AN ANALYSIS OF COST-SIZE RELATIONSHIPS IN HOG PRODUCTION

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of the Requirements for the Degree

Doctor of Philosophy

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by

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The undersigned, appointed by the Dean of the Graduate Faculty, have examined a thesis entitled An Analysis of Cost-Size Relationships In Hog Production

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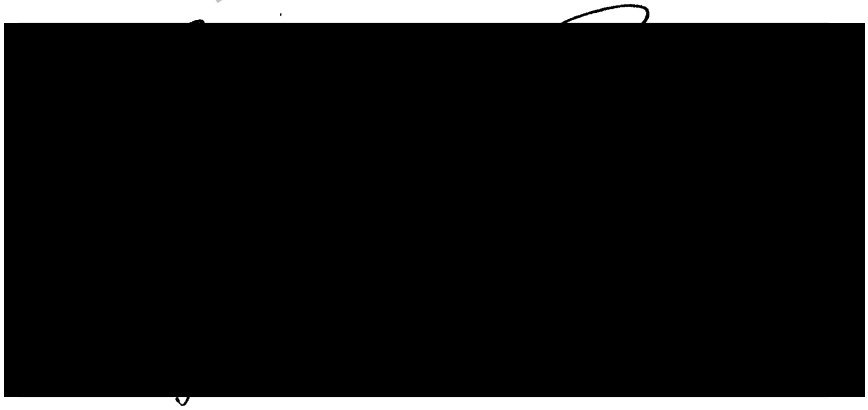

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CHAPTER I

INTRODUCTION

The state of Missouri was fourth in the production of market hogs in the United States in 1968. Hogs are produced in every county and on 40 percent of the farms in the state. Figure I-1 shows the distribution and intensity of hog production in Missouri. Two fairly distinct types of hog enterprises are present in Missouri: the northern one-half of the state, the feed grain area, is primarily engaged in the production of market hogs for slaughter; the southern one-half of the state is recognized as a production region of quality feeder pigs. Hog receipts account for about 20 percent of the state's cash farm receipts. The measure, cash farm receipts, gives no indication of the cash expenses, depreciation, and other production costs. Net farm income from the hog enterprise would be a more useful measure of the relative and absolute contribution of an enterprise. However, cost data are not currently available from which net farm income from these sources can be estimated. Once budgets determining the total cost of production are synthesized for various size hog enterprises, the relative importance of the hog enterprise can be more effectively evaluated.

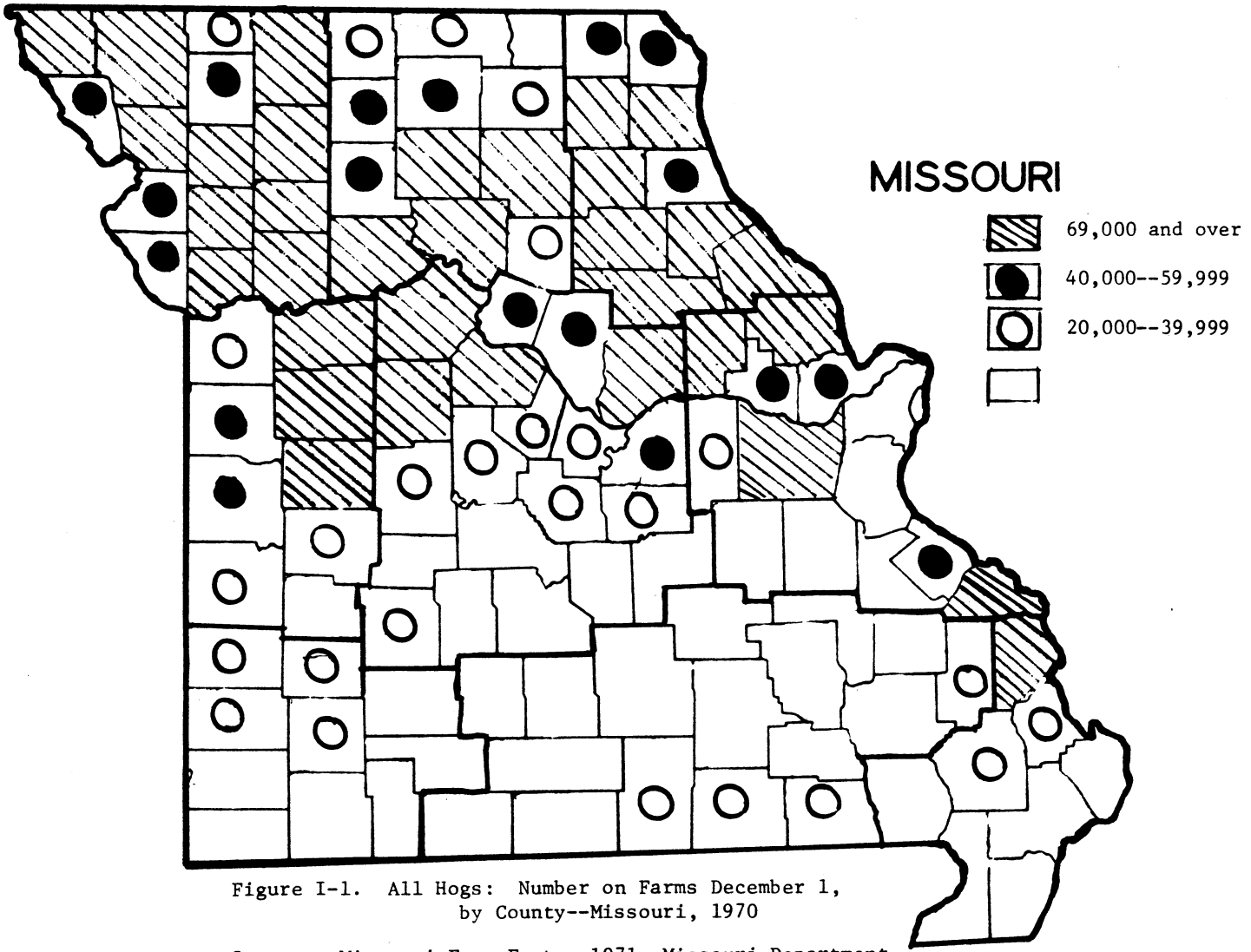

Figure I-1. All Hogs: Number on Farms December 1, by County--Missouri, 1970

Source: Missouri Farm Facts--1971, Missouri Department of Agriculture, April, 1971, Page 25.

Table A of Appendix C indicates the production, civilian consumption and per capita consumption of pork for the United States for selected years. By any measure, pork is one of the major sources of meat for American families. It appears the total production of pork has been increasing over the time period from 1945 to 1967. The production of pork went from 10,697 million pounds to 12,556 million pounds in the years 1945 to 1967 respectively. Consumption decreased from 66.6 pounds per person in 1945 to 58.0 pounds per person in 1966. Per capita consumption in 1968 was 65.8 pounds, indicating a potential change in the trend for the consumption of pork.

The production of hogs involves much more than the hog producer, his level of production, and the type of operation. Individuals employed with farm supply firms handling hog equipment, buildings, feed, and storage equipment are affected by the decisions of hog producers. Non-farm as well as many farm firms involved in the production of factor inputs used in the production of swine may be forced to alter their businesses to coincide with the technical system of production chosen by swine producers.

Still other individuals are employed in the handling of pork in such activities as transportation, processing, storage, wholesaling, retailing, and the financing of these marketing functions. The intensity of these activities and

1.1 million (Table C, Appendix A). An examination of Table C will show that the number of farms decreased while both the number of hogs and pigs on farms and the number of hogs and pigs sold increased from 1945 to 1964.

Two basic structural changes have occurred in the hog industry (Table D, Appendix A). First, the number of farms farrowing sows and gilts have declined from 1,839,458 farms in 1945 to 749,714 farms in 1964. Second, changes in the technique or method of producing hogs resulted in the Census changing the criteria for measurement of the number of hogs being produced from "sows and gilts for spring farrowing" to "sows and gilts farrowing (total litters)." This was necessary due to the adoption of new technology which allowed hog producers to farrow sows and gilts throughout the entire year, and to handle multiple farrowings.

Table E of Appendix A presents a more detailed analysis of hogs and pigs by size groups for Missouri in 1964. The majority of the 5,948,667 hogs were raised by producers falling into the three size groups of hogs and pigs per farm. These were: 25-99, 100-199, and 200-499 head per farm. The 1968 pig crop for Missouri was 7,404,000 head. The 1967 pig pig crop was 7,242,000 head. The average number of pigs per litter was 7.30 in 1968 compared with 7.37 in 1967.

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JUSTIFICATION AND OBJECTIVES OF THE STUDY

If Missouri's Market Hog Industry is to compete effectively in the coming decade, with hog producers in other states and with alternative uses of resources in other farm enterprises, the amount of capital invested in growing and finishing facilities will be substantial. Facilities, especially of the confinement type, are expensive to construct and once completed have few, if any, alternative uses. In addition, the very nature of hog production entails a high degree of risk both with respect to disease and price changes.

Missouri hog farmers have been using confinement units in recent years with varying degrees of success. When these units are utilized at the levels of capacity for which they were designed, they appear to have been quite popular and profitable, although there have been some unfavorable results with poorly designed units. While these experiments appear to be economically desirable--farmers have responded to changes in hog prices in various ways.

With favorable hog prices management often operates their facilities at higher levels of capacity than for which they were originally designed. Overcrowding and relatively poor ventilation results. The incidence of disease increases and the overall level of performance of the growing and finishing enterprise decreases, resulting in higher

costs per unit of output and lower net returns.

On the other hand many producers have responded to higher hog prices through an expansion of their plant capacity (an increase in their physical facilities--the number and size of buildings, etc.). Many of these producers are also experiencing higher costs per unit of output and lower net returns.

It appears that in both of these cases the physical and/or economic management factors are contributing to these lower profit levels. However, it is not known at what specific levels of capacity or intensity of use that these conditions are most likely to occur.

Before a farmer can make a decision on the hog enterprise, knowledge of the expected cost of production and expected returns under different systems of production would be desirable. The decision may involve different alternatives within the swine enterprise.

Hog production systems with a capacity of 1,000 or more hogs require a large capital investment. Cost information is vital to producers making decisions with respect to type of system and the optimum capacity of that system. Considering the uncertainties and risks involved in hog production, the high capital and labor requirements, and recent trends of hog enterprise expansion, the objectives of this study are: (1) to study the cost-size relationships for the conventional and confinement systems as a producer

changes from two to four to six farrowings per year; (2) to study the cost-size relationship for the conventional and confinement systems if the producer stays within a given farrowing intensity; (3) to analyze the effect of 7.0 pigs per litter on the costs of production for facilities designed for 8.5 pigs per litter.

DESCRIPTION OF STUDY

Six different systems of raising hogs are defined for purposes of this study. These systems are broken into three phases of farrowing, growing, and finishing. The following presents the six systems and the phases for each system:[2]

	Phase I Farrowing	Phase II Growing	Phase III Finishing
System 1	pasture-limited facilities A-frame house	pasture-limited facilities, shade and self feeder	pasture-limited facilities, shade and self feeder
System 2	individual houses (pasture or dry lot)	conventional (dry lot-open type shelter)	conventional (dry lot-open type shelter)
System 3	confinement (farrowing crates)	confinement (slotted floors, etc.)	confinement (slotted floors, etc.)
System 4	conventional (separate pens, single bldg.)	conventional (dry lot and open type shelter)	conventional (dry lot and open type shelter)

[2]These systems were selected on the basis of direct observation and consultation with farm management personnel at the University of Missouri: Dr. Kenneth Boggs, Dr. C. E. Harshbarger, Dr. Robert Finley and Mr. John Moorehead.

System 5	pasture-limited facilities A-frame house	pasture-limited facilities, shade and self-feeder	conventional (dry lot-open type shelter)
System 6	pasture-limited facilities A-frame house	pasture-limited facilities, shade and self-feeder	confinement (slotted floors etc.)

This research effort will compare the non-feed costs of systems 3 and 4, as shown above (the confinement system and the conventional system, respectively) as the capacity[3] of either system is expanded through the following sow increments:[4] 8, 30, 60, 100, 150, and 200. Under these conditions, the number of hogs produced depends on the number of farrowings and the capacity level. One basic ration is assumed for each period such as: growing, finishing, gestation and lactation. A complete discussion of hog capacities and swine rations is presented in Chapter IV.

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[3]Capacity in this case is defined as the minimum physical facilities necessary to farrow the specified number of sows or gilts at one time, and the facilities that are required to grow and finish the pigs obtained from a single farrowing of a set of sows, assuming 8.5 pigs per litter. However, as multiple farrowings are added--additional growing and/or finishing facilities are required.

[4]For the different levels of farrowing the number of sows were increased by a multiple of two or three at each of the selected levels. These were 8, 30, 60, 100, 150 and 200 sow units. For example, four farrowings consisted of two sets of sows with each set being farrowed twice; and in the case of six farrowings this would consist of three sets of sows with each set being farrowed twice.

DEFINITION OF TERMS

The terms defined in this section will be used throughout this research:

1. Fixed costs are those costs which occur at all levels of output even if no production occurs. Fixed costs include insurance, real estate taxes, personal taxes, depreciation, land charges or rent, operator's labor and interest.
2. Variable costs are those costs which vary with the level of output. Variable costs include such items as feed costs, veterinary expenses, insurance for marketing, hired labor, fuel and oil, electricity, machinery repair, death loss, and interest on investment in hogs.
3. Opportunity cost is the return given up for resources used in hog production equal to what those resources could earn in their best alternative uses.
4. Total cost is the sum of the variable and fixed costs and includes an opportunity cost-interest charge on variable and fixed investments.
5. Economies of scale refers to declining average cost per unit of output as output increases when all productive factors are increased in the same proportion.

6. Diseconomies of scale refers to an increase in average cost per unit of output as output increases when all productive factors are increased in the same proportion.
7. Internal economies are those economies which are a result of action taken by the management of the firm involving the mix of resources and the level of resource use within the firm.
8. External economies are economies which are related to changes outside of the firm affecting (covering) the position of the long run cost curve of firms. External economies occur as the industry grows due to decreases in the prices of some factor inputs and/or increases in the physical efficiency and/or productivities of some inputs.
9. The short run refers to a time period where some inputs such as plant and equipment are fixed in amount; a firm can expand or contract its output only by varying the amounts of the other inputs.
10. The long run refers to a time period long enough to permit all inputs to be varied in amount; and a firm's output can vary from zero to an indefinitely large quantity. In this case there are no fixed costs.
11. The growing period is the period from weaning to the time when the pigs weigh 100 pounds.

12. The finishing period is the period when the pigs grow from 100 pounds to the market weight of 220 pounds.

13. The farrowing period is a period of time one week prior to giving birth and up to the time the pigs are weaned (six weeks).

14. The output of a hog system is the total number of hogs produced in a year for a given capacity of operational unit or the physical capacity of the operational unit for one production cycle (farrowing set) times the number of farrowing sets, farrowed per year. Under the assumptions of this study, output (number of hogs produced) can be increased two ways: by increasing the physical capacity of hog system or by using a given capacity level more intensively. Thus, multiple farrowings will achieve the more intensive use of a given set of facilities. While it is possible to shorten the growing and feeding time by more intensive feeding practices, this alternative was excluded from this analysis.

15. The conventional system is a production method (process) in which the building is open on one side with a solid concrete floor, a concrete feeding area, automatic feeders and waterers, and a lagoon may or may not be adjacent to the feeding floor. This system requires bedding as

the temperature inside the hog house is allowed to vary with the outside temperature.

16. The confinement system is a production method using a building which is completely enclosed, temperature environmentally controlled, completely or partially slotted concrete floors, automatic waterers and feeders. No bedding is required.

17. A market hog enterprise refers to the production of market hogs for commercial slaughter without regard to crop enterprises or complementary enterprises.

18. Multiple litters is the farrowing of two or more sets of sows, each farrowed two times per year. The greater the number of farrowings per year, the more intensive is the use of facilities. Management, both the physical aspects as well as the economic aspects, becomes critical under these conditions. For hog producers, more careful sanitation, accurate timing in breeding and farrowing, and a more rigid and prompt vaccination program are daily concerns.

19. A slotted floor is an elevated floor with space between the boards or slots uniformly spaced which allows manure and urine to fall through or to be worked through the slots as hogs walk or move about in the pen.

CHAPTER II

THEORETICAL FRAMEWORK, SHORT AND LONG RUN COSTS AND ASSOCIATED CONSIDERATIONS

The theory of production provides the basis for the study of economies of size. The production process can be divided into two basic steps. First, the basic technological function is the output specified as a function of the inputs used, such as land, labor, capital, and entrepreneural ability. A mathematical statement of this function may be specified as $y = f(X_1, X_2, X_3, \ldots, X_N)$ or y = f (land, labor, capital, management). The input-output relationships specified for technological functions of this order may be derived from synthesized budget techniques, survey data, experimental data, linear programming techniques, and statistical analysis. The second step is the application of prices to the inputs going into the production function. Price tags on inputs are converted to total dollar costs, and when related to alternative levels of output result in dollar costs per unit. This provides the basic dollar cost estimates associated with the technological function in producing a given output.

