO TO 3
      FOB1=(FOB*NUM)*(1+INST)
      CCP=FOB1+CCP
      AEC=((FOB1*(R*(1+R)**YRS))/(((1+R)**YRS)-1))-((SAL*R)/(((1+R)**YRS
     *)-1))
      REP1=FOB*NUM*REP
      AEC=REP1+AEC
      IF (N(10).EQ.1) WRITE (6,11) (NAME(I),I=1,5),FOB,NUM,YRS,INST,REP,
     *SAL,AEC
   11 FORMAT (5X,5A4,F10.2,2I6,2F6.2,F10.2,F12.2)
      TFC=AEC+TFC
      GO TO 10
    3 AEC=(FOB*NUM)*(1+R)
      IF (N(10).EQ.1) WRITE (6,21) (NAME(I),I=1,5),FOB,NUM,AEC
   21 FORMAT  (5X,5A4,2X,F8.0,2X,I4,30X,F10.2)
      TFC=AEC+TFC
      GO TO 10
    2 IF (N(10).EQ.1) WRITE (6,12) TFC
   12 FORMAT(//51X,'TOTAL FIXED COST',2X,F12.2)
      IF (N(10).EQ.1) WRITE(6,41) CCP
   41 FORMAT(//5X,'COST OF CONSTRUCTION NEW PLANT',10X,F20.2)
      RETURN
      END
```

VAR

```
      SUBROUTINE VAR(TVC)
      INTEGER L/'L'/,V/'V'/,E/'E'/
      COMMON /A1/N(30)
      INTEGER NAME(5)
      REAL NUM,PR
      VC=0.0
      CO=0.0
      CR=0.0
      TVC=0.0
      TVC1=0.0
      VC1=0.0
      VC2=0.0
      VC3=0.0
      VC4=0.0
      VC5=0.0
      VC10=0.0
      VCE=0.0
      VCA=0.0
      VCB=0.0
      VCC=0.0
      VCD=0.0
      K=1
```

```
 13 READ (5,1) ID,(NAME(I),I=1,5),IT,NUM,PR
  1 FORMAT(A1,5A4,I1,F14.0,F14.0)
    IF (ID.EQ.L) VC1=0.0
    IF (ID.EQ.L) VC2=0.0
    IF (ID.EQ.L) VC3=0.0
    IF (ID.EQ.L) VC4=0.0
    IF (ID.EQ.L) VC5=0.0
    IF (ID.EQ.L.AND.K.EQ.1) GO TO 19
    IF (ID.EQ.L.AND.K.GT.1) GO TO 18
    VC=NUM*PR
    IF (ID.EQ.V.AND.N(11).EQ.1) WRITE (6,12) (NAME(J),J=1,5),NUM,PR,VC
 12 FORMAT (5X,5A4,16X,F10.2,3X,F10.2,3X,F15.2)
    IF (IT.EQ.1) VC1=VC
    IF (IT.NE.1) VC1=0.0
    IF (IT.EQ.2) VC2=VC
    IF (IT.NE.2) VC2=0.0
    IF (IT.EQ.3) VC3=VC
    IF (IT.NE.3) VC3=0.0
    IF (IT.EQ.4) VC4=VC
    IF (IT.NE.4) VC4=0.0
    IF (IT.EQ.5) VC5=VC
    IF (IT.NE.5) VC5=0.0
    IF (ID.EQ.E) GO TO 11
    TVC=VC+TVC
    TVC1=VC+TVC1
    VCE=VCE+VC1
    VCA=VC2+VCA
    VCB=VC3+VCB
    VCC=VC4+VCC
    VCD=VC5+VCD
    GO TO 13
 18 IF (N(11).EQ.1) WRITE (6,32) TVC1
 32 FORMAT(/38X,'TOTAL PRODUCTION STAGE COST',2X,F15.2)
    TVC1=0.0
 19 IF(N(11).EQ.1) WRITE (6,2) (NAME(J),J=1,5)
  2 FORMAT(///4X,'PRODUCTION STAGE:',1X,5A4,/42X,'NO. OF UNITS',4X,
  2 'COST/UNIT',5X,'VARIABLE COST')
    K=K+1
    GO TO 13
 11 IF (N(11).EQ.1) WRITE (6,32) TVC1
    TVC=CR+TVC
    N3=N(3)
    R=FLOAT(N3)
    R=R/100
    CO=TVC*R
    IF (N(11).EQ.1) WRITE (6,41) CO
 41 FORMAT(//36X,'INTEREST ON OPERATING CAPITAL',2X,F15.2)
    TVC=TVC+CO
    IF (N(11).EQ.1) WRITE (6,14) TVC
 14 FORMAT(/36X,'TOTAL VARIABLE COST',12X,F15.2)
    IF (N(8).EQ.1) WRITE (6,31)
 31 FORMAT(//10X,'TOTAL VARIABLE REQUIREMENTS')
    IF (N(8).EQ.1) WRITE (6,33) VCE,VCA,VCB,VCC,VCD
 33 FORMAT (//5X,'ELECTRICITY REQUIREMENTS',6X,F20.2/
   *5X,'LABOR REQUIREMENTS',12X,F20.2/
   *5X,'REPAIR REQUIREMENTS',11X,F20.2/
   *5X,'NATURAL GAS REQUIREMENTS',6X,F20.2/
   *5X,'WATER REQUIREMENTS',12X,F20.2)
    RETURN
    END
```

NR

```
    SUBROUTINE NR(TR)
    INTEGER R/'R'/,E/'E'/,NAME(8)
    REAL NUM,PR
    COMMON /A1/N(30)/A2/T(20)
    TR=0.0
    READ (5,3) (T(I),I=1,20)
  3 FORMAT (20A4)
    IF (N(12).EQ.1) WRITE (6,4) (T(I),I=1,15)
  4 FORMAT('1',///24X,15A4////5X,'PRODUCT',16X,'NUMBER OF UNITS',8X,
   *'PRICE/UNIT',11X,'REVENUE')
 26 READ (5,1) ID,(NAME(J),J=1,5),NUM,PR
  1 FORMAT(A1,5A4,F15.0,F14.0)
    IF (ID.EQ.E) GO TO 2
    REV=NUM*PR
    TR=REV+TR
    IF (N(12).EQ.1) WRITE(6,13) (NAME(J),J=1,5),NUM,PR,REV
 13 FORMAT(5X,5A4,3(3X,F15.2))
    GO TO 26
  2 IF (N(12).EQ.1) WRITE (6,14) TR
 14 FORMAT(//44X,'TOTAL REVENUE',2X,F20.2)
    RETURN
    END
```

Appendix II

Definitions of Terms

Main Program

AFC	Average fixed cost
APROF	Average net revenue
AR	Average revenue
ATC	Average total cost
AVC	Average variable cost
C(I,J)	Matrix of costs, returns, and capacity utilization of all variable data sets used for plotting cost and revenue curves stored on temporary disc space for use in SAS. I goes from 1 through the number of variable data sets used Capacity utilization (in percent) is stored as C(I,1) Average fixed cost is stored as C(I,2) Average variable cost is stored as C(I,3) Average total cost is stored as C(I,4) Marginal cost is stored as C(I,5) Average revenue is stored as C(I,6)
N(I)	Control vector
N(1)	Capacity of plant
N(2)	Capacity utilization of the first variable data set (in percent)
N(3)	Interest rate
N(4)	Cost of raw materials
N(5)	Number of variable cost data sets
N(6)	Addition to capacity utilization (in percent)
N(7)	Generate cost curves
N(8)	Sort variable requirements and total
N(9)	Print input
