ECONOMIES OF SIZE IN NON-SLAUGHTERING MEAT PROCESSING PLANTS

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PREFACE

The purpose of this study was to develop guidelines as to the costs of constructing, equipping, and operating alternative sizes of non-slaughtering meat processing plants in Oklahoma. Short-run average cost curves were developed for the various sizes of plants using a modified economic-engineering synthetic method. The long-run average cost curve or planning curve was considered as a series of short-run situations and thus, was derived from the short-run average cost curves.

I wish to express my indebtedness to Dr. John R. Franzmann, my major adviser, for counsel, guidance, and for giving so unselfishly of his time throughout this study. Thanks are also due to the other members of my committee: Dr. Leo V. Blakley and Dr. John W. Goodwin.

Special appreciation is extended to Mr. Donald Hammons, for the design of the model plants, specification of equipment and labor forces, and for his assistance to the author in obtaining data from a cooperating firm.

Acknowledgment is made of the equipment cost data furnished by the Allbright-Nell Company, Koch Supply Company, Meat Packers Equipment Company, Julian Engineering Company, and Phil Hantover, Incorporated.

Acknowledgment is also made of data used for comparison which was furnished by R. Starr Parker and Associates, architects and engineers. The author

also acknowledges information submitted by Mr. Fred Halsey, architect, and Mr. H. S. Ashley, engineer.

The author is indebted to the owners and managers of the five cooperating firms who made their accounting records available. Without their cooperation, this study would not have been possible.

Acknowledgment is made of the assistance received from the secretarial and statistical staff of the Department of Agricultural Economics.

Finally, a special word of thanks is due to my wife, Barbara, for typing the final manuscript and for her patience and understanding throughout the study.

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CHAPTER I

INTRODUCTION

In recent years, many important changes in the primary determinants of demand for the products of the meat processing industry have taken place. From 1950 to 1964 the population of Oklahoma increased from 2,233,000 to 2,461,000 or a 10.2 percent increase. Eighty-nine percent of this increase was growth in the cities of Tulsa and Oklahoma City. During this period, the United States population grew from 151 million to 190 million, or 25.8 percent increase.

Significant changes have also occurred in the level and distribution of income. Per capita personal income of people of Oklahoma rose from $1,144 in 1950 to $2,236 in 1965 and in the United States from $1,491 to $2,724 during this same period. The percentage of consumer units in the United States with incomes between $5,000 and $10,000 increased from 23 percent in 1950 to 40 percent in 1962.

An examination of trend projections in population, income growth and distribution, and per capita consumption of red meats suggests further increases in production of processed meats in the future.

Two Census Bureau projections of population indicate a population of 225 to 235 million by 1975 with a continued relatively high rate of growth anticipated

for the Southern Plains region.[1] Average rates of growth in real disposable income have been estimated to the year 2000 by Landsberg, and others ranging from 15 to 28 percent per decade in terms of 1960 dollars.[2]

Brandow has estimated for future years that total beef consumption will increase approximately 3.8 percent per year and pork consumption will increase approximately .7 percent per year.[3] According to Burk, the percentage of meat animal products distributed in fresh or raw form has dropped in a fashion similar to that indicated for all foods, suggesting that higher proportions of meat are now consumed in processed form.[4]

Changes in the primary determinants of demand have been important factors in bringing about the increased production of sausages and cured and smoked meats in federally inspected plants from 9,515,437,000 pounds in 1952 to 10,833,657,000 pounds in 1964, a 13.9 percent increase.[5]

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[1]Willard F. Williams and Thomas T. Stout, Economics of the Livestock Meat Industry, (New York, 1964), p. 767.

[2]H. H. Landsberg, L. L. Fischman, and J. L. Fisher, Resources in America's Future; Patterns of Requirements and Availabilities, 1960-2000. (Baltimore, 1963), Tables A1-25, pp. 551-553.

[3]G. E. Brandow, Interrelations Among Demands for Farm Products and Implications for Control of Market Supply, Pennsylvania Agricultural Experiment Station, Bulletin 680, (State College, 1961), p. 23.

[4]Williams and Stout, p. 92.

[5]This information calculated from Livestock and Meat Statistics, Bulletin No. 333, Consumer and Marketing Service, United States Department of Agriculture, (Washington, 1963), and Livestock and Meat Statistics, Supplement for 1964 to Statistical Bulletin No. 333, Consumer and Marketing Service, United States Department of Agriculture, (Washington, 1965).

During the period 1947 to 1963, the number of plants in the meat processing industry in the United States increased from 1,264 to 1,341 and from 72 to 86 in the west south central region (Arkansas, Louisiana, Texas, and Oklahoma) during this same period. In Oklahoma the number of plants increased from 7 to 11 in the period 1947 to 1963.[6]

Assuming present trends in population, income, and consumption, by 1975, an additional 269,110,800 pounds of processed meats will be demanded each year in the United States.[7] For the existing 1,341 meat processing plants, this is an average requirement of an additional 200,679 pounds of production per plant per year. In Oklahoma an increased annual production of 1,646,560 pounds of processed meat will be demanded by 1975. For the 11 existing meat processing facilities in Oklahoma, this amounts to an additional 149,687 pounds of production per plant per year.[8]

Coinciding with changes in the number of meat processing plants there have been significant changes in processing technology. One long-time meat

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[6]U. S. Bureau of the Census, Census of Manufactures, 1954, 1963, (Washington, 1954, 1963), Table 1, p. 20A-5.

[7]This assumes a projected population of 230 million by 1975 using the 1963 estimated per capita consumption of red meats of 165.2 pounds and assumes 45 percent of this amount is luncheon meats, variety meats, sausage, bacon, ham, and ground beef derived from Meat Consumption Trends and Patterns, United States Department of Agriculture Handbook No. 187, (Washington, 1960), Figure 7, p. 15.

[8]This assumes an average annual increase in Oklahoma population of 22,150 to the year 1975 and that eating habits of the people of Oklahoma are similar to the average of the United States as used in footnote 8 above.

industry engineer has implied that before a book can be written and published on meat processing, that half of the plant equipment will be obsolete.[9]

As the meat industry adjusts to the forces of demand for processed meats, additional facilities will be located and built and newer technologies will be adopted and used in both existing and new facilities. In large measure, the future location of the meat industry is described in terms of the future location of livestock production and of human population. Most slaughtering plants generally will be located in supply areas, while most sausage kitchens and other processing facilities will gravitate toward the population centers.[10]

The trend toward this development creates questions in the minds of investors and plant managers concerning the costs of constructing, equipping, and operating a meat processing plant.

With the development of newer and larger feedlots, a large acreage of good range country, and location in a rapidly developing area of the United States, these questions should have particular relevance to the State of Oklahoma.

These developments suggest the possibility of growth of meat processing facilities in Oklahoma. This study was conducted to provide members of the

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[9]Correspondence in September, 1965, with Mr. H. S. Ashley of Fort Worth, Texas, who has spent a lifetime in meat industry engineering.

[10]Wilbur R. Maki, Charles Y. Liu, and William C. Motes, Interregional Competition and Prospective Shifts in the Location of Livestock Slaughter, Iowa State University Agricultural and Home Economics Experiment Station Research Bulletin 511, (Ames, 1962), p. 701.

non-slaughtering meat processing industry with information to make initial estimates of the construction, equipment, and operating costs for meat processing plants located in Oklahoma. More specifically, the study was directed to the questions:

(1) What are the construction and equipment costs for non-slaughtering meat processing plants designed to produce and handle approximately 50,000, 100,000, and 250,000 pounds of product weekly with a ratio of 38.5 percent of sausages, 38.5 percent of cured meats, 15.5 percent of fresh cuts, and 7.5 percent of jobbed customer service items?

(2) What are the costs of operating each of these plants when producing at 50, 75, and 100 percent of the designed output?

(3) What is the relationship between costs of processing meats and the output of plants?

CHAPTER II

THEORETICAL CONSIDERATIONS

Studies made to determine economies of size must consider both the short-run and the long-run effects of changes in size. The traditional method of handling this problem is to divide the time period into the "short run" and the "long run." For the purposes of this study the short run is defined to be a period of time short enough that the size of the plant is fixed. The long run is defined to be a period long enough that the firm is free to vary the size of the plant and the production technique, therefore there are no fixed input factors and no fixed costs in the long run.

A firm may be defined in a number of ways, but for this study a firm is defined as an economic unit which acquires raw materials, transforms them in some manner, and sells the resulting product for the purpose of making a profit from the transaction.

It is the purpose of this chapter to discuss the short-run and long-run cost functions of the single product firm which will provide the basis for estimating the relevant economic relationships needed in this analysis.[1]

Short Run

In this chapter it will be assumed that the firm purchases all factors of production in a perfectly competitive market.

The basic technical relationship of a firm is expressed in the production function. The production function assumes technical efficiency and expresses the maximum output that can be obtained from a given level of inputs. If the exact function is specified, this relationship may be shown graphically as the example in Figure 1.

When only one input is variable, the relation between the input and product are conventionally divided into three "stages" as shown in Figure 1. In Stage I, total product increases at an increasing rate as additional units of the variable input (X_1) are used. The firm enters Stage II at point A, where total product continues to increase, but at a diminishing rate. Stage II

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[1] The case of the multiple product firm will not be considered in this study as there was lack of data and other evidence to support such a cost analysis. Further, discussion with management and engineers of a major meat processing company revealed that a change of product mix does not significantly affect the variable costs of production of such an operation. For discussion of the theory of the multiple product firm, see Ralph W. Pfouts, "The Theory of Cost and Production in the Multi-Product Firm," Econometrica, Volume 29, No. 4, (1961), pp. 650-659, and Bob R. Holdren, The Structure of a Retail Market and the Market Behavior of Retail Units, (New Jersey, 1960), pp. 27-66, 125-133.

continues to point B, where total product increases to its maximum with the use of additional units of X_1 per unit of time. Beyond point B is Stage III of production where total product decreases as additional units of the variable resource are used per unit of time.

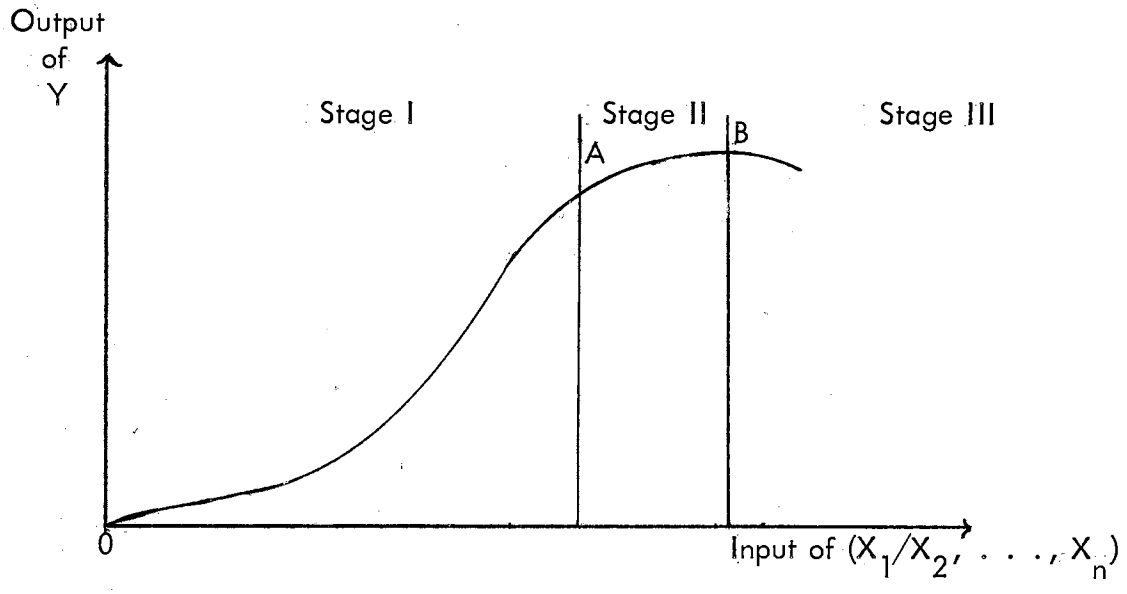

Figure 1. Hypothetical Production Function

In equation (2.1), output of product Y is a function of a set of inputs (X_n) of which j inputs are variable and n-j inputs are fixed.

$$Y = f(X_1, X_2, \ldots, X_j/X_{j+1}, X_{j+2}, \ldots, X_n) \qquad (2.1)$$

It is assumed that equation (2.1) has continuous first and second order derivatives.

The application of price data to the production inputs associated with the production function provides the basic cost data associated with the production of a given output. This application of price data results in the cost function.

Cost functions express the minimum cost of producing a specific output, given the technical conditions of the production function and the input prices, whereas production functions express the minimum resources to obtain a given output.

If P_i is the cost of the i^{th} variable input of the X_i variable inputs, and F is the cost of the fixed inputs, the total cost outlay of a firm producing product Y is given by:

$$TCY = F + \sum_{i=1}^{i} P_i X_i \qquad (2.2)$$

The total cost curve of a firm producing a single product with only one variable resource, X_1, and a given set of fixed factors may be represented graphically as in Figure 2. In Figure 2, total fixed cost, F, is represented by OA. The point A is the beginning of Stage I of production. As additional units of product Y are produced, total cost will increase at a decreasing rate to point B. At point B, the firm enters Stage II of production and continues to produce to point C with total cost increasing at an increasing rate as additional units of Y are produced. Beyond point C, using additional units of X_1 decreases the total production of Y_1 therefore total cost increases in a manner as shown by the dotted portion, CD, of the total cost curve. This portion represents Stage III of production as shown in Figure 1 and is obviously a noneconomic range of production.

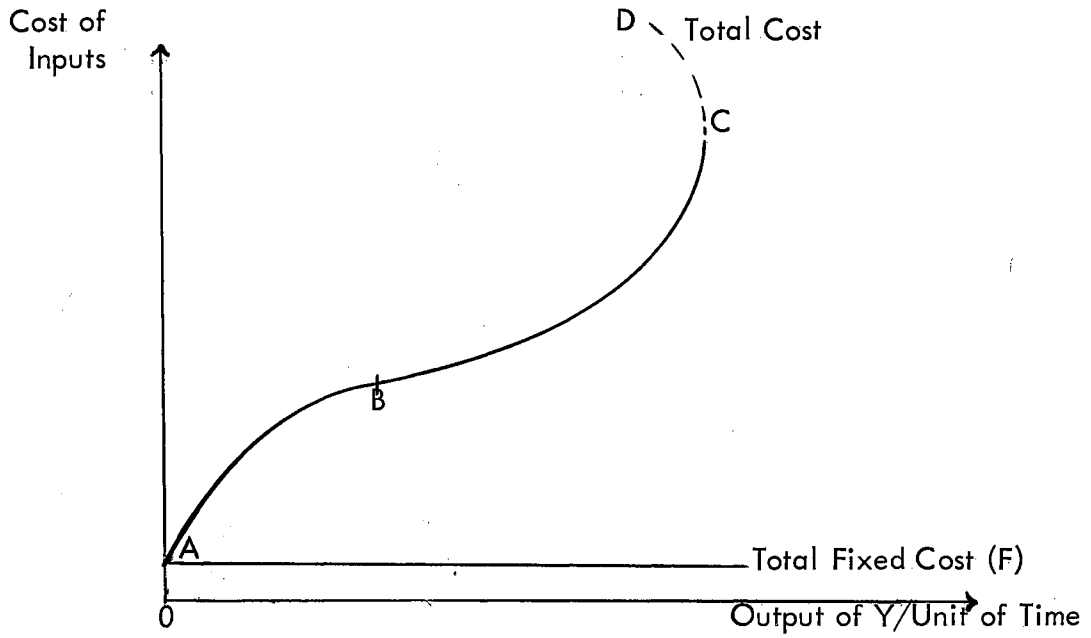

Figure 2. Hypothetical Total Cost Function

The firm's total cost function based on a given production function with several variable inputs and given input prices can be expressed as:

$$Z = F + \sum_{i=1}^{i} P_i X_i - \lambda \left[Y_k - f(X_1, X_2, \ldots, X_i / X_{i+1}, \ldots, X_n) \right] \tag{2.3}$$

where Z is the minimum cost of producing Y_k, an arbitrary level of output, with a given production function. λ is a Lagrangian multiplier.

First order conditions for the minimization of Z require that the first partial derivatives of Z with respect to the X_i and λ equal zero.[2]

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[2] See J. Parry Lewis, Mathematics for Students of Economics, (New York, 1962), pp. 238-245, and James N. Henderson and Richard E. Quandt, Micro-economic Theory, (New York, 1958), pp. 272-274 for the second order conditions.

$$\frac{\partial Z}{\partial X_1} = P_1 - \lambda \frac{\partial f}{\partial X_1} = 0$$

. . . .

. . . .

. . . . (2.4)

$$\frac{\partial Z}{\partial X} = P_n - \lambda \frac{\partial f}{\partial X_j} = 0$$

$$\frac{\partial Z}{\partial \lambda} = -Y_k + f(X_1, \ldots X_j/X_{j+1}, \ldots, X_n) = 0$$

This system of n+1 equations in n+1 unknowns, $(X_1, \ldots, X_n, \lambda)$, can be solved for the optimal values of the j variable inputs and the Lagrangian variable λ. The system (2.4) specifies that when the cost of producing Y_k is a minimum, the marginal physical product per dollar's worth of each X_j is equal. Since λ equals the ratio of each factor price to its marginal physical product, λ is equal to the marginal cost of production.

The conditions for minimizing the cost of producing an arbitrary quantity of Y are obtained from equation (2.3). To determine the firm's cost function, the firm's expansion path is needed. The expansion path given in equation (2.5) is a function of the variable production inputs for which the first- and second-order conditions for constrained maxima and minima are satisfied.

$$E(X_1, X_2, \ldots, X_j) = 0 \qquad (2.5)$$

The system of equations consisting of the production function, (2.1), total cost, (2.2), and the expansion path, (2.5), may be reduced to a single equation, (2.6), in which cost is stated as an explicit function of output plus the cost of the fixed inputs, F.

$$C = C(Y) + F \tag{2.6}$$

This function, (2.6), gives the minimum total cost of producing each output given the constraints of fixed inputs, the implied production function, and the input prices.

Five cost relations which are important in decision making with respect to pricing and output can be derived from equation (2.6). These cost functions are total variable cost (TVC), total fixed cost (TFC), average variable cost (AVC), average fixed cost (AFC), and marginal cost (MC). These relationships are given respectively by:

$$TVC = (C(Y) \tag{2.7a}$$

$$TFC = F \tag{2.7b}$$

$$AVC = \frac{C(Y)}{Y} \tag{2.7c}$$

$$AFC = \frac{F}{Y} \tag{2.7d}$$

$$MC = \frac{dC(Y)}{dY} \tag{2.7e}$$

Equation (2.6) and the first two equations of (2.7) may be represented as in Figure 3 if the law of diminishing returns holds which states:

> When total output, or production, of a commodity is increased by adding units of a variable input while the quantities of other inputs are held constant, the increases in total production become, after some point, smaller and smaller.[3]

Figure 4 is the conventional diagram of the short-run cost curves of the firm when cost is calculated as cost per unit of output.

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[3] Donald S. Watson, Price Theory and Its Uses, (Boston, 1963), p. 137.

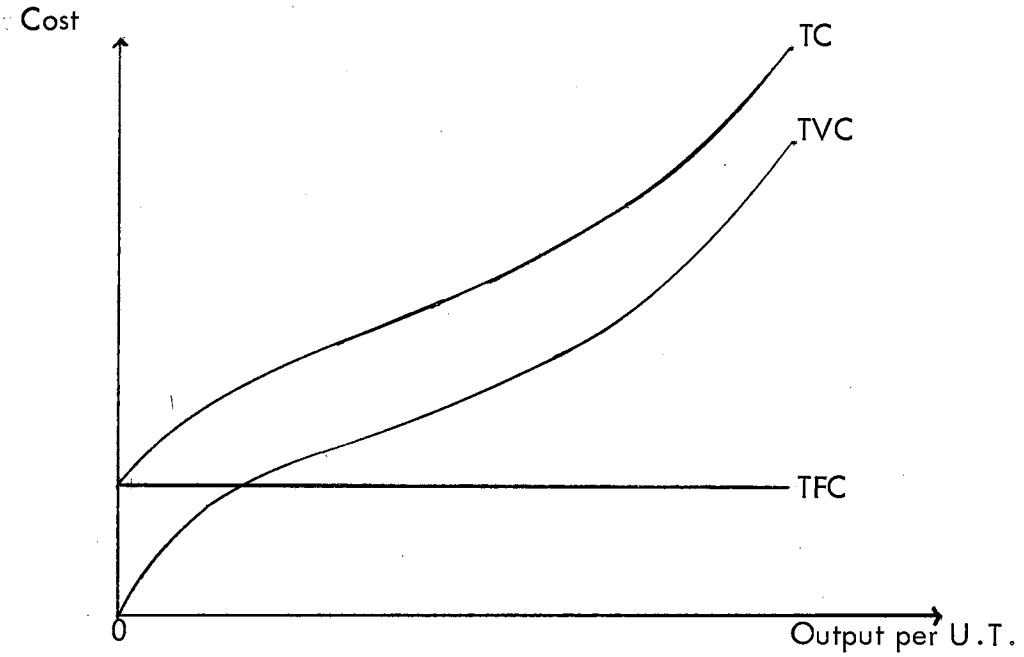

Figure 3. Theoretical Total Cost Curves

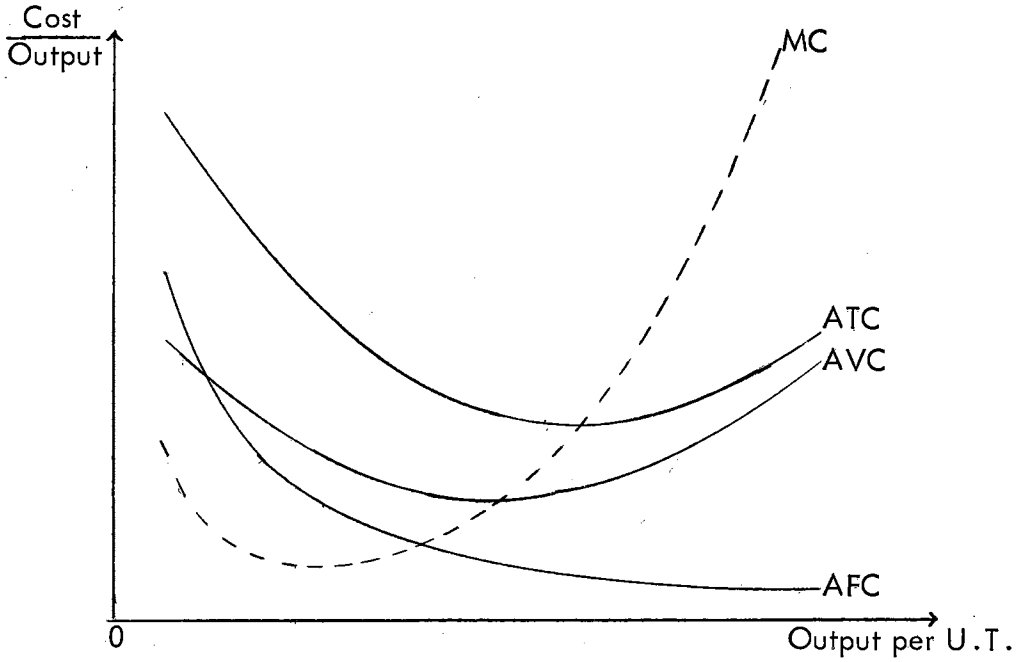

Figure 4. Theoretical Short-Run Cost Curves

Explaining the initial decline, then minimum, and finally the increase of the MC and AVC curves and thus the ATC curve of Figure 4 may be done by the law of diminishing returns and the relationships, $AVC = \frac{P}{APP}$ and $MC = \frac{P}{MPP}$, where APP and MPP represent the average physical product and marginal physical product, respectively, and P, the cost per unit of the variable input. Considering the production of a product employing a variable factor with a set of fixed resources, initial increases in the use of the variable factor may result in increasing MPP and APP. This results in declining MC, ATC, and AVC because of the inverse relationship existing between MPP and MC, and between APP and ATC or AVC. As stated above in the law of diminishing returns, with the addition of successive units of the variable input while the other inputs are held constant, the MPP of the variable input will decline after some point. When MPP declines, MC will rise, given that P in the relationship, $MC = \frac{P}{MPP}$, is a constant. Average costs will decline until increasing MC equals the declining average costs. Additional increases in output will result in MC being greater than AVC, and consequently, AVC will rise. The AFC curve is always declining as output increases because the fixed costs are spread over more and more units of production. Therefore, the AFC curve is strictly monotonic and is a rectangular hyperbola.

Long Run

The short-run problems of a firm concern the optimum utilization of a fixed plant. In the long-run, the firm is free to vary the size of plant and the

production technique, therefore, there are no fixed input factors and no fixed costs in the long run. Thus, the long-run problem is that of determining the optimum size of plant.

The long-run cost function gives the minimum cost of producing each output if the size of the plant is allowed to vary. This function can be obtained from the firm's long-run production function, equation (2.8), total cost function, equation (2.9), and expansion path, equation (2.10).

$$Y = f(X_1, \ldots, X_i, F) \tag{2.8}$$

$$TC = \sum_{i=1}^{i} P_i X_i + Y(F) \tag{2.9}$$

$$E = H(X_1, \ldots, X_i, F) \tag{2.10}$$

Equation (2.11), expresses total cost as a function of output level and plant size.

$$TC = k(Y, F) + (F) \tag{2.11}$$

Assuming F is continuously variable and since the long-run total cost curve represents the minimum cost of producing each output when plant size is allowed to vary, the long-run total cost curve is an envelope of the short-run cost curves. Likewise, the long-run average cost curve is an envelope of the short-run average cost curves.

Kells states:[4]

> If $f(X,Y,C) = 0$ represents a one-parameter family of curves and E is a curve which contacts tangentially (has a common tangent with) every curve of the family $f = 0$, and contacts tangentially one or more curves of $f = 0$ at each of its points, then E is an envelope of f.

The long-run cost equation expressing total cost as a function of output is given by:

$$C = C(Y) \tag{2.12}$$

This equation, (2.12), is obtained by eliminating F from:

$$G(X,Y,F) = 0 \tag{2.13}$$

where Y = output,

X = a vector of inputs,

F = size parameter.

F is eliminated from (2.13) by setting its first partial derivative with respect to F equal to zero,

$$G_F(X,Y,F) = 0 \tag{2.14}$$

then solving (2.13) for F and substituting the expression for F into (2.11) to obtain (2.12).

The conventional long-run average cost curve is usually considered as U-shaped like the short-run average cost curve. But the U-shape of the long-run average cost curve cannot be explained in terms of the law of diminishing

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[4]Lyman M. Kells, Elementary Differential Equations, (New York, 1965), p. 107.

returns as it was for the short-run average cost curve. This law does not apply to the long run since there are no fixed factors of production in the long run.

The decrease in the long-run average cost curve as output increases suggests that larger sizes of plants are more efficient than the smaller ones. The increase in the long-run average cost curve after a certain output suggests that successively larger sizes of plants become less and less efficient.

Division and specialization of labor, increasing possibilities of using advanced technological developments, and a lower supply price per unit capacity of high capacity equipment, are considered as forces giving rise to decreasing long-run average costs.[5] Such forces can be referred to as economies of size. When diseconomies of size more than offset the economies of size, the long-run average cost curve increases with increased output. Diseconomies of size are believed to occur when after some size, efficiency of management in coordinating and controlling a plant becomes a limiting factor.

It has been suggested that empirical research does not support the U-shaped version of the long-run cost curve, but suggests that there is a range of outputs where all sizes of plants have the same minimum costs.[6] Such a curve is represented in Figure 5.

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[5] Bob R. Holdren, The Structure of a Retail Market and the Market Behavior of Retail Units, (New Jersey, 1960), p. 31.

[6] Watson, P. 176.