THE ECONOMIES OF SIZE CONCEPT

Economies of size refers to the potential of reducing costs per unit by specifying variable technological

production functions associated with different capacity levels. Resources may be employed in varying proportions or in equal proportion. That is, the same ratio of resources is not necessarily maintained with respect to the initial resource mix; the proportion of land, labor, capital, and management may be variable. Some resources may be increased while others may be held constant or even decreased. Economies of scale, on the other hand, specifies that all resources are varied in a fixed and similar proportion. "Returns to scale" is a term reflecting the results of the effects of scale--or fixed technological functions at different capacity levels. Thus returns to scale may be increasing, decreasing or constant.

In this study both short-run cost theory and long-run cost theory are used as models for estimating costs at each of the various levels of capacity and intensity of use. Specifically, short-run costs require some level of fixed resources with variable levels of the use of inputs within specific production or accounting periods. Normally, in the short-run time period, fixed resources are defined as those inputs that are of such a nature that they are either not used up in the process of that production period or they cannot be changed within a single production or accounting period. Thus land, buildings, equipment and breeding stock all become fixed resources while feed, electricity, water and veterinary supplies are all treated

as variable inputs because these either are used up during a specific production period or because the manager (operator) may control the level of their use during that production period. In contrast with the short-run cost estimating model--the long-run cost estimating model prescribes that all inputs are variable; that is, all of the production inputs can be changed at any moment of time, or alternatively, that producers have sufficient time to change all inputs.

Some departure from the usual theoretical models is made in this study. Feed costs are treated as variable costs but at constant costs per unit of market hog produced regardless of the number of hogs produced and marketed. Moreover, breeding stock, (sows and boars) is assumed to be a variable input--even though these animals would not be used up during one accounting period. The costs of the use of breeding stock will be treated as fixed costs in this analysis. Thus, any attempt to measure an optimum size facility for a growing or finishing operation in the production of hogs will need to consider both short-run and long-run costs. Some producers may be required to start small but, over time, be able to acquire a larger operation. This analysis should specify the processes by which this should be accomplished.

Economies associated with size changes arise from two sources: pecuniary and technical. Pecuniary economies are not considered as a part of this study. Technical economies are associated with more effective or efficient

utilization of the productive capacity of the resources. Technical economies are associated with (1) the potential of increased output from a given set of resources resulting from the division and specialization of labor and (2) the ability of larger plants to utilize more efficient equipment in production.[5] With one man doing the entire production process, this man must perform several different operations. As he changes from job to job, inefficiencies occur. With specialization and division of labor warranted by increased output, additional men are hired. Each man performs a specified job and output per man increases. If factor prices remain unchanged, then costs per unit will be decreasing. With the addition of new technology in the form of new or different machines and/or new processes, costs potentially at least, may be reduced. The cheapest way of producing a small output does not necessarily involve nor warrant the use of highly specialized equipment and methods. As size of plant (capacity) increases, however, the fixed costs of specialized equipment can be spread over a larger number of units, making more efficient machines and processes feasible. Costs per unit may become substantially lower than was possible with a small size plant.

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[5]Efficiency may be associated with larger equipment capable of moving or processing a larger number of units in the production operation, and/or the utilization of equipment that reduces the effective time or amount of waste per unit of product in the production process.

Diseconomies of size occurs when further increases in the size of the firm results in higher costs per unit of output. Rising costs per unit of output are most often due to management's inability to control, direct, and coordinate the operation of the plant. The management may become specialized into separate departments and the communication between departments may not necessarily be optimal. After a certain size level has been achieved, the difficulties of coordination by the top management with regard to communication, decision making, and operational efficiency increases. Consequently, the long run average cost curve will tend to be a "U" shaped curve.

SHORT RUN COST THEORY

Jacob Viner assumed atomistic competition and rational economic behavior on the part of the producer in his classic article "Cost Curves and Supply Curves."[6] The assumptions of atomistic competitions are (1) the individual producer's output is such that he can not affect price; (his demand curve is a horizontal line and is equal to his price), (2) the individual producer produces a homogeneous product,

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[6]Jacob Viner, "Cost Curves and Supply Curves," from Zertschrift fur Nationalokonamie, Volume II (September, 1931), pp. 23-46.

(3) many firms exist in this industry, and (4) easy entry and exit into the industry by any firm is possible. Often included in the assumptions are equal knowledge for all firms, perfect mobility of resources, and the objective of profit maximization. Viner presents short run average cost curves and the associated marginal cost curve for an individual concern. Figure II-1 presents the costs for the short run for an individual firm of a given size as presented by Viner.

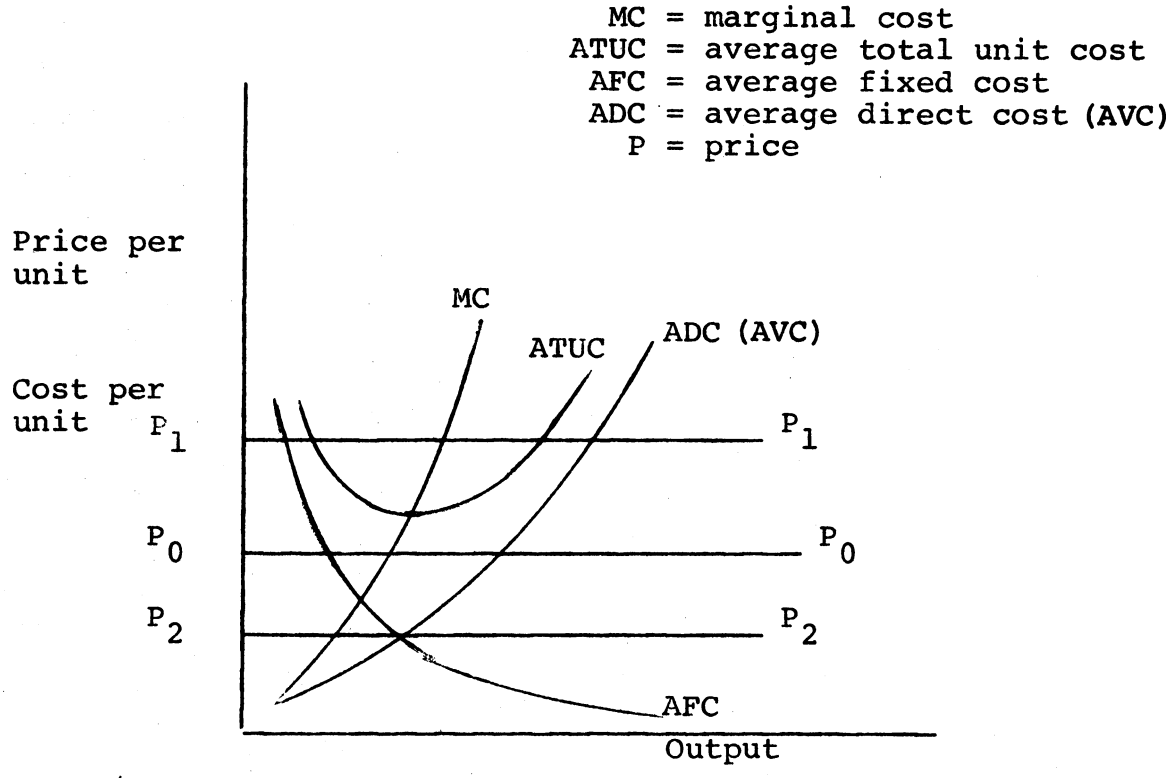

Figure II-1. Short Run Cost Curves

In the short-run for a given size plant, one or more inputs used in the production of an output are fixed. Resources are classified as fixed and variable. This allows

the associated costs to be termed "fixed costs" and "variable costs" (direct cost in Viner's article).

In Figure II-1, the curve labeled AFC (average fixed cost) represents the behavior of fixed costs per unit as output is increased. The AFC is a rectangular hyperbola or asymptotic to the axis. The AVC (average variable cost) reflects changes in costs per unit of output as output is increased by changing the level of variable input. With the application of additional units of a variable input to a given level of fixed factors the amount added to total output with each successive unit of the variable unit becomes less and less. The AVC has a positive slope in the relevant stage of production due to the fact that more of the variable input is required to obtain each additional unit of output, hence the average variable cost increases. With respect to the fixed factor, more intensive utilization is required to obtain additional units of output. The additional output can be secured only by the application of successively more units of variable inputs. The ratio of variable to fixed input increases as one seeks to obtain an extra unit of output.

The summation of the AVC and AFC at each level of output equals the average total cost.[7] The average total cost is necessarily U-shaped because of the nature of variable costs, and these are influenced by the law of diminishing marginal returns. The greater the proportion the fixed costs are of total costs the greater the pressures for firms to see those size plants which will reduce fixed costs per unit of output as well as total costs per unit of output. The relative lengths and steepness of slope of the negatively and positively inclined portions of the average total cost curve will depend upon the relative importance of the fixed cost to the total cost as well as the degrees of sharpness with which the law of diminishing marginal returns is affecting the total output. The marginal cost curve represents the change in total costs for a specific change in output. The geometry of marginal cost is such that the curve must go through the minimum points of the short run average variable cost (SRAVC) and the short run average cost (SRATC) curves.

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[7] Relationship of AVC and APP

$$AVC = \frac{TVC}{y} = \frac{PX_1 X_1}{y} = \frac{PX_1}{\frac{y}{x}} = \frac{PX}{APP}$$

Relationship of MC to MPP

$$MC = \frac{\Delta TVC}{\Delta y} = \frac{\Delta XPx}{\Delta y} = \frac{Px}{\frac{\Delta y}{\Delta x}} = \frac{Px}{MPP}$$

The APP and the MPP are derived from the production function.

A specific point on a short-run average cost curve represents the average cost of producing a specific level of output with a given size firm at one level of intensive use. Other points along the short run average cost curve represent costs as the firm produces at other levels of intensive use. The lowest point on the short-run average cost curve is where the firm could produce at least cost.

Each short-run average cost curve represents a given size and set of fixed resource inputs. By defining a sufficient number of fixed plants and developing their associated short-run average cost curves, the least cost size firm can be identified. Figure II-2 shows a series of short run average cost curves.

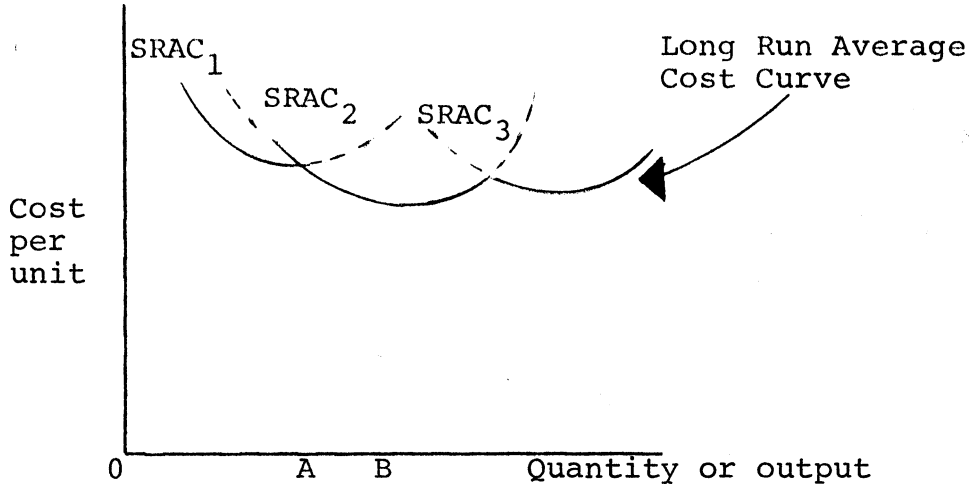

Figure II-2. SRAC Curves for Plants of Different Sizes

LONG RUN COST THEORY

All costs are variable in the long run as sufficient time has passed so that plant capacity can be increased.

The determination of the long run average cost curve is basic to the analysis of economies of size. The long run average cost curve shows the relationship between a firm's cost per unit of production and its size.

The long-run average cost curve (LRAC) is usually derived as the tangency of several short-run cost curves.[8] The long-run average cost curve shows the least possible cost per unit at various levels of output when the plant has sufficient time to grow to any size by changing any or all of its resources. The plant can vary labor, land, machinery, buildings, management, and other resources.

In Figure II-2 the darker solid line represents the long run average cost curve. If a sufficient number of plants of various sizes are constructed the long run average cost curve would approach a smooth continuous curve. The long run average cost curve indicates the optimal plant utilization. For example, in Figure II-2 output OA can be produced by plant 1 or 2 with $SRAC_1$, and $SRAC_2$ respectively. If OA is produced by plant 1, it is at its' optimal plant utilization. If OA is produced by plant 2, this is the most optimal way for this plan to produce this output in the

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[8]The point of tangency may not necessarily be the lowest point on the short-run average cost curve. The points of tangency of the long-run average cost curve represents minimum cost for operation in the long run, while the lowest points on the short-run average cost curves represent least operational cost for the fixed plant.

short run subject to the output limitations. For output OB, plant 2 would produce that output because costs are lower than for any level of output for Plant A. It is feasible in this case for plant 2 to produce even though it is operated at less than capacity and optimal utilization. Geometrically the long run average cost curve is a minimum and equal to the short run average cost curve which is also a minimum. This point of tangency is the optimum size of plant. Point A in Figure II-3 is such a point.

Figure II-3 presents a long-run average cost curve showing the relationship of the several short run average cost curves to this curve. To the left of point A, the minimum point on the long run average cost curve, economies of size occur, that is, as output and plant size increase

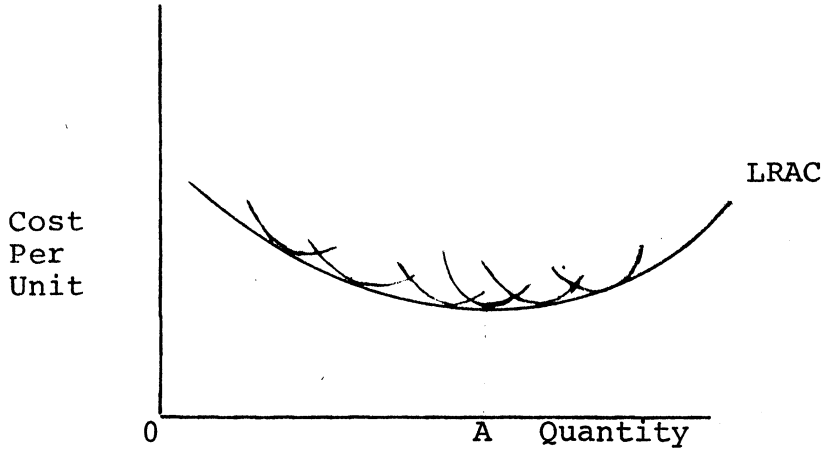

Figure II-3. The Long Run Average Cost Curve

the average cost per unit declines. Up to output OX the industry is often described as a decreasing cost industry. To the right of point A diseconomies of size occur as cost per unit of output increase as output and plant size

increase. Another possibility is for the long run average cost curve to become parallel to the horizontal or the quantity axis. This parallel portion of the curve reflects constant costs per unit of output and a constant cost industry where one size plant is as efficient as another.

Throughout the length of the long run average cost curve there are forces that result in economies and forces that result in diseconomies at each level of output. In the declining cost portion of the long run average cost curve the economies outweigh the diseconomies. In the constant cost phase the economies are equal to the diseconomies, and in the increasing cost phase the economies are outweighed by the diseconomies.

COST CONSIDERATIONS WITH REGARD TO THE HOG INDUSTRY

Individual businessmen frequently differ with one another regarding their views of costs and profits. Hog producers are quite typical of most businessmen. Some hog producers consider only the variable costs of their enterprises and do not include opportunity costs or fixed costs. If only the gross receipts and the operational expenses are included when computing costs and profits, then the fixed costs and opportunity costs are excluded. Other hog producers--typically those who have been in business a number of years, include all costs--these producers recognize that the real cost of producing hogs should include the returns

that the hog producer forgoes when he commits resources into his hog enterprise. This is part of the decision making (judgement) process for which a manager must be responsible.

Costs considerations are viewed differently by hog producers in the short-run and the long-run. In the short-run a hog producer can increase the frequency of farrowing, vary the market weight, or sell feeder pigs (shoats) and consider only the variable costs whereas in the long-run the variable, opportunity, and fixed costs must be covered. Fixed costs are present regardless of the number of hogs produced. At any plant capacity level--or set of facilities, the total fixed costs remain constant. As the number of hogs marketed for a given set of facilities increases, the average fixed cost per hog decreases. Hence, in the short-run the producer is concerned almost exclusively with variable costs. Hogs will be produced so long as the variable costs are paid. If there are any returns left after variable costs are covered, these returns can be applied to the fixed costs even though the fixed costs are not completely paid. Figure II-4 illustrates this concept.