N(10)	Print fixed costs by item
N(11)	Print variable costs by item
N(12)	Print revenue by item
PROF	Net revenue

P(1)	Number of models to be run
TC	Total cost
TCL	Total cost of previous variable data sets
TFC	Total fixed cost
TR	Total revenue at 100% capacity
TR1	Total revenue at various levels of capacity
TVC	Total variable cost
T(I)	Title vector

Subroutine FIX (TFC)

AEC	Annual equivalency cost
CCP	Cost of construction of new plant
FOB	FOB cost of one unit
FOB1	Installed cost of all machinery of one type or a complete building, etc.
ID	Identification of type of fixed cost item (whether a depreciable or non-depreciable item)
INST	Installation cost (as a percentage of FOB cost)
NAME(J)	Name of fixed cost item
NUM	Number of units of a fixed cost item needed
R	Interest rate
REP	Fixed repairs (as a percentage of FOB cost)
REP1	Fixed repairs (dollar amount)
SAL	Salvage value at the end of useful life
TFC	Total fixed cost
YRS	Years of useful life

Subroutine VAR (TVC)

CO	Interest on operating capital

ID	Identification of production stage or variable cost item
IT	Identification of type of variable resource
NAME(J)	Name of variable cost item
NUM	Number of units of a variable cost item needed
PR	Cost per unit of variable cost item
TVC	Total variable cost at specific level of capacity utilization
TVC1	Total variable cost of a production stage
VC	Variable cost of one variable resource
VCA	Total variable cost of labor for one level of capacity utilization
VCB	Total variable cost of repairs for one level of capacity utilization
VCC	Total variable cost of fuel for one level of capacity utilization
VCD	Total variable cost of water for one level of capacity utilization
VCE	Total variable cost of electricity for one level of capacity utilization
VC1	Variable cost of electricity in a production stage
VC2	Variable cost of labor in a production stage
VC3	Variable cost of repairs in a production stage
VC4	Variable cost of fuel in a production stage
VC5	Variable cost of water in a production stage

Subroutine NR (TR)

ID	Identification of revenue items
NAME(J)	Name of revenue item
NUM	Number of units of revenue item produced at 100% capacity utilization
PR	Price received per unit for each revenue item

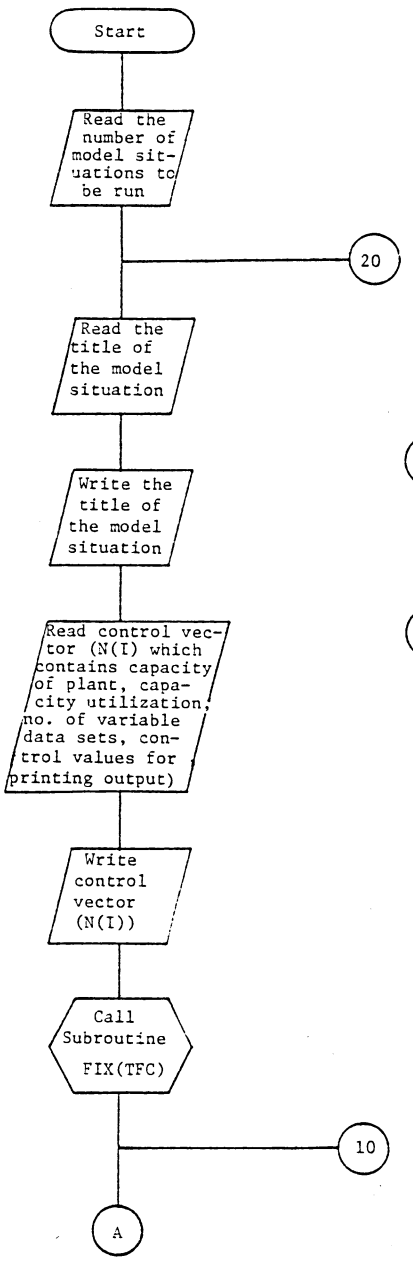
REV	Revenue generated by sale of each item
TR	Total revenue of processing plant from sale of all items produced at 100% of capacity utilizaton

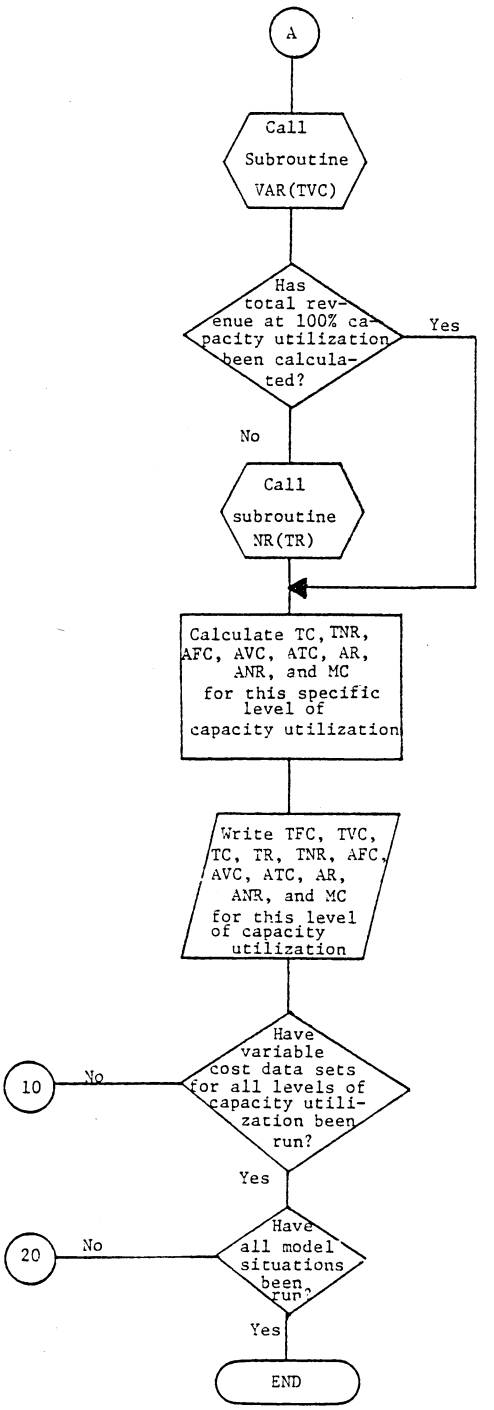
Appendix III

Program Flow Diagrams

Main Program

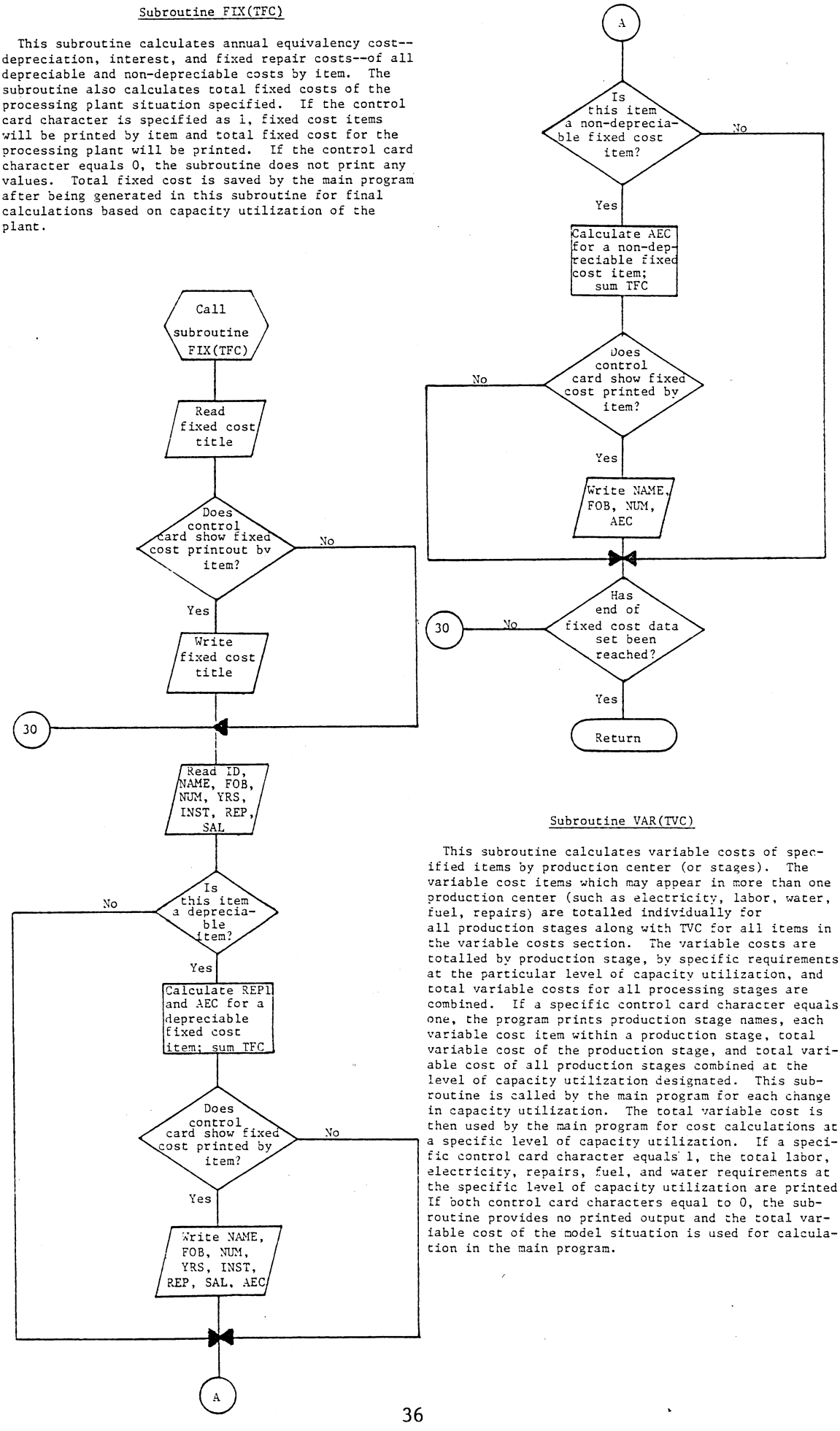
The main program reads a control vector which determines the amount of program output which is to be printed in the subroutines. The control vector also shows the level of capacity utilization of the data sets, the number of data sets to be run, and 100% capacity utilization in terms of input or output. The program then calls subroutines to determine TFC [subroutine FIX(TFC), which is called only once because fixed costs do not vary with changes in capacity utilization], TVC [subroutine VAR(TVC), which is called once for every level of capacity utilization specified], and TR [subroutine NR(TR), which is called only once to determine total revenue at 100% capacity utilization]. For each level of capacity utilization, TFC remains the same, TVC is generated by subroutine VAR(TVC), and TR is calculated in the main program, with the exception of TR at 100% capacity utilization, which is calculated in subroutine NR(TR). The program then calculates total cost, total net revenue, average fixed cost, average variable cost, average total cost, average revenue, average net revenue, and if more than one level of capacity utilization is used, marginal cost. The program then prints each of these values for each level of capacity utilization specified.





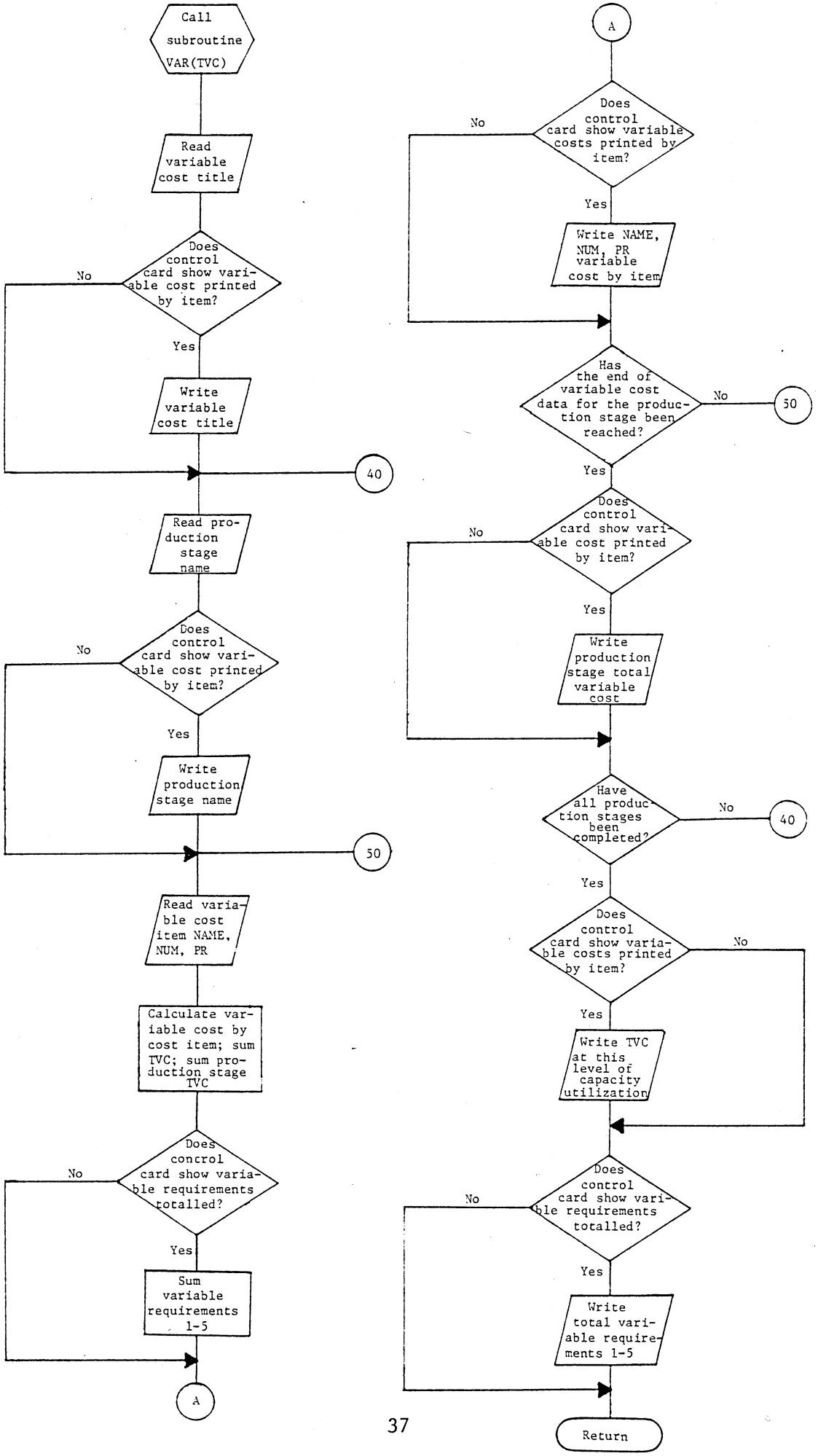
Subroutine FIX(TFC)

This subroutine calculates annual equivalency cost--depreciation, interest, and fixed repair costs--of all depreciable and non-depreciable costs by item. The subroutine also calculates total fixed costs of the processing plant situation specified. If the control card character is specified as 1, fixed cost items will be printed by item and total fixed cost for the processing plant will be printed. If the control card character equals 0, the subroutine does not print any values. Total fixed cost is saved by the main program after being generated in this subroutine for final calculations based on capacity utilization of the plant.