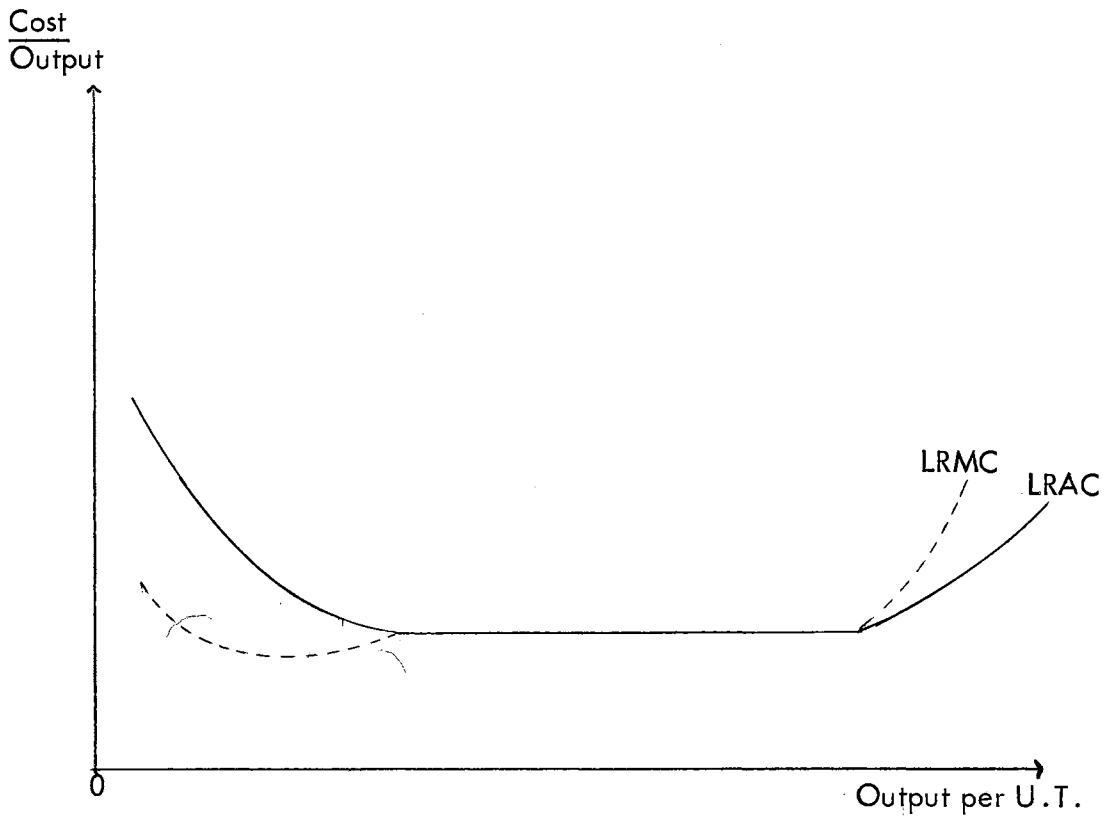

Figure 5. Hypothetical Average and Marginal Long-Run Cost Curves

CHAPTER III

OPERATIONS PERFORMED

Application of the theory discussed in the preceding chapter to the problem of estimating the cost relationships relevant to meat processing plants requires information pertaining to the functions performed by such plants. It is the purpose of this chapter to describe the various functions of the model plants.

Procurement, processing, sales and distribution are the three functions performed by the meat processor which determine his costs and revenues and, therefore, the optimum size and location of plant(s).

In this study a detailed analysis of the procurement function was not made even though it is an extremely important function. This function is a study in itself.

No detailed analysis was made of the sales and distribution function of the processor. This, too, is deserving of a separate study. For this study, sales cost was considered a constant charge per hundredweight of product sold based on the practice of firms that cooperated in the study. Distribution costs vary widely among meat processing plants. Many factors influence distribution costs. Some of these factors are (1) the delivery locale, whether local or more distant, (2) the load carried per vehicle, (3) the number of stops made, (4) climatological factors and (5) type, specifications, and state of repair of

delivery equipment. For this study, a constant charge per hundredweight of product processed based on conversation with meat processors that cooperated in the study was assumed to reflect the distribution cost.

Attention was focused on the processing function which includes the production of sausages, smoked and cured meats, and fresh pork items from fresh beef quarters and pork carcasses, and frozen pork. Bones and excess fat are the two offal products which the meat processing plant must handle. The plant may choose to render the excess fat, but none of the plants visited during this study boned enough product to justify any type of bone processing. It was assumed for the model plants that the bones and fat were sold and picked up at the plant for further processing.

Processing can be considered to begin when the plant receives the fresh meat in its receiving coolers from the slaughterer or receives the frozen meat in its freezer. One possible sequence of operations in the processing of the products mentioned above is presented in Figure 6 and described below.

From the receiving cooler, all fresh meat goes by rail to the cutting and boning department. Here the beef is boned and then sent to the meat grinder or the meat chopper in tub trucks. The ground beef is made into hamburger patties, then weighed and packaged and sent to the order assembly department. The chopped beef is further processed by mixing with pork meat and spices, then transferred by dump bucket and air hoist on an overhead rail to the stuffer. After stuffing, large cased products are tied semi-manually and placed on trees and the automatically linked and tied smaller casing products are placed in

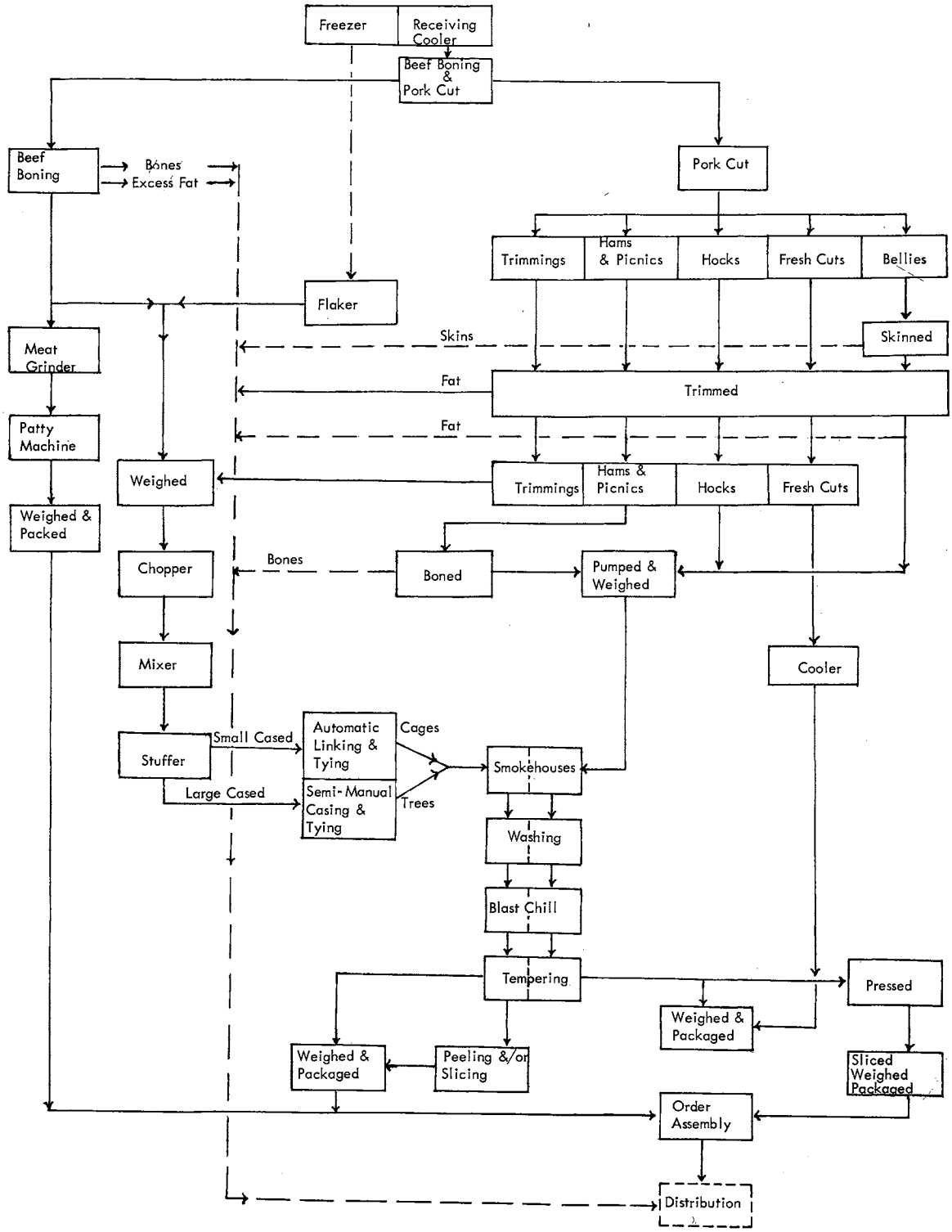

Figure 6. A Sequence of Operations in Processing Meats

cages then moved into the smokehouse by overhead rail. The time and temperature for the cooking or smoking operation depends upon the product being processed as set forth in the regulations of the Meat Inspection Division.

After cooking or smoking, the product is washed, moved through the blast chill, then sent to the tempering cooler. This cooler, a holding area for cooked and smoked products, allows the products to temper before further processing. For example, for wieners to peel satisfactorily they must be at a much lower temperature than smokehouse temperatures. Bacon also, must be at a relatively low temperature to press and slice properly. Other products are held to "take on desirable quality characteristics." Any product which receives a heat process must be cooled before packaging to prevent undesirable condensation in the package. The time a product remains in the tempering room is dependent somewhat upon the desires of the manager to obtain a quality standard which he has defined.

After tempering, smaller sausages, wieners and franks, are peeled; then weighed and packaged. Larger sausages may be left bulk in their casings or may be sliced and wrapped in small individual packages before being sent to the order assembly department.

The pork carcasses are cut into hams, picnics, bellies, hocks, fresh cuts, and trimmings. All cuts are further trimmed. Any excess fat and all bones are put in separate stainless steel tub trucks for removal at the end of the day.

The fresh cuts are transferred in tub trucks to a cooler where they are kept until orders are assmbled. Trimmings are transferred to the sausage meat mixing area where they are processed with the beef for sausages. Frozen pork is flaked and also processed into sausages with the beef. The bellies proceed, from the cutting and boning department to the cured meats department where they are skinned, trimmed, and pumped prior to smoking. After the smoking process, the bellies are washed, blast chilled, and then held at 27 degrees until pressing to form them before slicing, weighing, and packaging. After packaging, the bacon proceeds to the order assembly department.

The hams, picnics, and hocks are pumped, weighed, and then packaged in netting before smoking. Cooking times will vary with the product. For fully cooked products, the internal temperature should reach 155 degrees for two hours and for partially cooked products, the internal temperature should reach a minimum temperature of 145 degrees. After cooking and smoking, these items are washed, cooled in the blast chill, further tempered in the tempering room, de-netted, bagged in polyethylene, then stored in the packaging area until they are moved to the order assembly area.

In the order assembly department, products are stored on roller type shelves or pallets and shelf carts. Orders are filled for each truck route by assembling the items on a rapid roller conveyor which carries the product to the truck at the loadout door where the truck is loaded.[1]

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[1] In the small plant, a roller conveyor for order filling is not considered feasible. Therefore, orders are assembled entirely by manual labor from the pallets and shelf carts.

The supporting operations of plant maintenance and sanitation, box make-up, and accounting, clerical, and secretarial duties, without which the meat processing plant cannot function effectively, are provided for each model plant.

The box make-up is located in the dry storage area. As boxes are needed they are sent by means of a conveyor to the order assembly department.

An investment in a number of physical resources is required to conduct the various processing operations discussed earlier; to provide the various office functions; and to distribute the product of a non-slaughtering meat processing plant. As discussed in Chapter II, these resources may be classed as fixed and variable resources. For meat processing plants it might be said that certain costs may be further defined as discretionary costs, that is, they are costs which may be either fixed or variable with respect to output variations, but are decision variables in the short run.

One example of a fixed cost that is discretionary is the cost of standby delivery equipment. Some managers have an equivalent 100 percent of their delivery capacity in standby, while others will have 25 or 50 percent. Some variable costs may be classed as discretionary variable costs following the same reasoning--that a minimum of a resource, thus a minimum cost, is required to accomplish a certain function and any greater quantity used and thereby any greater cost incurred is discretionary.

Fixed resources are those that are considered as lump sum investments and used over several production periods. Included as fixed resources are land, buildings, and equipment. The office equipment may be cited as a discretionary

fixed cost since the investment for this item is usually at the discretion of the management. Many models of the same equipment are available which do the same job with the same relative efficiency, but their costs are vastly different and the amount invested for such equipment is discretionary.

After a firm has purchased these fixed resources, it must face an annual cost of ownership and an annual insurance cost for protection of the investment. These costs are incurred regardless of the level of output of the plant and since these costs do not vary appreciably over the life of the resource, they too are considered as a fixed cost component of the firm's total cost from year to year.

With a given plant size and the fixed investment cost determined, the variable costs to operate a plant will be a function of the quantities of the variable resources used. These variable and discretionary variable resources include labor, utilities, packaging materials, cleaning, laundry, maintenance, advertising, and miscellaneous supplies and services. Accounting records analysis or time-study analysis of plants similar in design, output, and product mix to the model plants may be used to determine the requirements for these variable resources. These methods may render different results particularly for laundry, maintenance, and cleaning since the cost of these items seems to be quite variable among plants and because the standard of maintenance and cleanness is largely at the discretion of the management.

The total cost curve for a plant may be developed by estimating the variable resource costs at several levels of production and adding them to the fixed cost for that plant. Converting the total cost curve to an average cost curve permits examination of per unit costs.

CHAPTER IV

COST ANALYSIS AND MODEL PLANT SPECIFICATIONS

There are several methods that can be used in estimating costs and economies of size relationships. The most efficient method of analysis depends upon the specific objectives of the study and the resources available. The purpose of this chapter is to discuss two of the more frequently used methods, the accounting records method and the economic-engineering synthetic method.

The Accounting Records Method of Cost Analysis

The accounting records method is named as such because the source of the fixed and variable cost information to estimate the average unit cost function is the accounting records of actual firms. This method is much simpler and consumes fewer research resources than the economic-engineering synthetic methods.

Statistical analysis of accounting records (the application of regression techniques to the per unit costs obtained from accounting records of actual firms) necessitates the selection of a sampling model drawn from a population stratified by size to be consistent with the objective of the study--the analysis of the effects of size or scale on plant costs. The regression line estimated from accounting records using the statistical method represents an average relationship, therefore it does not indicate the least cost for producing each volume. For this

reason the long-run average cost curve, or the planning curve as it is often called, developed by regression analysis of accounting data from firms over a wide range of sizes is recognized as lying somewhere above the true planning curve. To eliminate part of the upward bias inherent in the regression analysis, the population which is sampled may be defined to include only plants employing the most efficient technology, thereby eliminating some of the deviation.

Some of the problems in using accounting data in such a cost analysis besides a possible lack of comparable technologies among plants are (1) a lack of standardized accounting procedures among plants, (2) differences in quality of products and type of product mix, (3) the problem of separating scale from different levels of operating output, (4) accounting records may not express the time period in which various resources were used, (6) prices paid for the various factors of production may vary from firm to firm, (7) fixed costs taken from accounting records reflect variations in purchase data and rates and methods of depreciation, and (8) a satisfactory measure of output is difficult to establish from accounting data alone.

Supporting data may be collected and used with statistical techniques to cope with some of the problems encountered when using accounting data in a regression analysis. However, it must be remembered that the primary advantage of using the accounting records method is that it isn't as demanding on research resources and that the additional data collection and processing required to

overcome the problems of accounting records may increase costs to the point where the advantages of the method are lost.

The Economic-Engineering Synthetic Method of Cost Analysis

The economic-engineering synthetic method of cost analysis combines the sciences of economics and engineering to analyze the production processes of a plant to determine resource requirements and by applying costs to the resources used in the production processes of a product, per unit cost functions can be developed. This method of cost analysis, with several desirable features, provides an alternative to the accounting records method and some of its weaknesses.

One advantage of the economic-engineering synthetic method is that estimates of cost relationships can be provided in instances where historical records are nonexistent, span a period too short for statistical analysis, or span a period which does not encompass a relevant technology.

Since the input-output relationships for each stage of the production process are developed by this method of analysis, greater flexibility of analysis is possible by virtue of the requirement for detailed information concerning the productive process. Analysis of resource price changes can be readily made; cost curves can be developed; and planning can be done in the framework of anticipated prices rather than historical prices.

The synthesis of cost relationships minimizes the need for access to actual plant records in an industry of keen competition where there is a natural

reluctance by managers to disclose the detailed financial and production records of their plants.

In addition to the advantages mentioned above, the synthetic method: (1) permits analysis covering the same period of time for a comparable set of plants, (2) permits scale effects to be examined apart from the effects of varying resource proportions, (3) permits the use of uniform rates and methods of depreciation, and (4) provides a basis for measures of efficiency.

Even with its advantages the economic-engineering synthetic method does not eliminate all the problems of a cost analysis study. This method does not lend itself to tests by the standard measures of statistical reliability, and important problems in the aggregation and coordination of stages may be overlooked. Too, some cost items may be omitted, and because of the detailed analysis required at each stage, it is time consuming and expensive.

The Method Employed

This study combines the economic-engineering synthetic method for analysis of the fixed investment, labor costs, and utility costs, with the accounting records method of cost analysis for packaging supplies, office supplies, advertising expense, telephone, and certain other miscellaneous costs.

The modified economic-engineering synthetic method was chosen because (1) Oklahoma does not have a sufficiently large number of meat processing plants as described in Chapter III to permit a valid statistical sample to be drawn; and (2) many plant owners were reluctant to provide the detailed information required for analysis.

Cost Classification

The cost data requirements of this study are classified according to three broad categories: capital investments, ownership and use, and operating costs. Capital investment includes buildings, equipment, real estate, and an allowance for operating capital. Ownership and use costs include taxes, depreciation, insurance, interest, and repairs and maintenance cost. Operating costs include wages and salaries, packaging materials, utilities, telephone, laundry, and other supplies.

General Specifications of the Model Plants

For this analysis, the input-output relationships of three selected sizes of plants with maximum outputs of 50,000, 100,000, and 250,000 pounds per week were synthesized. Cost estimates were also made for each plant when producing three-fourths and one-half of the designed output. Each plant was designed to comply with regulations of the Meat Inspection Division of the United States Department of Agriculture.

The synthesized plants were designed to perform the general functions described in the preceding chapter. Thus, each plant consists of a receiving cooler, receiving freezer, sausage kitchen, cured meats processing area, smoke-houses, blast chill cooler, tempering cooler, slicing and packaging area, dry storage and box make-up area, order assembly area, welfare rooms, office space, areas for a plant shop, refrigeration equipment, boiler, and equipment storage, and sufficient parking area for delivery trucks, employees, and visitors.

The plants were presumed to operate eight hours per day for 260 operating days per year.

CHAPTER V

CAPITAL INVESTMENTS

The operation of a meat processing plant requires an initial investment in buildings, equipment and real estate. In addition to the capital investment in fixed assets, capital is required for operation of the business. This chapter will present the capital investments and the following two chapters will present the costs of ownership and use and the costs of operation respectively.

Building Description and Costs[1]

The cost of constructing a meat processing plant depends upon many factors, not all of which were considered in detail in this study. For this study, it was assumed that plants would be constructed on level ground in industrial areas suitable for meat processing operations and that the plants would meet all the requirements for Federal inspection.[2]

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[1] The cost estimates for plant construction presented here were found to compare favorably with estimates of other operations furnished by meat industry specialists such as R. Starr Parker Associates, engineers, architects, and consultants, Atlanta, Georgia.

[2] United States Department of Agriculture, Agricultural Research Service, Meat Inspection Division, U. S. Inspected Meat Processing Plants - No Slaughtering, (Washington, 1961).

The various departments and areas of a meat processing plant may be divided into four main categories for purposes of estimating construction costs. These consist of coolers and all refrigerated work areas to include the order assembly area and internal unloading dock; freezers; dry storage to include equipment storage, plant supplies storage, spice storage, plant shop, boiler room, refrigeration equipment room, and welfare rooms; and office space.

Cost estimates for coolers and refrigerated work areas, freezers, and dry storage areas assume that the Chicago construction cost index and Tulsa construction cost index had a relation to the construction cost index in 1961 similar to the current relation.[3] These indices are presented in Table I. Applying this index relation to the mid-range cost figures presented in Meat Industry Trends - 1961[4], construction costs were estimated for these plant area categories. These costs are presented in Table II. The construction cost for office areas was estimated by applying the current Tulsa construction cost index to the rate of $10 per square foot used by Franzmann and Kuntz[5] to obtain a cost rate of $10.50 per square foot.[6]

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[3]Indices of construction cost from Robert Snow Means Company, Inc., Building Construction Cost Data, 1966, (Duxbury, 1966), p. 95.

[4]H. L. Rothra, ed., Meat Industry Trends - 1961, (Chicago, 1961), p. 1-7.

[5]John R. Franzmann and B. T. Kuntz, Economies of Size in Southwestern Beef Slaughter Plants, Oklahoma State University Agricultural Experiment Station Bulletin B-648, (Stillwater, 1966), p. 8.

[6]This assumes the $10 per square foot rate to be equivalent to the 1963 index of 95.

TABLE I

CONSTRUCTION COST INDICES

Year	Indices Chicago	Tulsa	Historical
1965[a]	104	98	100
1961	95[b]	89[b]	91[a]

[a]As given in Robert Snow Means Company, Inc., Building Construction Cost Data, 1966, (Duxbury, 1966), p. 95.

[b]Estimated assuming that Chicago was 4 points higher than the historical index in 1961 as in 1965 and that Tulsa was 2 points below the historical index in 1961 as in 1965.

TABLE II

ESTIMATED CONSTRUCTION COST RATES

Type or Purpose	Cost $/Sq. Ft. FROM[a]	TO[a]	Mid-Range[b]	Computed[c]
30° Cooler or Refrigerated Work Area	15.00	20.00	17.50	18.25
Sub-Zero Freezer	18.00	23.00	20.50	22.25
Dry Storage Area	6.00	10.00	8.00	8.25

[a]From H. L. Rothra, ed., Meat Industry Trends - 1961, (Chicago, 1961), p. 1-7.

[b]Mid-range of the "FROM" to "TO" columns.

[c]These figures assume the mid-range cost rate estimates for the Chicago area, 1961, to be equivalent to the estimated 1961 index for Chicago of 95 presented in Table I. By ratio these figures are computed to correspond to the current construction cost index of 98 for Tulsa.

Area requirements for the model plant buildings and each of the departments in the buildings were synthesized by Mr. Donald Hammons.[7]

Receiving Coolers and Receiving Freezers

Receiving coolers are usually designed to meet the particular needs of an individual plant, therefore they are built in a variety of sizes and shapes. Several important factors are considered when designing any cooler. Nine such factors are listed: (1) the product flow pattern, (2) the type and amount of construction materials used, (3) the amount, type and temperature of product to be handled, (4) the cooler room temperature and relative humidity to be maintained, (5) the outdoor temperature, (6) the amount and size of electrical equipment in the cooler, (7) the number of individuals working in the coolers, (8) the frequency of air changes, and (9) the orientation of the coolers to the compass.

No attempt was made in this study to provide detailed specifications for receiving coolers or receiving freezers. Although certain construction detail was assumed to aid in the estimation of refrigeration equipment needs, these specifications were not used to estimate construction costs.

If an individual plant uses frozen meat in its operations, as the model plants were specified to do, the receiving freezer will be designed to meet the

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[7] Industrial Engineer, Handling and Facilities Research Branch, Transportation and Facilities Research Dvision, Agricultural Research Service, United States Department of Agriculture. Subsequent references to Mr. Donald Hammons will appear parenthetically in the text as (Industrial Engineer, United States Department of Agriculture).

specific needs of that plant. The same nine important factors as listed above which are considered when designing a cooler are considered when designing a freezer.

To estimate the receiving cooler size, the following specifications were employed: (1) the rails were spaced on 2.5 feet centers with an allowance of 12 inches of rail space per beef quarter and 18 inches of rail space per pork carcass, (2) all rails were spaced 3 feet from any wall, and (3) ceilings were 12 feet high. Rail space was provided to allow for 2.5 days' storage of beef quarters and 2 days' storage of pork carcasses when 60 percent of the boned meat utilized by the plant is prechilled fresh beef and 36 percent is prechilled fresh pork.

The area requirements for the freezer were estimated considering that (1) 10 percent of the boned pork or 4 percent of the meat for sausage products used by the plant would be frozen pork which would be bought once weekly, (2) that approximately 7.5 percent of the plant output would be jobbed customer service items, and (3) all items would be stored on pallets. Area requirements and estimated costs of construction of receiving coolers and freezers for the model plants are presented in Table III.

Cutting and Boning Department

In smaller plants, it may be found that the cutting and boning operation, sausage kitchen, and cured meats processing are all located in one large room.

TABLE III

SYNTHESIZED BUILDING REQUIREMENTS AND COSTS
FOR THE THREE MODEL PLANTS

Item	Cost Per sq. ft.[a]	Plant Size: Small Area[b]	Small Total Cost[c]	Medium Area[b]	Medium Total Cost[c]	Large Area[b]	Large Total Cost[c]
	(Dollars)	(sq. ft.)	(Dollars)	(sq. ft.)	(Dollars)	(sq. ft.)	(Dollars)
Receiving Cooler	18.25	796	14,527.00	1,235	22,538.75	2,475	45,168.75
Receiving Freezer	22.25	389	8,665.25	650	14,462.50	709	15,775.25
Pork Cut & Beef Boning	18.25	584	10,658.00	881	16,078.25	1,980	36,135.00
Sausage Manufacturing	18.25	3,040	55,480.00	3,756	68,547.00	4,519	82,471.75
Cured Meats Department	18.25	1,161	21,188.25	1,542	28,141.50	3,404	62,123.00
Spice Storage	8.25	75	618.75	82	676.50	205	1,691.25
Smokehouses and Wash	18.25	953	17,392.25	1,781	32,503.25	2,339	42,686.75
Blast Chill	18.25	441	8,048.25	690	12,592.50	1,334	24,345.50
Tempering Cooler	18.25	761	13,888.25	1,415	25,823.75	2,826	51,574.50
Slicing and Packaging	18.25	1,739	31,736.75	3,001	54,768.25	5,566	101,579.50
Order Assembly	18.25	1,909	34,839.25	4,791	87,435.75	7,442	135,816.50
Equipment Storage	8.25	1,625	13,406.25	2,585	21,236.25	4,446	36,679.50
Packaging Supplies	8.25	440	3,630.00	4,693	38,717.25	6,147	50,712.75
Boiler Room	8.25	367	3,027.75	398	3,283.50	398	3,283.50
Plant Shop	8.25	-	-	570	4,702.50	588	4,851.00
Refrigeration Equipment	8.25	-	-	914	7,540.50	2,546	21,004.50
Dock	18.25	711	12,975.75	842	15,366.50	1,146	20,914.50
Welfare Room	8.25	473	3,902.25	860	7,095.00	1,294	10,675.50
Office	10.50	886	9,303.00	1,618	16,989.00	2,308	24,234.00
Total		16,350	263,287.00	32,304	478,588.50	51,672	771,723.00

[a]Estimated using procedure discussed in text.

[b]Areas synthesized by Mr. Donald Hammons (Industrial Engineer, United States Department of Agriculture).

[c]Cost per square foot multiplied by the appropriate area.

In larger plants, the cutting and boning operation is a separate department and if large enough, may be a conveyorized operation.

The cutting and boning department receives the chilled beef quarters and pork carcasses from the receiving cooler. The space provided for this department varies widely among meat processing plants as no specific definition of area requirements is given. Regulations of the Meat Inspection Division of the United States Department of Agriculture are very general and state:

> Meat preparation and processing departments shall be of sufficient size to permit the installation of all necessary equipment with ample space for plant operations and truckways.[8]

In this study, area requirements for the cutting and boning department were based on the area required for the equipment and data on work areas and truckways of cutting and boning departments of plants in the Southwest. A conveyorized system is not included in any of the model plants.

The cutting and boning department was provided with refrigeration to maintain a temperature not higher than 50 degrees as set forth in regulations of the Meat Inspection Division.[9]

Area requirements and estimated costs of construction for the cutting and boning departments of the model plants are presented in Table III.

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[8]United States Department of Agriculture, Agricultural Research Service, Meat Inspection Division, U. S. Inspected Meat Processing Plants - No Slaughtering, (Washington, 1961), p. 19.

[9]Ibid.

Sausage Kitchen and Cured Meats Departments

The entire meat processing plant should be designed to provide maximum efficiency in the flow of the product from the time the meat and supplies are received until the finished product leaves the plant.

The flow is extremely important in the sausage kitchen and cured meats departments as many operations are performed in these departments to convert the raw meat into the various products which will be shipped from the plant. The area requirements for these departments were estimated from equipment space requirements and data on sausage and cured meats departments in plants of the Southwest. Area requirements and estimated costs of construction for the respective departments in each of the model plants are presented in Table III.

Spice Storage

In meat processing plants with a sausage operation, an area readily accessible to the sausage kitchen is provided for the dry storage and weighing of spices. The area for spice storage in the model plants was estimated assuming that 3 percent of the sausage production was spices and that the average inventory of spices would be a three months' supply. Area requirements and estimated costs of construction for the spice storage areas of the model plants are presented in Table III.

Smokehouses

The smokehouse space was estimated considering that the smokehouses would operate 18 hours per day five days a week with 38.5 percent of the plant's output as sausages and 38.5 percent as cured meats. Of the sausage products, small casing products such as franks consisted of 49.7 percent; loaf products, 2.8 percent; large casing products such as bologna, 15.7 percent; ground beef and fresh sausage, 28.7 percent; and other products such as chili, 3.1 percent. Of the cured meats, bacon accounted for 45.2 percent; hams, 40.1 percent; picnics, 12.4 percent; and products such as cured jowls and hocks, 2.3 percent. The cost of the smokehouses was an average of prices received from major manufacturers of smokehouses. Costs of smokehouses are included in Table III.

Included in the smokehouse area was room for washing products after smoking and space for equipment storage. These areas were estimated using data compiled on operations of the Southwest. Area requirements and estimated costs of construction for the smokehouses and product washing areas of the model plants are presented in Table III.

Blast Chill

The blast chill cooler area of meat processing plants varies widely. The type of product being produced, the product mix, and the type of refrigeration equipment are three important factors influencing the area of the blast chill. For the model plants, the blast chill cooler was designed to hold

one day's production of products which were cooked and/or smoked. This will provide adequate facilities for blast chill when considering the product mix as listed in the paragraph describing the smokehouses. Area requirements and estimated costs of construction for the blast chill coolers of the model plants are presented in Table III.