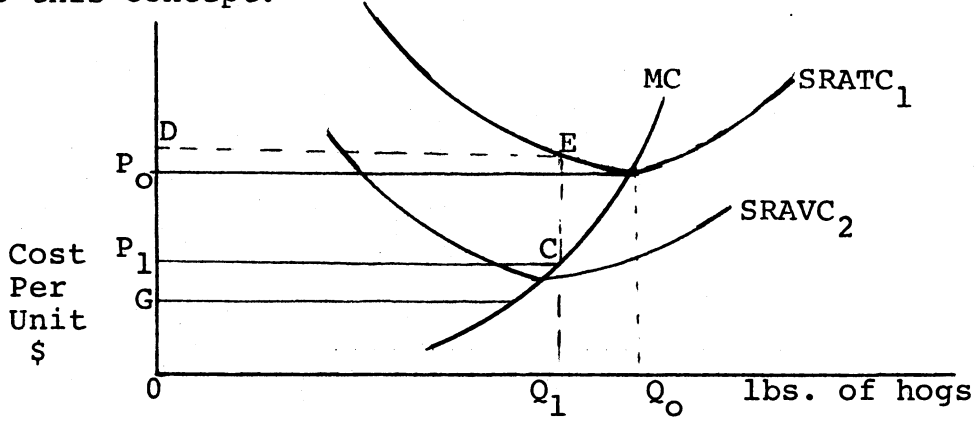

Figure II-4. Costs Considerations in the Short Run (Source: Hypothetical)

If the price of hogs per hundred weight is P_o and the cost curves of the producer are $SRATC_1$ and $SRAVC_2$, he will equate the price of hogs to his marginal cost producing OQ_o pounds of pork. With these cost curves and P_o for price the producer is receiving returns sufficient to cover his variable and fixed costs plus a normal profit. If the price fell to P_1, the area $ODEQ_1$, is the total cost of producing output OQ_1. This output level is determined by the profit rule, marginal cost equals marginal revenue (MC=MR). The total revenue is the area OP_1 C Q_1. Total revenue is less than total cost and the loss is the area P_1 DEC. In this case fixed costs have not been completely covered but the producer is in a better position than if he had not produced since the total fixed costs would have gone unpaid. This is a loss minimizing case. If this becomes the situation for any length of time the producer will exit or leave the industry unless he finds his capital costs of leaving the industry are greater than the sum of his expected short-run losses. In this case, he may simply re-value his fixed resources and keep operating.

If the price per hundred weight falls below OG it is best to close the plant since the variable costs are not

being paid.[9] If the price goes above P_o then excess profits will be present and the plant will increase output, using the same plant. In the long run profits that are in excess will encourage existing firms to use their facilities more intensively and to seek larger size operations. Moreover, new firms will be attracted into this industry. These actions will shift the market supply curve to the right--(increased market supply) and will tend toward reducing price and profits to all firms. Ultimately this process will result in prices being equal to the minimum average cost for the most efficient size firms, which for them, will mean only normal profits.

The theory of production and costs is always an experimental process for producers where variations in the quantity and quality of resources available for production as well as the prices of factor inputs are subject to uncertainty. For hog producers both risks and uncertainties exist as real conditions for business operations.

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[9]Again, if the expected short run losses are less than the expected direct capital loss incurred by liquidation of the firm, the entrepreneur may "gamble" to stay. Typically, this situation is rather unique in that it requires that either we redefine the short run or that the short run loss is a spurious condition that is a result of almost complete uncertainty. Implied in the average cost curves is the element of risk as a cost--this is necessarily a part of the definitions of normal profit as a cost of production both for variable as well as fixed costs. If the risks are not fully accounted for in costs then it is presumed that the firms' costs are not effectively defined.

Nevertheless, costs can be approximated with some degree of accuracy and the effects of the theory of production costs can be specified. Thus the effects of size of firm on costs is one of the uncertainties and/or risks which hog producers need to have more information about to conduct better and more effective business operations.

CHAPTER III

A SELECTED REVIEW OF LITERATURE

Recent developments in the structure of many industries have resulted in increasing firm size over time. Large scale specialized operations now exist. A variety of research studies in agriculture and related areas have been undertaken to determine if economies of size were present. These studies show the relationship between cost per unit of productive output and size.

As examples of economies of size, the following are reviewed: (1) a 100,000 quart milk processing plant and various cold storage systems, (2) beef feedlots in Colorado, (3) cash grain farms in a highly commercialized agriculture, and (4) confinement finishing of hogs. Additional research concerning budgets for farrowing, nursery, and growing-finishing systems are also reviewed. Emphasis is placed on budgets since this technique is used in this study. Specific research regarding supplemental heat vs. bedding is presented as well. All the research reviewed is quite selective and is an effort to search for knowledge concerning the use of limited resources to produce a given output at the lowest cost or to budget different systems of producing a product.

100,000 QUART-PER-DAY MILK PLANT

Research by Devino and others examined the economies of size in fluid milk processing for plants above the 100,000 quart-per-day level.[10] This study was selected for review because it utilized similar techniques of analysis that are used in the present study. Synthesized data and the budgeting technique were utilized in estimating costs at various levels of output. Similar procedures were also used in this study.

Equipment and facilities were selected with the objective of achieving minimum operating cost per unit. Four cold storage systems were evaluated to reflect the advances in material handling technologies in fluid milk processing. In the Hollywood system, all products were handled manually. The second system used a palletized method of handling wholesale production, and retail production was handled by the Hollywood system. Additional systems included loading of trucks by either the truck drivers or by fork lift machines.

The model plant added labor saving equipment as long as the present value of the labor saving device was greater than the investment cost. A capital cost of

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[10]Gary Devino, et al., Economies of Size in Large Fluid Milk Processing Plants. (Vermont Agricultural Experiment Station, MP62, May, 1970).

6 percent was used and labor was charged at $4.22 per hour. Investment in equipment including the cost, installation and shipping was $983,649. The investment in the 100,000 quart-per-day building amounted to $574,120 or $18.48 per square foot. The 3 acres of land represented an outlay of $25,000. Cases used for the handling of the milk products was considered an investment of $64,713. With the output at 100,000 quart equivalent per day, the cost per quart equivalent was approximately $.034 per quart.

Examining the four cold storage systems, the Hollywood alternative had the lowest daily operating cost and also the lowest investment at $208,630. The daily operating costs were $314.07, $361.84, $368.01, and $343.01 for various alternatives presented.

BEEF FEEDLOTS IN COLORADO

An economies of size study of beef feedlots in Colorado conducted by Hunter and Madden[11] found that the cost per head decreased as the number of cattle fed increased. The average feeding cost per head fell rapidly as the size of the feedlot was expanded to 1,500 head.

The objectives of their research was to examine the internal physical economies of size in the cattle feeding

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[11]Elmer G. Hunter and J. Patrick Madden, Economies of Size for Specialized Beef Feedlots in Colorado. (Agricultural Economic Report No. 91, Economic Research Service, U.S.D.A., Washington, D.C., May, 1966).

industry. Three of their 5 specific objectives were: (1) to compare the investment and average operating cost per head for feedlots of various capacities using different equipment combinations for feeding; (2) to compare the investment and average operating cost per head for feedlots of various capacities for specified equipment combinations; and (3) to determine the least-cost organization and method of operation for various feedlot capacities.

The analytical procedure used was the synthetic budgeting technique using hypothetical equipment combinations and different levels of utilization for feedlot capacities from 135 to 15,300 yearling steers. The day-to-day costs were processing feed, distributing the feed, and handling and caring for the steers. Labor required was charged at the going wage rate. Interest for operating expense was figured at 6 percent. Data for the operating cost were obtained from interviews with cattle feeders, agri-business firms, other research, operators of feed mills, and the Colorado Tax Commission.

Interest costs on investment in facilities, machinery, and land was calculated at a 5 percent rate. Depreciation charges were based on the straight line basis--10 percent salvage and life ranging from 8 to 20 years. Data for the major investment items were based on actual purchase cost, prices quoted by lumberyards, wholesalers, processors, contractors, and machinery dealers.

The analysis of the Beef Feedlot Study resulted in 2 general conclusions. These were: (1) powerbox feeding was cheaper than hand feeding when resources were priced at market rates; and (2) costs were reduced by owning and operating an appropriate size feed mill in relation to the number of cattle on feed.

CASH CROP FARMS

In an economy of size study by Carter and Dean,[12] 37 farmers were interviewed to obtain cost data. Four acreage classes considered were: 160-320 acres, 320-640 acres, 640-1,200 acres, and greater than 1,200 acres. For each acreage category a representative set of equipment or machines were specified. Planning curves (LRAC curves) were derived by budgeting, linear programming, and regression methods. The cost curves developed by budgeting are of particular importance since this was essentially the approach used in this study.

Farm size expansion was limited in the short run by the fixed resources of machinery and equipment. The capacity of power machinery limited expansion in each of the 4 size categories. Limitations, institutional in nature, were government allotments, contracts, landlord

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[12]H. O. Carter and G. W. Dean, "Cost-Size Relationship for Cash Crop Farms in a Highly Commercialized Agriculture." Journal of Farm Economics, XLIII, May, 1961), 264-277.

requirements, and crop rotations. Labor, operating capital, land and all other resources were considered variable. The empirical procedure was to budget costs for the 4 machinery size groups, then an envelope cost curve was approximated to the 4 short-run cost curves.

The long-run average cost curve declined rapidly to an output of about $150,000-$180,000 (750-900 acres), then the curve tended to level out. For budgeting at the $100,000, $240,000, and $440,000 output levels, the cost per dollar of revenue received, respectively, was $0.80, $0.72, and $0.68. For linear programming, the envelope curve derived was U-shaped with $0.70, $0.65, and $0.72, respectively, for the above levels of output. Farms larger than 1,420 acres or over $240,000 output experienced diseconomies due to economic and institutional limitations.

If expansion exceeded 180 acres, greater profits per unit for the farms studied were realized. An operator in the 750-900 acre range had gained most of the cost economies available. This means that an operator in this size range can compete closely on a per unit cost and profit basis with still larger farms.

SWINE RESEARCH

Research by Bitney and Henderson at the University of Nebraska on hog operations examined capital requirements, labor requirements, and cost of production for both the

conventional system (open front shed with a feeding floor in front) and the enclosed confinement system.[13]

The source of data was from mailed questionnaires to farmers. Cost estimates were based on replies from 30 farmers using the controlled environment confinement system and 92 farmers using the open front shed system with a feeding floor in front. Of these 122 farmers, 32 farms were selected and were asked to keep a record of labor required by their swine enterprise for one week. These records served as a check against estimated labor requirements.

Capital requirements were based on the dimensions and the characteristics of buildings and equipment actually used by the producers visited. The data were gathered and examined by both the cooperator and agricultural engineers. Three sizes were budgeted for comparison of the two systems of production. These sizes were 107, 226, and 375 market hogs. (See Table III-1). This research shows that the total cost per hog was greatest for the commercially designed and built system and lowest for the conventional system for the 3 capacity systems.

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[13]Larry L. Bitney and Philip A. Henderson, Confinement Finishing of Hogs Cost Comparison, E. C. 68-835, University of Nebraska College of Agriculture and Home Economics, Lincoln, Nebraska, n.d.).

Table III-1

Estimated Construction Costs of Standard Swine Finishing Systems

Size & Type of System	Building Dollars	Equipment Dollars	Lagoon Dollars	Total Dollars	Cost Per Hog Dollars
107 Head Capacity					
Environment Controlled					
(a) Farm built	3,570	1,245	165	4,980	46.50
(b) Commercially designed and built	5,015	1,726	165	6,906	64.50
Conventional	1,439	675	165	2,279	21.25
226 Head Capacity					
Environment Controlled					
(a) Farm built	5,783	2,027	299	8,109	36.00
(b) Commercially designed and built	9,248	3,182	299	12,729	56.50
Conventional	2,923	1,224	299	4,446	19.75
375 Head Capacity					
Environment Controlled					
(a) Farm built	8,333	2,917	420	11,670	31.00
(b) Commercially designed and built	13,958	4,792	420	19,170	51.00
Conventional	4,730	1,809	420	6,959	18.50

Source: Bitney and Henderson, op. cit., page 32.

The building and equipment investment, on an annual basis, was then examined for the 3 size capacity plants considering depreciation, equipment, taxes, interest, insurance, and repairs for building and equipment. For annual building and equipment costs this research showed that as the size of the system increased, cost per hog decreased regardless of whether it was a farm-built unit, a commercially-constructed environment-controlled structure, or a conventional system. For the commercially-built system (10 year life) the cost for buildings and equipment in the 107, 226, and 375 head capacity systems were respectively $3.54, $3.08, and $2.80 per hog marketed.

Two alternative sets of assumptions were made regarding feed conversion rates by hogs in this study. First, no difference between the environment-controlled and conventional systems existed. Second, a 5 percent difference in feed conversion in favor of the environment-controlled systems would exist. A building life of 10 years and of 15 years were considered for both the equal-feed conversion assumption and the 5 percent difference in feed conversion assumption. Table III-2 summarizes the results of this research.

Purdue researchers[14] examined farrowing costs from the time the sow farrowed to 21 days after farrowing. Five

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[14] R. Daniel, et al., Productivity and Cost of Swine Farrowing and Nursery Systems, (Research Progress Report 315, Purdue University, Agricultural Experiment Station, Lafayette, Indiana, September, 1967).

Table III-2

Relative Costs of Finishing a Market Hog as Affected by Depreciable Life of Building and Rate of Feed Conversion

	Built by Farmers Dollars	Commercially Built Dollars	Conventional Dollars
10 year building life - equal feed conversion			
Building and equipment	1.97	3.08	1.08
Feed (160 pound gain)	14.04	14.04	14.04
Labor ($2.00 per hour)	.55	.55	.99
Bedding	--	--	.40
Veterinary and medicine	.18	.18	.14
Death loss	.33	.33	.33
Electricity	.40	.40	.08
Marketing	.80	.80	.80
Interest (hog and feed)	.41	.41	.41
Taxes (hog)	.13	.13	.13
Total - less feeder pig	18.81	19.92	18.40
Feeder pig (50 pound)	13.60	13.60	13.60
Total cost (210 pound hog)	32.41	33.52	32.00
Returns (210# x $16 per cwt.)	33.60	33.60	33.60
Returns over cost	1.19	.08	1.60

Table III-2 (continued)

	Built by Farmers Dollars	Commercially Built Dollars	Conventional Dollars
10 year building life - 5% difference in feed conversion			
Feed (160 pound gain)	13.34	13.34	14.04
Total cost - (210 pound hog)	31.71	32.82	32.00
Returns over costs	1.89	.78	1.60
15 year building life - equal feed conversion			
Building and equipment	1.67	2.62	.92
Total cost - (210 pound hog)	32.11	33.06	31.84
Returns over costs	1.49	.54	1.76
15 year building life - 5% difference in feed conversion			
Building and equipment	1.67	2.62	.92
Feed (160 pound gain)	13.34	13.34	14.04
Total cost - (210 pound hog)	31.41	32.36	31.84
Returns over costs	2.19	1.24	1.76

Source: Bitney and Henderson, op. cit., page 32.

different enclosed farrowing systems and 1 individual housing system were studied. The individual-housed sow's pigs weighed .5 pounds more than the pigs farrowed in the enclosed systems. Pigs farrowed in the enclosed systems were similar in weight.

The total costs of the six systems were similar--about $32.00 per sow and litter. The lower building and equipment costs of the individual houses were offset by higher feed, labor, and bedding costs. The enclosed systems had higher investment costs, but these were offset by lower labor and bedding requirements.

The individual houses required about $100 to $200 less investment per sow and litter than the enclosed systems. With regard to the labor requirement, .66 to 1.75 hours more labor was necessary in the individual house system when compared with the confinement systems. Table III-3 gives the budgeted cost projected to 32-sow units for farrowing systems from 0 to 21 days of age.

Additional work regarding nursery systems was examined using four different systems.[15] Costs were charged from 21 days of age to 56 days of age. Total costs were about $0.70 per pig lower in the pole nursery than in the two enclosed slotted-floor systems and the individual houses. Death losses in the pole nursery were 1.5 to

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[15]Ibid.