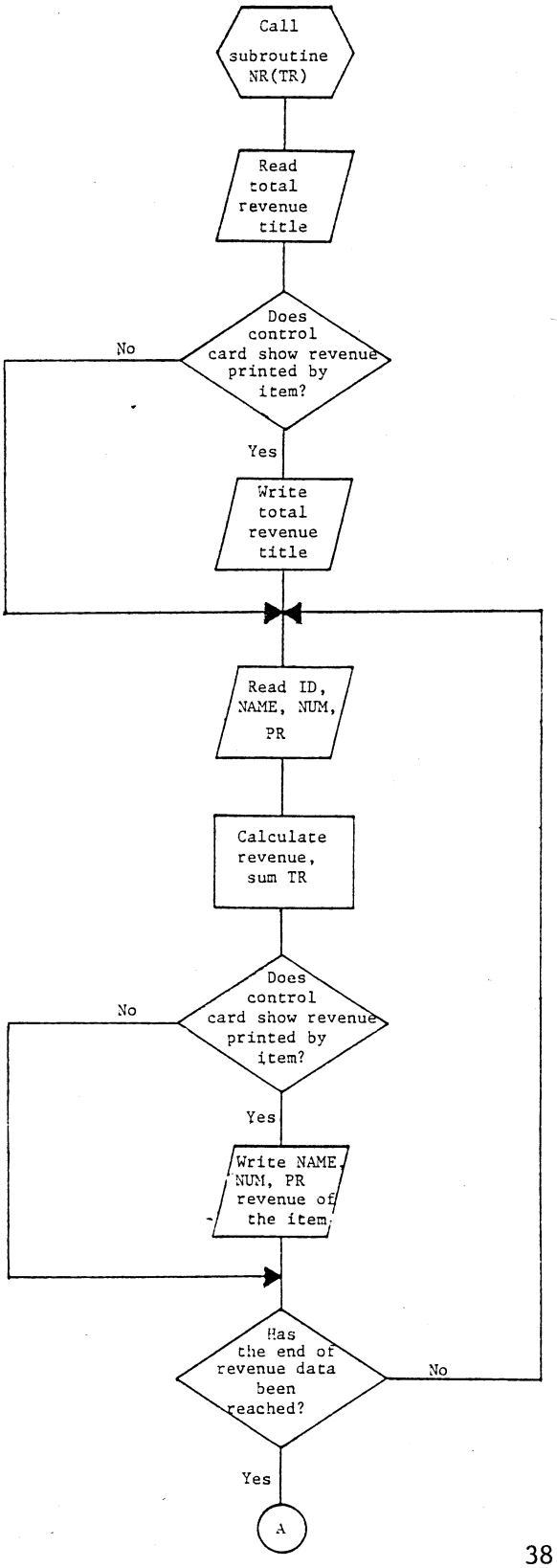
Subroutine VAR(TVC)

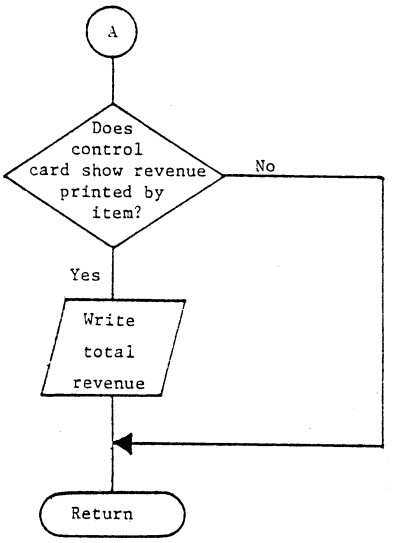
This subroutine calculates variable costs of specified items by production center (or stages). The variable cost items which may appear in more than one production center (such as electricity, labor, water, fuel, repairs) are totalled individually for all production stages along with TVC for all items in the variable costs section. The variable costs are totalled by production stage, by specific requirements at the particular level of capacity utilization, and total variable costs for all processing stages are combined. If a specific control card character equals one, the program prints production stage names, each variable cost item within a production stage, total variable cost of the production stage, and total variable cost of all production stages combined at the level of capacity utilization designated. This subroutine is called by the main program for each change in capacity utilization. The total variable cost is then used by the main program for cost calculations at a specific level of capacity utilization. If a specific control card character equals 1, the total labor, electricity, repairs, fuel, and water requirements at the specific level of capacity utilization are printed. If both control card characters equal to 0, the subroutine provides no printed output and the total variable cost of the model situation is used for calculation in the main program.


Call subroutine VAR(TVC)
Read variable cost title
Does control card show variable cost printed by item?
No
Yes
Write variable cost title
40
Read production stage name
Does control card show variable cost printed by item?
No
Yes
Write production stage name
50
Read variable cost item NAME, NUM, PR
Calculate variable cost by cost item; sum TVC; sum production stage TVC
Does control card show variable requirements totalled?
No
Yes
Sum variable requirements 1-5
A
A
Does control card show variable costs printed by item?
No
Yes
Write NAME, NUM, PR variable cost by item
Has the end of variable cost data for the production stage been reached?
No
50
Yes
Does control card show variable cost printed by item?
No
Yes
Write production stage total variable cost
Have all production stages been completed?
No
40
Yes
Does control card show variable costs printed by item?
No
Yes
Write TVC at this level of capacity utilization
Does control card show variable requirements totalled?
No
Yes
Write total variable requirements 1-5
Return

Subroutine NR(TR)

This program calculates revenue generated by each product produced by the processing plant and total revenue generated from all products combined at 100% capacity utilization. If a specific control character equals 1 on the control card, the program prints revenue generated by item and total revenue of all products combined at 100% capacity utilization. TR is saved by the main program for generating TR and NR at alternative levels of capacity utilization.





Appendix IV

Data Plotting Procedure

Plotting Output of the Program Using SAS

The plotting portion of the program which plots the data in the C(I,J) matrix generated by the program is accomplished only if SAS software is available on the particular computer system used. SAS was developed for statistical research needs and contains a method by which the computer will plot data.

The first card (1) in the program introduces the data to the system. The system knows that any information read before the next semicolon is reached is data. The second card (2) shows the data is stored on a temporary disk file. The computer then reads the information stored as data. The input card (3) shows the specific character (A) associated with the first column of data, (B) with the second column, etc. The label card (4) gives each variable a specific name. The proc print card (5) prints a matrix of the data which are to be plotted and is an efficient method of checking the data after it has been read on and off the temporary disk storage space. The proc plot procedure (5) signifies that a specific method of plotting the data will follow.

The first plot card (6) plots average fixed cost, average variable cost, average total cost, marginal cost, and average revenue as capacity utilization levels change. The overlay statement is used to place all data points on one graph. The character in single quotes shows what character will be printed on the graph to indicate the plotted points (average fixed cost points are represented by B on the graph, average variable cost by a C, etc.). The second plot card (7) plots the same data points using periods as data point indicators. Individual curves can then be drawn on the graph by connecting the periods which locate the specific cost or revenue curve. The location of the points can be made clear by reference back to the initial graph using B, C, D, etc., as data point indicators.

The title card (8) is optional and is used for giving a title to the graphs produced by the plotting procedures. The program must contain an ENDJB card (9) which will return the program to a job control language card.

The SAS portion of the program is entered as follows:

Card Number	Column Number	Input
1	1-5	DATA;
2	1-12	INFILE TEMP;
3	1-5	INPUT
	7	A
	9	B
	11	C

Card Number	Column Number	Input
3	13	D
	15	E
	17-18	F;
4	1-5	LABEL
	7-16	A=CAPACITY
	18-22	B=AFC
	24-28	C=AVC
	30-34	D=ATC
	36-39	E=MC
	41-45	F=AR;
5	1-11	PROC PRINT;
	13-22	PROC PLOT;
6	1-10	PLOT
	6-12	B*A='B'
	14-20	C*A='C'
	22-28	D*A='D'
	30-36	E*A='E'
	38-44	F*A='F'
	46-54	/OVERLAY;
7	1-4	PLOT
	6-12	B*A='.'
	14-20	C*A='.'
	22-28	D*A='.'
	30-36	E*A='.'
	38-44	F*A='.'
	46-54	/OVERLAY;

Card Number	Column Number	Input
8 (optional)	1-31	TITLE COSTS AND REVENUE CURVES;
9	1-6	ENDJB;

Appendix V

Input Data Format and Deck Card Layout

Input Data Format

(All input is right hand justified except when LJ is used)

Card Number	Column		Variable		Explanation
1	1-5	I*	P(1)		Enter number of models to be run
2	1-80		T(I)		Enter title of the model job to be run
3	1-10		N(1)		Enter capacity of plant at 100 percent capacity utilization (example mill in tons per year)
3	11-13	I	N(2)		Enter capacity utilization of first variable cost data set (in percent)
3	14-15	I	N(3)		Enter interest rate (in percent)
3	16-21	I	N(4)		Enter cost of raw material
3	22-23	I	N(5)		Enter number of variable cost data sets
3	24-26	I	N(6)		Enter addition to capacity utilization between variable cost data sets (in percent)
3	27	I	N(7)	1=YES 2=NO	Generate cost curves
3	28	I	N(8)	1=YES 2=NO	Sort variable requirements and total
3	29	I	N(9)	1=YES 2=NO	Print input
3	30	I	N(10)	1=YES 2=NO	Print fixed cost by item
3	31	I	N(11)	1=YES 2=NO	Print variable cost by item
3	32	I	N(12)	1=YES 2=NO	Print revenue by item

* I represents an integer, therefore no decimal points are allowed in these numbers.

Fixed Cost

Card Number	Columns	Variable	Explanation
4	1-80	FIXED COST	Title. Must enter FIXED COST
5	1	F	Identification. Must enter F
5	LJ 2-21	NAME	Enter name of depreciable fixed cost item
5	22-30	FOB	Enter cost of the item
5	31-35 I	NUM	Enter number of units of this item needed
5	36-40 I	YRS	Enter years of useful life of the capital item
5	41-45	INST	Enter installation as a fraction of FOB cost
5	46-50	REP	Enter fixed repair per year as a fraction of FOB cost
5	51-60	SAL	Enter salvage value at the end of useful life (dollars)

One card number 5 is needed for each fixed cost item. The number of items can range from one to whatever number is needed. For explanatory purposes see deck card layout, p. 49.

Non-depreciable Fixed Costs

(Insurance, taxes, and fixed salaries)

6	1	C	Identification. Must enter C
6	LJ 2-21	NAME	Enter name of non-depreciable fixed cost item
6	22-30	COST	Enter cost per year
6	31-35	NUM	Enter number needed

One card number 6 for each non-depreciable fixed cost item is used. The number of these cards is also unlimited.

7	1-3	END	Must enter END

Variable Cost

Card Number	Columns	Variable	Explanation
8	1-80	VARIABLE COST	Identification. Must enter VARIABLE COST
9	1	L	Identification. Must enter L
9	LJ 2-21	NAME	Enter name of the production stage
10	1	V	Identification. Must enter V
10	LJ 2-21	NAME	Enter name of the variable
10	22 (optional)	1,2,3,4, or 5	This is used to sort the variable costs and total. If column 26 of the control card (card 3) has a 1 in it, then this column must have one of the following numbers: 1. for electricity 2. for labor 3. for repair 4. for natural gas or other fuel 5. for water
10	23-36	NUM	Enter number of units of the variable input needed at the specific level of capacity
10	37-50	PR	Enter cost per unit of the variable resource

The number of variable cost cards (card 10) for each production stage is unlimited plus the number of production stages are unlimited. A production stage card (card 9) is not necessary. However, it may be used to break cost components in to production stages for analysis. A variable cost data set is necessary for each level of capacity to be analyzed. (Example: If the first data set is at 80% capacity (N(2)) and the change in capacity utilization level is 10 percent (N(6)) then the number of data sets needed would be 3(N(5)). The data sets for 90 percent and 100 percent capacity utilization would be placed respectively behind the Total Revenue section.

11	1-3	END	Must enter END

Total Revenue

Card Number	Column	Variable	Explanation
12	1-80	TOTAL REVENUE	Title. Must enter TOTAL REVENUE (at 100% capacity utilization)
13	1	R	Identification. Must enter R
13	LJ 2-21	NAME	Enter name of product produced
13	22-36	NUM	Enter number of units of the product produced at 100% capacity utilization
13	37-50	PR	Enter price received for each unit of product produced

Must have a card number 13 for each product produced by the processing plant. The number of products can range from one to any number.