Tempering Cooler

The area of the tempering room was developed using data compiled on several meat processing plants in the Southwest. The size of this cooler varies from quite small to quite large among processing plants. In plants where a small tempering cooler was used, it was found that plant production had expanded based upon the other plant facilities; therefore, in order to faciliate the increased production, the product was moved through the tempering cooler more rapidly than before. The tempering cooler of the model plants was designed to hold one week's production of cured meat products. This basis for computing the size of the tempering cooler provides adequate tempering area for plants producing sausages, and cured meats, in the ratios mentioned previously. Area requirements and estimated costs of construction for the tempering coolers of the model plants are presented in Table III.

Slicing, Peeling, and Packaging Area

Like the other preparation and processing departments of the meat processing plant, the area for the slicing, peeling and packaging operations

was designed to provide sufficient space for equipment, work areas, and truckways to efficiently perform the slicing, peeling, and packaging operations. Area requirements and estimated costs of construction for the slicing, peeling, and packaging areas of the model plants are presented in Table III.

Order Assembly Department

The order assembly department brings all products of the plant to one central location for convenient and efficient filling of customer orders for distribution. The two largest model plants were equipped with an arrangement of roller shelves allowing easy shelving of products and efficiency in assembling orders. These order assembly departments were also equipped with a gravity roller conveyor which allows efficient loading of several trucks simultaneously. Sufficient space was also provided for storage of pallets which deliver the finished products to that department from the processing departments. In the small model plant, all products are stored on pallets and cart shelves and manually trucked to the loading points. The total area and arrangement of the order assembly department of the model plants is based upon order assembly departments of meat processing plants in the Southwest. Area requirements and estimated costs of construction for the order assembly areas of the model plants are presented in Table III.

Packaging Supplies Storage and Box Make-Up

The packaging supplies storage area varies in size among plants. Most plants try to provide sufficient dry storage to take advantage of large quantity

purchases. The model plants packaging supplies storage areas were designed to provide storage for a three months' supply of packaging materials and included adequate space for box construction. The design also complies with the Meat Inspection Division regulation which states "Provision must be made to store supplies on racks about 12 inches above the floor."[10] Area requirements and estimated costs of construction for the packaging supplies storage areas are presented in Table III.

Docks

Unloading docks were provided for receiving carcass pork, quartered beef, frozen pork, and customer service items in the holding cooler and holding freezer. The docks, designed as an internal part of the building, are 10 feet wide and as long as the width of the holding cooler and the necessary length to extend to the adjacent holding freezer. Internal unloading dock space was also provided to allow convenient unloading of packaging materials and other plant supplies at a point most accessible to the storage areas.

Constructing the dock as an internal part of the building prevents refrigeration loss when unloading and loading and allows maximum pest control afforded by bellowed door curtains.

Loading docks from the order assembly department were also designed as an internal part of the building. These docks are wide enough to allow adequate work space to load delivery vehicles directly from the gravity assembly

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[10] Ibid, p. 20.

area. Area requirements and costs of construction for docks of the model plants are presented in Table III.

Employee Welfare Rooms

Federally inspected meat processing plants are required to provide dressing rooms properly separated from toilet rooms.[11] Employee dressing rooms meeting the requirements for Federal inspection were specified for each of the model plants. The area of the dressing room was estimated on the basis of 17 square feet per production employee. Area requirements and estimated costs of construction of welfare rooms for the model plants are presented in Table III.

Offices

Three types of offices are found in a meat processing plant. These are a general office, a manager's office, and the Federal inspector's office. The size of the inspector's office must be at least 7 feet by 9 feet in size, but the general office and manager's offices vary widely in size often reflecting the personal preference of the manager more than any other factor. The office space for the model plants was estimated considering the number of office employees and management personnel.

The cost of constructing office areas can vary greatly depending upon the type of materials used in finishing. Tastes in office decor vary widely and are

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[11] Ibid, p. 23

reflected in the cost of the office space. Area requirements and estimated costs of construction of office space for the model plants are presented in Table III.

Real Estate Requirements and Costs

In determining the amount of land needed for a new plant, consideration must be given to: (1) the amount of space needed for the buildings, parking lots, and landscaping, (2) plans for future plant expansion, (3) expectations with regard to future price of adjacent tracts of real estate, and (4) the available supply of investment capital.

In this study, no assumptions were ventured with respect to items (2), (3), or (4), therefore the land area for each plant in this study includes space for the building, employee parking lots, load-out and receiving area, and landscape. The areas required for the buildings of the model plants were discussed in the previous section. This section will discuss the other real estate requirements and costs.

Parking Lots and Dock Apron

Parking lots are required by meat processing plants for the use of the plant employees and visitors. The procedure used to estimate the parking area in this study was that used by Franzmann and Kuntz:

> . . . an area of 9 feet by 30 feet (including the drive area between lines of cars) was allocated for each employee. An area equal to ten percent of the total employee parking was provided for visitor parking.[12]

A concrete dock apron 20 feet wide and the length of the unloading and loading docks was provided complying with Federal inspection requirements. An additional span of asphaltic concrete 20 feet wide and the length of the concrete apron was provided as a driveway, turning space, and parking area for loading and unloading trucks. The construction cost of the concrete dock aprons was estimated at $0.50 per square foot. The construction cost of the asphaltic concrete areas of the dock aprons and the parking lots were estimated at $0.56 per square foot. The parking lot and dock apron areas and costs of construction for the model plants are presented in Table IV.

Landscape

The amount of land allowed for the landscape of the plant was arbitrarily estimated as an area equal to the length of the office front by 10 feet in width.

Values of land suitable for non-slaughtering meat processing sites in the Oklahoma City area ranged from $1,000 per acre to $8,000 per acre depending mainly upon access to expressways.[13] In the absence of any good criteria for

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[12] John R. Franzmann and B. T. Kuntz, Economies of Size in Southwestern Beef Slaughter Plants, Oklahoma State University Agricultural Experiment Station Bulletin B-648, (Stillwater, 1966), p. 10.

[13] Conversation with Mr. Charles Boat, Industrial Division, Oklahoma City Chamber of Commerce.

assigning values in this range to particular sizes of plants, a cost of $4,356 per acre was arbitrarily selected as the basis for estimating the real estate investment for the model plants. These costs are presented in Table V.

TABLE IV

SYNTHESIZED PARKING LOT AND LOADING DOCK APRON AREAS AND COSTS FOR THE THREE MODEL PLANTS

Item	Weekly Plant Output[a]		
	50,000 lbs.	100,000 lbs.	250,000 lbs.
Employee Parking Lot Area (sq. ft.)[b]	5,670	10,800	17,820
Visitor Parking Lot Area (sq. ft.)[c]	567	1,080	1,782
Concrete Dock Apron (sq. ft.)[d]	1,840	3,180	3,900
Asphaltic Concrete Dock Apron (sq. ft.)[e]	1,840	3,180	3,900
Total Parking Lot and Dock Apron Area (sq. ft.)[f]	9,917	18,237	27,402
Parking Lot and Dock Apron Cost[g]	$5,443.12	$10,053.84	$16,061.12

[a]Designed output including customer service items.

[b]Number of employees multiplied by 270 sq. ft. per employee.

[c]Equivalent to 10 percent of Item 3.

[d]An area equal to 20 feet multiplied by the dock length as required by MID regulation.

[e]An area equivalent to the concrete apron to allow loading trucks a driveway, parking area, and turn-around area.

[f]Sum of Items 1, 2, 3, and 4.

[g]Items 1, 2, and 4 times $0.56 plus Item 3 times $0.50.

TABLE V

LAND REQUIREMENTS AND COSTS FOR THE THREE MODEL PLANTS

Plant Output[a] (Pounds)	Plant Area[b]	Landscape[c] (Square Feet)	Total Land Area[d]	Total Land Cost[e]	Annual Interest Cost[f] (Dollars)
50,000	26,399	420	26,819	2,681.90	160.91
100,000	44,655	650	45,315	4,531.50	271.89
250,000	73,044	650	73,694	7,369.40	442.16

[a]Designed weekly output including customer service items.

[b]The ground area required by the building plus the parking lot and dock apron areas from Table IV.

[c]An area equal to 10 times the length of the office front of the building arbitrarily used for landscape.

[d]Sum of Columns 2 and 3.

[e]Column 4 times $0.10 per square foot.

[f]An interest rate of 6 percent was applied to Column 5.

Equipment Costs and Specifications

Equipment for meat processing plants includes all equipment from office and welfare room equipment to the manufacturing and refrigeration equipment. The equipment requirements of the meat processing plants considered in this study may be placed in ten general categories: (1) sausage kitchen, (2) cured meats, (3) packaging, (4) smoking, (5) boning, (6) order assembly, (7) refrigeration, (8) office, (9) welfare, and (10) miscellaneous. An itemized equipment list for

each of the model plants specified by category as given above is presented in Appendix A, Tables I, II and III. Total costs of equipment by category for each plant are given in Table VI. No attempt was made to estimate the specific items of refrigeration equipment required for each plant. The capacity of the refrigeration equipment was estimated in terms of tons of refrigeration required to remove the total heat load from the plant.[14] These figures are presented in Appendix C, Table II.

TABLE VI

TOTAL EQUIPMENT COSTS BY CATEGORY FOR THE THREE MODEL PLANTS

Equipment Cost[b]	Weekly Plant Output[a]		
	50,000 lbs.	100,000 lbs.	250,000 lbs.
	(Dollars)		
Refrigeration	25,800.00	48,000.00	79,500.00
Sausage Kitchen	35,889.61	64,992.59	95,719.33
Cured Meats	21,809.57	29,963.07	38,621.69
Smoking	47,868.58	63,611.24	122,154.10
Packaging	24,755.10	27,067.39	37,414.56
Boning	1,625.59	4,028.62	4,535.22
Order Assembly	2,754.70	8,040.26	25,927.38
Miscellaneous	11,705.08	23,286.53	47,264.48
Office	6,445.00	8,284.00	11,599.00
Welfare Room	1,136.00	1,830.00	2,700.00
Total	179,809.33	279,104.20	465,435.76

[a] Includes jobbed customer service items.

[b] Equipment costs from Appendix A, Tables I, II, and III.

[14] The total heat load was calculated assuming certain construction specifications and considering refrigeration loss due to the people working in the various plant areas, electric motors powering the equipment, lights, and infiltration from open doors.

Equipment used in the processing of sausage and cured meats varies from manually operated models to the highly advanced electronically controlled and operated models for some items of equipment.

When purchasing meat processing equipment, a firm may buy new equipment or used equipment. New equipment costs vary widely depending on the degree of sophistication of the machines. And in general, used equipment costs are much different from costs of new equipment and vary greatly.

In this study, new equipment is specified throughout the model plants, thereby allowing more uniformity in equipment prices as well as in specifying the items of equipment and establishment of maintenance costs.

Size models of processing equipment are not perfectly divisible, therefore machines were specified for each model plant which would most nearly meet the requirements of that plant operating at its maximum designed volume.

Manufacturing equipment specifications were developed by Mr. Donald Hammons (Industrial Engineer, United States Department of Agriculture). Costs for the items of this equipment were supplied by several equipment manufacturers. These costs are given in Appendix A, Tables I, II, and III, and include freight cost as a cost from Chicago to Oklahoma City. Installation cost is also included where installation is a separate charge.

Estimates of the cost of refrigeration equipment varied considerably among the major manufacturers contacted. A cost rate of $750 per ton of refrigeration

was used for this study. Estimates of the refrigeration tonnage for the various plant departments are presented in Appendix C, Table II.[15]

The office equipment requirements were estimated from observations of several offices of meat processing plants in the Southwest. The items of equipment for each plant are given in Appendix A, Tables I, II and III. The cost estimates for the office equipment were obtained from price lists of several office equipment manufacturers and the estimates used for this study are presented in Appendix A, Tables I, II and III. Total costs of office equipment for the model plants are given in Table VI.

Welfare room equipment requirements are those as specified by the Meat Inspection Division of the United States Department of Agriculture, and are listed for each plant in Appendix A, Table I, II and III. Welfare room equipment prices were obtained from manufacturer's price lists and are given in Appendix A, Tables I, II and III. Total welfare equipment costs for each plant are given in Table VI.

The equipment listed for the three model plants is specific for the plants as defined according to volume and product mix and intended only as guidelines.

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[15]The cost estimates and tonnage estimates for refrigeration equipment were compiled by Mr. Donald Hammons (Industrial Engineer, United States Department of Agriculture). The $750 per ton figure includes the cost of installation.

Total Capital Investments

Total capital investments include capital for buildings, equipment, real estate, and operations. The total capital requirements for the three model plants each operating at three output levels are presented in Table VII.

TABLE VII

TOTAL CAPITAL REQUIREMENTS

Plant Size	Plant Output[b]	Building[c]	Equipment[d]	Real Estate[e]	Operating[f]	Total[g]
	(Pounds)			(Dollars)		
Small	25,000	263,287	179,809	8,125	144,534	595,755
	37,500	263,287	179,809	8,125	182,242	633,463
	50,000	263,287	179,809	8,125	223,308	674,529
Medium	50,000	478,589	279,104	14,585	254,324	1,026,602
	75,000	478,589	279,104	14,585	344,445	1,116,723
	100,000	478,589	279,104	14,585	436,767	1,209,045
Large	125,000	771,723	465,436	23,431	578,816	1,839,406
	187,500	771,723	465,436	23,431	766,307	2,026,897
	250,000	771,723	465,436	23,431	944,476	2,205,066

[a]Rounded to the nearest dollar.

[b]Weekly output including customer service items.

[c]Taken from Table III.

[d]Taken from Table VI.

[e]Land value taken from Table V, plus cost of paving parking lots from Table IV.

[f]Taken from Table XVI.

[g]Sum of building, equipment, real estate, and operating capital requirements.

CHAPTER VI

COSTS OF OWNERSHIP AND USE

The costs of ownership and use are incurred after a firm has invested capital in buildings, equipment, and real estate. These costs are indubitable, since the firm must consider the income foregone had the capital been invested elsewhere, the depreciation incurred from obsolescence and use, the taxation for ownership, the insurance to protect the investment, and the cost of maintenance and repairs to defer future investment. It is the purpose of this chapter to present these costs of ownership and use for the model plants of this study.

Interest

One cost which a firm must face is interest on the funds invested. An interest rate of six percent was applied to the land investment and to the non-depreciating salvage value of the equipment. A three percent rate was applied to the depreciable balance of the buildings, parking lots, and equipment. The interest charges on the capital investment for the model plants are presented in Table VIII.

TABLE VIII

ANNUAL INTEREST COST AND INSURANCE COST COMPUTATIONS FOR THE THREE MODEL PLANTS

Item	Plant Size		
	Small (50,000 lbs.)[a]	Medium (100,000 lbs.)[a]	Large (250,000 lbs.)[a]
		(Dollars)	
1. Building and Parking Lot[b]	268,730.12	488,612.10	787,784.12
2. Architectural[c]	16,123.81	29,316.72	47,267.05
3. Total Building and Parking Lot[d]	284,853.93	517,928.82	835,051.17
4. Equipment[e]	179,809.33	279,104.20	465,435.76
5. Salvage Value of Equipment[f]	17,980.93	27,910.42	46,543.58
6. Depreciable Balance of Equipment[g]	161,828.40	251,193.78	418,892.18
7. Total Depreciable Balance of Building, Parking Lots, and Equipment[h]	446,682.33	769,122.60	1,253,943.35
8. Land Value[i]	2,681.90	4,531.50	7,369.40
9. Insured Value of Building and Equipment[j]	354,477.06	606,154.16	989,727.01
10. Annual Insurance[k]	585.60	1,001.37	1,635.03
11. Annual Interest[l]	14,640.23	25,020.20	40,853.07

[a]Maximum designed output including customer service items.

[b]Building cost taken from Table III and parking lot cost taken from Table IV.

[c]Six percent of Item 1.

[d]Sum of Items 1 and 2.

[e]Taken from Table VI.

[f]Ten percent of Item 4.

[g]Item 4 minus Item 5.

[h]Sum of Items 3 and 6.

[i]Taken from Table V.

[j]Eighty percent of the original building cost found in Table III plus 80 percent of Item 4 following the Oklahoma Inspection Bureau's recommended practice of insuring buildings and equipment for 80 percent of their original cost.

[k]An estimated fire and business interruption insurance rate of $1.652 per $1000 insured value was obtained from the Oklahoma Inspection Bureau, 2000 Classen Building, Oklahoma City, Oklahoma, and was applied to Item 9.

[l]Three percent of Item 7 plus 6 percent of Items 5 and 8.

Depreciation

The services of buildings, parking lots, and equipment are used over a long period of time and may be considered as flow resources. The annual cost of such services may be computed by amortizing the investment in these assets over a suitable period of time.

Depreciation of buildings and equipment consists of: (1) depreciation from actual wear and tear associated with use, and (2) depreciation from obsolescence due to technological changes.[1]

Depreciation of buildings and equipment, especially where buildings and equipment are maintained, is difficult to measure empirically.

Data on the depreciation of buildings and equipment due to wear and tear are scarce, and to know depreciation from obsolescence is to know the future. The impracticalness of estimating the three components of depreciation separately leads to a commonly used alternative which attempts to estimate the loss in value from all three components simultaneously.

The annual depreciation cost for buildings and parking lots was estimated by dividing the total cost of the building including architectural costs, and the total cost of the parking lot, by their respective estimated useful lives. For

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[1] Land was not considered for depreciation purposes because its services are not affected by extent of use, the ravages of time, nor obsolescence.

all equipment, an estimate of the salvage value was subtracted from the total cost of new equipment before dividing by the estimated useful life.[2]

The annual depreciation cost for buildings, parking lots, processing equipment, and office equipment are presented in Table IX.

Taxes

The amount of personal property taxes to be paid is of concern to firms when examining their annual costs. For this study, personal property taxes were computed using the procedures and rates used in Oklahoma County.[3]

The assessment value of the plant, usually some percentage of actual market value, was determined by assessing the model plants at the following percentages: 25 percent of the market value of land, buildings, and parking lots; and 35 percent of the value of the equipment.

A tax rate of $92 per $1000 of assessed valuation was used in this study, since it is typical of the rate used for meat processing plants in Oklahoma City. A full tax rate was applied to the assessed value of land, buildings, and parking lots. Taxing equipment based on the assessed value of new equipment would be

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[2]The salvage value of all equipment was assumed to be equal to 10 percent of the initial cash price. Buildings were assumed to be fully depreciated in 45 years; parking lots in 20 years; processing equipment in 12 years; and office equipment in 10 years. The estimated useful lives of buildings, parking lots and equipment were taken from United States Treasury Department, Internal Revenue Service, Publication No. 456, Revised August, 1964, Depreciation-Guidelines and Rules - Revenue Procedure 62-21, (Washington, 1964), pp. 3-7.

[3]Tax procedures and rates were obtained from the County Assessor's Office, Oklahoma County Court House, Oklahoma City, Oklahoma.

TABLE IX

ANNUAL DEPRECIATION COST FOR THE THREE MODEL PLANTS

Item	Plant Size		
	Small (50,000 lbs.)[a]	Medium (100,000 lbs.)[a]	Large (250,000 lbs.)[a]
		(Dollars)	
Depreciable Balance:			
1. Buildings[b]	263,287.00	478,588.50	771,723.00
2. Parking Lots[c]	5,443.12	10,053.84	16,061.12
3. Processing Equipment[d]	156,027.90	243,738.18	408,453.08
4. Office Equipment[e]	5,800.50	7,455.60	10,439.10
Annual Depreciation Cost:			
5. Building[f]	5,850.82	10,635.30	17,149.40
6. Parking Lot[g]	449.85	502.69	1,272.60
7. Processing Equipment[h]	13,002.32	20,311.52	34,037.76
8. Office Equipment[i]	580.05	745.56	1,043.91
9. Total[j]	19,883.04	32,195.07	53,503.67

[a]Maximum weekly output of model plant.

[b]Taken from Table III.

[c]Taken from Table IV.

[d]Total processing equipment cost taken from Appendix A, Tables I, II, and III, minus 10 percent of that value as salvage value.

[e]Taken from office equipment cost in Table VI less 10 percent of that value as salvage value.

[f]Item 1 divided by 45 years.

[g]Item 2 divided by 20 years.

[h]Item 3 divided by 12 years.

[i]Item 4 divided by 10 years.

[j]Sum of Items 5, 6, 7, and 8.

over estimating the taxes of the plant since the value of equipment is decreasing over time. For this reason, the salvage value of the new equipment was subtracted and a tax rate of $46 per $1000 assessed value or one-half of the full rate, was applied to the depreciable balance. The salvage value was taxed at the full rate of $92 per $1000 assessment since the salvage value does not depreciate.

Personal property taxes must also be paid on the average inventory of product owned by the plant. The practice used in Oklahoma County is to average the inventory of the last day of the old year and the inventory of the first day of the new year and apply a tax rate of $92 per $1000 to 35 percent of the market value of the inventory.[4] The annual personal property taxes for the three model plants each operating at three levels of output are presented in Table X.

Insurance

Most meat processing firms in Oklahoma carry insurance against losses due to fire and unexpected interruptions of operation to protect their investment. Rates for this insurance are determined by the Oklahoma Inspection Bureau.

Several factors affect the insurance rate such as exposure to the elements, accessibility of the plant to fire department equipment, and type of construction. The most important factor is whether or not the building is equipped with a

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[4]Market value of the product inventory was estimated using January through December 1966 average Chicago wholesale processed meat prices obtained from weekly issues of the National Provisioner. Average wholesale prices were computed and weighted from these price data as listed for the following products: franks, .151; bologna, .062; polish sausage, .040; olive loaf, .021; liver loaf, .002; pork sausage, .109; hams, .158; bacon, .173; picnics, .054; and loins, .155. Customer service items were not considered in the inventory.

TABLE X

ANNUAL PERSONAL PROPERTY TAXES FOR THE THREE MODEL PLANTS

	Assessed Value				Taxes				
Output[a]	Real Estate[b]	Equipment[c]	Equipment Salvage[d]	Product[e]	Real Estate[f]	Equipment[b]	Equipment Salvage[h]	Product[i]	Total[j]
(Pounds)	(Dollars)								
25,000	67,853.01	56,639.94	6,293.33	1,799.26	6,242.48	5,210.87	289.49	165.53	11,908.37
37,500	67,853.01	56,639.94	6,293.33	2,698.90	6,242.48	5,210.87	289.49	240.02	11,982.86
50,000	67,853.01	56,639.94	6,293.33	3,598.54	6,242.48	5,210.87	289.49	331.07	12,073.91
50,000	123,293.46	87,917.82	9,768.65	3,598.54	11,342.00	8,088.43	372.07	331.07	20,133.57
75,000	123,293.46	87,917.82	9,768.65	5,397.80	11,342.00	8,088.43	372.07	496.60	20,299.10
100,000	123,293.46	87,917.82	9,768.65	7,197.08	11,342.00	8,088.43	372.07	662.13	20,464.63
125,000	198,788.38	146,612.26	16,290.25	8,996.34	18,288.53	13,488.33	620.46	827.66	33,224.98
187,500	198,788.38	146,612.26	16,290.25	13,494.52	18,288.53	13,488.33	620.46	1,241.50	33,638.82
250,000	198,788.38	146,612.26	16,290.25	17,992.70	18,288.53	13,488.33	620.46	1,655.33	34,052.65

[a]Weekly output including customer service items.

[b]Twenty-five percent of market value of land, buildings and improvements.

[c]Thirty-five percent of market value less the salvage value of the equipment.

[d]Thirty-five percent of the salvage value of the equipment.

[e]Computation explained in text. See page

[f]A tax rate of $92 per $1000 of assessed value in column 5 was used.

[g]A tax rate of $92 per $1000 was applied to the equipment assessed value of column 3 since value of equipment is being depreciated over time.

[h]A tax rate of $46 per $1000 assessed salvage value in column 4. Since the salvage value of equipment is assumed not to depreciate over the life of the equipment, one half of the tax rate is applied.

[i]A tax rate of $92 per $1000 was applied to the product inventory assessed value of column 5.

[j]The sum of columns 6, 7, 8, and 9.

sprinkler system. Rates for buildings without sprinkler systems are 5 times greater in some instances than for buildings including a sprinkler system.[5] Because of the additional fire protection provided and the lower rates involved, the model plants were specified to be equipped with sprinkler systems.

In computing the insurance cost, a rate of $1.652 per $1000.00 was applied to 80 percent of the cost of the buildings and equipment.[6] The $1.652 rate was selected from the lower end of the range of rates because the model plants were assumed to approximate "ideal" risks. The insurance cost on the buildings and equipment are listed in Table VIII.

Maintenance and Repairs

To minimize the expense of down-time, a meat processing plant must keep its equipment in good operating condition. To some plant managers who were visited during this study, preventive maintenance was thought to be a big cost. Usually, these plants were operated without a plant maintenance man and the only time equipment received mechanical servicing was when it was "down." Those plant managers who had a full time maintenance man or had their equipment checked regularly and serviced by repairmen were convinced that good preventive maintenance was much cheaper than the more costly "down-time."

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[5]This information obtained from the Oklahoma Inspection Bureau, 2000 Classen Building, Oklahoma City, Oklahoma.

[6]The present practice is to insure buildings for 80 percent of their value. One hundred percent coverage is offered, but only at a much higher rate. This information and the rates were obtained from the Oklahoma Inspection Bureau, 2000 Classen Building, Oklahoma City, Oklahoma.

Maintenance and repair costs of the building are included in the annual maintenance costs. To meet the requirements of Federal inspection, the building must be in a good state of repair.

The cost of equipment and building repair and maintenance is presented in Table XI. The cost of maintenance and repair of the individual items of equipment is presented in Appendix A, Tables I, II, and III. The cost of building maintenance and repair was estimated to cost one cent per square foot of floor space.[7]

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[7] This information based on conversation with a plant owner and on records of cooperating firms. Names are withheld to avoid identity of the firms.

TABLE XI

TOTAL ANNUAL MAINTENANCE COSTS FOR THE THREE MODEL PLANTS

Item	Plant Output[a] Plant Size Small	Medium	Large
		(Dollars)	
Plant Machinery[b]	3,622.00	4,150.00	5,637.50
Office Equipment[b]	210.25	270.25	330.25
Refrigeration Equipment[b]	774.00	1,440.00	2,385.00
Total Equipment[b]	4,616.75	5,870.75	8,363.25
Building[c]	163.50	323.04	516.72
Grand Total[d]	4,780.25	6,193.79	8,879.97

[a]Designed weekly output; 50,000, 100,000, and 250,000 pounds respectively, for the small, medium and large plants.

[b]Taken from Appendix A, Tables I, II and III.

[c]Respective building areas taken from Table III, multiplied times .01.

[d]Sum of "total equipment" and "building" items.

CHAPTER VII

OPERATING COSTS

In addition to the initial investment in buildings and equipment, and the costs of ownership and use, the actual operation of a meat processing plant requires expenditures for labor and salaries, utilities, delivery, and other services and supplies. Some of these operating costs are fixed over a range of outputs and some are variable.

Those items which may be considered as fixed operating costs are essentially fixed once the plant begins to operate. Ordinarily fixed operating costs do not vary with week to week changes in output once the plant has been set up and is operating within the range of its designed output. However, fixed operating costs might vary because of changes in plant operating practices, trade requirements, internal reorganization of the firm, or because of changes in supply and demand conditions in other industries. Fixed operating costs, then, are more easily subject to change in the short run than are fixed investment costs. Costs which may be considered as fixed operating costs are management and clerical salaries, telephone, legal and audit fees, office supplies, and postage. In this study, only management salaries were considered as fixed operating costs due to the nature of supporting data.

Variable costs are the costs of variable resources. Certain of these costs have a cost per unit of output which changes with output level. Items that could be included in this group are plant labor and utilities. There are also variable costs which have a cost per unit of output which is constant. Packaging materials, casing materials, and supplies are the major items of a meat processing plant that would be included in this category.

It is the purpose of this chapter to discuss the operating costs of the three model plants each operating at three different outputs, 100, 75, and 50 percent of the designed output level of the plants. The costs considered in the order of their magnitude are wages and salaries; plant supplies including casings, packaging materials, and spices; sales; delivery; interest on operating capital; advertising; utilities; laundry; and costs such as telephone, legal and audit fees, office supplies, claims and adjustments, postage, and dues, subscriptions, donations, and other miscellaneous costs.

Wages and Salaries

Wages and salaries consitituted the largest single operating expense item in this study. Changes in the cost of labor may be a result of changes in the length of the work week, or changes in the size of the labor force, or changes in wage rates. In this study, changes in the output of a model plant were considered only as a result of a change in the size of the labor force.[1]

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[1] Data were not available for the extended work week analysis and since the common practice of Oklahoma meat processors is to operate on a single shift basis, only the change in labor force is considered here.

Personnel requirements for production operations of the model plants were developed by Mr. Donald Hammons (Industrial Engineer, United States Department of Agriculture). Management and office personnel specifications were synthesized on the basis of observations of meat processing plants in Oklahoma and Texas. Total personnel requirements for each department of the model plants are presented in Table XII. Personnel specifications for the model plants are presented in Appendix B, Tables IA through IIIC.

Wages for personnel of the production departments were based upon 1963 meat industry wage statistics for the Southwest which were assumed to be in effect in 1965[2]. Wage data for office employees were developed based on an Oklahoma City survey.[3] Salaries for management personnel were developed from information supplied by management of meat processing plants. Wages and salaries used in the study are presented in Appendix B, Tables IA through IIIC.