Table III-3

Budgeted Costs for Seven Farrowing Systems From Farrowing to 21 Days of Age

Item	Sows Fed Inside				Sows Fed Outside		
	Crates Concrete Floor	Concrete Floor	Crates Raised Slotted Floor	Crates Slotted Floor With Pit	Crates Concrete Floor	Pens	Individual Outside Houses
	Dollars	Dollars	Dollars	Dollars	Dollars	Dol.	Dollars
Bldg. & equip.	10.31	10.61	11.31	12.12	9.38	10.45	9.29
Feed	5.06	5.06	5.06	5.06	5.06	5.06	6.61
Labor							
Cleaning & bedding	2.66	2.66	1.53	.40	1.33	1.27	.30
Feeding	.81	.81	.81	.81	3.33	3.13	2.83
Cleaning between farrowing	2.00	3.00	2.50	2.50	1.83	1.50	4.00
Misc.	.58	.58	.58	.58	.58	.61	.61
Bedding	--	--	--	--	--	.65	.63
Veterinarian & drugs	3.60	3.60	3.60	3.60	3.60	3.60	2.81
Sow & death loss	.80	.80	.80	.80	.80	,80	.80
Electricity	3.65	3.65	3.65	3.65	3.65	3.65	2.80
Other costs	1.86	1.86	1.86	1.86	1.86	1.86	1.90
Total cost/sow and litter	31.33	32.63	31.70	31.88	31.42	32.58	32.58
Invest/sow cap.	338.15	348.15	375.36	391.49	294.33	324.84	202.65
Hours labor/sow and litter	3.03	3.53	2.71	2.15	3.54	3.26	3.87

Source: Daniel, et. al., op. cit., page 36.

2.5 percent higher than in the other 3 nursery systems. However, these losses were offset by pigs in the pole nursery because they gained .1 pound per day more than did the pigs in the 2 enclosed slotted-floor nursery units, and .16 pound per day more than the pigs in the individual houses. Table III-4 gives the budgeted costs for 4 different nursery systems.

In another study at Purdue,[16] little difference was shown in the cost of producing hogs using systems ranging from pasture-portable houses to a completely slotted semi-controlled environment. The enclosed slotted floors required 60 percent less labor but required 200 percent more investment capital than either the pasture-portable house or pole building systems.

The investment in buildings and equipment for conventional and confinement systems were compared. The non-feed costs per hog and the investment costs per hog for the confinement system were about twice that of the conventional system. However, other savings partially offset the higher building costs for the confinement system. Total costs were generally only slightly higher for the confinement system when compared with the conventional system.

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[16] J. E. Kadlec, et al., Comparison of Swine Growing Finishing, Building Systems, (Research Bulletin 816, Purdue University, Agricultural Experiment Station, Lafayette, Indiana, August, 1966).

Table III-4

Budget Costs for Different Types of Nursery Systems

Item	3 Week Weaning		6 Week Weaning	
	Total Slats Dollars	Partial Slats Dollars	Pole Nursery Dollars	Individual Houses Dollars
Building and Equipment	.80	.77	.55	1.05
Feed	2.69	2.69	2.08	1.72
Total labor	.23	.27	.52	.82
Bedding	--	--	.06	.06
Veterinary and drugs	1.15	1.15	1.15	1.13
Death loss	.48	.48	.84	.61
Electricity	.93	.93	.13	.37
Sow weight loss	--	--	.12	.40
Other costs	.42	.42	.57	.57
Total cost per pig	6.70	6.71	6.02	6.73
Investment per cap.	26.64	25.41	15.39	22.52

Source: Daniel, et. al., op. cit., page 36.

Another study compared bedding costs and gas heat costs in open-front growing-finishing houses.[17] The study began on November 15, 1966 and was concluded on March 9, 1967. The purpose of the research was to determine whether bedding with no heat or gas heat and no bedding gave a better rate of gain and feed conversion in open-front growing-finishing houses.

A 20' by 36' open-front building with a front south door that extended to within 3' of the floor was used. The building was divided into 2 sides with 43 pigs per side. One side was bedded with wheat straw on an as needed basis, and the other side used a 3,000 B.T.U. gas heater during the comparison period.

Hogs in the bedded side gained .2 pound per day faster than the pigs in the non-bedded gas heated side. Thus the hogs in the bedded side required 15 pounds less feed per 100 pounds of gain. The bedded and non-bedded areas required .61 and .64 hours of labor per hog, respectively. The conclusion was that cost per hog was $2.19 higher in the gas heated non-bedded side than in the straw bedded non-heated side.

Another publication summarized a 4 year study of the value of bedding and supplemental gas heat in open-front

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[17] H. W. Jones, et al., A Comparison of Bedding vs. Gas Heat in Open-Front Growing-Finishing Houses, (Research Progress Report 313, Purdue University, Agricultural Experiment Station, Lafayette, Indiana, September, 1967).

swine finishing buildings.[18] The following conclusions were set forth: (1) hogs subjected to the bedded open-front growing-finishing building had a better daily rate of gain and feed utilization than hogs subjected to the gas supplemental heat and no bedding; and (2) the added cost of obtaining and handling bedding is more than offset by the improved performance of the pigs that are bedded when compared with the cost and performance of pigs that have been given supplemental heat and no bedding.

A considerable amount of research has been done with segments of the hog production process, with specified techniques, and with specified building capacity. Specific research involving economies of size up to approximately 300 market hogs per year for conventional and confinement facilities has been completed. Hence, research involving operations up to 10,000 head for the conventional and confinement systems at different farrowing levels would seem of value to agriculture.

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[18] J. E. Mentzer, et al., "Evaluation of Bedding and Supplemental Heat for Growing-Finishing Swine in Open-Fronted Housing," (Purdue University, Agricultural Experiment Station, Lafayette, Indiana, n.d.).

CHAPTER IV

RESEARCH PROCEDURE AND METHODOLOGY

In this study, budgeting is used as the principle research technique. All fixed costs and operational costs were synthesized from data acquired from farmers, agri-business firms, and professional people in engineering, agronomy, and the animal sciences and from other cost studies.

Physical production plants for farm enterprise(s) of specified capacities are being designed each day from which estimates of the costs of production can be derived. Estimation of construction costs for buildings and equipment costs are essential to determine the feasibility of the actual construction. Included in feasibility costs are estimates for manpower requirements, or labor. For purposes of this study, labor was estimated by job analysis, and the variable or operational costs were estimated by cost analysis. The coefficients or values for the variable costs were calculated using both known cost data and technical information from engineering, agronomy, and the animal sciences. Research by agricultural economists has revealed that technical coefficients are affected by the management and the practices used in the production of a product. Thus, this study attempts to modify purely technical

coefficients and provide better cost data for different levels of production.

A farmer considering building or adjusting his swine enterprise has to plan the system and budget to determine if profits will result, under his limitations and operational goals. As a farmer considers his swine enterprise, the following questions should be considered:

(a) How many hogs will be produced and how many farrowings per year?

(b) What production system shall be used--pasture, confinement, or conventional?

(c) What type of feeding, feed mixing, and manure handling facilities will be used?

(d) What buildings are needed, and will the environment be controlled?

SELECTION OF MODEL SIZES - MARKET HOG CAPACITY

Selection of the capacity size was determined by considering the smallest number of hogs that would be likely to be produced, the number of hogs that are typically produced, and the potential growth of the hog enterprise up to 10,200 market hogs per year. The Table IV-1 indicates six capacity levels, the number of sows, and the number of pigs weaned for the two, four, and six farrowing levels per year with the number of pigs saved calculated at 8.5 and 7.0 pigs per litter. Table IV-2 also presents the

seventy-two different budget combinations developed for this analysis giving the number of market hogs actually sold or marketed. Table IV-2 has taken into account the 1.2 percent death loss which occurs after weaning.

Table IV-1

The Number of Sows for the Selected Six Capacities and the Number of Pigs Weaned for Three Farrowing Intensities and Two Litter Sizes

Capacity Level	No. of Sows	Intensity levels* 2 Farrowings per year		4 Farrowings per year		6 Farrowings per year	
		No. of pigs		No. of pigs		No. of pigs	
		8.5	7.0	8.5	7.0	8.5	7.0
1	8	136	112	272	224	408	336
2	30	510	420	1020	840	1530	1260
3	60	1020	840	2040	1680	3060	2520
4	100	1700	1400	3400	2800	5100	4200
5	150	2550	2100	5100	4200	7650	6300
6	200	3400	2800	6800	5600	10200	8400

* 2 Farrowings per year--1 group of sows farrowed twice per year.
4 Farrowings per year--2 groups of sows farrowed twice per year.
6 Farrowings per year--3 groups of sows farrowed twice per year.

DATA REQUIREMENTS AND SOURCES

Data requirements were prices of inputs, technical input coefficients, and output coefficients. Production coefficients were obtained from independent research and

Table IV-2

The 72 Different Hog Models Representing Six Capacities, Three Farrowing Levels, Two Litter Sizes and Two Systems of Production

Capacity	2 Farrowings				4 Farrowings				6 Farrowings			
	CV* 8.5**	CV 7.0**	CF* 8.5**	CF 7.0**	CV 8.5**	CV 7.0**	CF 8.5**	CF 7.0**	CV 8.5**	CV 7.0**	CF 8.5**	CF 7.0**
	Number of Mkt. Hogs				Number of Mkt. Hogs				Number of Mkt. Hogs			
1	134	110	134	110	268	222	268	222	404	332	404	332
2	504	415	504	415	1008	830	1008	830	1515	1240	1515	1240
3	1008	830	1008	830	2040	1680	2040	1680	3024	2490	3024	2490
4	1680	1382	1680	1382	3360	2766	3360	2766	5040	4150	5040	4150
5	2520	2074	2520	2074	5038	4150	5038	4150	7558	6224	7558	6224
6	3360	2766	3360	2766	6718	5530	6718	5530	10078	8300	10078	8300

* CV refers to the conventional system; CF refers to the confinement system.
**Refers to net litter size assumed.

research results available in extension publications by The University of Missouri, Illinois, Kansas State and Purdue, and agri-business firms.[19] Farm management and production economists, an agricultural engineer, and an animal science nutritionist contributed to the development of these coefficients.

Prices used were those reported by farm supply firms and by dealers in the Central District of Missouri. Competitive brand farm supply and equipment catalogs for 1970 were also used to establish reasonable price data.[20] All prices were quoted prices. No allowance was made for trading or the farmer's ability to bargain on various deals involving purchases of equipment, buildings, or breeding stock.

BASIC ASSUMPTIONS

To facilitate the budgeting process, the following assumptions were made for this study:

(1) Capacity levels were based on the assumption of 8.5 pigs farrowed and saved per sow. However, budgets were established for both the 8.5 pigs per litter level and for 7.0 pigs per litter.

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[19]A list of material secured from agri-business firms can be found in Appendix B, Table A. Extension publications are cited in the Bibliography.

[20]A list of material used to obtain prices are given in the Appendix B, Table B.

(2) All pigs were fed the same ration regardless of the production system. The rations met the nutritional requirement level as recommended by the National Research Council (NRC) Committee for each weight category of the market pig and for the various physical conditions for the breeding stock such as gestation, lactation, and for the period of time just prior to breeding.

(3) Comparable sets of facilities for a given capacity level were utilized in the production of hogs for all systems. Costs for farrowing, growing, and finishing buildings were synthesized for each capacity level with the number of buildings and facilities dependent on the number of hogs produced and the intensity of farrowing.

(4) It was assumed that there were no differences in feed conversion or feed efficiency among the different production systems. The rate of gain is assumed to be the same for all systems and for all size levels within a system. While some studies show some differences in feed conversion among different systems, this was not considered to be within the scope of this study.

In the study done by Bitney and Henderson at Nebraska, costs were calculated based on an equal feed conversion for both the confinement and conventional systems.[21] Also a 5 percent better feed conversion rate favoring the confinement system was calculated.

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[21] op. cit., p. 32.

Dr. E. S. Bell of the Virginia Polytechnic Institute in our correspondence wrote,

> As you will note from the publication, we found that extensive control of the environmental temperatures did not affect growth rate when compared to our natural climate, and therefore have discounted this particular project.[22]

Bell's research in southeast Virginia consisted of one building completely enclosed and equipped to control temperature at an optimum condition of 65-70°F. Another building was of the open-shed type construction with its temperature allowed to vary with the natural weather conditions. The rate of gain, feed conversion efficiency, and carcass quality were found not to be significantly different.

An environmental-controlled system can be designed and/or managed in such a way that a poorer rate of gain and feed conversion results when compared with the conventional system. The producer's own management ability may be the most crucial factor in determining the efficiency of the actual feed conversion rather than differences between these two systems.

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[22]E. S. Bell, et al., "Effects of Controlled Temperatures, Slotted Floors, and Space Allowances on Swine Production in Southeastern Virginia," Research Division Report 134 (Virginia Polytechnic Institute, Blacksburg, Virginia, August, 1969).

(5) The inputs that go into the hog enterprise and the output were assumed to be homogeneous. The inputs of corn, soybean oil meal, labor, and the other facilities were considered homogeneous. The output was assumed to be a 220 pound No. 1 market hog.

(6) It was assumed that only the hog enterprise was to be examined even though most hog producers have a regular farming operation. This assumption ignores any supplementary, complementary, and other competitive enterprises.

(7) Volume purchases were not considered, though some pecuniary economies were built into the models with such items as electric motors, electricity, and building capacity. There were dimensional relationships causing an increasing return to size for buildings.

Volume discounts were found in the feed market in a study by Bursch.[23] These discounts took the form of a single purchase discount, an annual-usage discount, or a monthly usage discount. Discounts were also present in lieu of services provided by feed dealers and customer relationships. Discounts of this type included bulk discounts, pickup at dealer discounts, pickup at manufacture, and cash discounts.

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[23]William G. Bursch, "Price Structure and Service Costs in the Retail Feed Market in Illinois," Research Report AERR-100 Department of Agricultural Economics, Agricultural Experiment Station, (University of Illinois, College of Agricultural, Urbana, Illinois). September, 1969.

COST COEFFICIENT ASSUMPTIONS AND METHODOLOGY

(1) Buildings were assumed to last fifteen years and were constructed new by commercial contractors. The fact was recognized that many hog producers would assist or build their own buildings. An old barn or shed can be remodeled and worked into the hog enterprise, but this possibility was not considered. Buildings were assumed to have no salvage value and were depreciated, using the straight line method. The floors of the buildings were constructed of concrete. The conventional system's floors were solid concrete. The confinement system building floors were concrete, but were partially or completely slotted. The cost of slotted floors runs close to $0.75 per square foot including reinforcement rods and amortization of the slotted floor forms.

(2) Repairs and maintenance of buildings were estimated at 2 percent of the initial cost per year.

(3) Equipment consists of self feeders, automatic waterers, farrowing crates, augers, electric motors, heaters and mechanical equipment such as a tractor, manure handling equipment, a feed grinder, and associated milling equipment. Equipment was assumed to last ten years with a 5 percent charge of the new price allocated for repairs per year. At the end of ten years, the items had a 20 percent salvage value. The only exception was the

ventilation system which was calculated on a fifteen year base and with a 20 percent salvage value.

(4) Insurance on buildings, equipment and breeding stock per year was calculated at .05 percent of the purchase price.

(5) Land charges were calculated on the basis that each 1,000 hogs required eight acres. Eight acres of land per 1,000 hogs was assumed necessary for a building site, lagoon, drainage area, and manure spreading. The land was valued at $400 per acre and a 6 percent charge for interest was assumed per year. Taxes per acre were assumed at $4.00 per acre per year.

(6) Bedding or straw was calculated at $0.60 per sow per farrowing. Straw was budgeted only for the conventional system.

(7) Labor was the most crucial and the most difficult factor to measure. Labor coefficients were built on the basis of secondary sources of data--primarily, though not exclusively, from research conducted by other universities.

Job analysis was conducted by estimating the number of men and the time per man to perform each and every operation involved in the production of hogs. The operations included (a) the cleaning, washing, and bedding of sows; (b) feeding of sows during lactation, gestation, and prior to breeding; (c) feeding of boars; (d) feeding of market

hogs in the growing phase and finishing phase; (e) observation time during lactation, gestation, farrowing, breeding period, and the growing and finishing phases; (f) the time involved with iron shots, worming, castration, needle teeth removal and erysipelas shots; (g) records; (h) repair on buildings and equipment; (i) sorting of hogs; (j) manure removal and disinfecting. The labor cost was then charged at $3.00 per hour. While this figure is higher than shown in other studies, adjustments account for both inflation and opportunity costs for Missouri farmers.

Coefficients developed by other universities were also used to estimate labor costs. A study was done at Purdue University in 1956-57 involving a two litter system with sows farrowing in the spring and in the fall.[24] With 8.5 pigs born per sow and 6.8 pigs marketed, the average labor coefficient required for a twenty-eight sow unit was 1.0 hours per each 100 pounds of pork produced. Table IV-3 shows the labor coefficients for seven different capacities obtained from 118 enterprises studied. In the mid 1950s the conventional system was the major method used in swine production. In Baumons' study, the absence of known labor inputs for the conventional system required the use of rough estimates for the conventional technical labor coefficients. However, the technology used

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[24]Ronald H. Baumons, et al., "Economies of Size and Economic Efficiency in the Hog Enterprises," Research Bulletin No. 699, (Agricultural Experiment Station, Purdue University, Lafayette, Indiana). September, 1961.