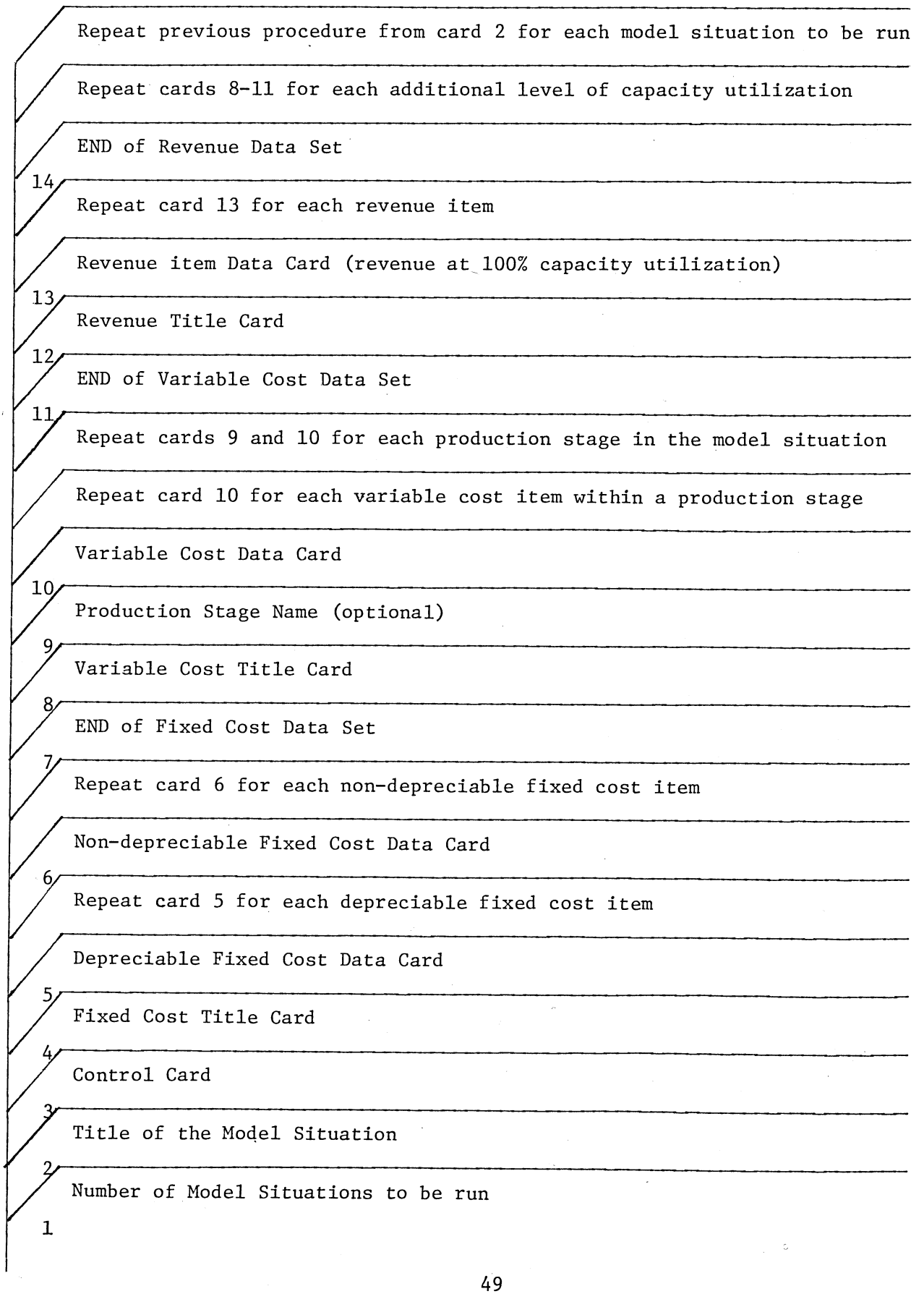
14	1-3	END	Must enter END

Additional data sets for each specified level of capacity utilization must be developed by the previously discussed method and entered here. These must be placed in increasing order in terms of capacity utilization (i.e., lowest first, highest last).

Appendix VI

Deck Arrangement

Deck Card Layout



Card Set Up With SAS

The processing plant cost estimation system is programmed in Fortran IV language and the plotting program is developed using SAS (Statistical Analysis System). SAS is a software package which must be available to the computer before the program can be used to plot the results.

The card deck arrangement for running on a computer which has the SAS software package available is:

Job Card

Control Cards

1. // EXEC FORTGCLG
2. //SYSIN DD *

Main Program

Subroutine Decks

1. Subroutine TITLE
2. Subroutine FIX(TFC)
3. Subroutine VAR(TVC)
4. Subroutine NR(TR)

Control Cards

1. //GO.FT04F001 DD DSN=&TEMP,DISP=(NEW,PASS),
2. // SPACE=(CYL,(1,1)),UNIT=SYSDA
3. //GO.SYSIN DD *

Data Cards (Sets of cards 1-14, Appendix V)

Control Cards

1. /*
2. // EXEC SAS
3. //TEMP DD DSN=&TEMP, DISP=(OLD, DELETE)
4. //SYSIN DD *

SAS Program

Control Cards

1. /*

2. //

The control cards which compile and execute the program are basic Fortran IV job control language cards. Added to the system of control cards when the SAS software package is available are cards to (a) read data generated onto scratch disk space from the Fortran program, (b) use these data for the SAS program, and (c) delete the data from the scratch disk space after use.

Appendix VII

Example Computer Printout

****PROCESSING PLANT COST ESTIMATION SYSTEM****
ECONOMICS, STATISTICS, AND COOPERATIVES SERVICE
USDA AND TEXAS TECH UNIVERSITY

600 TPD PRE-PRESS SOLVENT COTTONSEED OIL MILL MODEL

CAPACITY OF PLANT	198000	TONS
CAPACITY UTILIZATION	80%	
INTEREST RATE	10%	
COST OF RAW MATERIAL	109	
NUMBER OF VARIABLE DATA SETS	8	
ADDITION TO CAPACITY UTILIZATION	10%	
GENERATE COST CURVES	1	1=YES
SORT VARIABLE REQUIREMENTS AND TOTAL	1	0=NO
PRINT OUT INPUT	1	
PRINT OUT TOTAL FIXED COST BY ITEM	1	
PRINT OUT TOTAL VARIABLE COST BY ITEM	1	
PRINT OUT TOTAL REVENUE BY ITEM	1	
NUMBER OF PROBLEMS	1	

FIXED COST

ITEM NAME	FOB COST	NUM	YRS	INST	REP	SALVAGE VALUE	ANNUAL EQUIV. COSTS
LAND	1000.00	25	40	0.0	0.0	25000.00	2500.00
OFFICE	26.80	4000	40	0.0	0.02	21440.00	13057.75
SCALES	13952.00	1	30	1.45	0.0	1000.00	4893.45
TRUCK DUMP	56877.00	4	25	1.45	0.0	20000.00	61203.78
SEEDHOUSE	465750.00	2	40	0.0	0.02	186300.00	113463.56
OPEN STORAGE	57000.00	5	40	1.31	0.02	14250.00	72990.13
CONVEYORS	75520.00	1	20	1.45	0.0	3020.00	21680.16
CLEANING BLDG	13.50	3600	40	0.0	0.02	9920.00	5919.39
4-TRAY SHAKERS	29375.00	8	30	1.31	0.0	0.0	57585.16
CONVEYORS	18880.00	1	20	1.45	0.0	1888.00	5400.26
DELINTERING BLDG	13.50	16000	40	0.0	0.02	43200.00	26310.42
DELINTERS	14582.00	72	30	1.31	0.0	0.0	257271.81
CHAIN HOIST	2000.00	4	15	1.31	0.0	0.0	2429.64
GUMMERS	15845.00	6	30	0.76	0.0	0.0	17749.53
LINT FLUE SYS 1ST	2500.00	20	25	1.31	0.0	0.0	12724.42
LINT ROBBING SYS1ST	3500.00	2	25	1.31	0.0	0.0	1781.42
LINT PICKUP SYS 1ST	3000.00	2	25	1.31	0.0	0.0	1526.93
LINT CLEANERS 1ST	24744.00	2	30	1.31	0.0	0.0	12126.70
LINT FLUE SYS2ND	2500.00	52	25	1.31	0.0	0.0	33083.50
LINT PICKUP SYS 2ND	13000.00	1	25	1.31	0.0	0.0	3308.35
LINT CLEANERS 2ND	24744.00	4	30	1.31	0.0	0.0	24253.40
MOTES PICKUP SYS	3000.00	2	25	1.31	0.0	0.0	1526.93
CONVEYORS	56880.00	1	25	1.31	0.0	0.0	14475.30
BALE PR-STOR BLDG	12.30	24000	40	0.0	0.02	61440.00	37419.25
BALE PRESS	143620.00	2	40	1.31	0.0	20000.00	67806.38
CHAIN HOIST	2000.00	2	15	1.31	0.0	0.0	1214.82
HULL-SEP BLDG	13.50	4850	40	0.0	0.02	13095.00	7975.34
SAFETY SHAKERS	8378.00	2	25	1.31	0.0	0.0	4264.21
HULLER	14993.00	8	30	1.31	0.0	0.0	29391.47
PURIFYING HULLER	7383.00	8	30	1.31	0.0	0.0	14473.23
DOUBLE DRUM BEATER	13230.00	4	30	1.31	0.0	0.0	12967.68
H AND S MACHINE	7378.00	8	30	1.31	0.0	0.0	14463.43
MEATS PURIFER	11793.00	4	30	1.31	0.0	0.0	11559.18
TAILINGS BEATER	7545.00	4	30	1.31	0.0	0.0	7395.40
MOTES BEATER	5395.00	2	30	1.31	0.0	0.0	2644.02
CONVEYORS	5040.00	1	20	1.31	0.0	0.0	1367.51
HULLS BLOWING SYS	10100.00	2	20	1.31	0.0	2000.00	5445.99
HULL STORAGE	13.20	23400	40	0.0	0.02	61776.00	37623.90
MEATS COND BLDG	13.50	2000	40	0.0	0.02	5400.00	3298.80
BOILER	87727.00	1	30	1.31	0.0	8775.00	21442.56
8-HIGH COOKER	173700.00	2	30	1.31	0.0	0.0	85128.00
FLAKING ROLLS	38500.00	4	30	1.31	0.0	0.0	37736.66
CONVEYORS	20250.00	1	25	1.31	0.0	0.0	5153.39
EXTRACTION BLDG	13.50	2000	40	0.0	0.02	5400.00	3298.80
SCREWPRESS	109610.00	6	30	1.31	0.0	0.0	161155.06
BUCKET ELEVATOR	9210.00	1	25	1.31	0.0	0.0	2343.84
SETTLING TANK	44000.00	1	25	1.31	0.0	0.0	11197.48
FILTER PRESS	52864.00	1	25	1.31	0.0	0.0	13453.27
PUMP-CONVEYORS	70320.00	1	25	1.31	0.0	0.0	17895.63
SOLVENT EXT BLDG	14.10	2100	40	0.0	0.02	6000.00	3606.54
SOLVENT EXT PLANT	705000.00	1	30	1.45	0.0	70500.00	182796.81
OIL STORAGE	48000.00	2	30	0.0	0.02	9600.00	12045.25
MEAL STORAGE	13.20	19000	40	0.0	0.02	50160.00	30549.30
REPAIR BLDG	12.80	2400	40	0.0	0.02	6150.00	3741.91
REPAIR MACHINERY	30000.00	1	10	0.76	0.0	3000.00	8404.75
REPAIR PARTS INV	80000.00	1	1	0.0	0.0	0.0	88000.38
MILL MANAGER	30000.	1					32999.58
MILL SUPT	28000.	1					30799.58
SHIFT SUPV.	26000.	4					114399.94
FOREMAN	25000.	9					247499.81
SECRETARIES	10000.	5					54999.97
BUY-SALES	25000.	4					109999.94
BOOKKEEPER	25000.	1					27499.98
TAXES	7461.	14					114899.31
INSURANCE	14922.	6					98485.13

TOTAL FIXED COST 2546071.00

COST OF CONSTRUCTION NEW PLANT 14922016.00

VARIABLE COST

PRODUCTION STAGE: COTTONSEED BUY

	NO. OF UNITS	COST/UNIT	VARIABLE COST
COTTONSEED	59400.00	109.39	6497766.00
TRANSPORTATION IN	59400.00	5.00	297000.00
TOTAL PRODUCTION STAGE COST			6794765.00

PRODUCTION STAGE: UNLOADING-STORAGE

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	9.00	6352.00	57168.00
SEASONAL LABOR	8.00	4000.00	32000.00
ELECTRICITY	59400.00	0.16	9504.00
REPAIR PARTS	59400.00	0.25	14850.00
REPAIR LABOR	59400.00	0.24	14256.00
TOTAL PRODUCTION STAGE COST			127777.88

PRODUCTION STAGE: CLEANING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	6352.00	19056.00
ELECTRICITY	99.00	144.00	14256.00
REPAIR PARTS	59400.00	0.25	14850.00
REPAIR LABOR	59400.00	0.05	2970.00
TOTAL PRODUCTION STAGE COST			51132.00

PRODUCTION STAGE: DELINTERING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	15.00	7248.00	108720.00
HEAD LINTERMAN	3.00	8000.00	24000.00
ELECTRICITY	99.00	1380.00	136620.00
REPAIR PARTS	59400.00	0.58	34452.00
REPAIR LABOR	59400.00	0.20	11880.00
TOTAL PRODUCTION STAGE COST			315671.88

PRODUCTION STAGE: BALING-BALE STOR

	NO. OF UNITS	COST/UNIT	VARIABLE COST
PRESS LABOR	4.00	6352.00	38112.00
STORAGE LABOR	9.00	7248.00	65232.00
ELECTRICITY	99.00	36.00	3564.00
BAGGING-TIES	17100.00	1.85	31634.99
REPAIR PARTS	59400.00	0.09	5346.00
REPAIR LABOR	59400.00	0.03	1782.00
TOTAL PRODUCTION STAGE COST			145670.81

PRODUCTION STAGE: HULLING-SEPARTING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	6.00	7248.00	43488.00
ELECTRICITY	99.00	216.00	21384.00
REPAIR PARTS	59400.00	0.47	27918.00
REPAIR LABOR	59400.00	0.15	8910.00
TOTAL PRODUCTION STAGE COST			101699.88

PRODUCTION STAGE: MEAL CONDITIONING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	7248.00	21744.00
ELECTRICITY	99.00	342.00	33858.00
WATER	59400.00	0.04	2376.00
NATURAL GAS	59400.00	1.08	64151.99
REPAIR PARTS	59400.00	0.32	19008.00