Three costs associated with the number of employees and their wages are Social Security tax, employee benefits, and liability insurance. Social Security taxes are required by law to be paid for all employees. Under the 1965 Social Security amendments, the contribution rate is an increasing percentage of the employee's creditable earnings until the year, 1987. For purposes of this study

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[2]United States Department of Labor, Bureau of Labor Statistics, Industry Wage Survey - Meat Products, Bulletin No. 1415 (Washington, 1963), Section 1, Tables 6 and 7.

[3]Oklahoma Employment Security Commission, Oklahoma State Employment Service Research and Planning Division, Occupational Wage Survey Oklahoma City Metropolitan Area - June, 1965, (Oklahoma City, 1965), Table 1.

TABLE XII

PERSONNEL REQUIRED TO OPERATE THE THREE MODEL PLANTS

	Plant Size								
	Small			Medium			Large		
	Weekly output[a]								
Employment	25,000	37,500	50,000	50,000	75,000	100,000	125,000	187,500	250,000
	(Personnel[b])								
Boning Department	1	1	1	1	2	3	3	4	5
Curing Department	4	5	6	6	9	11	14	17	20
Sausage Department	3	3	4	4	5	8	9	12	13
Order Assembly	3	4	5	5	7	9	9	10	11
Sanitation and Maintenance	1	1	1	3	3	3	6	6	6
Office Personnel	2	2	2	4	4	4	5	5	5
Management	1	1	1	1	1	1	3	3	3
Total Employment	15	17	20	24	31	39	49	57	63

[a] Output in pounds including jobbed customer service items.

[b] See Appendix B for departmental personnel specifications.

Social Security taxes were computed using the 1967-68 rate of 4.4 percent of employee earnings up to $6,600. The cost to the firm for Social Security taxes is presented for the three model plants, each operating at three levels of output, in Table XIII.

Employee benefits included in this study included retirement contributions, life and health insurance, vacation, and holiday pay. Of the plants cooperating in this study, these benefits were the most common. Social Security was assumed to be 3.5 percent of the wages and benefits cost, vacation and holidays, 3.4 percent; retirement, 2.5 percent; and insurance, 2.6 percent.[4] The percentages assumed for vacation and holidays, retirement, and insurance, were each calculated as a percent of the Social Security percentage (i.e., 3.4/3.5, 2.5/3.5, and 2.6/3.5, respectively). These decimal fractions were summed, then multiplied by the 1967-68 Social Security contribution rate of .044 to give the constant .106857. This constant was then multiplied by the actual amount of the Social Security contribution to estimate the employee benefits cost. These costs for each of the model plants operating at three output levels are presented in Table XIII.

General liability and product liability insurance coverages are optional to the individual firm. Common practice of the firms cooperating in this study was to carry $25,000 bodily injury, $100,000 property damage, and $50,000

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[4]These figures taken from Financial Facts About the Meat Packing Industry - 1964, Department of Marketing, American Meat Institute (Chicago, 1964), Table 16.

TABLE XIII

ESTIMATED TOTAL ANNUAL PAYROLL FOR THE THREE MODEL PLANTS[a]

	Plant Size								
	Small			Medium			Large		
	Weekly output[b]								
Item[b]	25,000	37,500	50,000	50,000	75,000	100,000	125,000	187,500	250,000
	(Dollars)								
Boning Department[b]	3,744.00	3,744.00	3,744.00	3,744.00	7,488.00	10,150.40	10,150.40	13,894.40	17,638.40
Curing Department[b]	13,852.80	17,472.00	21,673.60	21,673.60	32,136.00	39,062.40	49,899.20	59,841.60	70,678.40
Sausage Department[b]	9,921.60	9,921.60	12,979.20	13,187.20	16,244.80	25,688.00	28,745.60	38,667.20	41,308.80
Order Assembly[b]	10,254.40	13,998.40	16,764.80	22,963.20	22,963.20	29,473.60	29,473.60	33,217.60	35,984.00
Sanitation and Maintenance[b]	977.60	977.60	977.60	7,488.00	7,488.00	7,488.00	14,976.00	14,976.00	14,976.00
Office Salaries[b]	8,497.00	8,497.00	8,497.00	17,971.60	17,971.60	17,971.60	21,928.00	21,928.00	21,928.00
Management Salaries[b]	12,000.00	12,000.00	12,000.00	15,000.00	15,000.00	15,000.00	48,000.00	48,000.00	48,000.00
Social Security	2,369.30	2,693.28	3,134.41	3,846.89	4,879.23	5,366.80	7,690.84	8,902.30	9,781.79
Fringe Benefits	6,331.00	7,117.81	8,189.13	10,240.04	12,746.16	15,476.55	21,710.47	24,633.17	26,769.12
Total Annual Payroll	67,947.70	76,421.69	87,959.74	109,916.13	136,917.99	166,312.99	232,588.36	264,060.27	287,064.51

[a] Information in this table taken from Appendix B, Tables IA through IIIC.

[b] Output is expressed as pounds including customer service items.

product liability. These coverages are carried to protect the firm, its employees, and customers, and were specified for all meat processing plants in this study in the amounts just mentioned. The rates for these coverages are based on the total payroll: for property damage, $.0234 per $100 of payroll; for bodily injury, $.096 per $100 of payroll; and for product liability, $.068 per $100 of payroll.[5] A fee of $25 is charged for writing each general liability policy and a $15 fee is charged for attaching the product liability rider. The costs of liability insurances are presented in Table XIV. Computations for the annual payrolls of the model plants are presented in Appendix B, Tables IA through IIIC. Estimated total annual payrolls for the three model plants are presented in Table XIII.

Plant Supplies

Costs for plant supplies are costs that vary in direct proportion to the output of the plant. Items included under plant supplies costs are casings, product packaging, and spices. Costs per pound for these items can vary depending upon the product mix and the type of packaging. Plants cooperating in this study reported costs ranging from 1.58 cents per pound to 1.70 cents per pound. The median figure of 1.64 cents per pound was arbitrarily selected as the cost rate for plant supplies. This price was applied to all items of production.[6] The

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[5]Rates obtained from Mr. C. R. Millard, Millard Agency, Stillwater, Oklahoma.

[6]Does not include customer service items.

TABLE XIV

ESTIMATED ANNUAL LIABILITY INSURANCE COST FOR THE THREE MODEL PLANTS

Plant Size	Weekly Output (Pounds)	Wage Payroll[b]	Bodily Injury[c]	Property Damage[d]	Product Liability[e]	Policy Fee and Rider[f]	Total Liability Insurance Cost[g]
					(Dollars)		
	25,000	59,247.40	56.88	13.86	40.29	40.00	151.00
Small	37,500	66,610.60	63.95	15.59	45.30	40.00	165.00
	50,000	76,636.20	73.57	17.93	52.11	40.00	184.00
	50,000	95,829.20	92.00	22.42	64.80	40.00	219.00
Medium	75,000	119,291.60	114.52	27.91	81.12	40.00	264.00
	100,000	145,334.00	139.52	34.01	98.83	40.00	312.00
	125,000	203,173.05	195.05	47.54	138.16	40.00	421.00
Large	187,500	230,524.80	221.30	53.94	156.76	40.00	472.00
	250,000	250,513.60	240.49	58.62	170.35	40.00	509.00

[a]Includes customer service items.

[b]Annual wage figures taken from Appendix B, Tables IA through IIIC.

[c]Wage payroll times the bodily injury insurance rate of $.096 per $100 wage payroll.

[d]Wage payroll times the property damage insurance rate of $.0234 per $100 wage payroll.

[e]Wage payroll times the product liability insurance rate of $.068 per $100 wage payroll.

[f]Includes $25 for writing the general liability insurance policy and $15 for the product liability rider.

[g]Rounded to nearest dollar.

cost for plant supplies of the three model plants each operating at three levels of output are presented in Table XV.

Delivery and Sales Cost

A product of good quality is not necessarily easily sold, therefore, salesmanship is quite important. The selling function of a firm is deserving of a detailed study in itself. For the purposes of this study, sales cost was estimated by applying a cost of one dollar per hundredweight of plant output including customer service items. The one dollar per hundredweight is a figure considered by some cooperating plant owners as their cost of sales exclusive of any sales manager's salary.

Many factors must be considered in the charge for the delivery of processed meats. For this reason a detailed study is also needed on the delivery of processed meats. For the purposes of this study, a figure of $1.25 per hundredweight was used to estimate the delivery cost of processed meats for the model plants, assuming all product to be delivered within a 150 mile radius of the plant. Both the sales cost and delivery cost for the three model plants operating at three different levels of output are presented in Table XV.

Interest on Operating Capital

For a firm to operate, a certain amount of capital is required to carry on daily operations. Included as operating capital are wages and salaries, and costs of delivery, sales, utilities, plant supplies, maintenance and repairs, office supplies, and other costs associated with office operations.

TABLE XV

SPECIFIC OPERATING COSTS OF THE THREE MODEL PLANTS[a]

		Plant Size								
		Small			Medium			Large		
		Weekly output[b]								
Item	Unit	25,000	37,500	50,000	50,000	75,000	100,000	125,000	187,500	250,000
Total Annual Output[c]	lbs.	1,300,000	1,950,000	2,600,000	2,600,000	3,900,000	5,200,000	6,500,000	9,750,000	13,000,000
Packaged Items	lbs.	1,196,781	1,803,750	2,393,562	2,393,562	3,590,343	4,787,124	5,983,904	8,975,856	11,967,809
Customer Service Items	lbs.	103,219	146,250	206,438	206,438	309,657	412,876	516,096	774,144	1,032,191
Casings, Packaging Materials and Spices Expense	Dol.	19,627	29,582	39,254	39,254	58,900	78,533	98,166	147,249	196,322
Delivery Cost	Dol.	16,250	24,375	32,500	32,500	48,750	65,000	81,250	121,875	162,500
Sales Cost	Dol.	13,000	19,500	26,000	26,000	39,000	52,000	65,000	97,500	130,000
Advertising Expense	Dol.	2,586	3,802	5,172	9,189	13,783	18,378	28,465	42,698	56,931
Interest on Operating Capital	Dol.	6,882	8,678	10,634	12,111	16,402	20,798	27,566	36,491	44,975
Laundry Expense	Dol.	1,767	2,039	2,447	2,583	3,761	4,623	5,574	6,662	7,478
Telephone Expense	Dol.	1,954	2,324	2,697	2,286	3,201	3,949	4,053	5,797	7,052
Loan & Audit Fees	Dol.	598	880	1,197	1,197	1,795	2,394	2,992	4,488	5,984
Office Supplies	Dol.	419	631	838	775	1,163	1,550	1,556	2,334	3,112
Claims & Adjustments	Dol.	273	402	546	546	820	1,093	1,366	2,049	2,732
Dues, Subscriptions, Donations	Dol.	165	242	330	330	495	659	824	1,236	1,649
Postage	Dol.	127	186	253	253	380	507	633	950	1,266
Total	Dol.	63,965	93,046	122,383	127,584	189,121	250,458	318,691	471,043	622,175

[a]All cost items were computed as explained in Chapter VII.

[b]Output is expresed in pounds including customer service items.

[c]Output breakdown assumes 92.5 percent of total annual output to be packaged items and 7.5 percent to be customer service items which are not packaged.

The interest on the operating capital must be considered as the opportunity cost of investing that money in some other alternative.

For the purposes of this study, it was assumed that the operating capital requirements were supplied by both internal and external sources in such proportions that the effective average interest rate was five percent per annum. Costs of interest on operating capital for each of the model plants are computed in Table XVI and included in Table XV.

Advertising

Advertising of processed meat products may take several forms. The most commonly thought of advertising media are radio, television, newspapers, and magazines. But advertising may include product demonstrations in stores, feature product advertising by retailers, public relations, special packaging, and many other means of attracting the consumer's attention to a particular brand or product. All processors contacted in this study spent money for advertising, but none of these processors had any definite rule for advertising expenditures. Much advertising was done in periods of decreased sales.

Analysis of accounting data revealed that advertising expenditures were quite erratic among processors. Advertising and promotion expenditures for the model plants are based on accounting records data. For the small plant, producing from 25,000 to 50,000 pounds of product, weekly advertising

TABLE XVI

ESTIMATED ANNUAL OPERATING CAPITAL FOR THE THREE MODEL PLANTS

Plant Size	Weekly Output[a]	Wages and Salaries[b]	Maintenance[c]	Utilities[d]	Liability Insurance[e]	Product Inventory Taxes[f]	Other Operating Expenses	Interest on Operating Capital	Total Operating Capital
	(Pounds)				(Dollars)				
	25,000	67,948	4,780	7,841	151	166	56,766	6,882	144,534
Small	37,500	76,422	4,780	7,994	165	240	83,963	8,678	182,242
	50,000	87,960	4,780	8,185	184	331	111,234	10,634	223,308
	50,000	109,916	6,194	10,640	219	331	114,913	12,111	254,324
Medium	75,000	136,918	6,194	12,212	264	497	171,958	16,402	344,445
	100,000	166,313	6,194	13,802	312	662	228,686	20,798	436,767
	125,000	232,582	8,880	18,663	421	828	289,879	27,563	578,816
Large	187,500	264,060	8,880	22,324	472	1,242	432,838	36,491	766,307
	250,000	287,065	8,880	26,356	509	1,655	575,036	44,975	944,476

[a]Includes customer service items.

[b]Taken from Table XIII.

[c]Taken from Table XI.

[d]Taken from Tables XVIII, XIX, and XX.

[e]Taken from Table XIV.

[f]Taken from Table X.

[g]Taken from Table XV.

[h]Taken from Table XVI.

expenditures were estimated to be .2161 cent per pound of processed product.[7] For the medium dized plant, producing from 50,000 to 100,000 pounds weekly, advertising expenditures were estimated to be .3839 cent per pound of processed product. For the large plant, producing from 125,000 to 250,000 pounds weekly, advertising expenditures were estimated to be .4757 cent per pound of processed products. Advertising expenses are presented in Table XV.

Utilities

Any plant processing meats must have an adequate and dependable supply of electricity, gas, and water. Equally important and often considered coupled with the water supply, is the need for adequate sewer service. Earlier it was assumed that the model plants would be located in an industrial area suitable for a meat processing plant where these utilities are readily available. Therefore, there would be no capital investment in a water well system, a sewer system, or any other equipment of this nature.

Electricity

The lack of similarities in the sample plants' and the model plants' electrical requirements rendered the utility records of the sample plants virtually useless for purposes of estimating the electrical consumption of the model plants

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[7] Processed products for advertising purposes exclude customer service items for each of the model plants.

directly from plant records. After studying the equipment, lighting, plant building, and operations of a cooperating meat processing firm the electricity consumption was synthesized for that plant. Comparison of the actual electricity consumption records and the synthesized estimate for the one cooperating plant revealed that the synthesized electrical consumption for a one-month average period was within three percent of the actual average monthly consumption for a twenty-four month period. Since the magnitude of the cost of electricity is quite small when compared to the total operating costs, it seemed that a synthesized estimate using the procedures used to estimate the one actual operation would be the most accurate data obtainable for electricity consumption of the model plants.

The demand charge percentage of the electricity consumption was estimated using the data of two cooperating firms. In terms of the output of the model plants defined in this study, one of these plants would be classified as very small and the other as a medium sized plant. The demand charge percentage for the very small plant was .28969 percent of the total electrical consumption. The demand charge percentage at the higher output was .35609 percent of the total electrical consumption.

Both of these observations were 18 month averages of data from the actual plants' records. Although this limited data suggests that the demand charge percentage may be a function of output, it is possible that the difference in the demand charge percentages (.28969 percent to .35609 percent of the total electricity consumption) is variation from a mean and thus there is

possibly no relation of the demand charge percentage and electricity consumption at different output levels. However, conversation with utility company personnel confirmed that it is possible for the demand charge to vary with a plant's output since the demands of electrical equipment are usually greater with increased production.

Using the above data, the demand charge percentage of the total electricity consumption was estimated for the various output levels under consideration using the equation below.

$$\hat{Y} = .26741 - .02589(X) \qquad (7.1)$$

where $\hat{Y}$ = the estimated demand chage percentage

X = annual output of the plant in millions of pounds excluding customer service items.

Table XVII presents the estimated demand charge percentages used in computing the electricity costs for the model plants.[8]

The electricity consumption of the three model plants, each operating at three levels of output, was synthesized following the procedure presented in Appendix C. Total estimated electricity consumption for lighting, manufacturing equipment, and refrigeration equipment, and the annual cost of the consumption for each model plant operating at each of three specified output levels are presented in Table XVIII. It should be pointed out that the electricity cost for

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[8]Since the consumption of electricity at the three output levels of the small model plant does not meet the minimum monthly consumption requirement for the industrial electricity rate in any instance, the demand charge percentages in Table XVII for the small plant are irrelevant.

TABLE XVII

ESTIMATED ELECTRICITY DEMAND CHARGE PERCENTAGES

Plant Size	Weekly Output[a]	Constant Term[b]	Production Coefficient[c]	Annual Production[d]	Estimated Demand Charge Percentage[e]
	25,000	.26741	.02589	1.191781	.29839
Small	37,500	.26741	.02589	1.759172	.31389
	50,000	.26741	.02589	2.393562	.32938
	50,000	.26741	.02589	2.393562	.32938
Medium	75,000	.26741	.02589	3.590343	.36036
	100,000	.26741	.02589	4.787124	.39135
	125,000	.26741	.02589	5.983904	.42233
Large	187,500	.26741	.02589	8.975856	.49979
	250,000	.26741	.02589	11.967809	.57725

[a] Weekly output in pounds including customer service items.

[b] From equation (7.1).

[c] From equation (7.1).

[d] Annual production in millions of pounds excluding customer service items.

[e] $\hat{Y}$ discussed in the text.

TABLE XVIII

ESTIMATED ELECTRICITY CONSUMPTION AND ANNUAL COST

Plant Size	Weekly Output[a]	Electricity Consumption					Annual Cost[e]	Kilowatt Demand[f]
		Lighting[b]	Processing Equipment[b]	Refrigeration Equipment[b]	Total[c]	Monthly[d]		
	(Pounds)	(Kilowatt Hours)					(Dollars)	
Small	25,000	46,549.7	30,654.0	116,580.0	193,783.7	16,148.6	4,560.00	[g]
	37,500	46,549.7	38,452.5	135,690.0	220,692.2	18,391.0	4,560.00	[g]
	50,000	46,549.7	46,148.4	154,800.0	247,498.1	20,624.8	4,560.00	[g]
Medium	50,000	78,453.8	96,623.9	274,170.0	449,247.7	37,437.3	6,099.00	123.29
	75,000	78,453.8	122,720.6	330,165.0	531,339.4	44,278.3	7,354.00	159.56
	100,000	78,453.8	140,175.7	386,160.0	604,789.5	50,399.1	8,568.00	197.24
Large	125,000	108,684.1	145,832.6	462,960.0	717,476.7	59,789.7	10,387.00	252.51
	187,500	108,684.1	196,005.8	554,910.0	859,599.9	71,633.3	13,302.00	358.02
	250,000	108,684.1	239,193.8	646,860.0	994,737.9	82,894.8	16,426.00	478.51

[a] Includes customer service items.

[b] Taken from Appendix C, Tables I, II, IIIA through IIIC.

[c] Sum of electricity consumption for lighting, processing equipment, and refrigeration equipment.

[d] Total kilowatt hours divided by 12.

[e] Monthly rate as presented in text applied to monthly kilowatt hours consumption multiplied by 12, then rounded to nearest dollar.

[f] The estimated demand charge percentages of Table XVII applied to the corresponding monthly kilowatt hours column of this table.

[g] Kilowatt demands for the small plant are irrelevant since at all outputs under consideration the small plant does not meet the minimum billing requirements as discussed on page 81.

the small model plant is the same regardless of the output between 25,000 pounds and 50,000 pounds per week. This is a result of the assumption made earlier that the model plants would be located on an industrial site suitable for meat processing operations. This assumption implies that adequate electrical facilities will be provided by the utility company to support industrial operations. When a plant locates in such an area, it is obligated to accept these facilities or bear the entire cost of altering the facilities of the utility company to provide the plant's specific electrical requirement. Meat processing plant managers confirmed that such alteration costs would far outweigh the cost of paying the minimum bill for the industrial service which would be required if they ever expanded their operations. For this reason, all output levels of the smallest model plant are charged the minimum bill for industrial users.

The cost of the electricity consumed by each model plant, operating at each of the three output levels, was computed by applying the industrial electricity rate for Oklahoma City to the consumption estimates. The rates used were as follows:[9]

Demand Charge

First 100 KW of billing demand $1.90 per KW per month

Next 400 KW of billing demand $1.45 per KW per month

Next 500 KW of billing demand $1.25 per KW per month

Excess KW of billing demand $1.15 per KW per month

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[9]The electrical rate was taken from the Industrial Power Rate Schedule-PID-1, Oklahoma Gas and Electric Company, Oklahoma City, Oklahoma.

Energy Demand

First 200,000 KWH per month at .75¢ per KWH

Next 800,000 KWH per month at .6¢ per KWH

Excess KWH per month at .44¢ per KWH.

Natural Gas

Several attempts were made to relate natural gas consumption to the output of processed meat products, but no significant relationship was indicated from the analyses of accounting records of several firms.

Factors which enter into gas consumption may include the cooking and smoking time of the product, the product being cooked or smoked, the outside temperature, and the size and condition of the boiler.

Since analyses of accounting records gave no good indications of gas consumption related to output, gas consumption was synthesized using estimates of BTU requirements for cooking and smoking meats[10] and for operation of boilers.[11] The detailed procedure for synthesizing gas consumption is presented in Appendix D. The cost of the natural gas consumption for each model plant operating at three different output levels was computed using the estimated

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[10]H. L. Rothra, ed., Meat Industry Trends - 1961 (Chicago, 1961), pp. D-18, D-62.

[11]Samuel H. Logan and Gordon A. King, Economies of Scale in Beef Slaughter Plants, California Agricultural Experiment Station Gianni Foundation of Agricultural Economics, Gianni Foundation Research Report No. 260 (Davis, 1962), p. 87.

consumption and applying the industrial rate of the Oklahoma Natural Gas Company which is presented below.

Table XIX presents the gas consumption estimates and annual cost of natural gas for each of the model plants.

First 10 CCF per month at 18.1¢ per CCF

Next 10 CCF per month at 6.7¢ per CCF

Next 10 CCF per month at 6.5¢ per CCF

Next 970 CCF per month at 4.6¢ per CCF

Next 19,000 CCF per month at 2.3¢ per CCF

Next 20,000 CCF per month at 1.9¢ per CCF

Next 60,000 CCF per month at 1.9¢ per CCF

Next 200,000 CCF per month at 1.75¢ per CCF

Water

Several attempts were made to relate water consumption to the output of processed meat products using multiple regression, but, like natural gas consumption, no relationship obtained from analyses of accounting records adequately explained the water consumption for the sample plants of this study. Plant managers revealed that no rule of thumb could be used to explain water use for meat processing plants since the water consumption of a plant was dependent upon so many factors. Among factors considered important by plant managers were the cleanliness standards of inspectors and plant managers, the materials used in plant construction, the number of employees, the individual employee, the water pressure, and the equipment.

TABLE XIX

ESTIMATED GAS CONSUMPTION AND ANNUAL COST

Plant Size	Weekly Output[a]	Monthly Gas Consumption			Annual Cost[c]
		Boiler	Smoking	Total[b]	
			(CCF)		
	25,000	8,022.0	793.0	8,815.0	2,730
Small	37,500	8,022.0	1,152.5	9,172.5	2,829
	50,000	8,022.0	1,508.5	9,530.5	2,927
	50,000	10,526.4	1,508.5	12,035.0	3,619
Medium	75,000	10,526.4	2,262.9	12,789.5	3,827
	100,000	10,526.4	3,017.1	13,543.5	4,035
	125,000	20,301.0	3,754.7	24,056.5	6,742
Large	187,500	20,301.0	5,227.6	25,529.0	7,078
	250,000	20,301.0	7,438.0	27,739.0	7,581

[a]Weekly output in pounds including customer service items.

[b]Gas consumption estimates taken from Appendix D, Table II and are rounded to nearest 50 cubic feet.

[c]The gas rate given in the text applied to the total monthly gas consumption estimate, then rounded to the nearest dollar.

For purposes of this study, the water consumption was synthesized considering that the water was to be used for cleaning, manufacturing, and employee welfare. For cleaning purposes, welfare rooms, curing departments, slicing, peeling, and packaging areas, boning departments, and sausage kitchens were assumed to be cleaned daily. Receiving coolers and equipment storage areas were assumed to be cleaned once each week. A rate of 2 gallons per square yard per cleaning was considered sufficient to adequately clean the areas. The synthesis of the water cleaning requirements is presented in Appendix E, Table I. Total water requirements for cleaning the model plants are presented in Table XX.

The water requirements for manufacturing which includes all water required for cooking, showering, and cleanup in the smoking area were obtained from Meat Industry Trends - 1961.[12] For those output levels not given, interpolations were made between the nearest two given outputs assuming linear relationships. The computations of the manufacturing water requirements are given in Appendix E, Table II. The total water requirements for manufacturing for the model plants, each operating at three output levels, are presented in Table XX.

Employee welfare water requirements assumed sixteen gallons per employee for 22 work days per month. Total employee welfare water requirements are

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[12] H. L. Rothra, Ed., Meat Industry Trends - 1961 (Chicago, 1961), p. D-62.

TABLE XX

ESTIMATED WATER CONSUMPTION AND ANNUAL COST

Plant Size	Weekly Output	Monthly Water Consumption				Annual Cost
		Employee Use[a]	Cleaning[a]	Manufacturing[a]	Total[b]	Water and Sewer[c]
	(Pounds)	(Gallons)				
	25,000	5,632	33,276	30,800	69,708	551.00
Small	37,500	6,336	33,276	41,800	81,412	605.00
	50,000	7,040	33,276	52,800	98,116	698.00
	50,000	9,504	53,476	52,800	115,780	923.00
Medium	75,000	11,968	53,476	81,400	146,844	1,032.00
	100,000	14,784	53,476	110,000	179,260	1,199.00
	125,000	17,600	86,792	141.174	245,566	1,534.00
Large	187,500	21,120	86,792	219,142	327,054	1,945.00
	250,000	23,232	86,792	297,000	407,024	2,348.00

[a]From Appendix E, Tables I through III.

[b]Sum of monthly water consumption by employees, clean-up and manufacturing.

[c]The water and sewer rates discussed in the text applied to the total monthly water consumption, then rounded to the nearest dollar.

presented in Table XX. Synthesis of the employee welfare water requirements is presented in Appendix E, Table III.

The cost of the water consumed was estimated by applying the water rates of Oklahoma City to the consumption estimates. The rate[13] used was as follows:

			Gross	Discount	Net
(A)	First	1,000 gallons	Included in Minimum Bill		
	Next	4,000 gallons	.62	.02	.60
	Next	10,000 gallons	.54	.02	.52
	Next	135,000 gallons	.39	.02	.37
	Next	350,000 gallons	.29	.02	.27
	Next	4,000,000 gallons	.22	.02	.20
All Over		5,000,000 gallons	.18	.02	.16

Sewer service costs are based directly upon the water consumption of a plant. For plants producing no more than 250,000 pounds per week, the following sewer rate is applicable for Oklahoma City.

First 30,000 gallons of water $4.50

All Over 30,000 gallons of water at 15¢ per 1,000

In addition to the above rate, an additional $5.25 per month metering charge is included.[14] Water and sewer costs for each of the model plants operating at three different output levels are presented in Table XX.

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[13]Water rate taken from the Oklahoma City Council's Ordinance No. 9303, Rates and Charges for Water Service of Various Kinds. Including Minimum Bills, Meter Setting and Service Installation Charges.

[14]The sewer rates obtained from the Oklahoma City Water Department, Oklahoma City, Oklahoma.

Laundry Expense

The operation of a meat processing plant requires that employees coming in contact with the product wear clean white garments or wear a white garment over their street clothing. The cost for laundry service including the white clothing is borne either by the plant or by the individual and depends upon the plant's policy or labor contract. Common practice of plants in Oklahoma is for the plant to furnish this service. Plant owners and managers said this service costs them, on the average, $11.33 per manufacturing employee per month. The laundry cost for the model plants operating at three different outputs is presented in Table XV.

Telephone Expense

The type of telephone communcations equipment and the numbers of pieces of equipment have a significant bearing on the telephone expense of a firm. If a plant is too small or for some other reason does not have a sales force for its products or a buyer for its raw materials, the telephone may be the means the owner or manager uses to perform these functions of his business. If so, his long distance call service may be a large percentage of his telephone service bill. In this study no assumptions were made with respect to the telephone system equipment or the percentage of the telephone expense which was attributed to long distance services. Average costs taken from accounting records were used to estimate the telephone costs which are presented in Table XV.

Miscellaneous

Five other costs which may be referred to as office costs were considered as operating costs for meat processing firms. These items included: (1) office supplies, (2) postage, (3) dues, subscriptions, and donations, (4) claims and adjustments, and (5) legal and audit fees. Average costs per pound of processed product were taken from accounting records to estimate these costs on an annual basis. Due to the nature of the accounting data, individual estimates were not available for each output level for all cost items considered in this study. The rates used were: .035, .032, and .026 cents per pound for office supplies for the small, medium, and large plants, respectively; .010582 cent per pound for postage expenses; .013875 cent per pound for dues, subscriptions and donations; .022828 cent per pound for claims and adjustments; and .05 cent per pound for legal and audit fees. These costs are presented in Table XV.