Table IV-3

Labor Requirements as Related to Size of the Enterprise, Central Indiana 1956 and 1957. In Hours and Dollars

Labor Item	Number of Sows							
	Av.10	10-19	20-29	30-39	40-49	50-59	60	Average 28 sows
Hours per 100 lbs. of hogs produced	1.3	1.1	1.0	.9	.8	.7	.6	1.0
Hours per sow & two litters	34	31	29	27	24	20	19	28
Average cost per 100 lbs. of hog produced at $2.00 per hour	$ 2.58	$ 2.19	$ 2.08	$ 1.79	$ 1.51	$ 1.48	$ 1.37	$ 1.97
Labor cost to weaning per sow and litter	$28.22	$21.74	$18.92	$18.71	$17.14	$16.52	$16.09	$18.40
Labor cost to market per sow and litter	$42.12	$32.45	$28.24	$27.92	$25.58	$24.65	$24.02	$27.46
Labor cost from weaning to market	$13.90	$10.71	$ 9.21	$ 9.21	$ 8.44	$ 8.13	$ 7.93	$ 9.06

Source: Baumon, et al., op. cit., p. 51.

in the swine industry has changed drastically over the past fifteen years and labor inputs appear to have decreased sharply.

In more recent years Purdue researchers budgeted labor costs for a thirty-two sow farrowing unit.[25] Costs were calculated from farrowing to twenty-one days of age. Table IV-4 presents the labor input charged at $2.00 per hour. Labor included time for feeding, bedding, and cleaning of the sows. The cleaning included preparations for the next farrowing. The chores that were not included in the labor charge were hauling manure, grinding, and hauling feed. Miscellaneous charges included washing and weighing the sows when entering the farrowing unit, ear notching the pigs, removal of needle teeth, placing of iodine on navels, giving iron shots, and weighing the pigs after birth. With the same assumptions, labor costs were budgeted for a thirty-two sow herd for the nursery stage of production. Table IV-5 presents the labor input up to three weeks of age for confinement and up to six weeks of age for pole nursery, referred to in the present study, as the conventional system of farrowing hogs.

Table IV-6 presents the labor data recorded during each experiment in the comparison of swine growing-finishing research conducted by Purdue University researchers. Labor for cleaning and bedding were the actual labor requirements for the experiment while labor for feeding and observing

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[25]Daniel, et al., op. cit., p. 36.

Table IV-4

Labor Cost for a 32-Sow Unit from Farrowing to 21 Days of Age for Selected Farrowing Systems

	Sows Fed Inside			Sows Fed Outside	
	Crates Concrete Floor	Crates Raised Slotted Floor	Crates Slotted Floor With Pit	Crates Concrete Floor	Pen
Labor cleaning and bedding ($)	2.66	1.53	.40	1.33	1.27
Feeding ($)	.81	.81	.81	3.33	3.13
Cleaning between farrowings ($)	2.00	2.50	2.50	1.83	1.50
Miscellaneous ($)	.58	.58	.58	.58	.61
Labor/Sow and litter (Hours)	3.03	2.71	2.15	3.54	3.26

Source: Daniel, et al., op. cit., p. 36.

Table IV-5

The Labor Cost Budgeted for a 32-Sow Herd Unit For the Nursery State of Production

	3 Week Weaning		6 Week Weaning
	Total Slats	Partial Slats	Pole Nursery
Labor:			
Cleaning and bedding ($)	.0	.0	.2
Feeding ($)	.08	.08	.12
Cleaning between groups ($)	.11	.11	.08
Labor per pig (Minutes)	6.91	8.11	15.62

Source: Daniel, et al., op. cit., p. 36.

Table IV-6

Labor Used Per Hog for Various Systems
Winter versus Summer

	A	B	C		D		
	Conventional Pens 18' x 20' Inside and Outside	Enclosed Partially Slotted Floor 4¼' x 14' Pens	Enclosed Concrete Floor 18'x18' Pens	Enclosed Partially Slotted 18'x18' Pens	Enclosed Partially Slotted 1¼" Slats 18'x18' Pens	Enclosed Slotted Floor 4" Slats 18'x18' Pens	Pasture Portable House
Winter			Minutes Per Hog				
Cleaning/Bedding	29	5	13	11	3	3	
All other	24	30	30	30	36	30	
TOTAL	53	35	43	41	39	33	
Summer							
Cleaning/bedding includes clipping pasture and filling mud holes	40	5	35	22	3	3	18
All other	24	30	30	30	36	30	36
TOTAL	64	35	65	52	39	33	36
Average per hog Summer and winter	58.5	35	54	46.5	39	33	54

Source: Kadlec, et. al., op. cit., page 38.

pigs was estimated using other studies and direct farm observations. From the table one can observe the buildings having slotted floors (under columns labeled D), and the partially slotted floor buildings (under columns labeled B) required twenty to thirty minutes less time per hog for cleaning and bedding than did the conventional systems. Six to twelve minutes more observation time was alloted to the high-density confinement system buildings and pasture type operations. Buildings (under columns labeled C) (completely concrete enclosed) required about the same labor as the conventional systems. The partially slotted floor buildings under column C require about ten minutes less labor than the conventional and pasture systems.

Bitney and Henderson also showed there was a difference in labor requirements per hog related to the size of the operation. Labor efficiency increased as the size of operation increased. Table IV-7 presents the labor required per hog. The time required per hog included labor for observation, adjustment of equipment, cleaning and bedding, washing, spraying, disinfecting, maintenance, medication, and record keeping. Labor which was not included was time for feed processing, filling bulk tanks, or hauling manure.

Table IV-8 shows the labor required for finishing hogs for the conventional and confinement systems by jobs. The open front system requires almost twice the labor time

in comparison with the confinement system. The other labor item in Table IV-8 was time spent for medicating, marketing, acquiring hogs, and record keeping. Time for feeding, feed processing, and manure handling were not included in Table IV-8.

Table IV-7

Average Labor Requirements for Three Size Capacities for Conventional and Confinement Systems in Nebraska, 1964

Size	Labor Required Per Hog	
200 # Hog Capacity	Environment Controlled System Minutes	Conventional System Minutes
Group 1 (100-149)	21.0	45.5
Group 2 (150-249)	16.6	29.8
Group 3 (250-800)	16.3	26.0

Source: Bitney and Henderson, op. cit., p. 32.

Table IV-8

Average Labor Requirements by Jobs for Confinement and Conventional Production Techniques

	Labor in Minutes Required Per Hog	
	Confinement	Conventional
Observation and Adjusting	9.6	4.0
Cleaning and Bedding	2.7	22.9
Washing and Disinfecting	1.4	2.5
Maintenance	1.2	.8
Other	2.5	3.5
Total	17.4	33.7

Source: Bitney and Henderson, op. cit., p. 32.

Research conducted by Van Arsdall presented labor coefficients for pasture and confinement systems.[26] Of particular interest was his labor coefficients for confinement. Caution must be used with these coefficients as the data are generally suited to operations ranging from fifty to 800 litters.

Table IV-9 presents an estimate of the monthly and annual labor requirements for the confinement system. Van Arsdall's labor requirements of Table IV-9 were based on a farm management manual, detailed cost reports, labor records kept at a research farm, and other research involving farrowing and slotted floors. The labor coefficients contain an estimate of 15 percent of total labor requirements as indirect or overhead labor requirements. Indirect labor examples are mowing fence rows, care of service drive, and repair of general farm buildings.

(8) Total death losses were assumed to be 1.2 percent of the total number of pigs weaned at either the 8.5 litter size or the 7.0 litter size for all capacity levels and all farrowing intensity levels. These losses were divided assuming that 0.6 percent would occur in the

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[26] Roy N. Van Arsdall, "Resource Requirements, Investment, Costs, and Expected Returns From Hog Production Systems in Illinois, 1965," AE-4074, Illinois Agricultural Experiment Station, University of Illinois, Urbana, Illinois, 1965.

Table IV-9

Monthly Labor Requirements Per Litter for Selected Systems of Raising Hogs in Confinement

	Labor (Hours Per Litter)												
	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Two litters													
Jan-July	1.14	.60	.76	.65	.67	.74	1.11	.64	.79	.61	.61	.74	9.06
Feb-Aug	.74	1.13	.62	.76	.67	.64	.71	1.17	.65	.73	.61	.63	9.06
March-Sept	.63	.73	1.15	.62	.78	.64	.61	.77	1.18	.59	.73	.63	9.06
Four Litters													
Jan-Apr-July-Oct	.89	.62	.75	.90	.66	.74	.86	.65	.78	.87	.60	.74	9.06
Feb-May-Aug-Nov	.74	.88	.64	.75	.92	.63	.71	.92	.66	.72	.87	.62	9.06
March-June-Sept-Dec	.62	.73	.90	.64	.77	.89	.60	.77	.93	.60	.72	.89	9.06
Six Litters													
Jan-March-etc.	.84	.65	.85	.67	.87	.66	.81	.69	.88	.65	.83	.66	9.06
Feb-April-etc.	.66	.83	.67	.85	.69	.84	.63	.87	.70	.83	.65	.84	9.06

Source: Van Arsdall, op. cit.

100-150 lbs. weight category and 0.6 percent would occur in the 150-220 lbs. weight category. Death losses were assumed to be identical for both the conventional and confinement systems. This 1.2 percent estimate was based on the percent death losses used in other research and appeared to be a reasonable figure for this study.

(9) Costs for the water system were based on the assumption that one well, pump, and pump house was necessary for each 3000 hogs. The well and equipment was selected for a shallow 4" well lasting fifteen years with no salvage and the pump lasting ten years.

(10) Electricity consumption for electrical motors and supplemental heat was calculated using the Missouri University Guide, No. 1400, Electricity Used--Farm and Home Equipment, 1964. The average kilowatt hours used for five selected items are as follows:

Item	Average KWH Used
Motor	1 KWH per Horsepower or .35 KWH/ton
Water System	2 KWH/1000 gallons
Grinder Automatic or Hammer	4 KWH/ton
Heat Lamp	6 KWH/day
Hog Waterer (Heat)	200 KWH/season

The charge per kilowatt hour varies as the rate of usage increases. The rates used in this study were those charged to farmers by the Boone County Rural Electric Association.

(11) Storage capacity costs were calculated for corn and soybean oil meal. Storage costs were based on

$0.10 per bushel for corn and $3.50 per ton for soybean oil meal. The cost of storage for soybean oil meal was approximately the same per pound as corn. These rates were typical of those charged by commercial storage firms. Estimating storage costs via this method appeared to be equivalent to those costs, had the producer constructed, depreciated, and maintained his own storage facilities.

(12) Fences were assumed to last fifteen years with no salvage value. A 2 percent charge of the original cost, for maintenance costs, was also made. Fences consisted of steel panels and gates for the growing, finishing, and farrowing buildings, and of woven wire and posts for the gestation and breeding areas.

(13) Lagoon costs were calculated on the basis of 15 cubic yards per pig times the given capacity of the building. Removal of a cubic yard of ground costs between $0.25 and $0.30.

(14) Costs for breeding stock were calculated as follows: boars at $400 with $100 salvage and three years of useful life, and gilts at $150 with $80 salvage and two years of useful life.

(15) Interest on fixed and variable capital was calculated at 8 percent per year. Variable Costs were calculated on a six months basis as the market hogs were sold prior to reaching six months of age.

MANAGEMENT ASSUMPTIONS, METHODOLOGY AND PRACTICES

(1) Sows were rebred after weaning with weaning occurring at six weeks of age. The sows generally can be successfully bred at the first heat period after weaning. It was necessary to schedule breeding so that the buildings were fully utilized. Table IV-10 shows the first farrowing, the breeding period, and the date when the second farrowing is due for twelve different periods.

There were no problems in scheduling two farrowings per year. The farrowing buildings and the growing-finishing buildings could be used twice in the year with no problems.

Management problems associated with scheduling building utilization arise with four or six farrowings per year. Table IV-11 gives the days each building would be occupied. The data follows each farrowing through the entire finishing process. For example, the first farrowing in the six farrowing system includes days 1 to 45 in the farrowing house, days 45 to 105 in the growing building, and days 105 to 165 in the finishing house. Close examination of this process reveals that once the system becomes operational, the entire cycle of six farrowings requires 360 days assuming no breakdown in any of the phases of the total operation. There are ten days to clean and air out the farrowing house, but at most, only one day to clean and air out the growing and finishing buildings. A manager

Table IV-10

Some Possible Dates for Farrow-Breeding and Refarrowing of Sows in a Year

Sows's First Farrowing	Sow Rebred Seven Weeks After First Farrowing	Second Farrowing
January 1-15	March 1-15	June 24-July 10
February 1-15	April 1-15	July 24-August 10
March 1-15	May 1-15	August 24-September 10
April 1-15	June 1-15	September 24-October 10
May 1-15	July 1-15	October 24-November 10
June 1-15	August 1-15	November 24-December 10
July 1-15	September 1-15	December 24-January 10
August 1-15	October 1-15	January 24-February 10
September 1-15	November 1-15	February 24-March 10
October 1-15	December 1-15	March 24-April 10
November 1-15	January 1-15	April 24-May 10
December 1-15	February 1-15	May 24-June 10

Table IV-11

The Time Schedules for 4 and 6 Farrowings for the Farrowing House, the Growing Building, and the Finishing Building

(Two Sets of Sows-Farrowed Twice)

Sow Set #	Farrowing Number	Period in Days Farrowing House	Period in Days Growing House	Period in Days Finishing
1	1	1-45	45-105	105-165
2	2	90-135	135-195	195-255
1	3	180-225	225-285	285-345
2	4	270-315	315-375	375-435
		(Three Sets of Sows-Farrowed Twice)		
1	1	1-45	45-105	105-165
2	2	60-105	105-165	165-225
3	3	120-165	165-225	225-285
1	4	175-225	225-285	285-345
2	5	235-285	285-345	345-405
3	6	295-345	345-405	405-465

could keep the pigs in the farrowing house slightly longer to increase the time of cleaning and disinfecting of the growing and finishing facilities. This would also decrease the pressure on the timing involved with six farrowings per year. While six farrowings could be pushed through the same buildings as four farrowings, the timing and scheduling becomes very crucial.

(2) For the gestating sow, 15 square feet was the minimum space allowed for shelter. The sow's ration also met the nutritional requirements for her condition. The gestating sows may be fed either in pens or stalls. The stalls require extra investment in equipment and more attention and care by the attendant.

(3) Boar(s) were kept by themselves when not in use. The boar(s) required 15 to 20 square feet of floor space plus sufficient area for pasture and exercise. The boar's maximum use was for forty litters per year with the most matings in a breeding period set at twenty sows. Management could keep one or two extra boars to insure a high conception rate when more than two sows came in heat the same day.

(4) Care of the sow at farrowing should begin one week prior to the actual farrowing. Before the sow is placed in her quarters she is scrubbed with soap and warm water. The sow is then placed in a pen or farrowing crate depending on the system. The temperture in the farrowing house was assumed to be maintained in the 55^{o} - 65^{o}F. range.

The little pigs for the first week needed a temperature near 80°. To provide the supplemental heat, heat lamps were used.

Sows were farrowed in farrowing crates in the confinement system. The conventional system used a pen 4 1/2 x 12' x 3' with a corner isolated from the sow for the young pigs. When the pigs were born, tincture of iodine was applied to the naval. Also the ears were notched to identify the boar and sow.

(5) Needle teeth, two on each side of both the upper and lower jaw, were removed with a cutting plier soon after birth.

(6) An iron shot consisting of one c.c. of an iron-dextron compound was injected intra-muscularly prior to three days of age. This shot reduces the possibility of anemia in sucking pigs confined to concrete pens.

(7) Docking of the tail was done to avoid tail biting. Tails were docked for both the conventional and confinement systems at the time the needle teeth were removed and the iron shot administered to the pig.

(8) Castration was done at three-four weeks of age so that the pigs were healed prior to weaning. The castration process requires a sharp knife, soap, disinfectant, and water.

(9) Vaccination for erysipelas was done one to two weeks after weaning. Two c.c. of the vaccine is required per pig for sufficient vaccination.

(10) Worming was accomplished using a liquid wormer at two different weight categories. A suitable solution was used and each pig received one ounce in the two wormings.

(11) The growing phase begins at weaning and ends when the pig reached 100 pounds. Each pig required 3-4 square feet of floor space in the growing phase. Each pen was large enough to hold 20-25 pigs. Equipment requirements included one water space per 25 pigs and one feeder space per four hogs.