REPAIR LABOR	59400.00	0.21	12474.00
TOTAL PRODUCTION STAGE COST			153611.81

PRODUCTION STAGE: PRE-PRESS EXT

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	6.00	7248.00	43488.00
ELECTRICITY	99.00	858.00	84942.00
REPAIR PARTS	59400.00	0.30	17820.00
REPAIR LABOR	59400.00	0.13	7722.00
TOTAL PRODUCTION STAGE COST			153971.88

PRODUCTION STAGE: EXTRACTION

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	5362.00	16086.00
HEAD EXTRACTION	3.00	8000.00	24000.00
ELECTRICITY	99.00	186.00	18414.00
WATER-SEWAGE	59400.00	0.10	5940.00
NATURAL GAS	59400.00	1.26	74843.94
HEXANE	59400.00	0.68	40392.00
REPAIR PARTS	59400.00	0.35	20790.00
REPAIR LABOR	59400.00	0.20	11880.00
TOTAL PRODUCTION STAGE COST			212345.69

PRODUCTION STAGE: OIL-MEAL-HULL STOR

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	9.00	7248.00	65232.00
ELECTRICITY	99.00	54.00	5346.00
REPAIR PARTS	58400.00	0.28	16352.00
REPAIR LABOR	59400.00	0.17	10098.00
TOTAL PRODUCTION STAGE COST			97027.88

PRODUCTION STAGE: MISCELLANEOUS

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR MAINTENANCE	9.00	7248.00	65232.00
LABOR CLEANING	9.00	7248.00	65232.00
LAB ANALYSIS	59400.00	0.10	5940.00

BROKERAGE FEES	59400.00	1.00	59400.00
OFFICE	59400.00	1.25	74250.00
INSURANCE	59400.00	0.88	52272.00
	TOTAL PRODUCTION STAGE COST		322325.88
	INTEREST ON OPERATING CAPITAL		847597.38
	TOTAL VARIABLE COST		9323574.00

TOTAL VARIABLE REQUIREMENTS

ELECTRICITY REQUIREMENTS	327837.94
LABOR REQUIREMENTS	768979.50
REPAIR REQUIREMENTS	173167.56
NATURAL GAS REQUIREMENTS	139995.88
WATER REQUIREMENTS	8315.99

TOTAL REVENUE (AT 100% CAPACITY)

PRODUCT	NUMBER OF UNITS	PRICE/UNIT	REVENUE
COTTONSEED OIL	68706000.00	0.31	21642384.00
COTTONSEED MEAL	91377.00	143.70	13130874.00
COTTONSEED LINTERS	3762000.00	0.08	2896738.00
COTTONSEED HULLS	44451.00	31.78	1412652.00
	TOTAL REVENUE		39082624.00

RESULTS OF THE MODEL AT 30% CAPACITY

TOTAL FIXED COST	2346071.00
TOTAL VARIABLE COST	9323574.00
TOTAL COST	11369645.00
TOTAL REVENUE	11724785.00
TOTAL NET REVENUE	-144860.00
AVERAGE FIXED COST	42.86
AVERAGE VARIABLE COST	156.96
AVERAGE TOTAL COST	199.83
AVERAGE REVENUE	197.39
AVERAGE NET REVENUE	-2.44

VARIABLE COST

PRODUCTION STAGE: COTTONSEED BUY

	NO. OF UNITS	COST/UNIT	VARIABLE COST
COTTONSEED	79200.00	109.39	8663687.00
TRANSPORTATION IN	79200.00	5.00	396000.00
	TOTAL PRODUCTION STAGE COST		9059687.00

PRODUCTION STAGE: UNLOADING-STORAGE

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	9.00	8337.00	75033.00
SEASONAL LABOR	8.00	4000.00	32000.00
ELECTRICITY	79200.00	0.16	12672.00
REPAIR PARTS	79200.00	0.25	19800.00
REPAIR LABOR	79200.00	0.24	19007.99
TOTAL PRODUCTION STAGE COST			158512.88

PRODUCTION STAGE: CLEANING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	8337.00	25011.00
ELECTRICITY	132.00	144.00	19008.00
REPAIR PARTS	79200.00	0.25	19800.00
REPAIR LABOR	79200.00	0.05	3960.00
TOTAL PRODUCTION STAGE COST			67778.94

PRODUCTION STAGE: DELINTERING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	15.00	9513.00	142695.00
HEAD LINTERMAN	3.00	10500.00	31500.00
ELECTRICITY	132.00	1380.00	182160.00
REPAIR PARTS	79200.00	0.58	45936.00
REPAIR LABOR	79200.00	0.20	15840.00
TOTAL PRODUCTION STAGE COST			418130.88

PRODUCTION STAGE: BALING-BALE STOR

	NO. OF UNITS	COST/UNIT	VARIABLE COST
PRESS LABOR	6.00	8337.00	50022.00
STORAGE LABOR	9.00	9513.00	85617.00
ELECTRICITY	132.00	36.00	4752.00
BAGGING-TIES	22800.00	1.85	42179.98
REPAIR PARTS	79200.00	0.09	7128.00
REPAIR LABOR	79200.00	0.03	2376.00
TOTAL PRODUCTION STAGE COST			192074.81

PRODUCTION STAGE: HULLING-SEPARTING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	6.00	9513.00	57078.00
ELECTRICITY	132.00	216.00	28512.00
REPAIR PARTS	79200.00	0.47	37224.00
REPAIR LABOR	79200.00	0.15	11880.00
TOTAL PRODUCTION STAGE COST			134693.88

PRODUCTION STAGE: MEAL CONDITIONING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	9513.00	28539.00
ELECTRICITY	132.00	342.00	45144.00
WATER	79200.00	0.04	3168.00
NATURAL GAS	79200.00	1.08	85535.94
REPAIR PARTS	79200.00	0.32	25344.00
REPAIR LABOR	79200.00	0.21	16632.00
TOTAL PRODUCTION STAGE COST			204362.75

PRODUCTION STAGE: PRE-PRESS EXT

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	6.00	9513.00	57078.00
ELECTRICITY	132.00	858.00	113256.00
REPAIR PARTS	79200.00	0.30	23760.00
REPAIR LABOR	79200.00	0.13	10296.00
	TOTAL PRODUCTION STAGE COST		204389.88

PRODUCTION STAGE: EXTRACTION

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	8337.00	25011.00
HEAD EXTRACTION	3.00	10500.00	31500.00
ELECTRICITY	132.00	186.00	24552.00
WATER-SEWAGE	79200.00	0.10	7920.00
NATURAL GAS	79200.00	1.26	99791.94
HEXANE	79200.00	0.68	53855.99
REPAIR PARTS	79200.00	0.35	27720.00
REPAIR LABOR	79200.00	0.20	15840.00
	TOTAL PRODUCTION STAGE COST		286190.69

PRODUCTION STAGE: OIL-MEAL-HULL STOR

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	9.00	9513.00	85617.00
ELECTRICITY	132.00	54.00	7128.00
REPAIR PARTS	79200.00	0.28	22176.00
REPAIR LABOR	79200.00	0.17	13464.00
	TOTAL PRODUCTION STAGE COST		128384.88

PRODUCTION STAGE: MISCELLANEOUS

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR MAINTENANCE	9.00	9513.00	85617.00
LABOR CLEANING	9.00	9513.00	85617.00
LAB ANALYSIS	79200.00	0.10	7920.00
BROKERAGE FEES	79200.00	1.00	79200.00
OFFICE	79200.00	1.25	99000.00
INSURANCE	79200.00	0.88	69695.94
	TOTAL PRODUCTION STAGE COST		427049.88
	INTEREST ON OPERATING CAPITAL		1128122.00
	TOTAL VARIABLE COST		12409355.00

TOTAL VARIABLE REQUIREMENTS

ELECTRICITY REQUIREMENTS	437183.94
LABOR REQUIREMENTS	1004854.50
REPAIR REQUIREMENTS	231263.50
NATURAL GAS REQUIREMENTS	135327.88
WATER REQUIREMENTS	11087.99

RESULTS OF THE MODEL AT 40% CAPACITY

TOTAL FIXED COST	2546071.00
TOTAL VARIABLE COST	12409355.00
TOTAL COST	14955426.00
TOTAL REVENUE	15633048.00
TOTAL NET REVENUE	677622.00
AVERAGE FIXED COST	32.15
AVERAGE VARIABLE COST	156.68
AVERAGE TOTAL COST	188.83
AVERAGE REVENUE	197.39
AVERAGE NET REVENUE	8.56
MARGINAL COST	156.05

VARIABLE COST

PRODUCTION STAGE: COTTONSEED BUY

	NO. OF UNITS	COST/UNIT	VARIABLE COST
COTTONSEED	99000.00	109.39	10829609.00
TRANSPORTATION IN	99000.00	5.00	495000.00
TOTAL PRODUCTION STAGE COST			11324609.00

PRODUCTION STAGE: UNLOADING-STORAGE

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	9.00	10719.00	96471.00
SEASONAL LABOR	8.00	4000.00	32000.00
ELECTRICITY	99000.00	0.16	15840.00
REPAIR PARTS	99000.00	0.25	24750.00
REPAIR LABOR	99000.00	0.24	23759.99
TOTAL PRODUCTION STAGE COST			192820.88

PRODUCTION STAGE: CLEANING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	10719.00	32157.00
ELECTRICITY	165.00	144.00	23760.00
REPAIR PARTS	99000.00	0.25	24750.00
REPAIR LABOR	99000.00	0.05	4950.00
TOTAL PRODUCTION STAGE COST			85616.94

PRODUCTION STAGE: DELINTERING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	15.00	12231.00	183465.00
HEAD LINTERMAN	3.00	13500.00	40500.00
ELECTRICITY	165.00	1380.00	227700.00
REPAIR PARTS	99000.00	0.58	57420.00
REPAIR LABOR	99000.00	0.20	19800.00
TOTAL PRODUCTION STAGE COST			528384.98

PRODUCTION STAGE: BALING-BALE STOR

	NO. OF UNITS	COST/UNIT	VARIABLE COST
PRESS LABOR	6.00	10719.00	64314.00
STORAGE LABOR	9.00	12231.00	110079.00
ELECTRICITY	165.00	36.00	5940.00
BAGGING-TIES	28500.00	1.85	52724.98
REPAIR PARTS	99000.00	0.09	8910.00
REPAIR LABOR	99000.00	0.03	2970.00
TOTAL PRODUCTION STAGE COST			244937.81

PRODUCTION STAGE: HULLING-SEPARTING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	6.00	12231.00	73386.00