CHAPTER VIII

TOTAL AND AVERAGE COSTS

Individual costs of investment, ownership and use, and operations have been discussed in the three preceding chapters. The purpose of this chapter is to analyze these costs in total and as averages to determine the relationships of average costs to various output levels of the model plants.

Total Annual Costs

Annual fixed ownership cost comprised the smaller portion of the total annual costs when compared with payroll and all other operating costs. Depreciation was the largest component of the annual fixed ownership cost and ranged from approximately $19,883 for the smallest plant to $53,504 for the largest plant as can be seen in Table XXI. In relative terms the depreciation ranged from 10.39 to 7.36 percent for the small plant, from 9.69 to 6.25 percent for the medium plant, and from 7.56 to 3.81 percent for the large plant as presented in Table XXIII. Interest on the investment ranked second and amounted to less than one-third of the annual fixed ownership cost. Taxes and insurance on the investment formed the balance of the fixed investment cost. Taxes ranged from approximately $11,743 for the small plant to $32,397 for the large plant. These costs are also presented in Table XXI.

TABLE XXI

ANNUAL FIXED OWNERSHIP COSTS

Item	Plant Output[a] 50,000	100,000	250,000
		(Dollars)	
Depreciation[b]	19,883.04	32,195.07	53,503.67
Interest[c]	14,640.23	25,020.03	40,853.07
Insurance[d]	585.60	1,001.37	1,635.03
Taxes[e]	11,742.84	19,802.50	32,397.32
Total[f]	46,851.71	78,018.97	128,389.09

[a]Maximum designed weekly output in pounds.

[b]Taken from Table IX.

[c]Taken from Table IX.

[d]Taken from Table IX.

[e]Table X, Column (10) - Column (9).

[f]Total of the appropriate column.

Total annual fixed ownership costs were estimated to be $46,852, $78,019, and $128,389 for the small, medium, and large plants respectively and are presented in Tables XXI and XXII. In relative terms these figures represent 17.34, 15.16, and 11.97 percent of the total annual costs, respectively, for the model plants operating at 100 percent of their designed outputs. In Table XXIII it can be seen that as output increases for each model plant, that annual fixed ownership costs become a smaller percentage of the total annual costs. Although these costs can be ignored in the short run, they must be covered in the long run if the firm is to survive.

Annual operating costs, including all operating costs except wages and salaries are the largest component of the total annual costs. Of the operating costs considered, packaging and casing materials, delivery, sales and advertising were the four main components in that order of ranking. Total operating costs, exclusive of wages and salaries as presented in Table XVI, were estimated at 50.10, 52.53, and 61.27 percent of the total annual costs respectively for the small, medium, and large plants operating at 100 percent of the designed output.

Payroll costs to include wages and salaries as presented in Table XXII comprised the remainder of the total annual costs. These costs were estimated as 32.56, 32.31, and 26.76 percent respectively for the small, medium, and large plants operating at 100 percent of the designed output. These percentages are presented in Table XXIII.

TABLE XXII

ANNUAL COSTS[a]

Total Annual Output[b] (Pounds)	Percent of Designed Output	Ownership[c]	Maintenance[d]	Payroll[e]	Other Operating[f]	Utilities[g]	Total[h]	Average Cost per Pound[i]
					(Dollars)			
1,196,781	50	46,851.71	4,780.00	67,948.00	63,965.00	7,841.00	191,386.00	.159917
1,803,750	75	46,851.71	4,780.00	76,422.00	93,046.00	7,994.00	229,094.00	.127010
2,393,562	100	46,851.71	4,780.00	87,960.00	122,383.00	8,185.00	270,160.00	.112870
2,393,562	50	78,018.97	6,194.00	109,916.00	127,574.00	10,640.00	332,343.00	.138849
3,590,343	75	78,018.97	6,194.00	136,918.00	189,121.00	12,212.00	422,464.00	.117667
4,787,124	100	78,018.97	6,194.00	166,313.00	250,458.00	13,802.00	514,786.00	.107536
5,893,904	50	128,389.09	8,880.00	232,582.00	318,691.00	18,663.00	707,205.00	.118184
8,975,856	75	128,389.09	8,880.00	264,060.00	471,043.00	22,324.00	894,696.00	.099678
11,967,809	100	128,389.09	8,880.00	287,065.00	622,175.00	26,356.00	1,072,865.00	.089646

[a]All costs are rounded to the nearest whole dollar.

[b]Includes all products manufactured by the plant. Excludes customer service items.

[c]Taken from Table XXI.

[d]Taken from Table XI.

[e]Taken from Table XIII.

[f]Taken from Table XV and includes interest on operating capital, liability insurance, and product inventory taxes.

[g]Taken from Tables XVIII, XIX, and XX.

[h]Sum of the annual costs.

[i]Total annual costs divided by the annual output in pounds.

TABLE XXIII

COST COMPONENTS AS PERCENTAGES OF TOTAL ANNUAL COSTS[a]

	Plant Size								
	Small			Medium			Large		
	Weekly Output (Pounds)								
Cost Item	25,000	37,500	50,000	50,000	75,000	100,000	125,000	187,500	250,000
	(Percentages)								
Ownership[b]	24.48	20.45	17.34	23.48	18.47	15.16	18.15	14.35	11.97
Depreciation	10.39	8.68	7.36	9.69	7.62	6.25	7.56	5.98	4.99
Interest	7.65	6.39	5.42	7.53	5.92	4.86	5.78	4.57	3.81
Insurance	.30	.26	.21	.30	.24	.19	.23	.18	.15
Taxes	6.14	5.12	4.35	5.96	4.69	3.85	4.58	3.62	3.02
Payroll[c]	35.50	33.36	32.56	33.07	32.41	32.31	32.89	29.51	26.76
Management Salaries	7.09	5.92	5.02	5.08	4.00	3.28	7.64	6.03	5.03
Clerical Salaries	5.11	4.27	3.62	6.22	4.90	4.02	3.57	2.82	2.35
Labor	23.30	23.16	23.91	21.77	23.51	25.01	21.68	20.66	19.37
Other Operating[d]	33.42	40.61	45.30	38.39	44.77	48.65	45.06	52.65	57.99
Packaging, etc.	10.26	12.91	14.53	11.81	13.94	15.26	13.88	16.46	18.30
Delivery	8.49	10.64	12.03	9.78	11.54	12.63	11.49	13.62	15.15
Sales	6.79	8.51	9.62	7.82	9.23	10.10	9.19	10.90	12.12
Advertising	1.35	1.66	1.91	2.76	3.26	3.57	4.02	4.77	5.31
Interest on Operating Capital	3.60	3.79	3.94	3.64	3.88	4.04	3.90	4.08	4.19
Laundry, Telephone, Legal and Audit, Office Supplies, Claims and Adjustments, Dues, Subscriptions, and Donations, Postage, Liability, Product Inventory Taxes	2.93	3.10	3.27	2.58	2.92	3.05	2.58	2.82	2.92
Maintenance[e]	2.50	2.09	1.77	1.86	1.46	1.20	1.26	.99	.83
Utilities[f]	4.10	3.49	3.03	3.07	2.89	2.68	2.64	2.50	2.45

[a]Total annual costs from Table XXII.

[b]Ownership costs from Table XXI.

[c]Payroll costs from Table XIII.

[d]Specific operating costs from Table XV.

[e]Maintenance costs from Table XI.

[f]Utility costs from Table XXII.

An examination of the total annual costs in relation to the size of plant provides information concerning the existence or nonexistence of size economies. Using the small plant at its designed output for comparison, it can be noted that as the size of the plant is increased by multiplies of 2 and 5, that total costs are increased respectively by 1.90 and 3.98. These results imply the existence of some economies of size for the model plants.

Short-Run Average Costs

By examining the short-run cost curves of the model plants, the implied size economies may be investigated more closely. The average cost estimates obtained for the three model plants, operating at their respective designed outputs were 11.29 cents per pound for the small plant, 10.75 cents per pound for the medium plant, and 8.96 cents per pound for the large plant.[1] These estimates for each model plant are presented in Table XXIV and plotted in Figure 7.

A reduction in short-run average costs from 11.29 cents per pound for the small plant to 10.75 cents per pound for the medium plant results in a total annual cost reduction of $26,534. This would indicate that one medium sized plant producing at its designed output is more efficient than two small sized plants producing at their designed outputs, when the medium plant has

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[1] Cost estimates per pound are for those products produced by the plant and does not include jobbed customer service items.

TABLE XXIV

AVERAGE COSTS PER POUND[a]

	Plant Size								
	Small			Medium			Large		
	Weekly Output (Pounds)								
Cost Item	25,000	37,500	50,000	50,000	75,000	100,000	125,000	187,500	250,000
	(Cents per Pound)								
Ownership	3.91	2.60	1.96	3.26	2.17	1.63	2.15	1.43	1.07
Depreciation	1.66	1.10	.83	1.35	.90	.67	.89	.60	.45
Interest	1.22	.81	.61	1.05	.70	.52	.68	.46	.34
Insurance	.05	.03	.02	.04	.03	.02	.03	.02	.01
Taxes	.98	.65	.49	.83	.55	.41	.54	.36	.27
Payroll	5.68	4.24	3.68	4.59	3.81	3.47	3.89	2.94	2.40
Mangement Salaries	1.13	.75	.57	.71	.47	.35	.90	.60	.45
Clerical	.82	.54	.41	.86	.58	.43	.42	.28	.21
Labor	3.73	2.94	2.70	3.02	2.77	2.69	2.56	2.06	1.74
Other Operating	5.34	5.16	5.11	5.33	5.27	5.23	5.33	5.25	5.20
Packaging	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64
Delivery	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36
Sales	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09
Advertising	.22	.22	.22	.38	.38	.38	.48	.48	.48
Interest on Operating Capital	.58	.48	.44	.51	.46	.43	.46	.41	.38
Other	.47	.39	.37	.36	.34	.33	.30	.28	.26
Maintenance	.40	.27	.20	.26	.17	.13	.15	.10	.07
Utilities	.66	.44	.34	.43	.34	.29	.31	.25	.22
Total Cost Per Pound	15.99	12.70	11.29	13.88	11.77	10.75	11.82	9.97	8.96

[a]Average costs per pound are based on the product manufactured and do not include customer service items.

[b]Costs are rounded to the second decimal place and may not necessarily equal the total. These costs are based on the cost percentages of Table XXIII and the annual costs of Table XXII.

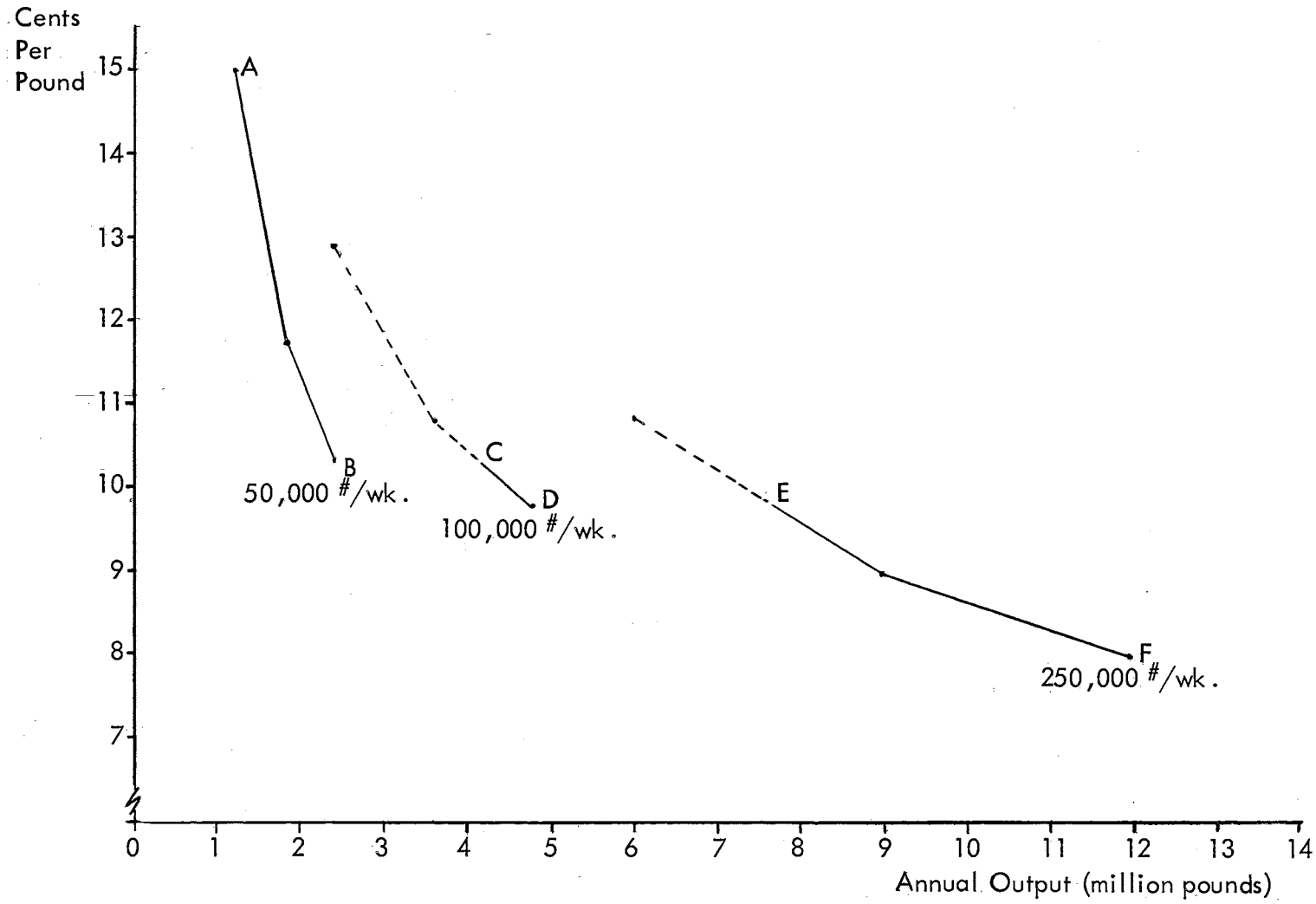

Figure 7. Short-Run and Long-Run Average Cost Curves

twice the designed output of the small plant. When the small plant and the large plant are compared at maximum designed outputs, the reduction in average cost per pound from 11.29 cents per pound to 8.96 cents per pound results in reducing total annual costs $277,935, when the designed output of the large plant is five times the designed output of the small plant.

Average short-run costs decreased for each size of plant as the output increased from 50 to 100 percent of their designed outputs. The average cost decreased 4.70, 3.13, and 2.86 cents per pound, respectively for the small, medium, and large plants as output increased from 50 percent to 100 percent of the designed output. This comparison must be extended further to appreciate the magnitude of the change in average cost per pound. A 4.70 cents per pound change in average cost for the small plant amounted to $112,570; a 3.13 cents per pound change in average cost for the medium plant amounted to $149,667; and a 2.86 cents per pound reduction in average cost for the large plant amounted to $342,130. For each plant, average costs declined at a slower rate from 75 to 100 percent of the designed output than from 50 to 75 percent of the designed output, thus, producing a "kinked" relationship.

Examination of Table XXII reveals three cost groups. One group, ownership, management, clerical, and maintenance costs are fixed in total for each model plant, producing a kinked average cost relationship. A second group, packaging, delivery, sales, advertising, and certain miscellaneous expenses, have a constant per unit cost (average cost) for each model plant, thus, a straight line average cost curve for these costs. In the third group, ownership and

use costs, and utilities have a variable relationship to output; thus, producing a kinked relationship when connecting only three points.

Examination of Table XXIV may seem to reveal some odd relationships when expressing each individual item of the total costs as an average cost per pound of production. Advertising expense is often expressed as a cost per dollar of sales and maintenance costs are often expressed as a percentage cost of the new cash price of the equipment and not related to production.

Individual comparisons of some cost items for the three model plants may not seem to yield logical results. Labor costs per pound of output are decreasing more rapidly for the large plant. This results from the imperfect divisibility of processing equipment. Fewer people are required to operate the more highly automated, increased-capacity equipment of the large plant.

Utility costs decrease most rapidly for the small plant. This results from the utility cost rate structure, and the equipment starting demands for electricity not being significantly different for various outputs.

Maintenance costs per pound are higher for the small plant reflecting the greater building maintenance cost per pound for the small plant. Also, maintenance costs for a specific machine, whether a large machine or a smaller machine, were insignificantly different.

The point of least average cost for each of the model plants was attained at 100 percent of the designed output. Since plant output was limited to the declining portion of the average cost curve by smokehouse, blast chill, and tempering room capacities, the model plants are restricted to operation in

Stage I of the production process. If the capacities of the smokehouses, blast chill, and tempering room were increased, then the production rate of some other department would become a limiting factor. This points up the fact that matching equipment exactly for the various departments to achieve a specified range of output is virtually impossible since equipment models are not manufactured which are perfectly divisible.

Long-Run Average Costs

Theoretically, the long-run average cost curve is a locus of points tangent to an infinite number of short-run average cost curves, thus, representing the least cost of producing any output under the given assumptions. When less than an infinite number of short-run average cost curves are possible, then the solid line portions, AB, CD, and EF of the short-run cost curves as shown in Figure 7 describe the long-run cost curve. The broken line portions of the short-run average cost curves are irrelevant in the long run since the firm could reduce costs by changing size of plants.

In the long run, economies of size are indicated for plants with a designed capacity at least up to 250,000 pounds of total product per week. A comparison of the minimum points of the small and medium plants indicates economies of .54 cent per pound. Comparison of the minimum points of the medium and large plants indicate further economies of 1.79 cents per pound.

The reduction in long-run average costs between the 50,000 and 100,000 pounds per week plants is the aggregate effect of a .33 cent per pound reduction

in fixed ownership costs and a .21 cent per pound reduction in payroll costs.

The reduction in long-run average costs between the 100,000 and 250,000 pounds per week plants is the aggregate effect of a .56 cent per pound reduction in fixed ownership costs; a 1.07 cents cents per pound reduction in payroll costs; and a .16 cent per pound reduction in all other operating costs.

CHAPTER IX

SUMMARY AND CONCLUSIONS

Changes in consumption patterns of processed meats and in the location of cattle feeding operations suggest the possibility of growth of meat processing facilities in the Southwest. The feasibility of such growth depends, in part, on the costs of construction and operating processing plants in the region. The objectives of this study were to: (1) estimate the construction and equipment costs for non-slaughtering meat processing plants designed to produce and handle approximately 50,000, 100,000, and 250,000 pounds of meat products and customer service items weekly with a ratio of 38.5 percent sausages, 38.5 percent cured meats, 15.5 percent fresh cuts, and 7.5 percent customer service items; (2) estimate the costs of operating each of these plants when producing at 50, 75, and 100 percent of the designed output; and (3) examine the relationships of average costs to the output of the plant.

The method used to estimate these costs was a modified synthetic approach. The cost of building construction, equipment, payroll, utilities, packaging materials, delivery, sales, maintenance, and laundry were estimated separately and combined as building blocks with estimates of costs for advertising, telephone expense, and a few minor expense items from plants for sizes similar to the model plants.

In specifying the nature of the three model plants, restrictions such as mentioned below, prevented all of the plants from employing identical technologies but the technologies used were the most recent for which data were available. Equipment is not perfectly divisible, therefore, some of the equipment of the small plant is not as highly automated as equipment for the medium and large plants. The small plant does not include a conveyorized order-assembly department as do the medium and large plants, but instead, uses a palletized system. In addition to these differences, the small plant, due to its output, does not have a fresh sausage and pork cuts cooler, but utilizes the receiving cooler for holding these products when necessary. The medium and large plants were specified to have internally housed refrigeration equipment requiring additional building space, whereas, the small plant has roof-mounted refrigeration equipment.

Average short-run costs decreased for each size of plant as output increased from 50 percent to 100 percent of their designed outputs. The average short-run cost of the small plant decreased from 15.99 cents per pound to 11.29 cents per pound or 4.70 cents per pound. The average short-run cost of the medium plant decreased from 13.88 to 10.75 cents per pound or 3.13 cents per pound. The reduction in short-run average cost for the large plant was from 11.82 to 8.96 cents per pound or a 2.86 cents per pound reduction. For each plant, all average costs per pound of product were reduced with increased output except for those operating costs which had a fixed cost per pound.

In this study, the smokehouse capacity limited the designed output of the model plants. An expansion of smokehouse facilities would allow increased

output and also induce increased total costs. Average costs, however, may be expected to continue to decline because of greater utilization of the original plant, equipment, and management resources. A second labor shift would not be possible if the smokehouses only were expanded as the blast chill and tempering coolers were designed for one eight-hour shift per day. If smokehouse, blast chill, and tempering cooler capacities were increased in combination, then output could be expanded using the same receiving coolers with more frequent carcass purchases, by either enlarging the labor force or running a multiple shift. In addition to altering procurement practices, the distributive function would have to be altered if the order assembly department was not expanded. In either case, with a multiple shift or larger work force, average costs may be expected to continue to decline as was indicated by the continuously decreasing average costs over the range of output of the plants of this study.

The short-run relationships derived in this study imply the plants should be operated at maximum physical capacity to attain minimum cost. Thus, given that marginal cost equals marginal revenue and this equality is greater than average variable cost, output would be increased at least to the point of minimum average cost if profits are to be maximized.

The long-run average cost curve in this analysis was composed of line segments from the short-run average cost curves for the 50,000, 100,000, and 250,000 pounds per week plants. Long-run average costs decreased by .54 cent per pound between the 50,000 and 100,000 pounds per week plants and, further, decreased 1.79 cents per pound between the 100,000 and 250,000 pounds per week plants. These reductions in long-run average costs indicate economies of

size for outputs between 25,000 and 250,000 pounds per week. These economies were due to reductions in average costs for fixed ownership costs, payroll costs, and all other operating costs.

The results of this study indicate that increased efficiency is gained as plant size is increased from 50,000 pounds per week to 250,000 pounds per week. It must be emphasized that this considers only a single shift operation and that procurement costs were not considered in this study. Further, the conclusion of the study might be altered significantly for plants designed with larger labor forces.

Examination of data in the 1963 Census of Manufactures[1] reveals that approximately 73 percent of the meat processing plants in Oklahoma employed fewer than 20 employees. Assuming that the labor force of Oklahoma plants is equally as efficient as the labor of the model plants in this study and that Oklahoma plants have a similar product mix to the model plants, then 73 percent of the non-slaughtering meat-processing plants of Oklahoma or approximately 8 plants produce a maximum of 50,000 pounds of product per plant per week or a total of 400,000 pounds per week for Oklahoma plants with fewer than 20 employees. Further assuming that plants in Oklahoma have designed outputs and short-run average cost curves identical to those of the model plants of this study, a reorganization to produce this 400,000 pounds of product with four medium sized plants producing 100,000 pounds per week at a cost of 10.75

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[1] U. S. Bureau of the Census, Census of Manufactures, 1963, (Washington, 1963), Table 1, 1. 20A-5.

cents per pound would result in a savings of approximately $2160 per week or approximately $112,320 per year over the production by the 8 small sized plants producing at a maximum of 50,000 pounds per week per plant for 11.29 cents per pound. Reorganization to produce this 400,000 pounds per week with two large sized plants producing a maximum of 250,000 pounds per week per plant at a cost of 8.96 cents per pound would result in a savings to the meat industry of approximately $9,320 per week or approximately $484,640 per year. This comparison suggests the need for a study of the demand for processed meats which might aid the Oklahoma meat industry in taking advantage of the increased revenues from the cost reduction just mentioned.

Suggestions for Further Studies

As with most research, this study could be improved and extended by further studies. Some of these studies would be concerned with assumptions underlying this study and others would be concerned with areas not considered by this study.

The research reported in this study considered only the cost relationships of the in-plant operations for specialized non-slaughtering meat processing plants.

Extending the results of this study to include cost relationships associated with procurement would provide more complete information relating to investment decisions.

In this study, the output of the plant was assumed to be consumed within a specified radius of the plant regardless of the output. The results of this study

could be extended to provide more detailed information relating to distribution patterns and delivery costs of processed meats. Likewise, extension of this study to include a detailed study of the sales function including advertising of meat processing firms would provide additional information relating to investment decisions.

Other studies which would be useful to the meat industry are: (1) an extension of this study to include redesigning for multiple-shift operations; (2) input-output studies of management and clerical operation; (3) cost studies on maintenance and repairs; (4) a detailed study of water consumption and cost of meat processing plants; (5) cost studies of full-line meat processing plants; (6) cost studies of integrated slaughter-processing operations; (7) cost studies of other specialized meat processing operations to include breaking and boning plants; and studies to determine the optimum type and optimum location of various meat processing facilities.

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APPENDIX A

APPENDIX A, TABLE I

EQUIPMENT REQUIREMENTS, PURCHASE COST, AND ANNUAL MAINTENANCE COST FOR SMALL MODEL PLANT[a]

Equipment	Quantity	Unit F.O.B. Cost[c]	Total F.O.B. Cost[d]	Installation Cost[e]	Freight Cost[f]	Total Cost[g]	Annual Maint. Cost[h]
				DOLLARS			
Sausage Kitchen							
Buckets, Dump	3	215.00	645.00	-	13.80	658.80	-
Cutter, Silent	1	8,909.00	8,909.00	600.00	181.90	9,690.90	400.00
Forks, S.S. Meat	2	19.00	38.00	-	1.38	39.38	-
Grinder, Meat	1	2,548.00	2,548.00	140.00	70.88	2,758.88	50.00
Hoist, Air	2	441.00	882.00	49.00	4.96	935.96	10.00
Linker, Sausage	1	3,732.00	3,732.00	-	23.00	3,755.00	550.00
Machine, Casing Closure	1	650.00	650.00	-	-	650.00	-
Machine, Patty	1	1,427.00	1,427.00	84.00	16.56	1,527.66	500.00
Mixer, Meat	1	2,416.00	2,416.00	148.00	4.96	2,568.96	75.00
Pails, 12 Qt. S.S.	5	11.80	59.00	-	1.15	60.15	-
Scale, Bench	1	693.00	693.00	-	13.80	706.80	20.00
Scale, Floor	1	159.00	159.00	-	4.60	163.60	20.00
Scale, Provision	1	199.00	199.00	-	4.60	203.60	15.00
Scale, Spice	1	28.00	28.00	-	1.61	29.61	15.00
Sink, 2 Compt. S.S.	1	117.00	117.00	7.00	5.75	129.75	-
Slicer, Hydraulic	1	2,850.00	2,850.00	158.00	123.83	3,131.83	350.00
Stuffer, Sausage	2	3,087.50	6,175.00	772.00	248.51	7,195.51	100.00
Table, S.S. Stuffing	2	230.00	460.00	-	14.72	474.72	-
Table, S.S. Utility	1	335.00	335.00	-	9.20	344.20	-
Vat, Cooking	1	801.00	801.00	45.00	18.40	864.40	10.00
Total Sausage Equipment			33,123.00	2,003.00	763.61	35,889.61	2,115.00
Cured Meats							
Barrels, 55 Gal. S.S.	100	76.50	7,650.00	-	268.20	7,918.20	-
Injector, Pickle	1	3,870.00	3,870.00	215.00	34.50	4,119.50	100.00
Machine, Vacuum Packaging	1	1,550.00	1,550.00	85.00	16.56	1,651.56	250.00
Pump, Pickle Injector	1	130.00	130.00	8.00	1.93	139.93	55.00
Scale, Ham Pumping	1	527.00	527.00	29.00	5.29	561.29	20.00
Scale, 2000# Floor	1	2,145.00	2,145.00	100.00	87.10	2,332.10	25.00
Skinner, Pork Cut	1	1,930.00	1,930.00	120.00	13.80	2,063.80	20.00
Sink, 2 Compt. S.S.	1	117.00	117.00	7.00	5.75	129.75	-
Table, S.S. Utility	4	176.50	706.00	-	29.44	735.44	-
Vat, Pickle Pumping	2	1,022.00	2,044.00	114.00	-	2,158.00	10.00
Total Cured Meats Equipment			20,669.00	678.00	462.57	21,809.57	480.00

[a]See footnotes b through h at the end of Appendix A, Table III.