For the confinement operation sufficient ventilation and heat was provided according to weather conditions. Automatic feeders and waterers, fully slotted floors, temperature near 60^{O}F., and humidity uncontrolled but at satisfactory levels were part of the physical requirements. The conventional system has the same space, waterers, and feeder equipment requirements, but the floors are solid concrete and the south side of the building is open.

(12) The finishing phase begins at 100 pounds and ends at 220 pounds. The waterer and feed equipment requirements were one water space per 25 pigs and one feeder space per four hogs. Six square feet of floor space was needed for each 100 to 150 pound hog. As the hog reached 150 pounds, 8 square feet was the recommended space requirement. Pens 16' x 10' were assumed to hold twenty pigs.

(13) Manure handling for the conventional and confinement systems were different. Variations in manure handling occurs as the hog operation becomes larger in terms of the number of market hogs produced. The approximate amount of manure produced daily by a 100 pound live weight hog was 1/8 cubic foot, or 1.0 gallons, or 7.5 pounds. Table IV-12 shows the production of manure for pigs of different ages or weights, sows and boars of different ages and weights, and for the sow plus her litter.

Table IV-12

Approximate Daily Manure Production for Swine of Different Ages and Weights*

Age in Weeks	Weight (lbs)	Waste Production Liquid & Solids (gal)	Solids Only (lbs)
Sow and Litter	----	4	6
6-9	20-40	.5	2.7
9-13	40-100	1.0	4.3
13-18	100-150	1.7	5.8
18-23	150-210	2.1	7.3
Sow and Boars	----	---	---
20-52	200-300	2.5	7.5
52	300-500	3	8

*The figures in the table are median values for undiluted, fresh manure without bedding.

Source: Handling Swine Manure, Agricultural Engineer's Digest, E. C. 69-784, Midwest Planning Service, Ames, Iowa, April, 1969.

If solid manure is to be handled efficiently the solid floor must be easily bedded and cleaned. Equipment such as a manure loader and spreader was purchased to load, haul and spread the manure on nearby fields. Efficient handling of manure also involves planning the floor slopes of the farrowing building, growing and finishing buildings. Manure in the conventional system is usually handled as a solid with some of the larger systems (capacities 4, 5, and 6) washing the manure into an adjacent lagoon.

Liquid manure requires a slotted floor-lagoon or slotted floor-pit combination. Modification of the liquid system includes a storage facility, a pit, equipment that will stir and pump, haul, and spread the liquid on nearby fields. The slope of the floor and proper ventilation are critical factors in the liquid system. Ventilation is even more important when stirring or emptying manure storage pits. The capacity of the storage facility depends on the number of hogs, size of hogs (manure production), frequency of emptying, and water added. Some lagoons after eight years of use have never been cleaned out completely.

FEEDING THE SWINE

Rations specified in this section were rations used for swine testing or a standard swine ration obtained from Dr. T. L. Veum, of the University of Missouri Animal Husbandry Department. The rations were formulated to meet the minimum nutrient requirements as recommended by the N.R.C. Committee.

The following ration in Table IV-13 is for the boar at two weights, 125 to 200 pounds and over 200 pounds. These rations are complete, ground mixed, and pelleted for self-feeding.

Table IV-14 gives rations for sows for gestation and lactation periods. Each sow receives approximately 4.0 pounds daily the first two-thirds of gestation and approximately 5.0 pounds the last one-third of gestation. Table IV-15 shows the rations for creep and weaning to 50 pounds, 50-100 pounds, 100 to 150 pounds and 150 to 200 pounds per hog.

RATION COST

Cost of feed per market hog was identical for both the conventional and the confinement systems. Table IV-16 shows the rations and costs for all phases of production for the market hogs, boars, and sows. Costs per pound are shown for each item in the ration, pounds of each item in one ton, the cost per ton, and the cost per head.

The feed costs for the market hog totaled $19.51 with this distributed in weight categories as follows: Creep--$1.05: 20-25 lbs.--$1.75: 50-100 lbs.--$4.88: 100-150 lbs.--$4.92: and 150-220--$6.90. The feed costs per boar for the year was calculated at $62.04. To maintain the sow for a year feed costs of $65.84 were incurred with $29.88

Table IV-13

Rations for Boars-Pounds of Ingredient Per Ton, Calculated Composition, and the Vitamin and Antibiotic Mix

Ingredient	Ration 125-200 lbs.	Ration Over 200 lbs.
Corn #2 Yellow	1,622	760
Oats		700
Soybean meal 44% protein	180	120
Meat & bone scraps 50% protein	40	50
Fish meal 60%	40	
Alfalfa meal dehydrated 17% protein (7,500 I.U.Vita)	40	350
Dried whey - 12% protein	40	---
Trace mineral salt*	10	10
Calcium Carbonate 38% CA	12	---
Dicalcium phosphate 26% Ca_1 18% P	6	---
Vitamin Aitibiotic Mix	10	10
Total	2,000	2,000
Composition		
% Crude protein	14.19	14.4
% T.D.N.	75.0	64.5
% Ca	.69	.59
% Phosphorous	.50	.45
Vitamin and Antibiotic Premix		
Vitamin A I.U.	1,500,000	
Vitamin D I.U.	400,000	
Riboflavin gm.	4	
Pantothenic acid gm.	8	
Nicotimic Acid gm.	8	
Vitamin B_{12} gm.	20	
Antibiotic[2] gm. (aureomycin or terromycin)	10	
Zinc gm. 55 ppm	50	

Source: Rations for Swine Testing, Iowa State University, February, 1968.

Table IV-14

Rations for Sows During Gestation and Lactation, Composition Analysis, and Vitamin Mix-Ton Lots

Ingredients	Sow-Gestation	Sow-Lactation
Yellow Corn #2	1,448	1,358
Soybean Oil Meal 44%	250	250
Meat and Bone Meal	50	50
Dehydrated Alfalfa Meal 17%	200	200
Wheat Bran, 16%		100
Dicalcium phosphate (26% Ca+ 18% P)	20	6
Calcium carbonate 38% Ca	10	14
Trace Mineralized Swine Salt	10	10
Vitamin Supplement	12	12
Total Pounds	2,000	2,000
Analysis		
% Crude Protein	15	15.4
% Calcium	.89	.77
% Phosphorous	.61	.52
Vitamin Supplement Includes Vitamin A, D and B.		

Source: T. L. Veum, "Standard Swine Rations," University of Missouri, Department of Animal Husbandry, Columbia, Missouri, 1969.

designated for gestation, $29.26 assigned to lactation, and $6.60 for the breeding and keeping period. The feed costs of the breeding stock were calculated separately.

Table IV-15

Rations for Nursery, Growing, and Finishing
Ages of Pigs by Weight Class

Ingredients	Creep	Weaning-50	50-100	100-150	150-200
Corn #2	1079.9	1407.9	1528.9	1634.4	1746.0
Soybean Meal 44%	640	450	350	260	175
Meat & Bone Meal 50%	120	90	70	50	30
Granulated Sugar	110	---	---	---	---
Dicalcium Phosphate 26% Ca + 18% P	10	13	14	18	15
Calcium Carbonate 38% Ca	10	12	12	14	14
Trace Mineralized Salt	10	10	10	10	10
Zinc Oxice 78% Zn	.1	.1	.1	.1	.1
Vitamin Supplement	16	14	12	12	10
AureoSP-250	4.0	3.0	---	---	---
Tylan 10	---	---	3.0	1.5	---
Analysis					
% Crude Protein	22.2	18.6	16.4	14.3	12.4
% Calcium	.98	.90	.81	.80	.68
Phosphorous	.71	.65	.60	.58	.50

Vitamin Supplement Contains Vitamin A, D, Vitamin B_{12}, pantolhenic acid, nicotinic acid and chlorine.

Source: T. L. Veum, "Standard Swine Rations," University of Missouri, Department of Animal Husbandry, Columbia, Missouri, 1969.

Table IV-16

Rations for Market Hogs, Boars, and Sows for All Periods Involved in Production: Cost Per Pound of Feed; Amount of Each Item in One Ton; Cost per Ton; and Consumption, Weight Gain, Days Each Ration Fed, and Cost Per Pig Per Period*

Ration A--Market Hog

Period--Suckling-Weaning

Weight of Pig--2.5 lbs. to 25 lbs.

Day Fed--30 days

Feed Consumed per Pig--25 lbs.

Total Cost Per Ton--$83.99

Cost Per Pig--$1.05

Item	Cost Per lb.	Lbs./Ton	Total Cost
Corn	$ .024	1079.9	$25.92
Soybean meal 44%	.05	640.0	32.00
Granulated Sugar	.08	110.0	8.80
Meat and Bone Meal	.065	120.0	7.80
Dicalcium Phosphate 26%	.06	10.0	.60
Calcium Phos. - 38% Ca	.02	10.0	.20
Trace Mineralized Salt	.03	10.0	.30
Zinc Oxide 78% Zn	1.30	.10	.13
Vitamin Supplement	.065	16.0	1.04
Aureo Sp-250	1.80	4.0	7.20

*All prices in these rations A-H were quoted prices from a local feed store in Higginsville, Missouri on December 12, 1970.

Table IV-16 (continued)

Ration B--Market Hog

Weight of Pig--25 lbs.-50 lbs.

Days Fed--25

Feed Consumed Per Pig--50 lbs.

Total Cost Per Ton--$69.90

Cost Per Pig--$1.75

Item	Cost Per lb.	Lbs./Ton	Total Cost
Corn	$ .024	1407.9	$33.79
Soybean Meal 44%	.05	450.0	22.50
Meat and Bone Meal	.065	90.0	5.85
Dicalcium Phosphate 26%	.06	13.0	.78
Calcium Carbonate 38%	.02	12.0	.24
Trace mineralized salt	.03	10.0	.30
Zinc Oxide 78%	1.30	.1	.13
Vitamin Supplement	.65	14.0	.91
Aureo SP-250	1.80	3.0	5.40

Table IV-16 (continued)

Ration C--Market Hog

Weight of Pig--50 lbs.-100 lbs.

Days Fed--30

Feed Consumer Per Hog--150 lbs.

Total Cost Per Ton--$65.08

Cost Per Pig--$4.88

Item	Cost Per lb.	Lbs./Ton	Total Cost
Corn	$ .024	1528.9	$36.69
Soybean meal 44%	.05	350.0	17.50
Meat and Bone Meal 50%	.065	70.0	4.55
Dicalcium phosphate 26%	.06	14.0	.84
Calcium Phosphate 38%	.02	12.0	.24
Trace mineral salt	.03	10.0	.30
Zinc oxide 78%	1.30	.1	.13
Vitamin Supplement	.065	12.0	.78
Tylan 10	1.35	3.0	4.05

Table IV-16 (continued)

Ration D--Market Hog

Weight of Pig--100-150 lbs.

Days Fed--30

Feed Consumer Per Hog--165 lbs.

Total Cost Per Ton--$59.63

Cost Per Pig--$4.92

Item	Cost Per lb.	Lbs./Ton	Total Cost
Corn	$ .024	1634.4	$39.23
Soybean meal 44%	.05	260.0	13.00
Meat & Bone Meal 50%	.065	50.0	3.25
Dicalcium phosphate 26%	.06	14.0	.84
Calcium Carbonate 38%	.02	10.0	.20
Trace mineralized salt	.03	10.0	.30
Zinc Oxide 78% Zn	1.30	.1	.13
Vitamin Supplement	.065	10.0	.65
Tylan 10	1.35	1.5	2.03

Table IV-16 (continued)

Ration E--Market Hogs

Weight of Pig--150 lbs. to 220 lbs.

Days Fed--40

Feed Consumed Per Pig--252 lbs.

Total Cost Per Ton--$54.86

Cost Per Pig--$6.91

Item	Cost Per lb.	Lbs./Ton	Total Cost
Corn	$ .024	1746.0	$41.90
Soybean Meal 44%	.050	175.0	8.75
Meat and Bone Meal 50%	.065	30.0	1.95
Dicalcium Phosphate 26%	.06	15.0	.90
Calcium Carbonate	.02	14.0	.28
Trace Mineral Salt	.03	10.0	.30
Zinc Oxide 78% Zn	1.30	.1	.13
Vitamin Supplement	.065	10.0	.65

Table IV-16 (continued)

Ration F--Boar

Feeding Rate--4 months at 6 lbs. per day
8 months at 4.5 lbs.

Total Consumption per year--1,825

Total Cost Per Ton--$67.99

Total Cost Per Boar--$62.04

Item	Cost Per lb.	Lbs./Ton	Total Cost
Corn	$ .024	760	$18.24
Oats (rolled)	.056	700	39.20
Soybean Meal 44%	.05	120	6.00
Meat & Bone Scraps 50%	.065	50	3.25
Alfalfa Meal Dehydrated 17%	.035	16	.35
Trace Mineral Salt	.03	10	.30
Vitamin Antibiotic Mix	.065	10	.65

Table IV-16 (continued)

Ration G--Sow Gestation

Feeding Rate--4 lbs/day for first 75 days of gestation
5 lbs/day for last 40 days of gestation

Total Feed Per Sow Per Gestation--500 lbs.

Total Feed Cost Per Sow Per Gestation--$14.99

Cost Per Ton--$59.98

Item	Cost Per lb.	Lbs./Ton	Total Cost
Corn	$ .024	1448.0	$34.75
Soybean Meal 44%	.05	250.0	12.50
Meat and Bone Meal	.065	50.0	3.25
Dehydrated alfalfa 17%	.035	200.0	7.00
Dicalcium phosphate 26% Ca--18% Phos.	.06	20.0	1.20
Calcium Carbonate 38%	.02	10.0	.20
Trace Mineralized Salt	.03	10.0	.30
Vitamin Supplement	.065	12.0	.78

Table IV-16 (continued)

Ration H--Sows-Lactation

Feeding Rate--12 lbs. per day for 40 days

Total Feed Per Sow Per Lactation--480 lbs.

Cost Per Ton--$60.98

Cost Per Sow Per Lactation--$14.63

Item	Cost Per lb.	Lbs./Ton	Total Cost
Corn	$ .024	1358	$32.59
Soybean Meal 44%	.05	250	12.50
Meat and Bone Meal	.065	50	3.25
Dehydrated Alfalfa Meal 17%	.035	200	7.00
Wheat Bran 16%	.042	100	4.20
Dicalcium Phosphate (26% Ca and 18% Phos.)	.06	6	.36
Trace Mineralized Salt	.03	10	.30
Vitamin Supplement	.065	12	.78

CHAPTER V

MISSOURI'S SWINE INDUSTRY 1964-1968

The purpose of this section is to examine Missouri's swine industry with emphasis on those swine producers marketing 300 or more hogs per year. The following items of Missouri's swine industry were considered: (1) the change in the number of producers and changes in numbers fed in the swine industry from 1964 through 1968; (2) the extend of producer concentration described by the distribution of the number of producers and the distribution of the number of hogs fed for the 9 crop and livestock reporting districts of Missouri from 1964 to 1968; and (3) the entry and exit of hog producers by size group and district from 1964 to 1968.

Data for this analysis was obtained through Mr. Glen Grimes, Extension Livestock Marketing Specialist at the University of Missouri. These are unpublished data collected as a part of an on-going study of the hog industry in Missouri by the Agricultural Extension Service. All producers reporting the number of hogs fed each year are included in the reports to Mr. Grimes. However, only those producers, (and the hogs produced by same) feeding 300 hogs and over per year, were included in this analysis. Since each individual producer could be identified, changes could be traced. This classification was used to permit an analysis of the changes in the number of pigs fed over the

5 year period, and to examine the level of entry and/or exit of producers. Producers were divided into groups according to the number of hogs fed per year. These groups were as follows: 300-399, 400-599, 600-799, 800-999, 1000-1500, and greater than 1500 head per year. The size groups will be referred to as A, B, C, D, E, and F, respectively.

CHANGES IN THE NUMBER OF PRODUCERS AND NUMBER OF HOGS FED 1964-1968

Table V-1 shows the number of producers and the number of hogs fed in Missouri by size groups from 1964 to 1968. In 1964, there were 2,309 (total of all producers for the six size groups) separate hog operations compared with 3,525 in 1968. For the same producers, the total number of hogs fed in Missouri increased from 1,049,670 head in 1964 to 1,704,490 head in 1968. For the 5 year period (1964 through 1968) the net entry was 1,216 producers and a net increase of 654,820 hogs fed. In nearly all size groups there was a steady increase in the number of hogs fed over the 5 year period. Exceptions to this were in size groups A and E for 1968, and for size group F for the years 1966 and 1967.

Table V-2 shows the percentage of both numbers of producers and hogs fed in Missouri by size groups from 1964 through 1968. In 1964 producers in size groups A and B represented 83.7 percent of the total hogs produced. Comparing this to 1968, producers in size group A and B represented 80.0 percent of the total producers and fed 59.4 percent of the hogs.