ELECTRICITY	165.00	216.00	35640.00
REPAIR PARTS	99000.00	0.47	46530.00
REPAIR LABOR	99000.00	0.15	14850.00
TOTAL PRODUCTION STAGE COST			170405.88

PRODUCTION STAGE: MEAL CONDITIONING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	12231.00	36693.00
ELECTRICITY	165.00	342.00	56430.00
WATER	99000.00	0.04	3960.00
NATURAL GAS	99000.00	1.08	106919.94
REPAIR PARTS	99000.00	0.32	31680.00
REPAIR LABOR	99000.00	0.21	20790.00
TOTAL PRODUCTION STAGE COST			256472.75

PRODUCTION STAGE: PRE-PRESS EXT

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	6.00	12231.00	73386.00
ELECTRICITY	165.00	858.00	141570.00
REPAIR PARTS	99000.00	0.30	29699.99
REPAIR LABOR	99000.00	0.13	12870.00
TOTAL PRODUCTION STAGE COST			257525.88

PRODUCTION STAGE: EXTRACTION

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	10719.00	32157.00
HEAD EXTRACTION	3.00	13500.00	40500.00
ELECTRICITY	165.00	186.00	30690.00
WATER-SEWAGE	99000.00	0.10	9900.00
NATURAL GAS	99000.00	1.26	124739.88
HEXANE	99000.00	0.68	67319.94
REPAIR PARTS	99000.00	0.35	34650.00
REPAIR LABOR	99000.00	0.20	19800.00
TOTAL PRODUCTION STAGE COST			359756.63

PRODUCTION STAGE: OIL-MEAL-HULL STOR

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	9.00	12231.00	110079.00
ELECTRICITY	165.00	54.00	8910.00
REPAIR PARTS	99000.00	0.28	27720.00
REPAIR LABOR	99000.00	0.17	16829.99
TOTAL PRODUCTION STAGE COST			163538.88

PRODUCTION STAGE: MISCELLANEOUS

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR MAINTENANCE	9.00	12231.00	110079.00
LABOR CLEANING	9.00	12231.00	110079.00
LAB ANALYSIS	99000.00	0.10	9900.00
BROKERAGE FEES	99000.00	1.00	99000.00
OFFICE	99000.00	1.25	123750.00
INSURANCE	99000.00	0.88	87119.94
	TOTAL PRODUCTION STAGE COST		539927.88
	INTEREST ON OPERATING CAPITAL		1412446.00
	TOTAL VARIABLE COST		15536920.00

TOTAL VARIABLE REQUIREMENTS

ELECTRICITY REQUIREMENTS	546479.94
LABOR REQUIREMENTS	1278994.00
REPAIR REQUIREMENTS	289079.50
NATURAL GAS REQUIREMENTS	231659.81
WATER REQUIREMENTS	13959.99

RESULTS OF THE MODEL AT 50% CAPACITY

TOTAL FIXED COST	2546071.00
TOTAL VARIABLE COST	15536920.00
TOTAL COST	18082976.00
TOTAL REVENUE	19541312.00
TOTAL NET REVENUE	1458336.00
AVERAGE FIXED COST	25.72
AVERAGE VARIABLE COST	156.94
AVERAGE TOTAL COST	182.66
AVERAGE REVENUE	197.39
AVERAGE NET REVENUE	14.73
MARGINAL COST	157.96

VARIABLE COST

PRODUCTION STAGE: COTTONSEED BUY

	NO. OF UNITS	COST/UNIT	VARIABLE COST
COTTONSEED	118800.00	109.39	12995531.00
TRANSPORTATION IN	118800.00	5.00	594000.00
	TOTAL PRODUCTION STAGE COST		13589531.00

PRODUCTION STAGE: UNLOADING-STORAGE

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	9.00	12307.00	110763.00
SEASONAL LABOR	12.00	4000.00	48000.00
ELECTRICITY	118800.00	0.16	19007.99
REPAIR PARTS	118800.00	0.25	29700.00
REPAIR LABOR	118800.00	0.24	28511.99
	TOTAL PRODUCTION STAGE COST		235982.88

PRODUCTION STAGE: CLEANING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	12300.00	36900.00
ELECTRICITY	198.00	144.00	28512.00
REPAIR PARTS	118800.00	0.25	29700.00
REPAIR LABOR	118800.00	0.05	5940.00
	TOTAL PRODUCTION STAGE COST		101051.94

PRODUCTION STAGE: DELINTERING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	15.00	14043.00	210645.00
HEAD LINTERMAN	3.00	15500.00	46500.00
ELECTRICITY	198.00	1380.00	273240.00
REPAIR PARTS	118800.00	0.58	68903.94
REPAIR LABOR	118800.00	0.20	23760.00
	TOTAL PRODUCTION STAGE COST		623048.88

PRODUCTION STAGE: BALING-BALE STOR

	NO. OF UNITS	COST/UNIT	VARIABLE COST
PRESS LABOR	6.00	12307.00	73842.00
STORAGE LABOR	9.00	14043.00	126387.00
ELECTRICITY	198.00	36.00	7128.00
BAGGING-TIES	34200.00	1.85	63269.98
REPAIR PARTS	118800.00	0.09	10692.00
REPAIR LABOR	118800.00	0.03	3564.00
	TOTAL PRODUCTION STAGE COST		284882.81

PRODUCTION STAGE: PULLING-SEPARTING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	6.00	14043.00	84258.00
ELECTRICITY	198.00	216.00	42768.00
REPAIR PARTS	118800.00	0.47	55836.00
REPAIR LABOR	118800.00	0.15	17820.00
	TOTAL PRODUCTION STAGE COST		200681.88

PRODUCTION STAGE: MEAL CONDITIONING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	14043.00	42129.00
ELECTRICITY	198.00	342.00	67716.00
WATER	118800.00	0.04	4752.00
NATURAL GAS	118800.00	1.08	128303.94
REPAIR PARTS	118800.00	0.32	38016.00
REPAIR LABOR	118800.00	0.21	24948.00
	TOTAL PRODUCTION STAGE COST		305864.75

PRODUCTION STAGE: PRE-PRESS EXT

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	6.00	14043.00	84258.00
ELECTRICITY	198.00	858.00	169884.00
REPAIR PARTS	118800.00	0.30	35639.99
REPAIR LABOR	118800.00	0.13	15444.00
	TOTAL PRODUCTION STAGE COST		305225.88

PRODUCTION STAGE: EXTRACTION

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	12307.00	36921.00
HEAD EXTRACTION	3.00	15500.00	46500.00
ELECTRICITY	198.00	186.00	36828.00
WATER-SEWAGE	118800.00	0.10	11879.99
NATURAL GAS	118800.00	1.26	149687.88
HEXANE	118800.00	0.68	80783.94
REPAIR PARTS	118800.00	0.35	41579.99
REPAIR LABOR	118800.00	0.20	23760.00
	TOTAL PRODUCTION STAGE COST		427940.63

PRODUCTION STAGE: OIL-MEAL-HULL STOR

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	9.00	14043.00	126387.00
ELECTRICITY	198.00	54.00	10692.00
REPAIR PARTS	118800.00	0.28	33264.00
REPAIR LABOR	118800.00	0.17	20195.99
	TOTAL PRODUCTION STAGE COST		190538.88

PRODUCTION STAGE: MISCELLANEOUS

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR MAINTENANCE	9.00	14043.00	126387.00
LABOR CLEANING	9.00	14043.00	126387.00
LAB ANALYSIS	118800.00	0.10	11879.99
BROKERAGE FEES	118800.00	1.00	118800.00
OFFICE	118800.00	1.25	148500.00
INSURANCE	118800.00	0.88	104543.94
	TOTAL PRODUCTION STAGE COST		636497.88

INTEREST ON OPERATING CAPITAL	1690119.00
TOTAL VARIABLE COST	18591312.00

TOTAL VARIABLE REQUIREMENTS

ELECTRICITY REQUIREMENTS	455775.94
LABOR REQUIREMENTS	1486641.00
REPAIR REQUIREMENTS	346895.50
NATURAL GAS REQUIREMENTS	277991.81
WATER REQUIREMENTS	16631.99

RESULTS OF THE MODEL AT 60% CAPACITY

TOTAL FIXED COST	2546071.00
TOTAL VARIABLE COST	18591312.00
TOTAL COST	21137376.00
TOTAL REVENUE	23449568.00
TOTAL NET REVENUE	2312192.00
AVERAGE FIXED COST	21.43
AVERAGE VARIABLE COST	156.49
AVERAGE TOTAL COST	177.92
AVERAGE REVENUE	197.39
AVERAGE NET REVENUE	19.46
MARGINAL COST	154.26

VARIABLE COST

PRODUCTION STAGE: COTTONSEED BUY

	NO. OF UNITS	COST/UNIT	VARIABLE COST
COTTONSEED	138600.00	109.39	15161453.00
TRANSPORTATION IN	138600.00	5.00	693000.00
TOTAL PRODUCTION STAGE COST			15854453.00

PRODUCTION STAGE: UNLOADING-STORAGE

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	9.00	14689.00	132201.00
SEASONAL LABOR	12.00	4000.00	48000.00
ELECTRICITY	138600.00	0.16	22175.99
REPAIR PARTS	138600.00	0.25	34650.00
REPAIR LABOR	138600.00	0.24	33263.99
TOTAL PRODUCTION STAGE COST			270290.88

PRODUCTION STAGE: CLEANING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	14689.00	44067.00
ELECTRICITY	231.00	144.00	33264.00
REPAIR PARTS	138600.00	0.25	34650.00
REPAIR LABOR	138600.00	0.05	6930.00
TOTAL PRODUCTION STAGE COST			118910.94

PRODUCTION STAGE: DELINTERING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	15.00	16761.00	251415.00
HEAD LINTERMAN	3.00	18500.00	55500.00
ELECTRICITY	231.00	1380.00	318780.00
REPAIR PARTS	138600.00	0.58	80387.94
REPAIR LABOR	138600.00	0.20	27720.00
TOTAL PRODUCTION STAGE COST			733802.88

PRODUCTION STAGE: BALING-BALE STOR

	NO. OF UNITS	COST/UNIT	VARIABLE COST
PRESS LABOR	6.00	14689.00	88134.00
STORAGE LABOR	9.00	16761.00	150849.00
ELECTRICITY	231.00	36.00	8316.00
BAGGING-TIES	39900.00	1.85	73814.94