APPENDIX A, TABLE I (Continued)

Equipment[b]	Quantity[b]	F.O.B. Cost[c]	F.O.B. Cost[d]	Installation Cost[e]	Freight Cost[f]	Total Cost[g]	Annual Maint. Cost[h]
				DOLLARS			
Packaging							
Conveyor & Slicer, Bacon	1	9,000.00	9,000.00	500.00	147.30	9,647.30	68.00
Conveyor, Packaging	1	1,274.00	1,274.00	71.00	27.14	1,372.14	12.00
Hot Plate, Packaging	1	62.00	62.00	-	1.00	63.00	.50
Peeler, Wiener	1	275.00	275.00	14.00	11.50	300.50	12.50
Press, Bacon	1	8,145.00	8,145.00	453.00	25.30	8,623.30	150.00
Slicer, Lunch Meat	1	4,455.00	4,455.00	300.00	13.86	4,768.86	50.00
Total Packaging Equipment			23,211.00	1,338.00	226.10	24,775.10	293.00
Smoking							
Coge, Bologna	8	34.00	272.00	-	14.72	286.72	3.00
Cage, Sausage	32	67.00	2,144.00	-	247.85	2,391.85	21.00
Generator, Smoke	1	2,146.00	2,146.00	120.00	49.10	2,315.10	40.00
Smokehouse, 4 Cage	3	14,000.00	42,000.00	-	-	42,000.00	420.00
Stick, S.S. Smoke	585	1.45	848.00	-	26.91	874.91	-
Total Smoking Equipment			47,410.00	120.00	338.58	47,868.58	484.00
Boning							
Saw, Beef Cutting Power	1	100.00	100.00	-	.64	100.64	10.00
Saw, Beef Cutting Hand	2	9.00	18.00	-	.41	18.41	5.00
Saw, Pork Cutting Power	1	575.00	575.00	-	1.84	576.84	25.00
Table, S.S. Boning	2	458.00	916.00	-	13.80	929.80	-
Total Boning Equipment			1,609.00		16.69	1,625.69	40.00
Order Assembly							
Tubs, Aluminum	10	26.10	261.00	-	6.90	267.90	-
Skids, Steel Frame	35	65.71	2,300.00	-	186.80	2,486.80	-
Total Order Assembly			2,561.00		193.70	2,754.70	
Miscellaneous							
Boiler, 100 H.P.	1	7,342.00	7,342.00	-	-	7,342.00	150.00
Compressor, Air	1	815.00	815.00	-	34.60	849.60	24.00
Hose, Steam	3	59.00	177.00	-	5.13	182.13	-
Jack, Skid Lift	5	37.00	185.00	-	6.83	191.83	1.00
Mold, Loaf	-	-	238.00	-	8.37	246.37	-
Scale, Overhead Rail	1	959.00	959.00	53.00	41.95	1,053.95	30.00
Stapler, Box	1	250.00	250.00	-	-	250.00	2.00
Truck, Tub	12	128.17	1,538.00		51.20	1,589.20	3.00
Total Miscellaneous Equipment			11,504.00		148.08	11,705.08	210.00

APPENDIX A, TABLE I (Continued)

Equipment[b]	Quantity[b]	F.O.B. Cost[c]	F.O.B. Cost[d]	Installation Cost[e]	Freight Cost[f]	Total Cost[g]	Annual Maint. Cost[h]
				DOLLARS			
Refrigeration Equipment	34.4 tons	750.00	25,800.00	-	-	25,800.00	774.00
Total Processing Equipment	-	-	165,887.00	4,192.00	2,149.33	172,228.33	4,396.00
Office Equipment							
Bookcase	2	135.00	270.00	-	-	270.00	-
Cabinet, File	4	115.00	460.00	-	-	460.00	-
Cabinet, Supply	2	48.00	96.00	-	-	96.00	-
Calculator, Desk	2	600.00	1,200.00	-	-	1,200.00	70.00
Chair, Executive	1	162.50	162.50	-	-	162.50	-
Chair, Guest	4	40.00	160.00	-	-	160.00	-
Chair, Management	2	60.00	120.00	-	-	120.00	-
Chair, Secretarial	1	65.25	65.25	-	-	65.25	-
Clock, Wall	1	22.00	22.00	-	-	22.00	-
Clock, Time Punch	1	150.00	150.00	-	-	150.00	-
Desk, Executive	1	300.50	300.50	-	-	300.50	-
Desk, Management	2	219.00	438.00	-	-	438.00	-
Desk, Secretarial	1	264.75	264.75	-	-	264.75	-
Duplicator	1	379.00	379.00	-	-	379.00	35.00
Fountain, Drinking	1	182.00	182.00	-	-	182.00	5.25
Intercommunication	10	35.00	350.00	-	-	350.00	15.00
Lamp, Desk	4	10.00	40.00	-	-	40.00	-
Machine, Adding	2	256.00	512.00	-	-	512.00	30.00
Rack, Cloak	2	14.00	28.00	-	-	28.00	-
Safe	1	250.00	250.00	-	-	250.00	-
Scale, Postal	1	160.00	160.00	-	-	160.00	-
Typewriter	1	465.00	465.00	-	-	465.00	35.00
Typewriter	1	240.00	240.00	-	-	240.00	20.00
Writer, Check	1	130.00	130.00	-	-	130.00	-
Total Office Equipment			6,445.00			6,445.00	210.25

APPENDIX A, TABLE I (Continued)

Equipment[b]	Quantity[b]	F.O.B. Cost[c]	F.O.B. Cost[d]	Installation Cost[e]	Freight Cost[f]	Total Cost[g]	Annual Maint. Cost[h]
				DOLLARS			
Welfare Equipment							
Containers, Waste	2	20.00	40.00	-	-	40.00	-
Fountain, Drinking	2	182.00	364.00	-	-	364.00	10.50
Locker, Metal	18	38.00	624.00	-	-	624.00	-
Mirrors	4	12.00	48.00	-	-	48.00	-
Total Welfare			1,136.00			1,136.00	10.50
Grand Total All Equipment			173,468.00	4,192.00	2,149.33	179,809.33	4,616.75

APPENDIX A, TABLE II

EQUIPMENT REQUIREMENTS, PURCHASE COST, AND ANNUAL MAINTENANCE COST FOR MEDIUM MODEL PLANT[a]

Equipment[b]	Quantity[b]	Unit F.O.B. Cost[c]	Total F.O.B. Cost[d]	Installation Cost[e]	Freight Cost[f]	Total Cost[g]	Annual Maint. Cost[h]
				DOLLARS			
Sausage Kitchen							
Buckets, Dump	6	193.50	1,161.00	-	27.60	1,188.60	-
Cutter, Silent	1	15,678.00	15,678.00	870.00	363.59	16,911.59	400.00
Flaker, Hydraulic	1	4,388.00	4,388.00	244.00	149.45	4,781.45	350.00
Forks, S.S. Meat	2	19.00	38.00	-	1.38	39.38	-
Grinder, Meat	1	2,522.00	2,522.00	140.00	113.16	2,775.16	50.00
Hoist, Air	2	441.00	882.00	49.00	4.97	935.97	10.00
Linker, Sausage	1	3,732.00	3,732.00	-	46.00	3,778.00	550.00
Machine, Patty	1	3,760.00	3,760.00	220.00	16.56	3,996.56	500.00
Machine, Casing Closure	2	650.00	1,300.00	-	-	1,300.00	-
Mixer, Meat	1	3,132.00	3,132.00	174.00	106.75	3,412.75	75.00
Pails, 12 Qt. S.S.	5	11.80	59.00	-	1.15	60.15	-
Scale, Bench	1	693.00	693.00	-	13.80	706.80	20.00
Scale, Floor	1	159.00	159.00	-	4.60	163.60	20.00
Scale, Provision	1	199.00	199.00	-	4.28	203.28	15.00
Scale, Spice	1	28.00	28.00	-	1.61	29.61	15.00
Shovels, S.S.	2	33.00	66.00	-	.74	66.74	-
Sink, 2 Compt. S.S.	1	117.00	117.00	7.00	5.75	129.75	-
Stuffer, Sausage	3	6,547.67	19,643.00	1,591.00	390.71	21,624.71	150.00
Table, S.S. Stuffing	4	189.00	756.00	-	60.72	816.72	-
Table, S.S. Utility	1	176.00	176.00	-	8.28	184.28	-
Truck, S.S.	3	233.33	700.00	-	22.77	722.77	7.00
Truck, Shelf	1	281.00	281.00	-	19.32	300.32	3.00
Vat, Cooking	1	801.00	801.00	45.00	18.40	864.40	10.00
Total Sausage Equipment			60,271.00	3,340.00	1,381.59	64,992.59	2,175.00
Cured Meats							
Barrels, 55 Gal. S.S.	200	76.50	15,300.00	-	579.60	15,879.60	-
Injector, Pickle	1	3,870.00	3,870.00	215.00	34.50	4,119.50	100.00
Machine, Vacuum Packaging	1	1,550.00	1,550.00	85.00	25.30	1,660.30	250.00
Pump, Pickle Injector	1	130.00	130.00	8.00	1.93	139.93	55.00
Scale, Ham Pumping	1	527.00	527.00	29.00	5.29	561.29	20.00
Sink, 2 Compt. S.S.	1	117.00	117.00	7.00	5.75	129.75	-
Scale, 2000# Floor	1	2,145.00	2,145.00	100.00	87.10	2,332.10	25.00
Skinner, Pork Cut	1	1,930.00	1,930.00	120.00	13.80	2,063.80	20.00
Table, S.S. Utility	5	176.40	882.00	-	36.80	918.80	-
Vat, Pickle Pumping	2	1,022.00	2,044.00	114.00	-	2,158.00	10.00
Total Cured Meats Equipment			28,495.00	678.00	790.07	29,963.07	480.00

[a]See footnotes b through h at the end of Appendix A, Table III.

APPENDIX A, TABLE II (Continued)

Equipment[b]	Quantity[b]	Unit F.O.B. Cost[c]	Total F.O.B. Cost[d]	Installation Cost[e]	Freight Cost[f]	Total Cost[g]	Annual Maint. Cost[h]
				DOLLARS			
Packaging Area							
Belt, Packaging Line	1	1,609.00	1,609.00	90.00	64.05	1,763.05	8.00
Conveyor, General Purpose	1	1,274.00	1,274.00	71.00	27.14	1,372.14	12.00
Slicer, Lunchmeat	1	4,445.00	4,445.00	300.00	13.86	4,768.86	50.00
Hot Plate, Packaging	2	62.00	124.00	-	.36	124.36	1.00
Peeler, Wiener	2	247.50	495.00	28.00	23.00	546.00	25.00
Press, Bacon	1	8,145.00	8,145.00	453.00	247.66	8,845.66	150.00
Slicer, Bacon and Conveyor	1	9,000.00	9,000.00	500.00	147.32	9,647.32	100.00
Total Packaging Equipment			25,092.00	1,442.00	523.39	27,067.39	346.00
Smoking							
Cages, Sausage	22	60.32	1,327.00	-	187.22	1,514.22	6.00
Cages, Wiener	20	74.70	1,494.00	-	170.20	1,664.20	15.00
Generator, Smoke	1	2,146.00	2,146.00	120.00	49.10	2,315.10	40.00
Smokehouse, 6 Cage	2	15,500.00	31,000.00	-	-	31,000.00	310.00
Smokehouse, 3 Cage	2	12,500.00	25,000.00	-	-	25,000.00	250.00
Stick, S.S. Smoke	1170	1.45	1,706.00	-	53.82	1,759.82	-
Trees, Bologna	10	34.00	340.00	-	18.40	358.40	3.00
Total Smoking Equipment			63,013.00	120.00	478.74	63,611.74	624.00
Boning							
Saw, Band	2	1,152.00	2,304.00	128.00	76.82	2,508.82	220.00
Table, S.S. Boning	3	490.50	1,471.50	-	48.30	1,519.80	-
Total Boning Equipment			3,775.50	128.00	125.12	4,028.62	220.00
Order Assembly							
Tubs, Aluminum	10	26.10	261.00	-	6.90	267.90	-
Conveyor, Roller Shipping	1	1,988.00	1,988.00	-	-	1,988.00	15.00
Conveyor, Highlift	1	1,200.00	1,200.00	-	-	1,200.00	9.00
Rack, Flow Cublicles	-	-	4,400.00	-	-	4,400.00	11.00
Scale, Table Utility	1	177.00	177.00	-	7.36	184.36	2.00
Total Order Assembly			8,026.00		14.26	8,040.26	37.00

APPENDIX A, TABLE II (Continued)

Equipment[b]	Quantity[b]	Unit F.O.B. Cost[c]	Total F.O.B. Cost[d]	Installation Cost[e]	Freight Cost[f]	Total Cost[g]	Annual Maint. Cost[h]
				DOLLARS			
Miscelloneous							
Boiler, 140 H.P.	1	13,475.00	13,475.00	-	-	13,475.00	150.00
Compressor, Air	1	815.00	815.00	-	34.27	849.27	24.00
Jack, Skid Lift	5	37.00	185.00	-	7.36	192.36	1.00
Truck, Dump	5	171.00	855.00	-	46.00	901.00	5.00
Truck, 2 Wheel Utility	2	22.00	44.00	-	3.22	47.22	1.00
Mold, Loaf	-	-	364.00	-	16.74	492.75	-
Hose, Steam	6	59.00	354.00	-	10.49	364.59	-
Scale, Overhead Rail	1	959.00	959.00	53.00	41.95	1,053.95	30.00
Truck, Sausage	5	213.40	1,067.00	-	25.30	1,092.30	5.00
Washer, Mold	1	4,275.00	4,275.00	238.00	55.20	4,568.20	50.00
Stapler, Box	1	250.00	250.00	-	-	250.00	2.00
Total Miscellaneous Equipment			22,643.00	291.00	240.53	23,286.53	268.00
Refrigeration Equipment	64.0 tons	750.00	48,000.00	-	-	48,000.00	1,440.00
Total Processing Equipment	-	-	260,680.50	5,999.00	2,310.70	268,990.20	5,590.00
Office Equipment							
Bookcose	4	135.00	540.00	-	-	540.00	-
Cabinet, File	8	115.00	920.00	-	-	920.00	-
Cabinet, Supply	4	48.00	192.00	-	-	192.00	-
Calculator, Desk	2	600.00	1,200.00	-	-	1,200.00	70.00
Chair, Executive	1	162.50	162.50	-	-	162.50	-
Chair, Guest	8	40.00	320.00	-	-	320.00	-
Chair, Management	4	60.00	240.00	-	-	240.00	-
Chair, Secretarial	1	65.25	65.25	-	-	65.25	-
Clock, Wall	1	22.00	22.00	-	-	22.00	-
Clock, Time Punch	1	150.00	150.00	-	-	150.00	-
Desk, Executive	1	300.50	300.50	-	-	300.50	-
Desk, Management	4	219.00	875.00	-	-	875.00	-
Desk, Secretarial	1	264.75	264.75	-	-	264.75	-
Duplicatar	1	379.00	379.00	-	-	379.00	35.00
Fountain, Drinking	1	182.00	182.00	-	-	182.00	5.25
Intercommunication	10	35.00	350.00	-	-	350.00	15.00
Lamp, Desk	8	10.00	80.00	-	-	80.00	-
Machine, Adding	3	256.00	768.00	-	-	768.00	90.00
Rack, Cloak	2	14.00	28.00	-	-	28.00	-
Safe	1	250.00	250.00	-	-	250.00	-
Scale, Postol	1	160.00	160.00	-	-	160.00	-
Typewriter	1	465.00	465.00	-	-	465.00	35.00
Typewriter	1	240.00	240.00	-	-	240.00	20.00
Writer, Check	1	130.00	130.00	-	-	130.00	-
Total Office Equipment			8,284.00			8,284.00	270.25

APPENDIX A, TABLE II (Continued)

Equipment[b]	Quantity[b]	Unit F.O.B. Cost[c]	Total F.O.B. Cost[d]	Installation Cost[e]	Freight Cost[f]	Total Cost[g]	Annual Maint. Cost[h]
				DOLLARS			
Welfare Equipment							
Container, Waste	2	20.00	40.00	-	-	40.00	-
Fountain, Drinking	2	182.00	364.00	-	-	364.00	10.50
Locker, Metal	35	38.00	1,330.00	-	-	1,330.00	-
Mirrors	8	12.00	96.00	-	-	96.00	-
Total Welfare			1,830.00			1,830.00	10.50
Grand Total All Equipment			270,794.50	5,999.00	2,310.70	279,104.20	5,870.75

APPENDIX A, TABLE III

EQUIPMENT REQUIREMENTS, PURCHASE COST, AND ANNUAL MAINTENANCE COST FOR LARGE MODEL PLANT[a]

Equipment[b]	Quantity[b]	Unit F.O.B. Cost[c]	Total F.O.B. Cost[d]	Installation Cost[e]	Freight Cost[f]	Total Cost[g]	Annual Maint. Cost[h]
				DOLLARS			
Sausage Kitchen							
Buckets, Dump	9	193.55	1,742.00	-	41.40	1,783.40	-
Cutter, Silent	2	15,678.00	31,356.00	1,740.00	727.18	33,823.18	800.00
Flaker, Hydraulic	1	4,388.00	4,388.00	244.00	149.45	4,781.45	350.00
Forks, S.S. Meat	3	19.00	57.00	-	1.38	58.38	-
Grinder, Meat	1	2,522.00	2,522.00	140.00	113.15	2,775.15	50.00
Hoist, Air	2	441.00	882.00	49.00	4.97	935.97	10.00
Linker, Automatic	1	10,000.00	10,000.00	-	10,000.00	10,000.00	750.00
Machine, Patty	1	4,200.00	4,200.00	-	16.56	4,216.56	500.00
Machine, Casing Closure	2	650.00	1,300.00	-	-	1,300.00	-
Mixer, Meat	2	3,132.00	6,264.00	348.00	213.50	6,825.50	75.00
Pails, 12 Qt. S.S.	10	11.80	118.00	-	2.30	120.30	-
Scale, Bench	3	693.00	2,079.00	-	41.40	2,120.40	60.00
Scale, Floor	2	159.00	318.00	-	9.20	327.20	40.00
Scale, Provision	2	199.00	398.00	-	8.56	406.56	30.00
Scale, Spice	1	28.00	28.00	-	1.61	29.61	15.00
Shovels, S.S,	4	30.00	120.00	-	1.48	121.48	-
Sink, 2 Compt. S.S.	2	117.00	234.00	-	11.50	245.50	-
Stuffer, Sausage	3	6,547.67	19,643.00	1,591.00	390.71	21,624.71	150.00
Table, S.S. Stuffing	3	230.00	690.00	-	20.50	710.50	-
Table, S.S. Utility	2	305.00	610.00	-	18.40	628.40	-
Truck, Shelf	4	281.00	1,124.00	-	77.28	1,201.28	12.00
Vat, Cooking	2	801.00	1,602.00	45.00	36.80	1,683.80	20.00
Total Sausage Equipment			89,675.00	4,157.00	11,887.33	95,719.33	2,862.00
Cured Meats							
Vat, Pickle Pumping	2	1,022.00	2,044.00	114.00	-	2,158.00	10.00
Barrels, 55 Gal. S.S.	300	76.50	22,950.00	-	869.40	23,819.40	-
Injector, Ham Pickle	1	378.50	378.50	-	4.60	383.10	10.00
Injectar, Bellies Pickle	1	3,870.00	3,870.00	215.00	34.50	4,119.50	100.00
Machine, Vacuum Packaging	1	1,550.00	1,550.00	85.00	25.30	1,660.30	250.00
Pump, Pickle Injector	1	130.00	130.00	8.00	1.93	139.93	55.00
Scale, Ham Pumping	1	527.00	527.00	-	5.29	532.29	20.00
Scale, 2000# Floor	1	2,145.00	2,145.00	100.00	87.10	2,332.10	25.00
Skinner, Pork Cut	1	1,930.00	1,930.00	120.00	13.80	2,063.80	20.00
Sink, 2 Compt. S.S.	1	117.00	117.00	7.00	5.75	129.75	-
Table, S.S. Utility	7	176.00	1,232.00	-	51.52	1,283.52	-
Total Cured Meats			36,873.50	649.00	1,099.19	38,621.69	490.00

[a]See footnotes b through h at the end of Appendix A, Table III.

APPENDIX A, TABLE III (Continued)

Equipment[b]	Quantity[b]	Unit F.O.B. Cost[c]	Total F.O.B. Cost[d]	Installation Cost[e]	Freight Cost[f]	Total Cost[g]	Annual Maint. Cost[h]
				DOLLARS			
Packaging Area							
Conveyor, Packaging	1	1,274.00	1,274.00	71.00	27.14	1,372.14	12.00
Conveyor, Linked Product	2	520.00	1,040.00	-	36.80	1,076.80	8.00
Hot Plate, Packaging	2	62.00	124.00	-	.36	124.36	1.00
Peeler, Wiener	3	275.00	825.00	42.00	34.50	901.50	41.00
Press, Bacon	1	8,145.00	8,145.00	45.30	247.66	8,437.96	150.00
Slicer, Conveyorized Bacon	1	21,033.00	21,033.00	-	-	21,033.00	150.00
Slicer, Lunchmeat	1	4,455.00	4,455.00	-	13.80	4,468.80	90.00
Total Packaging Equipment			36,896.00	158.30	360.26	37,414.56	452.00
Smoking							
Cages, Bologna	25	34.00	850.00	-	42.70	892.70	8.50
Cages, Wiener	45	74.20	3,339.00	-	355.00	3,694.00	33.00
Generator, Smoke	2	2,146.00	4,292.00	239.00	87.40	4,618.40	80.00
Smokehouse, 6 Cage	6	15,500.00	93,000.00	-	-	93,000.00	930.00
Smokehouse, 4 Cage	1	13,500.00	13,500.00	-	-	13,500.00	135.00
Stick, S.S. Smoke	2000	1.11	3,220.00	-	92.00	3,312.00	-
Trees, Sausage	46	60.30	2,774.00	-	363.00	3,137.00	28.00
Total Smoking Equipment			120,975.00	239.00	940.10	122,154.10	1,214.50
Boning							
Saw, Band	2	1,152.00	2,304.00	128.00	76.82	2,508.82	220.00
Table, Boning	4	490.50	1,962.00	-	64.40	2,026.40	-
Total Boning Equipment			4,266.00	128.00	141.22	4,535.22	220.00
Order Assembly							
Scale, Table Utility	1	177.00	177.00	-	7.36	184.36	2.00
Tubs, Aluminum	25	29.00	725.00	-	17.02	742.02	-
Conveyor, Roller Shipping	-	4,001.00	4,001.00	-	-	4,001.00	20.00
Conveyor, High Lift	1	1,200.00	1,200.00	-	-	1,200.00	9.00
Rack, Flow Cubicle	-	-	19,800.00	-	-	19,800.00	100.00
Total Order Assembly			25,903.00		24.38	25,927.38	131.00

APPENDIX A, TABLE III (Continued)

Equipment[b]	Quantity[b]	Unit F.O.B. Cost[c]	Total F.O.B. Cost[d]	Installation Cost[e]	Freight Cost[f]	Total Cost[g]	Annual Maint. Cost[h]
				DOLLARS			
Miscellaneous							
Boiler, 270 H.P.	1	26,490.00	26,490.00	-	-	26,490.00	150.00
Compressor, Air	2	815.00	1,630.00	-	68.54	1,698.54	24.00
Hose, Steam	6	59.00	354.00	-	10.49	364.49	-
Jack, Skid Lift	10	41.00	410.00	-	14.72	424.72	2.00
Molds, Loaf	-	-	841.50	-	30.50	872.00	-
Scale, Overhead Rail	1	959.00	959.00	53.00	41.95	1,053.95	25.00
Skids, Steel Frame	100	58.00	5,800.00	-	533.60	6,333.60	-
Stapler, Box	1	250.00	250.00	-	-	250.00	2.00
Truck, Dump	5	171.00	855.00	-	46.00	901.00	5.00
Truck, Tub	24	123.33	2,960.00	-	68.54	3,028.54	6.00
Truck, Utility	4	22.00	88.00	-	6.44	94.44	4.00
Unloader, Loaf Mold	1	1,185.00	1,185.00	-	-	1,185.00	-
Washer, Mold	1	4,275.00	4,275.00	238.00	55.20	4,568.20	50.00
Total Miscellaneous Equipment			46,097.50	291.00	875.98	47,264.48	268.00
Refrigeration Equipment	106 tons	750.00	79,500.00	-	-	79,500.00	2,385.00
Total Processing Equipment	-	-	430,186.00	5,622.30	15,328.46	451,136.76	8,022.50
Office Equipment							
Bookcase	6	135.00	810.00	-	-	810.00	-
Cabinet, File	12	115.00	1,380.00	-	-	1,380.00	-
Cabinet, Supply	7	48.00	236.00	-	-	236.00	-
Calculator, Desk	3	600.00	1,800.00	-	-	1,800.00	105.00
Chair, Executive	1	162.50	162.50	-	-	162.50	-
Chair, Guest	8	40.00	320.00	-	-	320.00	-
Chair, Management	9	60.00	540.00	-	-	540.00	-
Chair, Secretarial	1	65.25	65.25	-	-	65.25	-
Clock, Wall	1	22.00	22.00	-	-	22.00	-
Clock, Time Punch	1	150.00	150.00	-	-	150.00	-
Desk, Executive	1	300.50	350.00	-	-	300.50	300.50
Desk, Management	9	219.00	1,971.00	-	-	1,971.00	-
Desk, Secretarial	1	264.75	264.75	-	-	264.75	-
Duplicator	1	379.00	379.00	-	-	379.00	35.00
Fountain, Drinking	1	182.00	182.00	-	-	182.00	5.25
Intercommunication	10	35.00	350.00	-	-	350.00	15.00
Lamp, Desk	11	10.00	110.00	-	-	110.00	-
Machine, Adding	3	256.00	768.00	-	-	768.00	45.00
Rack, Cloak	2	14.00	28.00	-	-	28.00	-
Safe	1	300.00	300.00	-	-	300.00	-
Scale, Postal	1	160.00	160.00	-	-	160.00	-
Typewriter	2	465.00	930.00	-	-	930.00	105.00
Typewriter	1	240.00	240.00	-	-	240.00	20.00
Writer, Check	1	130.00	130.00	-	-	130.00	-
Total Office Equipment			11,599.00			11,599.00	330.25

APPENDIX A, TABLE III (Continued)

Equipment[b]	Quantity[b]	Unit F.O.B. Cost[c]	Total F.O.B. Cost[d]	Installation Cost[e]	Freight Cost[f]	Total Cost[g]	Annual Maint. Cost[h]
			DOLLARS				
Welfare Equipment							
Container, Waste	2	25.00	50.00	-	-	50.00	-
Fountain, Drinking	2	182.00	364.00	-	-	364.00	10.50
Locker, Metal	57	38.00	2,166.00	-	-	2,166.00	-
Mirrors	10	12.00	120.00	-	-	120.00	-
Total Welfare Equipment			2,700.00			2,700.00	10.50
Grand Total All Equipment			444,485.00	5,622.30	15,328.46	465,435.76	8,363.25

[b]The equipment listed was specified by Mr. Donald Hammons (Industrial Engineer, United States Department of Agriculture).

[c]F.O.B. cost is total cost for those items of equipment which have no installation or freight cost listed.

[d]Column (1) multiplied by column (2).

[e]Manufacturers vary in their charges for installation of equipment, therefore the installation charge is an average figure of several manufacturers where such charges are made.

[f]Freight cost where applicable is based on a Chicago to Oklahoma City rate of $4.60 per hundredweight for items weighing less than 1500 pounds and $4.27 per hundredweight for items weighing more than 1500 pounds.

[g]The sum of columns (3), (4), and (5).

[h]Maintenance costs for processing machinery and office equipment were obtained from cooperating plant owners. Refrigeration maintenance figures are 3 percent of the total F.O.B. cost for refrigeration listed in this table.

APPENDIX B

APPENDIX B, TABLE IA

DEPARTMENTAL PERSONNEL REQUIREMENTS AND ANNUAL PAYROLL COSTS FOR THE SMALL MODEL PLANT PRODUCING 25,000 POUNDS WEEKLY[a]

Operation[b]	Hourly Wage[c]	Number of Employees[d]	Annual Wage[e]	Social Security[f]	Retirement, Insurance, Vacation & Holidays[g]	Total Annual Payroll[h]	Annual Cost Per Worker[i]
	DOLLARS		DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
Boning Department							
Boner, Beef Break-up Men Handlers	1.80	1	3,744.00	164.74	400.07	4,308.81	4,308.81
Boning Department Totals	-	1	3,744.00	164.74	400.07	4,308.81	-
Curing Department							
Boners, Ham Belly Trimmers Trimmer of Trimmings Ham Skinner Machine	1.88	1	3,910.40	172.06	417.85	4,500.31	4,500.31
Loin Puller Pickle Pumper Ham Pumper	1.88	1	3,910.40	172.06	417.85	4,500.31	4,500.31
Hanger, Bellies Slicing Machine Operator	1.45	2	6,032.00	265.41	644.56	6,941.97	3,470.98
Curing Department Totals	-	4	13,852.80	609.53	1,480.26	15,942.59	-
Sausage Department							
Slicing Machine Operator Casing Peeler Operator	1.36	1	2,828.80	124.47	302.28	3,255.55	3,255.55
Sausage Stuffer Sausage Maker Spice Weigher	1.78	1	3,702.40	162.91	395.63	4,260.94	4,260.94
Mixer Operator Smoker	1.63	1/3	3,390.40	149.18	362.29	3,901.87	3,901.87
Sausage Department Totals	-	3	9,921.60	436.56	1,060.20	11,418.36	-

[a]Weekly production includes jobbed customer service items. See footnotes b through j on page 143.