Table V-1

Number of Producers and Number of Hogs Fed in Missouri by Size Groups
1964 - 1968*

	300-399 A		400-599 B		600-799 C		800-999 D		1000-1500 E		1500 F		Total	
Year	# of prod	# hogs fed	# of prod	# hogs fed	# of prod	# hogs fed	# of prod	# hogs fed	# of prod	# hogs fed	# of prod	# hogs fed	## of prod	# hogs fed
1964	1,335	410,655	602	263,625	190	118,540	60	49,550	88	98,600	34	108,700	2,309	1,049,670
1965	1,388	427,050	713	314,725	210	131,290	86	70,650	116	131,650	52	156,700	2,565	1,232,065
1966	1,532	471,635	778	343,715	210	131,990	93	76,850	143	161,850	47	138,550	2,803	1,324,590
1967	1,772	544,985	924	409,445	256	161,290	127	104,750	170	193,550	51	141,800	3,300	1,555,820
1968	1,753	538,555	1,069	474,845	293	183,890	148	122,150	210	239,650	52	145,400	3,525	1,704,490
Total	7,780	2,392,880	4,086	1,806,355	1,159	727,000	514	423,950	727	825,300	236	691,150	14,502	6,866,635

*Producers with less than 300 hogs fed are not included in this table.

Data for 1967 in Chariton County in Northcentral District were missing--data were estimated only if there were producers feeding hogs in that county for the years 1966 and 1969.

Data for 1968 in Perry County in East Central District were missing--no data were generated by the missing data and statistical techniques.

Table V-2

Percentage of the Number of Producers and Number of Hogs Fed
in Missouri by Size Groups
1964 - 1968*

Year	300-399 A		400-599 B		600-799 C		800-999 D		1000-1500 E		1500 F		Total	
	% of all prod	% of all hogs fed	% of all prod	% of all hogs fed	% of all prod	% of all hogs fed	% of all prod	% of all hogs fed	% of all prod	% of all hogs fed	% of all prod	% of all hogs fed	% CF all prod	% CF all hogs fed
1964	57.8	39.1	26.1	25.1	8.2	11.3	2.6	4.7	3.8	9.4	1.5	10.4	100.0	100.0
1965	54.1	34.7	27.8	25.5	8.2	10.7	3.4	5.7	4.5	10.7	2.0	12.7	100.0	100.0
1966	54.7	35.6	27.8	25.9	7.5	10.0	3.3	5.8	5.1	12.2	1.7	10.5	100.0	100.0
1967	53.7	35.0	28.0	26.3	7.8	10.4	3.8	6.7	5.2	12.4	1.5	9.1	100.0	100.0
1968	49.7	31.6	30.3	27.9	8.3	10.8	4.2	7.2	6.0	14.1	1.5	8.5	100.0	100.0

*Producers with less than 300 hogs fed are not included in this table.

Data for 1967 in Chariton County in North Central District were missing--data were estimated only if there were producers feeding hogs in that county for the years 1966 and 1968.

Data for 1968 in Perry County in East Central District were missing--no data were generated by the missing data statistical technique.

The number of producers in size groups A and B increased from 1,937 in 1964 to 2,822 in 1968, and the number of pigs fed by the same producers increased from 674,280 in 1964 to 1,013,400 in 1968. The percentage for size group A moved from 57.8 and 39.1 in 1964 to 49.7 and 31.6 for the number of producers and number of hogs fed, respectively. For size group B, from 1964 to 1968, the percentage of producers and of hogs fed increased from 26.1 and 25.1 to 30.3 and 27.9 percent, respectively. Combining size groups D, E, and F for the years of 1964 and 1968, the percentage for the number of producers and hogs fed increased from 7.9 and 24.5 to 11.7 and 29.8 percent, respectively. The total numbers of producers and hogs fed increased in all categories from A to F, however, the percentage changes indicate that groups A and F decreased, while groups B, D, and E increased in relative importance.

GEOGRAPHIC DISTRIBUTION OF MISSOURI'S SWINE INDUSTRY

The principle hog feeding section of Missouri is that area in Missouri north of the Missouri River. This area is composed of three crop and livestock reporting

districts[27] of the Northwest, North Central, and the Northeast.[28] In 1968 the Northwest district had 25.4 percent of all the producers and 25.9 percent of all hogs fed. The second area of concentration of producers was the Northeast district with 19 percent of the state's producers feeding 18.1 percent of the total number of hogs fed. Table V-3 does not appear to indicate any significant changes in the distribution of hog producers and numbers of hogs fed over this five year period. While some changes appear to have taken place, the time period is too short to determine if these changes indicate a trend. Figure V-1 shows the geographic location of Missouri's swine industry indicating the percentage of the total for both the number of producers and the number of hogs fed by districts.

Table V-4 contains the number of producers and the number of hogs fed in the 9 districts of Missouri from 1964 to 1968. Of the state's 3,525 producers in 1968, 2,115 or 60 percent were located in the districts of the Northwest, North Central, and Northeast. These 2,115 producers fed 987,670 head or 57.9 percent of the state's 1,704,490 hogs. In 1968, the number of producers and number of hogs fed in

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[27]The 9 crop and livestock reporting districts of Missouri are the Northwest, North Central, Northeast, West Central, Central, East Central, Southwest, South Central, and Southeast.

[28]Table V-3 gives the percentage of the number of producers and number of hogs fed in the nine districts of Missouri.

Table V-3

Percentage of the Number of Producers and Number of Hogs
Fed in the Nine Districts of Missouri
1964 - 1968*

District	1964		1965		1966		1967		1968	
	% of all prod	% of all hogs fed	% of all prod	% of all hogs fed	% of all prod	% of all hogs fed	% of all prod	% of all hogs fed	% of all prod	% of all hogs fed
North West	24.9	25.7	26.4	27.4	25.8	25.5	25.1	25.6	25.4	25.9
North Central	17.5	16.7	17.0	15.9	15.7	15.0	15.6	14.6	15.1	13.9
North East	15.2	16.0	13.7	14.0	16.1	15.7	16.4	16.1	19.0	18.1
West Central	8.6	8.9	8.8	8.9	9.1	9.5	9.0	9.4	8.7	9.5
Central	15.5	14.7	16.6	15.7	15.1	14.6	15.5	15.6	15.1	15.7
East Central	11.3	11.4	11.0	11.7	11.9	12.9	12.9	13.4	10.4	10.5
South West	2.7	2.4	2.6	2.4	2.5	2.2	2.1	1.7	2.9	2.5
South Central	2.2	2.1	2.0	2.1	2.1	2.8	2.1	2.2	2.1	2.4
South East	2.1	2.1	1.9	1.8	1.7	1.8	1.3	1.5	1.4	1.5
Total for State	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*Producers with less than 300 hogs are not included in this table.

Data for 1967 in Chariton County in North Central District were missing--data were estimated only if there were producers feeding hogs in that county for the years 1966 and 1968.

Data for 1968 in Perry County in East Central District were missing--no data were generated by the missing data statistical technique.

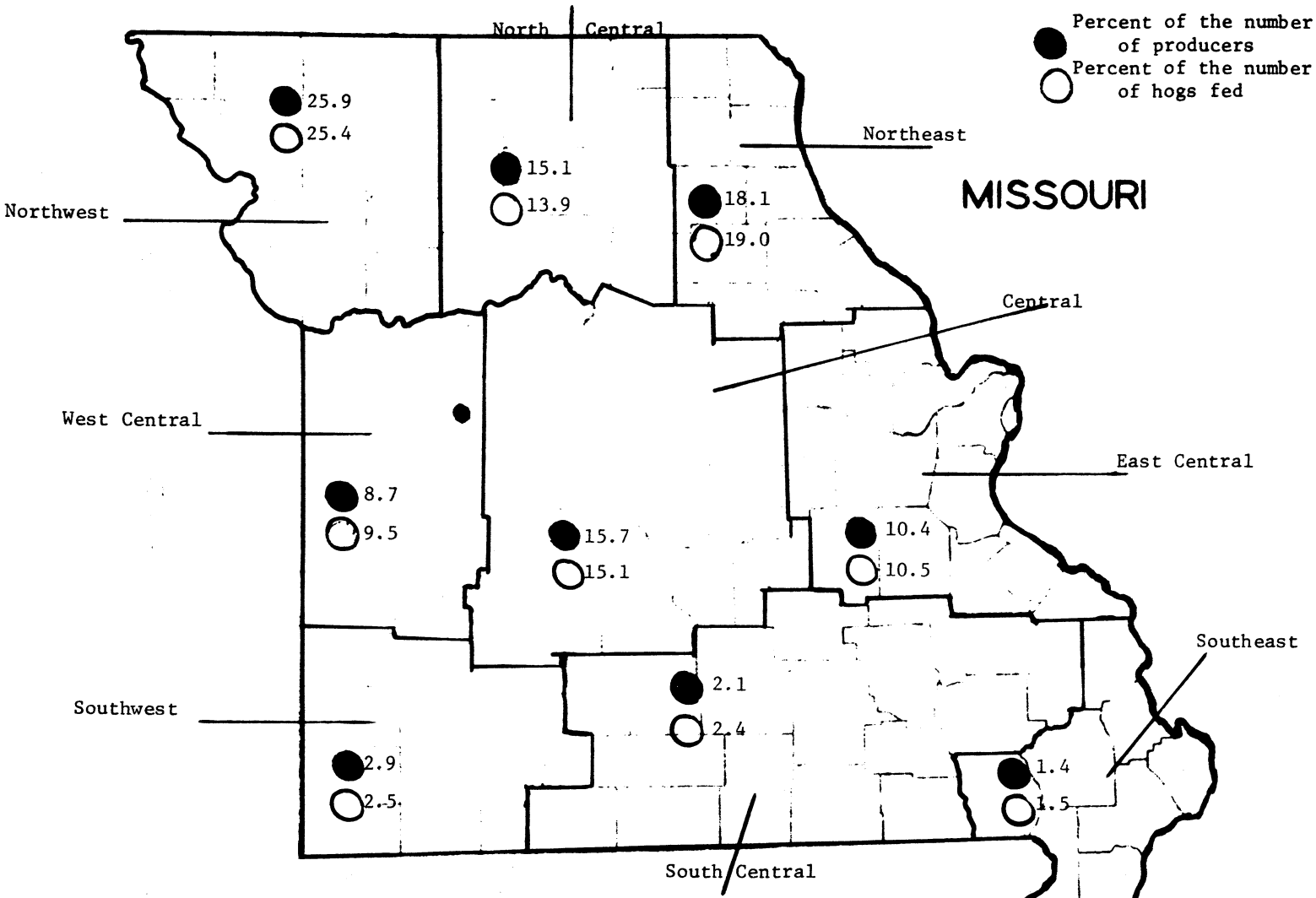

Figure V-1 Location of the Hog Industry by Crop and Livestock Reporting Districts in Missouri, 1968

Table V-4

Number of Producers and Number of Hogs Fed in the Nine Districts of Missouri
1964 - 1968*

District	1964		1965		1966		1967		1968		# Change	
	# of prod	# hogs fed	# of prod	# hogs fed	# of prod	# hogs fed	# of prod	# hogs fed	# of prod	# hogs fed	# of prod	#hogs fed
North West	574	269,750	676	337,905	723	337,905	828	398,190	894	441,135	55.7	63.5
North Central	405	175,220	435	195,970	439	198,750	515	227,290	533	237,235	31.6	35.4
North East	351	167,475	352	172,625	452	207,525	541	250,000	668	309,300	90.3	84.7
West Central	198	92,960	227	109,805	255	125,630	297	146,080	306	161,405	54.5	73.6
Central	359	154,635	427	193,585	424	193,285	510	243,040	532	267,370	48.2	72.9
East Central	261	120,010	281	144,625	334	170,635	427	208,160	366	178,785	40.2	49.0
South West	63	25,580	66	29,000	69	29,350	70	26,550	102	42,100	61.9	64.6
South Central	50	22,270	52	26,020	59	37,720	68	33,720	75	41,370	50.0	85.8
South East	48	21,770	49	22,540	48	23,790	44	22,790	49	25,790	2.1	18.5
Total for State	2,309	1,049,670	2,565	1,232,065	2,803	1,324,590	3,300	1,555,820	3,525	1,704,490	52.7	62.4

*Producers with less than 300 hogs are not included in this table.

Data for 1967 in Chariton County in North Central District were missing--data were estimated only if there were producers feeding hogs in that county for the years 1966 and 1968.

Data for 1968 in Perry County in East Central District were missing--no data were generated by the missing data statistical technique.

the Northwest, North Central, and Northeast districts were 894 producers and 441,135 hogs; 533 producers and 237,235 hogs, and 668 producers and 309,300 hogs. Contrasting this to 1964 data, of the state's 2,309 producers, 1,330 or 57.6 percent of all producers were in the Northwest, North Central, and Northeast districts feeding 58.3 percent (612,445 hogs) of the state's total number of hogs fed.

In 1968 the Central District had 532 producers. These producers fed 267,370 hogs. The East Central districts had 366 producers and they fed 178,785 hogs, while the West Central district had 306 producers and they fed 161,405 hogs.

In 1968, the Southwest, South Central, and Southeast districts had a total of 226 producers or 7.5 percent of the state's total. These 226 producers fed 109,260 hogs or 6.4 percent of the state's total of all hogs fed.

DISTRIBUTION BY SIZE GROUP AND DISTRICTS--1968

Table V-5 presents the number of producers and number of hogs fed by size groups and by district in Missouri. In 1968, 210 producers were in size group E. Of these 210 producers, 64 or 30.5 percent were located in the Northwest district. The Northwest district had 464 (26.5 percent) of the state's total of 1,753 producers in size group A. The Northwest, North Central, and Northeast

Table V-5

Number of Producers and Number of Hogs Fed by Size Groups and Districts - Missouri 1968*

District	300-399 A		400-599 B		600-799 C		800-999 D		1000-1500 E		1500 F		Total	
	# of prod	# hogs fed	# of prod	# hogs fed	# of prod	# hogs fed	# of prod	# hogs fed	# of prod	# hogs fed	# of prod	# hogs fed	# of prod	# hogs fed
North West	464	144,190	245	109,105	80	50,940	30	24,800	64	73,500	11	38,600	894	441,135
North Central	303	92,885	151	67,050	44	27,300	14	11,500	14	17,200	7	21,300	533	237,235
North East	327	100,225	227	100,375	47	29,350	26	21,550	32	36,200	9	21,600	668	309,300
West Central	126	38,705	98	43,700	30	18,550	24	19,800	22	24,450	6	16,200	306	161,405
Central	245	74,600	173	76,870	48	30,700	25	20,200	29	33,500	12	31,500	532	267,370
East Central	171	52,300	115	50,335	28	17,300	20	16,650	26	29,000	6	13,200	366	178,785
South West	65	19,600	24	10,850	5	3,000	1	950	7	7,700	0	0	102	42,100
South Central	33	10,000	21	9,420	4	2,450	5	4,100	11	12,400	1	3,000	75	41,370
South East	19	6,050	15	7,140	7	4,300	3	2,600	5	5,700	0	0	49	25,790
Total for State	1,753	538,555	1,069	474,845	293	183,890	148	122,150	210	239,650	52	145,400	3,525	1,704,490

*Producers with less than 300 hogs are not included in this table.

Data for 1968 in Perry County in East Central District were missing--no data were generated by the missing data statistical technique.

districts had 1,094 producers out of a total 1,753 producers in size group A or 62.4 percent. Of the state's 1,069 producers in size group B the Northwest, North Central, and Northeast districts had 623 producers or 58.3 percent of the total in this size group. For size groups C and D the three northern districts claimed 58.4 percent and 47.3 percent of the state's producers, respectively.

In the greater than 1,500 size group, the Central districts had 12 producers feeding 31,500 hogs in 1968. This was the largest of all the 9 districts in terms of the number of producers in size group F and second largest with regard to the number of hogs fed. For size group A the West Central, Central, and East Central had 126, 245, and 171 producers respectively. For the size groups B, C, D, and E the West Central, Central, and East Central had, respectively, the following number of producers: 98, 173, and 115; 30, 48, and 28; 24, 25, and 20; and 22, 29, and 26.

There was only one producer in the Southern three districts that fed more than 1,500 hogs. The northwest, North Central, and Northeast district had 27 producers of the state's 52 producers in size group F. For size group A in 1968 the Southwest, South Central, and Southeast had 65, 33, and 19 producers feeding a total of 19,600, 10,000, and 6,050 hogs Northeast, Central, and East Central.

INCREASES AND DECREASES IN THE NUMBER OF HOGS FED BY PRODUCERS; AND ENTRY AND EXIT OF PRODUCERS--1964-1968

An increase was defined as those producers that increased the number of hogs fed within their size group and those that increased the number fed into any larger size group. If a producer was feeding 325 hogs in 1964 and then fed 375 hogs in 1965, this was defined as an increase in the number of hogs fed. If this same producer had fed 450 hogs in 1965 (the producer moved to the next larger size group) this was also considered an increase in the number of hogs fed. An entry was counted as an entry only if a producer reached the minimum level of 300 hogs fed per year. Once the producer reached the 300 hogs fed per year, any further increase in number of hogs fed was counted as an increase. Similarly, a decrease was counted when a producer decreased the number of hogs fed within the same size group (350 to 325) or if the producer decreased between size groups (450 to 325). An exit was a producer reducing his operation below a minimum of 300 hogs fed per year.