REPAIR PARTS	138600.00	0.09	12474.00
REPAIR LABOR	138600.00	0.03	4158.00
TOTAL PRODUCTION STAGE COST			337745.81

PRODUCTION STAGE: HULLING-SEPARTING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	6.00	16674.00	100044.00
ELECTRICITY	231.00	216.00	49896.00
REPAIR PARTS	138600.00	0.47	65141.99
REPAIR LABOR	138600.00	0.15	20790.00
	TOTAL PRODUCTION STAGE COST		235871.88

PRODUCTION STAGE: MEAL CONDITIONING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	16761.00	50283.00
ELECTRICITY	231.00	342.00	79002.00
WATER	138600.00	0.04	5544.00
NATURAL GAS	138600.00	1.08	149687.94
REPAIR PARTS	138600.00	0.32	44352.00
REPAIR LABOR	138600.00	0.21	29106.00
	TOTAL PRODUCTION STAGE COST		357974.75

PRODUCTION STAGE: PRE-PRESS EXT

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	6.00	16761.00	100566.00
ELECTRICITY	231.00	858.00	198198.00
REPAIR PARTS	138600.00	0.30	41579.99
REPAIR LABOR	138600.00	0.13	18018.00
	TOTAL PRODUCTION STAGE COST		358361.88

PRODUCTION STAGE: EXTRACTION

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	14689.00	44067.00
HEAD EXTRACTION	3.00	18500.00	55500.00
ELECTRICITY	231.00	186.00	42966.00
WATER-SEWAGE	138600.00	0.10	13859.99
NATURAL GAS	138600.00	1.26	174635.88
HEXANE	138600.00	0.68	94247.94
REPAIR PARTS	138600.00	0.35	48509.99
REPAIR LABOR	138600.00	0.20	27720.00
	TOTAL PRODUCTION STAGE COST		501506.63

PRODUCTION STAGE: OIL-MEAL-HULL STOR

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	9.00	16761.00	150849.00
ELECTRICITY	231.00	54.00	12474.00
REPAIR PARTS	138600.00	0.28	38807.99
REPAIR LABOR	138600.00	0.17	23561.99
	TOTAL PRODUCTION STAGE COST		225692.88

PRODUCTION STAGE: MISCELLANEOUS

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR MAINTENANCE	9.00	16761.00	150849.00
LABOR CLEANING	9.00	16761.00	150849.00
LAB ANALYSIS	138600.00	0.10	13859.99

BROKERAGE FEES	138600.00	1.00	138600.00
OFFICE	138600.00	1.25	173250.00
INSURANCE	138600.00	0.88	121967.94
	TOTAL PRODUCTION STAGE COST		749375.88
	INTEREST ON OPERATING CAPITAL		1974367.00
	TOTAL VARIABLE COST		21718032.00

TOTAL VARIABLE REQUIREMENTS

ELECTRICITY REQUIREMENTS	765071.94
LABOR REQUIREMENTS	1760279.00
REPAIR REQUIREMENTS	404711.50
NATURAL GAS REQUIREMENTS	324323.31
WATER REQUIREMENTS	19403.99

RESULTS OF THE MODEL AT 70% CAPACITY

TOTAL FIXED COST	2546071.00
TOTAL VARIABLE COST	21718032.00
TOTAL COST	24264096.00
TOTAL REVENUE	27357824.00
TOTAL NET REVENUE	3093728.00
AVERAGE FIXED COST	16.37
AVERAGE VARIABLE COST	156.70
AVERAGE TOTAL COST	175.07
AVERAGE REVENUE	197.39
AVERAGE NET REVENUE	22.32
MARGINAL COST	157.92

VARIABLE COST

PRODUCTION STAGE: COTTONSEED BUY

	NO. OF UNITS	COST/UNIT	VARIABLE COST
COTTONSEED	158400.00	109.39	17327360.00
TRANSPORTATION IN	158400.00	5.00	792000.00
	TOTAL PRODUCTION STAGE COST		18119360.00

PRODUCTION STAGE: UNLOADING-STORAGE

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	9.00	16674.00	150066.00
SEASONAL LABOR	12.00	4000.00	48000.00
ELECTRICITY	158400.00	0.16	25343.99
REPAIR PARTS	158400.00	0.25	39600.00
REPAIR LABOR	158400.00	0.24	38015.99
	TOTAL PRODUCTION STAGE COST		301025.88

PRODUCTION STAGE: CLEANING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	16674.00	50022.00
ELECTRICITY	264.00	144.00	38016.00
REPAIR PARTS	158400.00	0.25	39600.00
REPAIR LABOR	158400.00	0.05	7920.00
TOTAL PRODUCTION STAGE COST			135557.94

PRODUCTION STAGE: DELINTERING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	15.00	19026.00	285390.00
HEAD LINTERMAN	3.00	21000.00	63000.00
ELECTRICITY	264.00	1380.00	364320.00
REPAIR PARTS	158400.00	0.58	91871.94
REPAIR LABOR	158400.00	0.20	31680.00
TOTAL PRODUCTION STAGE COST			836261.98

PRODUCTION STAGE: BALING-BALE STOR

	NO. OF UNITS	COST/UNIT	VARIABLE COST
PRESS LABOR	6.00	16674.00	100044.00
STORAGE LABOR	9.00	19026.00	171234.00
ELECTRICITY	264.00	36.00	9504.00
BAGGING-TIES	45600.00	1.85	84359.94
REPAIR PARTS	158400.00	0.09	14255.99
REPAIR LABOR	158400.00	0.03	4752.00
TOTAL PRODUCTION STAGE COST			384149.81

PRODUCTION STAGE: HULLING-SEPARTING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	6.00	19026.00	114156.00
ELECTRICITY	264.00	216.00	57024.00
REPAIR PARTS	158400.00	0.47	74447.94
REPAIR LABOR	158400.00	0.15	23760.00
TOTAL PRODUCTION STAGE COST			269387.88

PRODUCTION STAGE: MEAL CONDITIONING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	19026.00	57078.00
ELECTRICITY	264.00	342.00	90288.00
WATER	158400.00	0.04	6336.00
NATURAL GAS	158400.00	1.08	171071.94
REPAIR PARTS	158400.00	0.32	50688.00
REPAIR LABOR	158400.00	0.21	33264.00
TOTAL PRODUCTION STAGE COST			408725.75

PRODUCTION STAGE: PRE-PRESS EXT

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	6.00	19026.00	114156.00
ELECTRICITY	264.00	858.00	226512.00
REPAIR PARTS	158400.00	0.30	47519.99
REPAIR LABOR	158400.00	0.13	20592.00
TOTAL PRODUCTION STAGE COST			408779.88

PRODUCTION STAGE: EXTRACTION

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	16674.00	50022.00
HEAD EXTRACTION	3.00	21000.00	63000.00
ELECTRICITY	264.00	186.00	49104.00
WATER-SEWAGE	158400.00	0.10	15839.99
NATURAL GAS	158400.00	1.26	199583.88
HEXANE	158400.00	0.68	107711.94
REPAIR PARTS	158400.00	0.35	55439.99
REPAIR LABOR	158400.00	0.20	31680.00
	TOTAL PRODUCTION STAGE COST		572381.63

PRODUCTION STAGE: OIL-MEAL-HULL STOR

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	9.00	19026.00	171234.00
ELECTRICITY	264.00	54.00	14256.00
REPAIR PARTS	158400.00	0.28	44351.99
REPAIR LABOR	158400.00	0.17	26927.99
	TOTAL PRODUCTION STAGE COST		256769.88

PRODUCTION STAGE: MISCELLANEOUS

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR MAINTENANCE	9.00	19026.00	171234.00
LABOR CLEANING	9.00	19026.00	171234.00
LAB ANALYSIS	158400.00	0.10	15839.99
BROKERAGE FEES	158400.00	1.00	158400.00
OFFICE	158400.00	1.25	198000.00
INSURANCE	158400.00	0.88	139391.94
	TOTAL PRODUCTION STAGE COST		854099.88

INTEREST ON OPERATING CAPITAL	2254600.00
TOTAL VARIABLE COST	24800608.00

TOTAL VARIABLE REQUIREMENTS

ELECTRICITY REQUIREMENTS	874367.94
LABOR REQUIREMENTS	1993704.00
REPAIR REQUIREMENTS	462527.50
NATURAL GAS REQUIREMENTS	370655.81
WATER REQUIREMENTS	22175.99

RESULTS OF THE MODEL AT 80% CAPACITY

TOTAL FIXED COST	2546071.00
TOTAL VARIABLE COST	24800608.00
TOTAL COST	27346672.00
TOTAL REVENUE	31266096.00
TOTAL NET REVENUE	3919424.00
AVERAGE FIXED COST	16.07
AVERAGE VARIABLE COST	156.57
AVERAGE TOTAL COST	172.64
AVERAGE REVENUE	197.39
AVERAGE NET REVENUE	24.74
MARGINAL COST	155.69

VARIABLE COST

PRODUCTION STAGE: COTTONSEED BUY

	NO. OF UNITS	COST/UNIT	VARIABLE COST
COTTONSEED	178200.00	109.36	19493296.00
TRANSPORTATION IN	178200.00	5.00	891000.00
TOTAL PRODUCTION STAGE COST			20384288.00

PRODUCTION STAGE: UNLOADING-STORAGE

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	9.00	19056.00	171504.00
SEASONAL LABOR	15.00	4000.00	60000.00
ELECTRICITY	178200.00	0.16	28511.99
REPAIR PARTS	178200.00	0.25	44550.00
REPAIR LABOR	178200.00	0.24	42767.99
TOTAL PRODUCTION STAGE COST			347333.98

PRODUCTION STAGE: CLEANING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	19056.00	57168.00
ELECTRICITY	297.00	144.00	42768.00
REPAIR PARTS	178200.00	0.25	44550.00
REPAIR LABOR	178200.00	0.05	8910.00
TOTAL PRODUCTION STAGE COST			153395.94

PRODUCTION STAGE: DELINTERING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	15.00	21744.00	326160.00
HEAD LINTERMAN	3.00	24000.00	72000.00
ELECTRICITY	297.00	1380.00	409860.00
REPAIR PARTS	178200.00	0.58	103355.94
REPAIR LABOR	178200.00	0.20	35640.00