APPENDIX B, TABLE IA (Continued)

Operation[b]	Hourly Wage[c]	Number of Employees[d]	Annual Wage[e]	Social Security[f]	Retirement, Insurance, Vacation & Holidays[g]	Total Annual Payroll[h]	Annual Cost Per Worker[i]
	DOLLARS		DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
Order Assembly Department							
Checkers, Loading Packers, Shipping	1.80	2	7,488.00	329.47	800.15	8,617.62	4,308.81
Luggers-Loaders	1.33	1	2,766.40	121.72	295.61	3,183.73	3,183.73
Order Assembly Department Totals	-	3	10,254.40	451.19	1,095.76	11,801.35	-
Sanitation and Maintenance							
Cleaners (night) Janitors Maintenance Men	1.88	1	977.60	43.01	104.46	1,125.07[j]	4,500.28
Sanitation & Maint. Dept. Totals	-	1	977.60	43.01	104.46	1,125.07	-
Office Personnel							
Secretary							
Bookkeeper	-	1	4,539.60	199.74	485.09	5,224.43	5,224.43
Clerks, Accounting	-	1	3,957.40	174.13	422.88	4,554.41	4,554.41
Office Totals	-	2	8,497.00	373.87	907.97	9,778.84	-
Management							
General Manager	-	1	12,000.00	290.40	1,282.28	13,572.68	13,572.68
Management Totals	-	1	12,000.00	290.40	1,282.28	13,572.68	-
Grand Totals	-	15	59,247.40	2,369.30	6,331.00	67,947.70	-

APPENDIX B, TABLE IB

DEPARTMENTAL PERSONNEL REQUIREMENTS AND ANNUAL PAYROLL COSTS FOR THE SMALL MODEL PLANT PRODUCING 37,500 POUNDS WEEKLY[a]

Operation[b]	Hourly Wage[c]	Number of Employees[d]	Annual Wage[e]	Social Security[f]	Retirement, Insurance, Vacation & Holidays[g]	Total Annual Payroll[h]	Annual Cost Per Worker[i]
	DOLLARS		DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
Boning Department							
Boner, Beef Break-up Men Handlers	1.80	1	3,744.00	164.74	400.07	4,308.81	4,308.81
Boning Department Totals	-	1	3,744.00	164.74	400.07	4,308.81	-
Curing Department							
Boners, Ham Belly Trimmers Trimmer of Trimmings	1.88	1	3,910.40	172.06	417.85	4,500.31	4,500.31
Ham Skinner Machine Loin Puller	1.88	1	3,910.40	172.06	417.85	4,500.31	4,500.31
Pickle Pumper Ham Pumper	1.74	1	3,619.20	159.24	386.74	4,165.18	4,165.18
Hanger Bellies Slicing Machine Operator	1.45	2	6,032.00	265.41	644.56	6,941.97	3,470.98
Curing Department Totals	-	5	17,472.00	768.77	1,867.00	20,107.77	-
Sausage Department							
Slicing Machine Operator Casing Peeler Operator	1.36	1	2,828.80	124.47	302.28	3,255.55	3,255.55
Sausage Stuffer Sausage Maker Spice Weigher	1.78	1	3,702.40	162.91	395.63	4,260.94	4,260.94
Mixer Operator Smoker	1.63	1	3,390.40	149.18	362.29	3,901.87	3,901.87
Sausage Department Totals	-	3	9,921.60	436.56	1,060.20	11,418.36	-

[a]Weekly production includes jobbed customer service items. See footnotes b through j on page 143.

APPENDIX B, TABLE IB (Continued)

Operation[b]	Hourly Wage[c]	Number of Employees	Annual Wage[e]	Social Security[f]	Retirement, Insurance, Vacation & Holidays[g]	Total Annual Payroll[h]	Annual Cost Per Worker[i]
	DOLLARS		DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
Order Assembly Department							
Checkers, Loading Packers, Shipping	1.80	3	11,232.00	494.21	1,200.22	12,926.43	4,308.81
Lugger-Loaders	1.33	1	2,766.40	121.72	295.61	3,183.73	3,183.73
Order Assembly Department Totals	-	4	13,998.40	615.93	1,495.83	16,110.16	-
Sanitation and Maintenance							
Cleaners (night) Janitors Maintenance Men	1.88	1	977.60	43.01	104.46	1,125.07[i]	4,500.28
Sanitation & Maint. Dept. Totals	-	1	977.60	43.01	104.46	1,125.07	-
Office Personnel							
Secretary Bookkeeper	-	1	4,539.60	199.74	485.09	5,224.43	5,224.43
Clerks, Accounting	-	1	3,957.40	174.13	422.88	4,554.41	4,554.41
Office Totals	-	2	8,497.00	373.87	907.97	9,778.84	-
Management							
General Manager	-	1	12,000.00	290.40	1,282.28	13,572.68	13,572.68
Management Totals	-	1	12,000.00	290.40	1,282.28	13,572.68	-
Grand Totals	-	17	66,610.60	2,693.28	7,117.81	76,421.69	-

APPENDIX B, TABLE IC

DEPARTMENTAL PERSONNEL REQUIREMENTS AND ANNUAL PAYROLL COSTS FOR THE SMALL MODEL PLANT PRODUCING 50,000 POUNDS WEEKLY[a]

Operation[b]	Hourly Wage[c]	Number of Employees[d]	Annual Wage[e]	Social Security[f]	Retirement, Insurance, Vacation & Holidays[g]	Total Annual Payroll[h]	Annual Cost Per Worker[i]
	DOLLARS		DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
Boning Department							
Boner, Beef Break-up Men Handlers	1.80	1	3,744.00	164.74	400.07	4,308.81	4,308.81
Boning Department Totals	-	1	3,744.00	164.74	400.07	4,308.81	-
Curing Department							
Boners, Ham Belly Trimmer Trimmer of Trimmings Ham Skinner Machine	1.88	2	7,820.80	344.12	835.71	9,000.63	4,500.32
Loin Puller Pickle Pumper Ham Pumper	1.88	2	7,820.80	344.12	835.71	9,000.63	4,500.32
Hanger Bellies Slicing Machine Operator	1.45	2	6,032.00	265.41	644.56	6,941.97	3,470.98
Curing Department Totals	-	6	21,673.60	953.65	2,315.98	24,943.23	-
Sausage Department							
Slicing Machine Operator	1.36	1	2,828.80	124.47	302.28	3,255.55	3,255.55
Casing Peeler Operator Sausage Stuffer	1.47	1	3,057.60	134.53	326.73	3,518.86	3,518.86
Sausage Maker Spice Weigher	1.78	1	3,702.40	162.91	395.63	4,260.94	4,260.94
Mixer Operator Smoker	1.63	1	3,390.40	149.18	362.29	3,901.87	3,901.87
Sausage Department Totals	-	4	12,979.20	571.09	1,386.93	14,937.22	-

[a]Weekly production includes jobbed customer service items. See footnotes b through j on page 143.

APPENDIX B, TABLE IC (Continued)

Operation[b]	Hourly Wage[c]	Number of Employees[d]	Annual Wage[e]	Social Security[f]	Retirement, Insurance, Vacation & Holidays[g]	Total Annual Payroll[h]	Annual Cost Per Worker[i]
	DOLLARS		DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
Order Assembly Department							
Checkers, Loading Packers, Shipping	1.80	3	11,232.00	494.21	1,200.22	12,926.43	4,308.81
Luggers-Loaders	1.33	2	5,532.80	243.44	591.22	6,367.46	3,183.73
Order Assembly Department Totals	-	5	16,764.80	737.65	1,791.44	19,293.89	-
Sanitation and Maintenance							
Cleaners (night)							
Janitors							
Maintenance Men	1.88	1	977.60	43.01	104.46	1,125.07	4,500.28
Sanitation & Maint. Dept. Totals	-	1	977.60	43.01	104.46	1,125.07	-
Office Personnel							
Secretary							
Bookkeeper	-	1	4,539.60	199.74	485.09	5,224.43	5,224.43
Clerks, Accounting	-	1	3,957.40	174.13	422.88	4,554.41	4,554.41
Office Totals	-	2	8,497.00	373.87	907.97	9,778.84	-
Management							
General Manager	-	1	12,000.00	290.40	1,282.28	13,572.68	13,572.68
Management Totals	-	1	12,000.00	290.40	1,282.28	13,572.68	-
Grand Totals	-	20	76,636.20	3,134.41	8,189.13	87,959.74	-

APPENDIX B, TABLE IIA

DEPARTMENTAL PERSONNEL REQUIREMENTS AND ANNUAL PAYROLL COSTS FOR THE MEDIUM MODEL PLANT PRODUCING 50,000 POUNDS WEEKLY[a]

Operation[b]	Hourly Wage[c]	Number of Employees[d]	Annual Wage[e]	Social Security[f]	Retirement, Insurance, Vacation & Holidays[g]	Total Annual Payroll[h]	Annual Cost Per Worker[i]
	DOLLARS		DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
Boning Department							
Boner, Beef Break-up Men Handlers	1.80	1	3,744.00	164.74	400.07	4,308.81	4,308.81
Boning Department Totals	-	1	3,744.00	164.74	400.07	4,308.81	-
Curing Department							
Boners, Ham Belly Trimmers Trimmer of Trimmings Ham Skinner Machine	1.88	2	7,820.80	344.12	835.71	9,000.63	4,500.32
Loin, Puller Pickle Pumper Ham Pumper	1.88	2	7,820.80	344.12	835.71	9,000.63	4,500.32
Hanger Bellies Slicing Machine Operator	1.45	2	6,032.00	265.41	644.56	6,941.97	3,470.98
Curing Department Totals	-	6	21,673.60	953.65	2,315.98	24,943.23	-
Sausage Department							
Slicing Machine Operator Casing Peeler Operator Sausage Stuffer	1.47	1	3,057.60	134.53	326.73	3,518.86	3,518.86
Sausage Maker Spice Weigher	1.78	1	3,702.40	162.91	395.63	4,260.94	4,260.94
Mixer Operator	1.46	1	3,036.80	133.62	324.50	3,494.92	3,494.92
Smoker	1.63	1	3,390.40	149.18	362.29	3,901.87	3,901.87
Sausage Department Totals	-	4	13,187.20	580.24	1,409.15	15,176.59	-

[a]Weekly production includes jobbed customer service items. See footnotes b through k on page 143.

APPENDIX B, TABLE IIA (Continued)

Operation[b]	Hourly Wage[c]	Number of Employees[d]	Annual Wage[e]	Social Security[f]	Retirement, Insurance, Vacation & Holidays[g]	Total Annual Payroll[h]	Annual Cost Per Worker[i]
	DOLLARS		DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
Order Assembly Department							
Checkers, Loading Packers, Shipping	1.80	3	11,232.00	494.21	1,200.22	12,926.43	4,308.81
Luggers-Loaders	1.33	2	5,532.80	243.44	591.22	6,367.46	3,183.73
Order Assembly Department Totals	-	5	16,764.80	737.65	1,791.44	19,293.89	-
Sanitation and Maintenance							
Cleaners (night)	1.37	1	2,849.60	125.38	304.50	3,279.48	3,279.48
Janitors	1.29	1	2,683.20	118.06	286.72	3,087.98	3,087.98
Maintenance Men	1.88	1	1,955.20	86.03	208.93	2,250.16[j]	4,500.32
Sanitation & Maint. Dept. Totals	-	3	7,488.00	329.47	800.15	8,617.62	-
Office Personnel							
Secretary	-	1	5,517.20	242.76	589.55	6,349.51	6,349.51
Bookkeeper	-	1	4,539.60	199.74	485.09	5,224.43	5,224.43
Clerks, Accounting	-	2	7,914.80	348.24	845.75	9,108.79	4,554.40
Office Totals	-	4	17,971.60	790.74	1,920.39	20,682.73	-
Management							
General Manager	-	1	15,000.00	290.40	1,602.86	16,893.26	16,893.26
Management Totals	-	1	15,000.00	290.40	1,602.86	16,893.26	-
Grand Totals	-	24	95,829.20	3,846.89	10,240.04	109,916.13	-

APPENDIX B, TABLE IIB

DEPARTMENTAL PERSONNEL REQUIREMENTS AND ANNUAL PAYROLL COSTS FOR THE MEDIUM MODEL PLANT PRODUCING 75,000 POUNDS WEEKLY[a]

Operation[b]	Hourly Wage[c]	Number of Employees[d]	Annual Wage[e]	Social Security[f]	Retirement, Insurance, Vacation & Holidays[g]	Total Annual Payroll[h]	Annual Cost Per Worker[i]
	DOLLARS		DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
Boning Department							
Boner, Beef Break-up Men Handlers	1.80	2	7,488.00	329.47	800.15	8,617.62	4,308.81
Boning Department Totals	-	2	7,488.80	329.47	800.15	8,617.62	-
Curing Department							
Boners, Ham Belly Trimmers Trimmer of Trimmings Ham Skinner Machine	1.88	3	11,731.20	516.17	1,253.56	13,500.93	4,500.31
Loin Puller Pickle Pumper	1.88	2	7,820.80	344.12	835.71	9,000.63	4,500.32
Ham Pumper	1.70	1	3,536.00	155.58	377.85	4,069.43	4,069.43
Hanger Bellies Slicing Machine Operator	1.45	3	9,048.00	398.11	966.84	10,412.95	3,470.98
Curing Department Totals	-	9	32,136.00	1,413.98	3,433.96	36,983.94	-
Sausage Department							
Slicing Machine Operator Casing Peeler Operator Sausage Stuffer	1.47	2	6,115.20	269.07	653.45	7,037.72	3,518.86
Sausage Maker	1.78	1	3,702.40	162.91	395.63	4,260.94	4,260.94
Spice Weigher Mixer Operator	1.46	1	3,036.80	133.62	324.50	3,494.92	3,494.92
Smoker	1.63	1	3,390.40	149.18	362.29	3,901.87	3,901.87
Sausage Department Totals	-	5	16,244.80	714.78	1,735.87	18,695.45	-

[a]Weekly production includes jobbed customer service items. See footnotes b through k on page 143.

APPENDIX B, TABLE IIB (Continued)

Operation[b]	Hourly Wage[c]	Number of Employees[d]	Annual Wage[e]	Social Security[f]	Retirement, Insurance, Vacation & Holidays[g]	Total Annual Payroll[h]	Annual Cost Per Worker[i]
	DOLLARS		DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
Order Assembly Department							
Checkers, Loading	1.65	1	3,432.00	151.01	366.73	3,949.74	3,949.74
Packers, Shipping	1.80	3	11,232.00	494.21	1,200.22	12,926.43	4,308.81
Luggers-Loaders	1.33	3	8,299.20	365.16	886.83	9,551.19	3,183.73
Order Assembly Department Totals	-	7	22,963.20	1,010.38	2,453.78	26,427.36	-
Sanitation and Maintenance							
Cleaners, (night)	1.37	1	2,849.60	125.38	304.50	3,279.48	3,279.48
Janitors	1.29	1	2,683.20	118.06	286.72	3,087.98	3,087.98
Maintenance Men	1.88	1	1,955.20	86.03	208.93	2,250.16[k]	4,500.32
Sanitation & Maint. Dept. Totals	-	3	7,488.00	329.47	800.15	8,617.62	-
Office Personnel							
Secretary	-	1	5,517.20	242.76	589.55	6,349.51	6,349.51
Bookkeeper	-	1	4,539.60	199.74	385.09	5,224.43	5,224.43
Clerks, Accounting	-	2	7,914.80	348.25	845.75	9,108.80	4,554.40
Office Totals	-	4	17,971.60	790.75	1,920.39	20,682.74	-
Management							
General Manager	-	1	15,000.00	290.40	1,602.86	16,893.26	16,893.26
Management Totals		1	15,000.00	290.40	1,602.86	16,893.26	-
Grand Totals	-	31	119,291.60	4,879.23	12,747.16	136,917.99	-

APPENDIX B, TABLE IIC

DEPARTMENTAL PERSONNEL REQUIREMENTS AND ANNUAL PAYROLL COSTS FOR THE MEDIUM MODEL PLANT PRODUCING 100,000 POUNDS WEEKLY[a]

Operation[b]	Hourly Wage[c]	Number of Employees[d]	Annual Wage[e]	Social Security[f]	Retirement, Insurance, Vacation & Holidays[g]	Total Annual Payroll[h]	Annual Cost Per Worker[i]
	DOLLARS		DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
Boning Department							
Boner, Beef Break-up Men	1.80	2	7,488.00	329.47	800.15	8,617.62	4,308.81
Handlers	1.28	1	2,662.40	117.15	284.50	3,064.05	3,064.05
Boning Department Totals	-	3	10,150.40	446.62	1,084.65	11,681.67	-
Curing Department							
Boners, Ham Belly Trimmers Trimmer of Trimmings Ham Skinner Machine	1.88	4	15,641.60	688.23	1,671.41	18,001.24	4,500.31
Loin Puller Pickle Pumper	1.88	2	7,820.80	344.12	835.71	9,000.63	4,500.32
Ham Pumper	1.70	1	3,536.00	155.58	377.85	4,069.43	4,069.43
Hanger Bellies Slicing Machine Operator	1.45	4	12,064.00	530.82	1,289.12	13,883.94	3,470.98
Curing Department Totals	-	11	39,062.40	1,718.75	4,174.09	44,955.24	-
Sausage Department							
Slicing Machine Operator	1.36	1	2,828.80	124.47	302.28	3,255.55	3,255.55
Casing Peeler Operator Sausage Stuffer	1.47	3	9,172.80	403.60	980.18	10,556.58	3,518.86
Sausage Maker	1.78	1	3,702.40	162.91	395.63	4,260.94	4,260.94
Spice Weigher	1.71	1	3,556.80	156.50	380.07	4,093.37	4,093.37
Mixer Operator	1.46	1	3,036.80	133.62	324.50	3,494.92	3,494.92
Smoker	1.63	1	3,390.40	149.18	362.29	3,901.87	3,901.87
Sausage Department Totals	-	8	25,688.00	1,130.28	2,744.95	29,563.23	-

[a]Weekly production includes jobbed customer service items. See footnotes b through k on page 143.

APPENDIX B, TABLE IIC (Continued)

Operation[b]	Hourly Wage[c]	Number of Employees[d]	Annual Wage[e]	Social Security[f]	Retirement, Insurance, Vacation & Holidays[g]	Total Annual Payroll[h]	Annual Cost Per Worker[i]
	DOLLARS		DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
Order Assembly Department							
Checkers, Loading	1.65	1	3,432.00	151.01	366.73	3,949.74	3,949.74
Packers, Shipping	1.80	4	14,976.00	658.94	1,600.29	17,235.23	4,308.81
Luggers-Loaders	1.33	4	11,065.60	486.89	1,182.44	12,734.93	3,183.73
Order Assembly Department Totals	-	9	29,473.60	1,296.84	3,149.46	33,919.90	-
Sanitation and Maintenance							
Cleaners,(night)	1.37	1	2,849.60	125.38	304.50	3,279.48	3,279.48
Janitors	1.29	1	2,683.20	118.06	286.72	3,087.98[k]	3,087.98
Maintenance Men	1.88	1	1,955.20	86.03	208.93	2,250.16	4,500.32
Sanitation & Maint. Dept. Totals	-	3	7,488.00	329.47	800.15	8,617.62	-
Office Personnel							
Secretary	-	1	5,517.20	242.76	589.55	6,349.51	6,349.51
Bookkeeper	-	1	4,539.60	199.74	485.09	5,224.43	5,224.43
Clerks, Accounting	-	2	7,914.80	348.25	845.75	9,108.80	4,554.40
Office Totals	-	4	17,971.60	790.75	1,920.39	20,682.74	-
Management							
General Manager	-	1	15,000.00	290.40	1,602.86	16,893.26	16,893.26
Management Totals		1	15,000.00	290.40	1,602.86	16,893.26	-
Grand Totals	-	39	145,334.00	5,366.80	15,476.55	166,312.99	-

APPENDIX B, TABLE IIIA

DEPARTMENTAL PERSONNEL REQUIREMENTS AND ANNUAL PAYROLL COSTS FOR THE LARGE MODEL PLANT PRODUCING 125,000 POUNDS WEEKLY[a]

Operation[b]	Hourly Wage[c]	Number of Employees[d]	Annual Wage[e]	Social Security[f]	Retirement, Insurance, Vacation & Holidays[g]	Total Annual Payroll[h]	Annual Cost Per Worker[i]
	DOLLARS		DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
Boning Department							
Boner, Beef Break-up Men	1.80	2	7,488.00	329.47	800.15	8,617.62	4,308.81
Handlers	1.28	1	2,662.40	117.15	284.50	3,064.05	3,064.05
Boning Department Totals	-	3	10,150.40	446.62	1,084.65	11,681.67	-
Curing Department							
Boners, Ham Belly Trimmers Trimmer of Trimmings Ham Skinner Machine	1.88	5	19,552.00	860.29	2,089.27	22,501.56	4,500.31
Loin Puller	1.88	3	11,731.20	516.17	1,253.56	13,500.93	4,500.31
Pickle Pumper Ham Pumper	1.70	1	3,536.00	155.58	377.85	4,069.43	4,069.43
Hanger Bellies	1.45	5	15,080.00	663.52	1,611.40	17,354.92	3,470.98
Slicing Machine Operator							
Curing Department Totals	-	14	49,899.20	2,195.56	5,332.08	57,426.84	-
Sausage Department							
Slicing Machine Operator Casing Peeler Operator	1.36	1	2,828.80	124.47	302.28	3,255.55	3,255.55
Sausage Stuffer	1.47	4	12,230.40	538.14	1,306.90	14,075.44	3,518.86
Sausage Maker	1.78	1	3,702.40	162.91	395.63	4,260.94	4,260.94
Spice Weigher	1.71	1	3,556.80	156.50	380.07	4,093.37	4,093.37
Mixer Operator	1.46	1	3,036.80	133.62	324.50	3,494.92	3,494.92
Smokers	1.63	1	3,390.40	149.18	362.29	3,901.87	3,901.87
Sausage Department Totals	-	9	28,745.60	1,264.82	3,071.67	33,082.09	-

[a]Weekly production includes jobbed customer service items. See footnotes b through m on page 143.

APPENDIX B, TABLE IIIA (Continued)

Operation[b]	Hourly Wage[c]	Number of Employees[d]	Annual Wage[e]	Social Security[f]	Retirement, Insurance, Vacation & Holidays[g]	Total Annual Payroll[h]	Annual Cost Per Worker[i]
	DOLLARS		DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
Order Assembly Department							
Checkers, Loading	1.65	1	3,432.00	151.01	366.73	3,949.74	3,949.74
Packers, Shipping	1.80	4	14,976.00	658.94	1,600.29	17,235.23	3,949.74
Luggers-Loaders	1.33	4	11,065.60	486.89	1,182.44	12,734.93	3,183.73
Order Assembly Department Totals	-	9	29,473.60	1,296.84	3,149.46	33,919.90	-
Sanitation and Maintenance							
Cleaners (night)	1.37	2	5,699.20	250.76	609.00	6,558.96	3,279.48
Janitors	1.29	2[l]	5,366.40	236.12	573.44	6,175.96	3,087.98
Maintenance Men	1.88	2	3,910.40	172.06	417.85	4,500.31[m]	4,500.31
Sanitation & Maint. Dept. Totals	-	6	14,976.00	658.94	1,600.29	17,235.23	-
Office Personnel							
Secretary	-	1	5,517.20	242.76	589.55	6,349.51	6,349.51
Bookkeeper	-	1	4,539.60	199.74	485.09	5,224.43	5,224.43
Clerks, Accounting	-	3	11,871.20	522.36	1,268.55	13,662.05	4,554.12
Office Totals	-	5	21,928.00	964.86	2,343.19	25,235.99	
Management							
General Manager	-	1	25,000.00	290.40	2,671.42	25,961.82	27,961.82
Sales Manager	-	1	12,000.00	290.40	1,282.28	13,572.68	13,572.68
Buyer	-	1	11,000.00	290.40	1,175.43	12,465.83	12,465.83
Management Totals	-	3	48,000.00	871.20	5,129.13	54,000.33	-
Grand Totals	-	49	203,173.05	7,690.84	21,710.47	232,582.05	-

APPENDIX B, TABLE IIIB

DEPARTMENTAL PERSONNEL REQUIREMENTS AND ANNUAL PAYROLL COSTS FOR THE LARGE MODEL PLANT PRODUCING 187,500 POUNDS WEEKLY[a]

Operation[b]	Hourly Wage[c]	Number of Employees[d]	Annual Wage[e]	Social Security[f]	Retirement, Insurance, Vacation & Holidays[g]	Total Annual Payroll[h]	Annual Cost Per Worker[i]
	DOLLARS		DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
Boning Department							
Boner, Beef Break-up Men	1.80	3	11,232.00	494.21	1,200.22	12,926.43	4,308.81
Handlers	1.28	1	2,662.40	117.15	284.50	3,064.05	3,064.05
Boning Department Totals	-	4	13,894.40	611.36	1,484.72	15,990.48	-
Curing Department							
Boners, Ham Belly Trimmers Trimmer of Trimmings Ham Skinner Machine	1.88	6	23,462.40	1,032.35	2,507.12	27,001.87	4,500.31
Loin Puller Pickle Pumper	1.88	3	11,731.20	516.17	1,253.56	13,500.93	4,500.31
Ham Pumper	1.70	1	3,536.00	155.58	377.85	4,069.43	4,069.43
Hanger Bellies Slicing Machine Operator	1.45	7	21,112.00	928.93	2,255.96	24,296.89	3,470.98
Curing Department Totals	-	17	59,841.60	2,633.03	6,394.49	68,869.12	-
Sausage Department							
Slicing Machine Operator	1.36	2	5,657.60	248.93	604.55	6,511.08	3,255.54
Casing Peeler Operator Sausage Stuffer	1.47	4	12,230.40	538.14	1,306.90	14,075.44	3,518.86
Sausage Maker	1.78	2	7,404.80	325.81	791.25	8,521.86	4,260.93
Spice Weigher	1.71	1	3,556.80	156.50	380.07	4,093.37	4,093.37
Mixer Operator	1.46	1	3,036.80	133.62	324.50	3,494.92	3,494.92
Smokers	1.63	2	6,780.80	298.36	724.58	7,803.74	3,901.87
Sausage Department Totals	-	12	38,667.20	1,701.36	4,131.85	44,500.41	-

[a]Weekly production includes jobbed customer service items. See footnotes b through m on page 143.

APPENDIX B, TABLE IIIB (Continued)

Operation[b]	Hourly Wage[c]	Number of Employees[d]	Annual Wage[e]	Social Security[f]	Retirement, Insurance, Vacation & Holidays[g]	Total Annual Payroll[h]	Annual Cost Per Worker[i]
	DOLLARS		DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
Order Assembly Department							
Checkers, Loading	1.65	1	3,432.00	151.01	366.73	3,949.74	3,949.74
Packers, Shipping	1.80	5	18,720.00	823.68	2,000.36	21,544.04	4,308.81
Luggers-Loaders	1.33	4	11,065.60	486.89	1,182.44	12,734.93	3,138.73
Order Assembly Department Totals	-	10	33,217.60	1,461.58	3,549.53	38,228.71	-
Sanitation & Maintenance							
Cleaners (night)	1.37	2	5,699.20	250.76	609.00	6,558.96	3,279.48
Janitors	1.29	2[l]	5,366.40	236.12	573.44	6,175.96	3,087.98
Maintenace Men	1.88	2	3,910.40	172.06	417.85	4,500.31[m]	4,500.31
Sanitation & Maint. Dept. Totals	-	6	14,976.00	658.94	1,600.29	17,235.23	-
Office Personnel							
Secretary	-	1	5,517.20	242.76	589.55	6,349.51	6,349.51
Bookkeeper	-	1	4,539.60	199.74	485.09	5,224.43	5,224.43
Clerk	-	3	11,871.20	522.33	1,268.52	13,662.05	4,554.02
Office Totals	-	5	21,928.00	964.83	2,343.16	25,235.99	-
Manogement							
General Manager	-	1	25,000.00	290.40	2,671.42	27,961.82	27,961.82
Sales Manager	-	1	12,000.00	290.40	1,282.28	13,572.68	13,572.68
Buyer	-	1	11,000.00	290.40	1,175.43	12,465.83	12,465.83
Management Totals	-	3	48,000.00	871.20	5,129.13	54,000.33	-
Grand Totals	-	57	230,524.80	8,902.30	24,633.17	264,060.27	-

APPENDIX B, TABLE IIIC

DEPARTMENTAL PERSONNEL REQUIREMENTS AND ANNUAL PAYROLL COSTS FOR THE LARGE MODEL PLANT PRODUCING 250,000 POUNDS WEEKLY[a]

Operation[b]	Hourly Wage[c]	Number of Employees[d]	Annual Wage[e]	Social Security[f]	Retirement, Insurance, Vacation & Holidays[g]	Total Annual Payroll[h]	Annual Cost Per Worker[i]
	DOLLARS		DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
Boning Department							
Boner, Beef Break-up Men	1.80	4	14,976.00	658.94	1,600.29	17,235.23	4,308.81
Handlers	1.28	1	2,662.40	117.15	284.50	3,064.05	3,064.05
Boning Department Totals	-	5	17,638.40	776.09	1,884.79	20,299.28	-
Curing Department							
Boners, Ham Belly Trimmers Trimmer of Trimmings Ham Skinner, Machine	1.88	7	27,372.80	1,204.40	2,924.98	31,502.18	4,500.31
Loin Puller Pickle Pumper	1.88	4	15,641.60	688.23	1,671.41	18,001.24	4,500.31
Ham Pumper	1.70	1	3,536.00	155.58	377.85	4,069.43	4,069.43
Hanger Bellies Slicing Machine Operator	1.45	8	24,128.00	1,061.63	2,578.25	27,767.88	3,470.98
Curing Department Totals	-	20	70,678.40	3,109.84	7,552.49	81,340.73	-
Sausage Department							
Slicing Machine Operator	1.36	2	5,657.60	248.93	604.55	6,511.08	3,255.54
Casing Peeler Operator	1.27	1	2,641.60	116.23	282.27	3,040.10	3,040.10
Sausage Stuffer	1.47	4	12,230.40	538.14	1,306.90	14,075.44	3,518.86
Sausage Maker	1.78	2	7,404.80	325.81	791.25	8,521.86	4,260.93
Spice Weigher	1.71	1	3,556.80	156.50	380.07	4,093.37	4,093.37
Mixer Operator	1.46	1	3,036.80	133.62	324.50	3,494.92	3,494.92
Smokers	1.63	2	6,780.80	298.36	724.58	7,803.74	3,901.87
Sausage Department Totals	-	13	41,308.80	1,817.59	4,414.12	47,540.51	-

[a]Weekly production includes jobbed customer service items. See footnotes b through m on page 143.

APPENDIX B, TABLE IIIC (Continued)

Operation[b]	Hourly Wage[c]	Number of Employees[d]	Annual Wage[e]	Social Security[f]	Retirement, Insurance, Vacation & Holidays[g]	Total Annual Payroll[h]	Annual Cost Per Worker[i]
	DOLLARS		DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
Order Assembly Department							
Checkers, Loading	1.65	1	3,432.00	151.01	366.73	3,949.74	3,949.74
Packers, Shipping	1.80	5	18,720.00	823.68	2,000.36	21,544.04	4,308.81
Luggers-Loaders	1.33	5	13,832.00	608.61	1,478.05	15,918.66	3,183.73
Order Assembly Department Totals	-	11	35,984.00	1,583.30	3,845.14	41,412.44	-
Sanitation and Maintenance							
Cleaners (night)	1.37	2	5,699.20	250.76	609.00	6,558.96	3,279.48
Janitors	1.29	2[l]	5,366.40	236.12	573.44	6,175.96	3,087.98
Maintenance Men	1.88	2	3,910.70	172.06	417.85	4,500.31[m]	4,500.31
Sanitation & Maint. Dept. Totals	-	6	14,976.00	658.94	1,600.29	17,235.23	-
Office Personnel							
Secretary	-	1	5,517.20	242.76	589.55	6,349.51	6,349.51
Bookkeeper	-	1	4,539.60	199.74	485.09	5,224.43	5,224.43
Clerk	-	3	11,871.20	522.33	1,268.52	13,662.05	4,554.02
Office Totals	-	5	21,928.00	964.83	2,343.16	25,235.99	-
Management							
General Manager	-	1	25,000.00	290.40	2,671.42	27,961.82	27,961.82
Sales Manager	-	1	12,000.00	290.40	1,282.28	13,572.68	13,572.68
Buyer	-	1	11,000.00	290.40	1,175.43	12,465.83	12,465.83
Management Totals	-	3	48,000.00	871.20	5,129.13	54,000.33	-
Grand Totals		63	250.513.60	9,781.79	26,769.12	287,064.51	-

[b] Operations listed are not necessarily all the operations performed, but due to lack of wage data, those jobs which were not listed in the wage surveys listed in footnote c below are included in a job title as closely describing the actual operation as possible.

[c] Where more than one job is performed by an individual, his wage is considered to be the highest wage of the jobs performed. Wages come from United States Department of Labor, Bureau of Labor Statistics, Bulletin 1415, Industry Wage Survey, Meat Products, (Washington, 1963), Section 1, Table 6 and Table 7.

[d] Production personnel were specified by Mr. Donald Hammons (Industrial Engineer, United States Department of Agriculture).

[e] Annual wage is column (2) multiplied times 40 hours per week times 52 weeks per year times column (3). For management personnel it is the salary as listed.

[f] Column (4) times .044, for all production employees and office workers and .044 times $6600 for management personnel.

[g] Computation explained in text.

[h] Sum of columns (4), (5), and (6).

[i] Column (7) divided by column (3).

[j] Three-fourths of the annual cost of the maintenance man is accounted for in the maintenance costs of Appendix A, Table I.

[k] One-half of the annual cost of the maintenance man is accounted for in the maintenance costs of Appendix A, Table II.

[l] One of the janitors is box make-up man.

[m] The annual cost of one maintenance man is accounted for in the maintenance costs of Appendix A, Table III.

APPENDIX C

ELECTRICITY CONSUMPTION SYNTHESIS

The synthesis of the electricity consumption for the model plants at various output levels assumes each model plant to have specific areas to be lighted and specific equipment to be operated for specified time periods. The lighting requirement was assumed not to change with output level, but as mentioned above equipment running times were specified for each output level, therefore, the difference in the running times of the equipment at the different levels of operation are responsible for the differences in electricity consumption at the different output levels.

The electrical power supplied to an electric motor cannot be obtained by multiplying volts and amperes since the power factor of an electric motor is not 100 percent. Therefore, to obtain a practical value of the power input to electric motors, two rules of thumb were employed: (1) multiply the horsepower rating of the motor by 1.2 if the motor was rated less than 1/2 horsepower and (2) multiply the horsepower rating of the motor by 1.0 if the motor was rated greater than 1/2 horsepower.[1] Once the power input is computed for a motor, the kilowatt hours used for billing purposes are obtained

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[1]This information is from R. H. Brown, Farm Electrification, (New York, 1956), p. 31.

by multiplying the power input times the running time in hours and dividing by 1000 (1000 watts/hr = 1 kilowatt hour).

The lighting requirements for the model plants were synthesized using the Lumen method.[2] The Lumen method of calculation consists of six key steps as follows:[3]

1. Determine the level of illumination.
2. Select the lighting system and luminaires.
3. Determine the coefficient of utilization.
4. Estimate the maintenance factor.
5. Calculate the number of lamps.
6. Determine the location of the luminaires.

The level of illumination used was that specified by the United States Department of Agriculture.[4] The lighting system specified uses fluorescent lamp fixtures with dual 40-watt standard cool white luminaires. The coefficient of utilization used was 0.52.[5] The maintenance factor was estimated to be 0.7.[6]

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[2]For a detailed discussion of the Lumen Method, see Illuminations Engineering Society IES Lighting Handbook, (New York, 1959), Section 9.

[3]Taken from Hienton, Truman E., Dennis E. Wiant, and Oral A. Brown, Electricity in Agricultural Engineering, (New York, 1958), 1. 230.

[4]United States Department of Agriculture, Agricultural Research Service, Meat Inspection Division, U. S. Inspected Meat Processing Plants-No Slaughtering, (Washington, 1961), p. 13.

[5]Illuminating Engineering Society, IES Lighting Handbook, (New York, 1959), Figure 9-3, p. 9-11.

[6]Ibid.

The number of lamps may be calculated as follows:

$$\text{Number of lamps} = \frac{\text{Foot-candles illumination} \times \text{floor area (square feet)}}{\text{Coefficient of utilization} \times \text{service factor}}$$

divided by the lumens generated by the lamp used (2450).[7]

For the synthesis of the electricity consumption by lights, the assumption was made that the lights would be on 45 hours per week, 52 weeks per year.[8] To compute the annual kilowatt hours for lighting, after calculating the number of lamps, multiply the number of lamps by the wattage (40) of the lamps and by the number of hours of operation (2340).[9] This gives the annual watt hours required. By dividing by 1000, the annual kilowatt hours are determined. Using the formula given above, this now gives:

$$\frac{\text{Number of lamps} \times \text{watts (40)} \times \text{hours (2340)}}{\text{1000 watts per kilowatt hour}} = \text{Annual kilowatt hours}$$

The electricity consumption from lighting requirements for each model plant and the electricity consumption of equipment for each output level of each model plant are presented in Appendix C, Table I.

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[7]The lamps specified for this synthesis were 48" 40-watt standard cool white fluorscent lamps generating 2450 lumens of luminous flux.

[8]This assumption holds except for the packaging supplies storage areas, boiler rooms, refrigeration equipment rooms, and equipment storage rooms. A 100 square feet area of the packaging supplies storage area for box make up was designated for box make up to be lighted 20 hours equivalence per week and the remainder of that area would be lighted only one-half hour per day equivalent for 260 days. The boiler and refrigeration rooms were assumed to be lighted one hour per day and the equipment storage would have full lighting equivalence of two hours per day for 260 days.

[9]The (40) and (2340) are the numbers referring to the figures used for computations of annual kilowatt hours in Appendix C, Table I with the exceptions noted in footnote 8.

APPENDIX C, TABLE I

ESTIMATED ANNUAL KILOWATT HOURS ELECTRICITY REQUIRED BY LIGHTING FOR THE THREE MODEL PLANTS

Department	Intensity of Illumination[a]	Plant Size: Small Area[b] Sq. ft.	Small Annual KWH[c]	Medium Area[b] Sq. ft.	Medium Annual KWH[c]	Large Area[b] Sq. ft.	Large Annual KWH[c]
Receiving Cooler	20	740.25	1,553.8	1,160.00	2,433.6	2,328.00	4,886.8
Fresh Pork Cooler	20	-	-	273.00	572.8	249.75	524.3
Freezer	20	348.00	730.1	680.00	1,428.3	577.50	1,212.3
Tempering Cooler	20	672.75	1,409.6	1,375.00	2,886.6	2,810.00	4,849.0
Blask Chill	20	390.00	818.1	660.00	1,385.3	1,245.00	2,613.4
Boning Department	50	575.00	2,875.5	875.00	4,592.0	1,950.00	10,231.6
Sausage Manufacturing	50	2,653.00	13,922.3	4,148.00	8,707.2	4,464.50	23,430.6
Spice Room	20	75.00	157.2	75.00	157.2	185.00	388.3
Curing Department	50	995.00	5,221.0	1,595.00	8,370.3	3,404.00	17,864.9
Slice, Peel and Package	50	1,609.50	8,446.4	3,099.00	16,263.0	5,550.00	29,125.3
Order Assembly	20	1,822.50	3,826.4	4,007.75	8,412.8	6,773.00	14,217.4
Welfare	20	361.00	758.2	750.00	1,574.3	992.75	2,083.9
Rest Rooms	20	52.25	110.4	60.00	125.9	57.00	119.7
Plant Shop	50	137.75	772.6	517.50	2,588.2	546.75	2,869.1
Boiler Room[d]	20	142.50	33.3	520.00	2,600.7	322.50	73.0
Packaging Supplies Storage[d]	20	390.00	127.1	3,580.00	591.6	5,776.00	871.8
Equipment Storage[d]	20	1,004.25	463.2	1,654.00	769.8	3,887.00	1,813.2
Smokehouse Area	20	575.25	1,207.4	1,113.00	2,336.3	1,938.00	4,068.1
Office	50	427.00	896.7	1,220.00	6,402.2	2,544.00	13,350.4
Inspectors Office	50	115.00	602.8	170.00	892.1	160.00	839.6
Stair Case	20	-	-	77.00	161.6	77.00	404.1
Dock Area	50	508.50	2,667.6	641.25	3,365.2	820.25	4,304.5
Refrigeration Room[d]	20	-	-	875.00	1,836.8	634.25	147.9
All Departments	--	-	46,549.7	-	78,453.8	-	108,684.1

[a] From United States Department of Agriculture, Agricultural Research Service, Meat Inspection Division, U.S. Inspected Meat Processing Plants-No Slaughtering, (Washington, 1961), p. 13.

[b] As specified for model plant by Mr. Donald Hammons (Industrial Engineer, United States Department of Agriculture).

[c] Computed for each area using the two formulae in Appendix C.

[d] See Footnote 8 of Appendix C.

APPENDIX C, TABLE II

ESTIMATED ANNUAL KILOWATT HOURS ELECTRICITY REQUIRED BY REFRIGERATION EQUIPMENT FOR THE THREE MODEL PLANTS EACH OPERATING AT THREE DIFFERENT OUTPUT LEVELS

	Output[a]											
	Small Plant				Medium Plant				Large Plant			
Department	Refrigeration Horsepower[b]	25,000	37,500	50,000	Refrigeration Horsepower[b]	50,000	75,000	100,000	Refrigeration Horsepower[b]	125,000	187,500	250,000
		Annual Kilowatt Hours				Annual Kilowatt Hours				Annual Kilowatt Hours		
Receiving Cooler	3.00				6.73				12.44			
Blast Chill	3.82				11.02				17.14			
Tempering Cooler	2.62				7.85				11.22			
Freezer	3.30				5.61				9.59			
Fresh Pork Cooler	-				6.12				10.91			
Total for Coolers and Freezer[c]	12.74	38,220	57,330	76,440	37.33	111,990	167,985	223,980	61.30	183,900	275,850	367,800
Curing Department	2.78				4.18				7.85			
Boning Department and Sausage Kitchen	4.20				9.18				14.28			
Order Assembly	6.08				13.67				24.38			
Total for Processing Departments[d]	13.06	78,360	78,360	78,360	27.03	162,180	162,180	162,180	46.51	279,060	279,060	279,060
Total Refrigeration	25.80	116,580	135,690	154,800	64.36	274,170	330,165	386,160	107.81	462,960	554,910	646,860

[a]Pounds of weekly production including customer service items.

[b]Refrigeration brake horsepower estimates were computed by Mr. Donald Hammons (Industrial Engineer, United States Department of Agriculture) by multiplying the tonnage estimates by the rule of thumb of 1.02 for the medium and large plants and by .75 for the small plant.

[c]Annual kilowatt hours for coolers and freezers are estimated by multiplying the refrigeration horsepower times the power intput factor of 1 times 20 hours per day times 300 days per year times the percent of designed output divided by 1,000.

[d]Annual kilowatt hours for processing department refrigeration are estimated by multiplying the refrigeration horsepower times the power input factor of 1, times 20 hours per day times 300 days per year, divided by 1,000.

APPENDIX C, TABLE IIIA

ESTIMATED ANNUAL KILOWATT HOURS ELECTRICITY REQUIRED BY PROCESSING EQUIPMENT FOR THE SMALL MODEL PLANT AT THREE OUTPUT LEVELS[a]

Item[b]	Horsepower[b]	Power Input Factor	Daily Running Time (Plant Output)[c]			Annual Electricity Consumption[d] (Plant Output)[c]		
			25,000	37,500	50,000	25,000	37,500	50,000
			(Hours)			(Kilowatt Hours)		
Air Compressor	5.00	1.0	4.00	4.00	4.00	5,200.00	5,200.00	5,200.00
Bacon Press	10.00	1.0	.55	.70	.90	1,430.00	1,820.00	2,340.00
Bacon Skinner	1.50	1.0	1.25	1.70	2.20	487.50	663.00	858.00
Bacon Slicer	5.00	1.0	.75	1.00	1.25	975.00	1,300.00	1,625.00
Bacon Slicer Conveyor	.50	1.2	1.00	1.25	1.50	156.00	195.00	234.00
Hydraulic Slicer	3.00	1.0	.25	.25	.25	195.00	195.00	195.00
Linker	.33	1.2	1.50	1.90	2.50	154.44	195.62	257.40
Meat Grinder	15.00	1.0	2.50	3.25	4.00	9,750.00	12,675.00	15,600.00
Meat Mixer	5.00	1.0	.65	.82	1.00	845.00	1,066.00	1,300.00
Patty Machine	.25	1.2	1.80	2.70	3.60	140.40	210.60	280.80
Silent Cutter	20.00	1.0	1.75	2.40	3.00	9,100.00	12,480.00	15,600.00
Slicer	.33	1.2	1.55	2.10	2.60	159.59	216.22	267.70
Smoke Generator	.33	1.2	9.00	9.00	9.00	926.64	926.64	926.64
Smoke Generator	.25	1.2	9.00	9.00	9.00	702.00	702.00	702.00
Vacuum Packaging Machine	.33	1.2	2.45	3.40	4.40	252.25	350.06	453.02
Wiener Peeler	.33	1.2	1.75	2.50	3.00	180.18	257.40	308.88
Total Annual KWH						30,654.00	38,452.54	46,148.44

[a]See Footnotes b through d at the end of Appendix C, Table IIIC.

APPENDIX C, TABLE IIIB

ESTIMATED ANNUAL KILOWATT HOURS ELECTRICITY REQUIRED BY PROCESSING EQUIPMENT FOR THE MEDIUM MODEL PLANT AT THREE OUTPUT LEVELS[a]

Item[b]	Horsepower[b]	Power Input Factor	Daily Running Time (Plant Output)[c]			Annual Electricity Consumption[d] (Plant Output)[c]		
			50,000	75,000	100,000	50,000	75,000	100,000
			(Hours)			(Kilowatt Hours)		
Air Compressor	5.00	1.0	6.00	6.00	6.00	7,800.00	7,800.00	7,800.00
Bacon Press	10.00	1.0	2.25	2.50	3.00	5,850.00	6,500.00	7,800.00
Bacon Skinner	1.50	1.0	2.00	2.50	3.00	1,820.00	2,275.00	2,730.00
Bacon Slicer	5.50	1.0	5.00	6.00	6.00	7,150.00	8,580.00	8,580.00
Band Saw	3.00	1.0	1.20	1.50	2.00	936.00	1,170.00	1,560.00
Conveyor	.50	1.2	8.00	8.00	8.00	1,248.00	1,248.00	1,248.00
Conveyor	.50	1.2	1.00	1.00	1.00	156.00	156.00	156.00
Hydraulic Flaker	12.00	1.0	.30	.50	.50	936.00	1,560.00	1,560.00
Linker	.33	1.2	1.75	2.50	3.00	182.00	260.00	312.00
Meat Grinder	40.00	1.0	4.00	5.00	6.00	41,600.00	52,000.00	62,400.00
Meat Mixer	7.50	1.0	1.50	1.50	2.50	2,925.00	2,925.00	4,875.00
Packing Line Belt	.33	1.2	8.00	8.00	8.00	832.00	832.00	832.00
Patty Machine	.25	1.2	3.60	4.50	6.00	312.00	351.00	468.00
Roller Conveyor	.75	1.0	8.00	8.00	8.00	1,260.00	1,260.00	1,260.00
Roller Conveyor	.75	1.0	8.00	8.00	8.00	1,260.00	1,260.00	1,260.00
Silent Cutter	50.00	1.0	1.20	2.00	2.00	15,600.00	26,000.00	26,000.00
Silent Cutter	1.50	1.0	.75	1.00	1.25	292.50	390.00	487.50
Slicer	.33	1.2	2.60	3.40	3.80	270.40	353.60	395.20
Smoke Generator	.33	1.2	5.00	7.00	9.00	520.00	728.00	936.00
Smoke Generator	.25	1.2	5.00	7.00	9.00	390.00	546.00	780.00
Vacuum Packaging Machine	.33	1.2	4.00	4.50	6.00	416.00	468.00	624.00
Washer	15.00	1.0	1.20	1.50	2.00	4,680.00	5,850.00	7,800.00
Wiener Peeler	.33	1.2	.90	1.00	1.50	94.00	104.00	156.00
Wiener Peeler	.33	1.2	.90	1.00	1.50	94.00	104.00	156.00
Total Annual KWH						96,623.90	122,720.60	140,175.70

[a]See Footnotes b through d at the end of Appendix C, Table IIIC.

APPENDIX C, TABLE IIIC

ESTIMATED ANNUAL KILOWATT HOURS ELECTRICITY REQUIRED BY PROCESSING EQUIPMENT FOR THE LARGE MODEL PLANT AT THREE OUTPUT LEVELS[a]

Item[b]	Horsepower[b]	Power Input Factor	Daily Running Time (Plant Output)[c] 125,000 (Hours)	187,500 (Hours)	250,000 (Hours)	Annual Electricity Consumption[d] (Plant Output)[c] 125,000 (Kilowatt Hours)	187,500 (Kilowatt Hours)	250,000 (Kilowatt Hours)
Air Compressor	5.00	1.0	6.00	6.00	6.00	7,800.00	7,800.00	7,800.00
Air Compressor	5.00	1.0	6.00	6.00	6.00	7,800.00	7,800.00	7,800.00
Bacon Press	10.00	1.0	2.00	2.75	3.50	5,200.00	7,150.00	9,100.00
Bacon Skinner	1.50	1.0	4.50	7.50	8.00	1,775.00	2,925.00	3,120.00
Bacon Slicer	5.00	1.0	2.90	4.10	5.30	3,770.00	5,330.00	6,890.00
Bacon Conveyor	.50	1.2	3.00	4.25	5.50	468.00	663.00	858.00
Band Saw	3.00	1.0	2.25	3.25	4.75	1,775.00	2,535.00	3,705.00
Band Saw	3.00	1.0	2.25	3.25	4.75	1,775.00	2,535.00	3,705.00
Conveyor	.75	1.0	8.00	8.00	8.00	1,872.00	1,872.00	1,872.00
Conveyor	.75	1.0	8.00	8.00	8.00	1,872.00	1,872.00	1,872.00
Conveyor	.50	1.0	4.00	4.00	4.00	624.00	624.00	624.00
Conveyor	.33	1.2	8.00	8.00	8.00	823.68	823.68	823.68
Hydraulic Flaker	12.00	1.0	.50	.50	.50	1,560.00	1,560.00	1,560.00
Linker	.33	1.2	5.25	7.25	8.00	540.54	746.46	823.68
Linker Conveyor	.33	1.2	5.25	7.25	8.00	540.54	746.46	823.68
Meat Grinder	30.00	1.0	2.80	3.95	5.00	21,840.00	30,810.00	39,000.00
Meat Mixer	7.50	1.0	1.85	2.50	3.20	3,607.50	4,875.00	6,240.00
Patty Machine	.33	1.2	5.30	8.00	8.00	545.69	823.68	823.68
Silent Cutter	50.00	1.0	2.80	3.95	5.00	36,400.00	51,350.00	65,000.00
Silent Cutter	50.00	1.0	2.80	3.95	5.00	36,400.00	51,350.00	65,000.00
Slicer	.33	1.2	4.00	5.80	8.00	411.84	597.17	823.68
Smoke Generator	.33	1.2	9.00	9.00	9.00	926.64	926.64	926.64
Smoke Generator	.33	1.2	9.00	9.00	9.00	926.64	926.64	926.64
Smoke Generator	.25	1.2	9.00	9.00	9.00	702.00	702.00	702.00
Smoke Generator	.25	1.2	9.00	9.00	9.00	702.00	702.00	702.00
Vacuum Packaging Machine	.33	1.2	4.50	6.10	8.00	463.32	628.06	823.68
Washer	15.00	1.0	.50	.50	.50	1,950.00	1,950.00	1,950.00
Wiener Peeler	.33	1.2	2.95	4.10	5.25	920.40	1,794.00	1,632.80
Wiener Peeler	.33	1.2	2.95	4.10	5.25	920.40	1,794.00	1,632.80
Total Annual KWH						145,832.59	196,005.79	239,193.76

[a]See Footnotes b through d at the end of Appendix C, Table IIIC.

[b]Equipment as specified by Mr. Donald Hammons (Industrial Engineer, United States Department of Agriculture).

[c]Weekly output in pounds.

[d]The product of horsepower times power input factor times daily running time times 255 days per year divided by 1000.

APPENDIX D

NATURAL GAS CONSUMPTION SYNTHESIS

To synthesize the natural gas consumption for the model plants of this study operating at several output levels, certain assumptions were made. Each plant was equipped with new boilers which were assumed to operate 8 hours per day for 22 days each month. Further, it was assumed that approximately 33,500 BTU's of heat are required hourly per horsepower of boiler at 100 percent efficient operation. Since boilers of 60 horsepower or greater operate at only 70 percent efficiency, the hourly BTU requirements for boilers of this study were calculated by multiplying 33,500 times the reciprocal of the efficiency to obtain an hourly BTU requirement for boilers of 44,857 BTU's.[1] It was also assumed that a cubic foot of natural gas was approximately equivalent to 1050 BTU's.[2]

BTU heat requirements for smoking cured meats and for cooking and smoking sausages were interpolated from data in Meat Industry Trends, 1961[3], and are

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[1] Samuel H. Logan and Gordon A. King, Economies of Scale in Beef Slaughter Plants, California Agricultural Experiment Station, Gianni Foundation of Agricultural Economics, Gianni Foundation Research Report No. 260, (Davis, 1962), p. 87.

[2] Charles D. Hodgman, Robert C. Weast, and Samuel M. Selby, eds., Handbook of Chemistry and Physics, 38th edition, by Chemical Rubber Publishing Company (Cleveland, 1957), p. 1786.

[3] H. L. Rothra, ed., Meat Industry Trends, 1961, (Chicago, 1961), pp. D-20 and D-62.

presented in Appendix D, Table II. BTU heat requirements and monthly gas consumption of boilers are presented in Appendix D, Table I.

APPENDIX D, TABLE I

BTU REQUIREMENTS AND GAS CONSUMPTION FOR BOILERS

Weekly Production[a]	Boiler Horsepower[b]	BTU Requirements		Monthly Gas Consumption[e]
		Hourly[c]	Monthly[d]	
				(CCF)
25-50	100	44,857	842,283,200	8,022.00
50-100	140	44,857	1,105,276,480	10,526.44
125-250	270	44,857	2,131,604,640	20,301.00

[a]Range of output of the model plants in thousands of pounds including customer service items and fresh pork cuts.

[b]Boiler horsepower for the three model plants recommended by Mr. Donald Hammons (Industrial Engineer, United States Department of Agriculture).

[c]For explanation of hourly BTU requirements of boilers, see text of Appendix D.

[d]Assumes 8 hours of operation for 22 days per month.

[e]Monthly BTU requirements divided by 1050 BTU per cubic foot divided by 100 to obtain CCF for billing purposes.

APPENDIX D, TABLE II

BTU REQUIREMENTS AND GAS CONSUMPTION FOR COOKING AND SMOKING OPERATIONS

Weekly Production[a]	BTU Requirements			Cured Meats and Sausages BTU/Day	Average Monthly Gas Consumption[g]
	Cured Meats		Sausages		
	BTU/Hr.[b]	BTU/Day[c]	BTU/Day[d]		
(Pounds)		(Millions)			(CCF)
20,000	.275	2.2	3.8- 4.2	3,100[e]	634.44
25,000				3,785[f]	793.05
37,500				5,500[f]	1,152.38
50,000	.800	6.4	7.5- 8.5	7,200[e]	1,508.57
75,000				10,800[f]	2,262.86
100,000	1.600	12.8	15.0-17.0	14,400[e]	3,017.14
125,000				17,920[f]	3,754.67
187,500				24,950[f]	5,227.62
250,000	4.000	32.0	38.0-40.0	35,500[e]	7,438.10

[a] Includes customer service items.

[b] Hourly BTU requirements for cured meats from H. L. Rothra, ed. Meat Industry Trends, 1961, (Chicago, 1961), p. D-20.

[c] The BTU per hour requirement for cured meats multiplied by 8.

[d] Daily BTU requirements for sausage from H. L. Rothra, ed. Meat Industry Trends, 1961, (Chicago, 1961), p. D-62.

[e] Daily BTU requirements for cured meats is the average of the daily BTU requirements for cured meats plus the midrange of the daily BTU requirements for sausages.

[f] Interpolated from the values obtained from the method discussed in footnote e above.

[g] The product of the midrange of column (4) times 22 days per month divided by 1050 BTU per cubic foot of gas divided by 100 to get CCF for billing purposes.

APPENDIX E

APPENDIX E, TABLE I

ESTIMATED WATER REQUIREMENTS FOR CLEANING

Department	Area			Monthly Water Consumption		
	Small	Medium	Large	Small	Medium	Large
	(Square Yards)			(Gallons)		
1. Welfare	40.1	83.3	110.2			
2. Slicing, Peeling, and Packaging	178.7	344.3	585.6			
3. Curing Department and Boning Department	110.2	177.2	378.2			
4. Sausage Department	392.0	548.2	768.0			
Total Departments 1-4	721.0	1,153.0	1,842.0	31,724[a]	50,732[a]	81,048[a]
5. Receiving Cooler	82.4	128.8	258.7			
6. Fresh Pork Cooler	-	30.4	27.8			
7. Equipment Storage	111.6	183.8	431.5			
Total Departments 5-7	194.0	343.0	718.0	1,552[b]	2,744[b]	5,744[b]
Total Water All Departments	-	-	-	33,276	53,476	86,792

[a]Monthly water consumption is the product of the area of the department(s) in square yards times 2 gallons of water per square yard times 22 cleaning days per month.

[b]Monthly water consumption is the product of the area of the department(s) in square yards times 2 gallons of water per square yard times 4 cleanings per month.

APPENDIX E, TABLE II

ESTIMATED WATER REQUIREMENTS FOR MANUFACTURING

Output[a]	Water Requirements	
	Daily	Monthly[d]
	(Gallons)	
20,000	1,200[b]	26,400
25,000	1,400[c]	30,800
37,500	1,900[c]	41,800
50,000	2,400[b]	52,800
75,000	3,700[c]	81,400
100,000	5,000[b]	110,000
125,000	6,417[c]	141,174
187,500	9,961[c]	219,142
250,000	13,500[b]	297,000

[a]Output is total weekly output of all products of the plant.

[b]Water requirements listed in H. L. Rothra, ed., Meat Industry Trends, 1961, (Chicago, 1961), p. D-62, for sausage smoking and cooking. This study assumes that cured meats would have a similar requirement.

[c]Interpolated from the two nearest values obtained from the source mentioned in footnote b.

[d]The product of the daily requirement times 22 days per month.

APPENDIX E, TABLE III

ESTIMATED WATER REQUIREMENTS FOR EMPLOYEES' WELFARE

Plant Size	Weekly Output[a]	Number of Employees[b]	Monthly Water Consumption[c]
			(Gallons)
	25,000	16	5,632
Small	37,500	18	6,336
	50,000	20	7,040
	50,000	27	9,504
Medium	75,000	34	11,968
	100,000	42	14,784
	125,000	50	17,600
Large	187,500	60	21,120
	250,000	66	23,232

[a] Output in pounds including customer service items.

[b] Includes all employees and inspectors.

[c] Number of employees times 16 gallons per employee times 22 days per month.

VITA

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