TOTAL PRODUCTION STAGE COST			947015.88

PRODUCTION STAGE: BALING-BALE STOR

	NO. OF UNITS	COST/UNIT	VARIABLE COST
PRESS LABOR	6.00	19056.00	114336.00
STORAGE LABOR	9.00	21744.00	195696.00
ELECTRICITY	297.00	36.00	10692.00
BAGGING-TIES	51300.00	1.85	94904.94
REPAIR PARTS	178200.00	0.09	16037.99
REPAIR LABOR	178200.00	0.03	5346.00
TOTAL PRODUCTION STAGE COST			437012.81

PRODUCTION STAGE: HULLING-SEPARTING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	6.00	21744.00	130464.00
ELECTRICITY	297.00	216.00	64152.00
REPAIR PARTS	178200.00	0.47	83753.94
REPAIR LABOR	178200.00	0.15	26729.99
TOTAL PRODUCTION STAGE COST			305099.88

PRODUCTION STAGE: MEAL CONDITIONING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	21744.00	65232.00
ELECTRICITY	297.00	342.00	101574.00
WATER	178200.00	0.04	7128.00
NATURAL GAS	178200.00	1.08	192455.94
REPAIR PARTS	178200.00	0.32	57024.00
REPAIR LABOR	178200.00	0.21	37422.00
TOTAL PRODUCTION STAGE COST			460835.75

PRODUCTION STAGE: PRE-PRESS EXT

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	6.00	21744.00	130464.00
ELECTRICITY	297.00	858.00	254826.00
REPAIR PARTS	178200.00	0.30	53459.99
REPAIR LABOR	178200.00	0.13	23166.00
TOTAL PRODUCTION STAGE COST			461915.88

PRODUCTION STAGE: EXTRACTION

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	19056.00	57168.00
HEAD EXTRACTION	3.00	24000.00	72000.00
ELECTRICITY	297.00	186.00	55242.00
WATER-SEWAGE	178200.00	0.10	17819.99
NATURAL GAS	178200.00	1.26	224531.81
HEXANE	178200.00	0.68	121175.94
REPAIR PARTS	178200.00	0.35	62369.99
REPAIR LABOR	178200.00	0.20	35640.00
TOTAL PRODUCTION STAGE COST			645947.56

PRODUCTION STAGE: OIL-MEAL-HULL STOR

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	9.00	21744.00	195696.00
ELECTRICITY	297.00	54.00	16038.00
REPAIR PARTS	178200.00	0.28	49895.99
REPAIR LABOR	178200.00	0.17	30293.99
TOTAL PRODUCTION STAGE COST			291923.88

PRODUCTION STAGE: MISCELLANEOUS

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR MAINTENANCE	9.00	21744.00	195696.00
LABOR CLEANING	9.00	21744.00	195696.00
LAB ANALYSIS	178200.00	0.10	17819.99

BROKERAGE FEES	178200.00	1.00	178200.00
OFFICE	178200.00	1.25	222750.00
INSURANCE	178200.00	0.88	156815.94
	TOTAL PRODUCTION STAGE COST		966977.88
	INTEREST ON OPERATING CAPITAL		2540141.00
	TOTAL VARIABLE COST		27941552.00

TOTAL VARIABLE REQUIREMENTS

ELECTRICITY REQUIREMENTS	983663.94
LABOR REQUIREMENTS	2279844.00
REPAIR REQUIREMENTS	520343.50
NATURAL GAS REQUIREMENTS	416987.75
WATER REQUIREMENTS	24947.99

RESULTS OF THE MODEL AT 90% CAPACITY

TOTAL FIXED COST	2546071.00
TOTAL VARIABLE COST	27941552.00
TOTAL COST	30487616.00
TOTAL REVENUE	35174352.00
TOTAL NET REVENUE	4686736.00
AVERAGE FIXED COST	14.29
AVERAGE VARIABLE COST	156.80
AVERAGE TOTAL COST	171.09
AVERAGE REVENUE	197.39
AVERAGE NET REVENUE	26.30
MARGINAL COST	153.63

VARIABLE COST

PRODUCTION STAGE: COTTONSEED BUY

	NO. OF UNITS	COST/UNIT	VARIABLE COST
COTTONSEED	198000.00	109.39	21659216.00
TRANSPORTATION IN	198000.00	5.00	990000.00
TOTAL PRODUCTION STAGE COST			22649216.00

PRODUCTION STAGE: UNLOADING-STORAGE

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	9.00	20644.00	185796.00
SEASONAL LABOR	15.00	4000.00	60000.00
ELECTRICITY	198000.00	0.16	31479.99
REPAIR PARTS	198000.00	0.25	49500.00
REPAIR LABOR	198000.00	0.24	47519.99
TOTAL PRODUCTION STAGE COST			374495.88

PRODUCTION STAGE: CLEANING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	20644.00	61932.00
ELECTRICITY	330.00	144.00	47520.00
REPAIR PARTS	198000.00	0.25	49500.00
REPAIR LABOR	198000.00	0.05	9900.00
TOTAL PRODUCTION STAGE COST			168851.94

PRODUCTION STAGE: DELINTERING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	15.00	23556.00	353340.00
HEAD LINTERMAN	3.00	26000.00	78000.00
ELECTRICITY	330.00	1380.00	455400.00
REPAIR PARTS	198000.00	0.58	114839.94
REPAIR LABOR	198000.00	0.20	39600.00
TOTAL PRODUCTION STAGE COST			1041179.88

PRODUCTION STAGE: BALING-BALE STOR

	NO. OF UNITS	COST/UNIT	VARIABLE COST
PRESS LABOR	6.00	20644.00	123864.00
STORAGE LABOR	9.00	23556.00	212004.00
ELECTRICITY	330.00	36.00	11880.00
BAGGING-TIES	57000.00	1.85	105449.94
REPAIR PARTS	198000.00	0.09	17819.99
REPAIR LABOR	198000.00	0.03	5940.00
TOTAL PRODUCTION STAGE COST			476957.81

PRODUCTION STAGE: HULLING-SEPARTING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	6.00	23556.00	141336.00
ELECTRICITY	330.00	216.00	71280.00
REPAIR PARTS	198000.00	0.47	93059.94
REPAIR LABOR	198000.00	0.15	29699.99
	TOTAL PRODUCTION STAGE COST		335375.88

PRODUCTION STAGE: MEAL CONDITIONING

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	23556.00	70668.00
ELECTRICITY	330.00	342.00	112860.00
WATER	198000.00	0.04	7920.00
NATURAL GAS	198000.00	1.08	213839.94
REPAIR PARTS	198000.00	0.32	63360.00
REPAIR LABOR	198000.00	0.21	41579.99
	TOTAL PRODUCTION STAGE COST		510227.75

PRODUCTION STAGE: PRE-PRESS EXT

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	6.00	23556.00	141336.00
ELECTRICITY	330.00	858.00	283140.00
REPAIR PARTS	198000.00	0.30	59399.99
REPAIR LABOR	198000.00	0.13	25740.00
	TOTAL PRODUCTION STAGE COST		509615.88

PRODUCTION STAGE: EXTRACTION

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	3.00	20644.00	61932.00
HEAD EXTRACTION	3.00	26000.00	78000.00
ELECTRICITY	330.00	186.00	61380.00
WATER-SEWAGE	198000.00	0.10	19799.99
NATURAL GAS	198000.00	1.26	249479.81
HEXANE	198000.00	0.68	134639.94
REPAIR PARTS	198000.00	0.35	69299.94
REPAIR LABOR	198000.00	0.20	39600.00
	TOTAL PRODUCTION STAGE COST		714131.56

PRODUCTION STAGE: OIL-MEAL-HULL STOR

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR	9.00	23556.00	212004.00
ELECTRICITY	330.00	54.00	17820.00
REPAIR PARTS	198000.00	0.28	55439.99
REPAIR LABOR	198000.00	0.17	33659.99
	TOTAL PRODUCTION STAGE COST		318923.88

PRODUCTION STAGE: MISCELLANEOUS

	NO. OF UNITS	COST/UNIT	VARIABLE COST
LABOR MAINTENANCE	9.00	23556.00	212004.00
LABOR CLEANING	9.00	23556.00	212004.00
LAB ANALYSIS	198000.00	0.10	19799.99

BROKERAGE FEES	198000.00	1.00	198000.00
OFFICE	198000.00	1.25	247500.00
INSURANCE	198000.00	0.88	174239.94
	TOTAL PRODUCTION STAGE COST		1063547.00
	INTEREST ON OPERATING CAPITAL		2816205.00
	TOTAL VARIABLE COST		30978256.00

TOTAL VARIABLE REQUIREMENTS

ELECTRICITY REQUIREMENTS	1092959.00
LABOR REQUIREMENTS	2471514.00
REPAIR REQUIREMENTS	578159.50
NATURAL GAS REQUIREMENTS	463219.75
WATER REQUIREMENTS	27719.99

RESULTS OF THE MODEL AT 100% CAPACITY

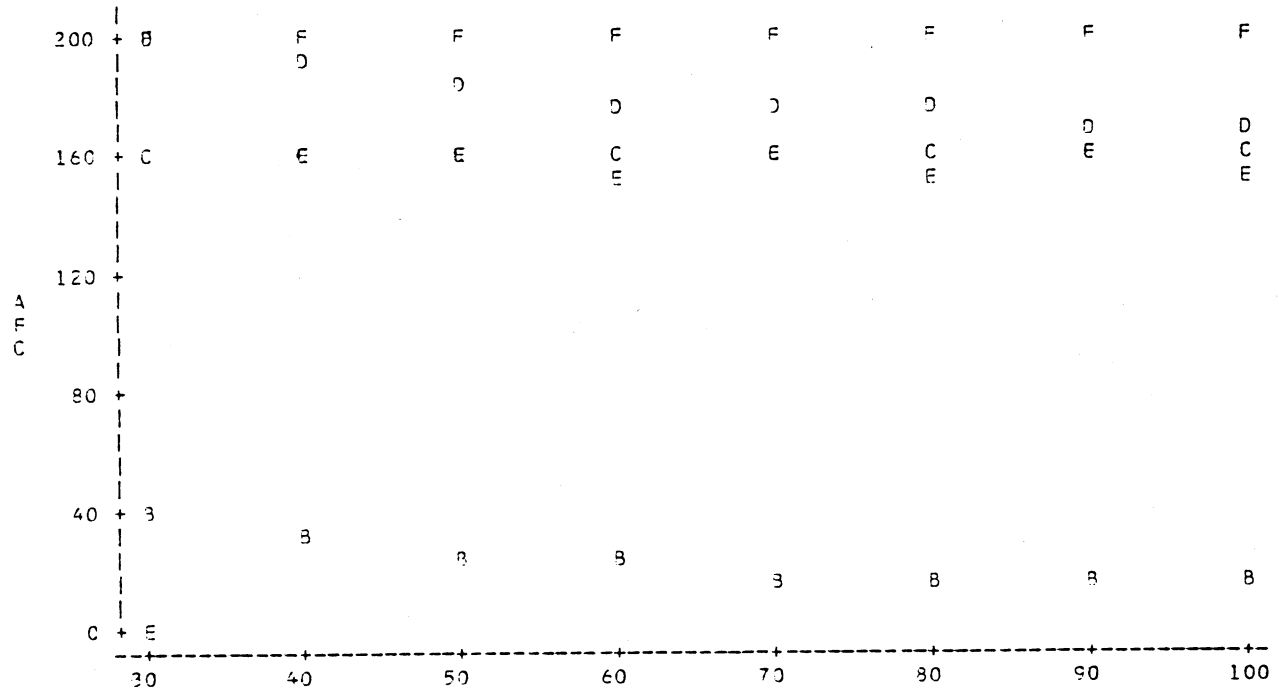
TOTAL FIXED COST	2546071.00
TOTAL VARIABLE COST	30978256.00
TOTAL COST	33524320.00
TOTAL REVENUE	39082624.00
TOTAL NET REVENUE	5558304.00
AVERAGE FIXED COST	12.86
AVERAGE VARIABLE COST	156.46
AVERAGE TOTAL COST	169.31
AVERAGE REVENUE	197.39
AVERAGE NET REVENUE	28.07
MARGINAL COST	153.37

S T A T I S T I C A L A N A L Y S I S S Y S T E M

OBS	A	B	C	D	E	F
1	30	42.86	156.90	199.76	0.00	197.39
2	40	32.15	156.68	188.83	156.05	197.39
3	50	25.72	156.94	182.66	157.96	197.39
4	60	21.43	156.49	177.92	154.26	197.39
5	70	18.37	156.70	175.07	157.92	197.39
6	80	16.07	156.57	172.64	155.69	197.39
7	90	14.29	156.80	171.09	158.63	197.39
8	100	12.86	156.46	169.31	153.37	197.39

COST AND REVENUE CURVES

PLOT OF B*A SYMBOL USED IS B
PLOT OF C*A SYMBOL USED IS C
PLOT OF D*A SYMBOL USED IS D
PLOT OF E*A SYMBOL USED IS E
PLOT OF F*A SYMBOL USED IS F



COST AND REVENUE CURVES

PLOT OF B*A SYMBOL USED IS .
PLOT OF C*A SYMBOL USED IS .
PLOT OF D*A SYMBOL USED IS .
PLOT OF E*A SYMBOL USED IS .
PLOT OF F*A SYMBOL USED IS .