For the years 1964 and 1968 four different events could occur. A producer could increase within his size group or move to a larger size group (both cases are increases), a producer was feeding less than 300 hogs and

could enter any one of the six size groups, a producer could decrease within or to a smaller size group (both cases are decreases), or the producer could feed less than 300 hogs and be counted as an exit. Table V-6 presents the data for the number of producers that increased and decreased with regard to the number of hogs fed and the number of producers that entered or exited by size group and district comparing 1964 to 1968. Table V-6, using the Northwest district and size group A(300-399) as an example, is read as follows:

a) In column 1, the 53 represents only those producers that have increased within the 300-399 size group, 1964 vs. 1968,--Northwest district. New entries are excluded by defination even though the new entries are increases in the number of hogs fed from less than 299 to 300 and more.

b) In column 2, the 231 represents the number of new hog producers that entered size group A, Northwest district 1964 vs. 1968. These producers entered from below 300 hogs fed per year.

c) In column 3, the 3 represents the number of hog producers that decreased the number of hogs fed within size group A or decreased from a larger size group such as B to size group A.

d) In column 4, the 95 represents the number of producers that exited the hog industry by feeding less

Table V-6

The Number of Producers that Increased and Decreased with Respect to the Number of Hogs Fed, and the Number of Producers Entering and Exiting by Size Group and District in Missouri 1964 vs. 1968

District	Size Group A 300-399 Inc*	Entry	Dec**	Exit	Size Group B 400-599 Inc	Entry	Dec	Exit	Size Group C 600-799 Inc	Entry	Dec	Exit
North West	53	231	3	95	24	145	8	18	9	35	6	8
North Central	13	127	5	74	12	71	6	15	5	18	1	5
North East	17	215	0	54	8	137	7	21	6	25	4	8
West Central	10	67	0	21	16	48	1	13	5	14	1	3
Central	22	102	1	57	12	100	6	22	5	27	2	6
East Central	30	120	1	71	9	71	6	35	7	16	4	9
South West	4	42	0	16	1	13	0	5	0	4	0	2
South Central	4	20	0	9	3	10	1	7	1	3	0	0
South East	3	6	0	9	1	10	0	7	1	1	0	3
Total for Size Groups	156	930	10	406	86	605	35	143	39	143	18	44

Table V-6 (continued)

District	Size Group E 1000-1500 Inc*	Entry	Dec**	Exit	Size Group F 1500 Inc	Entry	Dec	Exit	Total for District Inc	Entry	Dec	Exit
North West	3	21	3	2	0	4	2	3	90	450	24	130
North Central	3	1	2	2	1	0	1	0	38	224	18	96
North East	1	12	1	0	0	1	2	2	36	404	17	87
West Central	2	8	0	0	2	2	1	0	35	147	3	39
Central	1	13	5	3	3	4	0	1	44	262	14	89
East Central	0	9	3	2	1	2	0	2	51	224	15	119
South West	1	4	0	0	0	0	0	1	7	63	0	24
South Central	1	7	0	1	0	1	0	0	9	42	1	17
South East	0	3	1	1	0	0	0	0	0	22	1	21
Total for Size Group	12	78	15	11	7	14	6	9	315	1,838	93	622

*Increased
**Decreased

than 300 hogs per year.

Two other points should be made. The number 24, in column 1 of size group B, represents increases within--or a producer in 1964 in size group A increasing the number of hogs fed to move up to size group B. The number 18, in column 4 represents those producers that were in size group B (1964) and then dropped below the 300 hogs fed requirement (1968). The number 145, in column 2 represents entry from below 300 hogs fed per year to size group B.

The differences between columns 2 and 4 in Table V-6 indicates the net entry in the number of producers for the 5 year period for each size group. For example, the total entries for the state of 1,838, minus 622 exits gives a net entry of 1,216 producers. This is the same number obtained from Table V-7, by subtracting the total number of producers in Missouri in 1968 from the 1964 estimate, or 3,525 minus 2,309, equals 1,216 new producers that entered over the 5 year period. For the size groups of A, B, C, D, E, and F, the entry of producers from 1964 vs. 1968 was respectively, 524, 462, 99, 59, 67, and 9. Of the 1,216 new producers in the state, 986 had occurred in the size groups of A and B.

Increases and decreases may also be analyzed from Table V-6. Almost half of the adjustments for all districts occurred in the A size group with 156 producers increasing and 10 producers decreasing. For the 9 districts, the

Table V-7

Number of Producers and Number of Hogs Fed by Size Groups and Districts - Missouri 1964*

District	300-399 A		400-599 B		600-799 C		800-999 D		1000-1500 E		1500 F		Total	
	# of prod	# hogs fed	# of prod	# hogs fed	# of prod	# hogs fed	# of prod	# hogs fed	# of prod	# hogs fed	# of prod	# hogs fed	# of prod	# hogs fed
North West	361	111,585	116	50,675	52	32,190	11	8,900	25	28,900	9	37,500	574	260.750
North Central	257	78,820	96	41,550	25	15,450	10	8,600	11	13,200	6	17,600	405	175,220
North East	176	53,950	108	48,025	33	21,300	17	14,000	12	12,200	5	18,000	351	167,475
West Central	89	27,610	74	32,150	19	11,700	6	5,100	6	6,900	4	9,500	198	92,960
Central	214	65,135	97	42,400	25	15,500	4	3,200	13	14,600	6	13,800	359	154,635
East Central	145	44,725	69	30,235	23	14,450	8	6,400	13	13,900	3	10,300	261	120,010
South West	43	13,080	13	5,850	3	1,800	1	850	2	2,000	1	2,000	63	25,580
South Central	25	7,700	18	7,870	1	600	2	1,700	4	4,400	0	0	50	22,270
South East	25	8,050	11	4,870	9	5,550	1	800	2	2,500	0	0	48	21,770
Total for State	1,335	410,655	602	263,625	190	118,540	60	49,550	88	98,600	34	108,700	2309	1,049,670

*Producers with less than 300 hogs are not included in this table.

increases and decreases in the number of producers affecting size group A were as follows: Northwest - 53 and 3; Northeast - 17 and 0; East Central - 30 and 1; North Central - 13 and 5; Central - 22 and 1; West Central - 10 and 0; Southwest - 4 and 0; South Central 4 and 0; and Southeast - 3 and 0. The number of producers that increased or decreased dropped sharply for size group C and above.

Size group B had 86 increases and 35 decreases with the majority of the adjustments occurring in the three northern and three central districts. This size group won the second most important group from the standpoint of adjustments in entry and exit. The same pattern of adjustment (more adjustments in the Northern three districts than either the Central, or Southern districts) occurred in the size group of B, C, D, E, and F, when compared with the A size group. The total increases and decreases for selected districts for all size groups show the Northwest with 90 increases and 24 decreases, the Northeast with 36 increases and 17 decreases, the Central with 44 increases and 14 decreases, respectively. For the Southern three districts there were a total of 60 producers in size group C. In the Southwest there were 24 producers, in the South Central there were 21 producers, while in the Southeast there were only 15 producers in size group C.

An indication of the rate of growth in terms of the number of producers and number of hogs fed from 1964 to 1968

can be obtained when Table V-5 and V-7 are compared. The total number of producers and the total number of hogs fed in 1964 and 1968 were 2,309 and 1,049,670; and 3,525 and 1,704,490, respectively. There was a net increase of 1,216 producers and a net increase of 654,820 hogs fed. These changes represent almost a 55 percent increase in the number of producers and a 62 percent increase in the number of hogs.

The principal producing area, measured by the number of producers, was the Northwest district. The next three districts ranked by the number of producers were the North Central, Northeast, and Central. The Northwest district was first in total hogs fed followed by the North Central district.

In summary, changes in both number of producers and number of hogs, as measured by entries and exits, increases and decreases, or increases within or decreases within a size, revealed most of the activity occurred in the 300-399 size group and in the Northern three districts of Missouri. Table V-8 gives a summary of the net entry of the number of producers entering the swine industry in 1964 compared with 1968 by size group and the net entry of producers by district. The northern three districts followed by the central three districts had the majority of the new producers. If analyzed by size groups the A and B size groups had the

most net entries with 524 and 462 new producers, respectively (difference between entry and exit for that size group).

Table V-8

Net Increases in New Producers by Size Groups and District - Missouri 1964 - 1968

Size Group	Entry	District	Entry
300-399	524	North West	320
400-499	462	North Central	128
500-699	99	North East	317
700-999	59	West Central	108
1000-1500	67	Central	173
1500 and up	5	East Central	105
		South West	39
		South Central	25
		South East	1
State's total	1,216	State's total	1,216

CHAPTER VI

BUDGETED RESULTS FOR THE CONVENTIONAL AND CONFINEMENT SYSTEMS FOR VARIOUS CAPACITIES AND FARROWING INTENSITIES

ANALYSIS BY CAPACITY

Analysis by capacity refers to the investigation and comparison of the costs of production as the farrowing intensity is increased from 2 to 4 to 6 farrowings per year. As the farrowing intensity was increased the number of hogs fed increased, and changes in the production practices and techniques were necessary. These changes are indicated preceding the discussion of cost for that capacity level. Both the conventional and confinement systems are analyzed for each capacity level. Costs will be examined first for the 8.5 pigs per litter and then the effects of 1.5 pigs less per litter are analyzed in a later section. The capital required for each capacity, farrowing intensity, and system is presented in Appendix C, Table S.

Capacity 1

The basic physical differences budgeted for in the 2, 4 and 6 farrowing operations for capacity 1, are given in Table VI-1. Capacity 1 consists of 1 set of 8 sows farrowed twice (2 farrowings), 2 sets of 8 sows with each set

farrowed twice (4 farrowings), and 3 sets of 8 sows with each set farrowed twice (6 farrowings).

Table VI-1

Capacity 1--The Physical Operational Differences for the Conventional and Confinement Systems as Farrowing Intensity Changed

Farrowing Level	Conventional	Confinement
2 and 4	Processing and delivery of feed by commercial company to self feeders, manure handled as solids and spread on field	Processing and delivery of feed by commercial company to bulk tank, automatic feeding system, lagoon for manure disposal
6	Portable grinder mixer which unloads feed into self-feeders	Grinder mixer which unloads feed into bulk storage tanks and then automatically fed
2, 4 and 6	Conventional farrowing corner of pen isolated from sow	Farrowing crates
2, 4 and 6	Tractor and manure spreader	No tractor or manure spreader

With the exception of the conventional system at the 2 farrowing level, Table VI-2 shows that the average variable cost per hog remains relatively stable. One of the reasons for the variable cost being higher in the conventional 2 farrowing level situation was that the labor per

Table VI-2

Cost and Labor Measures for Capacity Level 1--
Conventional and Confinement Systems

Item	(CV)*	(CF)*	(CV)	(CF)	(CV)	(CF)
Number of farrowings	2	2	4	4	6	6
Number of market hogs	134	134	268	268	404	404
Average variable cost (AVC) per hog	$37.15	$34.96	$33.91	$33.67	$33.34	$32.20
Average fixed cost (AFC) per hog	$10.23	$ 6.67	$ 6.75	$ 5.60	$ 5.92	$ 5.38
Average total cost (ATC) per hog	$47.38	$41.63	$40.66	$39.27	$39.26	$37.58
Average total cost (ATC) per cwt.	$21.54	$18.92	$18.48	$17.85	$17.85	$17.08
Labor per hog (hours)	1.89	1.51	1.53	1.16	1.52	1.22

* CV refers to the conventional system, and CF refers to the confinement system.
Source: Based on calculated budgets, Appendix D, Tables A, B and C.

hog was much higher than in any of the other levels or systems. The average fixed cost continued to decline per hog as the facilities were used more intensively. The average fixed cost for the conventional 2 farrowing system was $10.23 per hog but these costs declined to $5.92 per hog at the 6 farrowing intensity level. The average fixed cost for the confinement system declined from $6.67 to $5.38 as the farrowing intensity increased from 2 to 6 farrowings per year.

Figure VI-1 presents the cost per hundred weight for both systems. As the farrowing intensity increased, the cost per hundred weight for the conventional and confinement systems decreased $3.69 and $1.84, respectively.

Capacity 2

The basic differences in the 2, 4, and 6 farrowing operations for capacity 2 are presented in Table VI-3. This capacity level consists of one set of 30 sows farrowed twice (2 farrowings), 2 sets of 30 sows with each set farrowed twice (4 farrowings), and 3 sets of 30 sows with each set farrowed twice (6 farrowings).

The physical operations remain the same as farrowing levels change for capacity 2, but important differences appear in capacity 2 compared with capacity 1 (Table VI-1). The grinder and feed mill are stationary and feed is not delivered by a commercial feed company. Table VI-4 presents

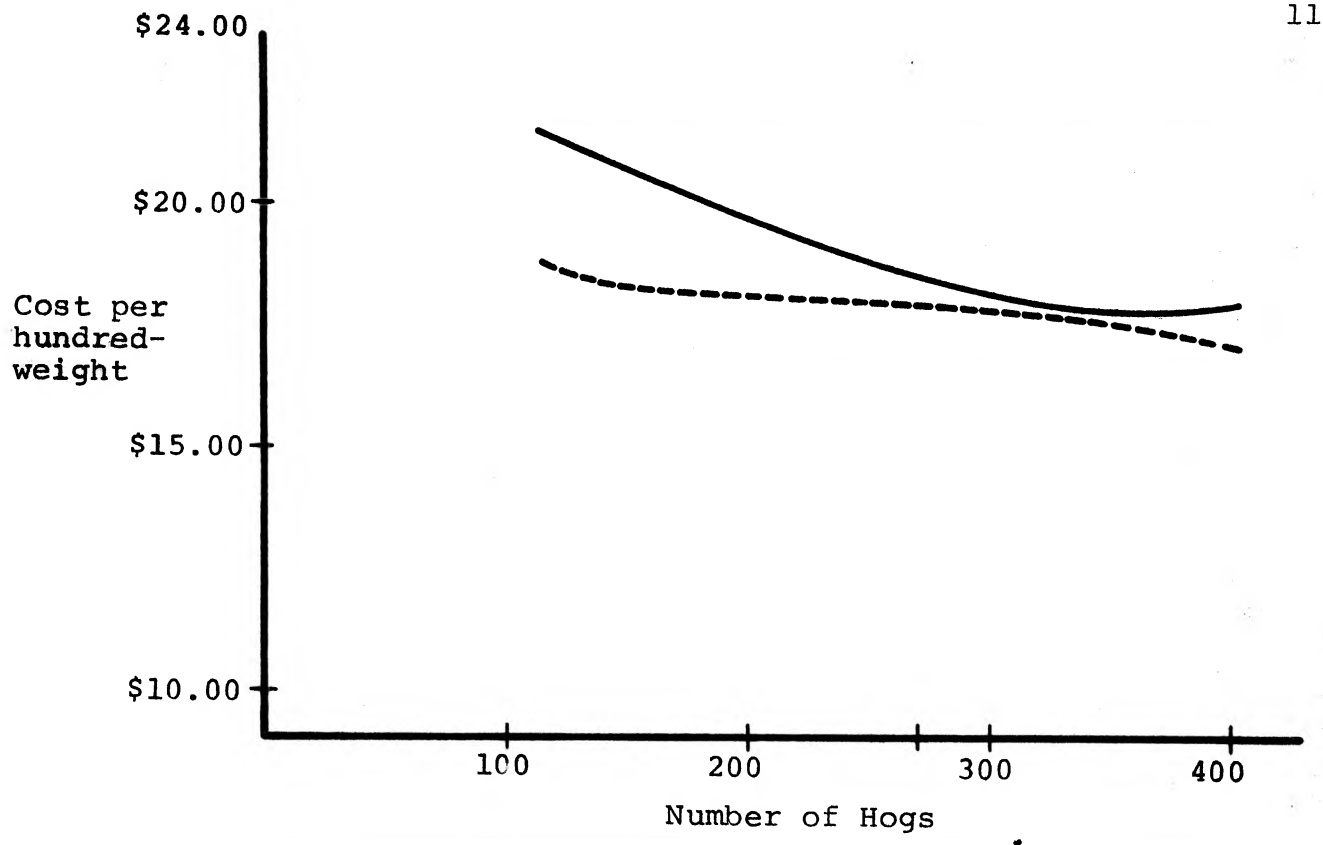

Figure VI-1. Cost Per Hundredweight-- Capacity 1, Conventional and Confinement Systems

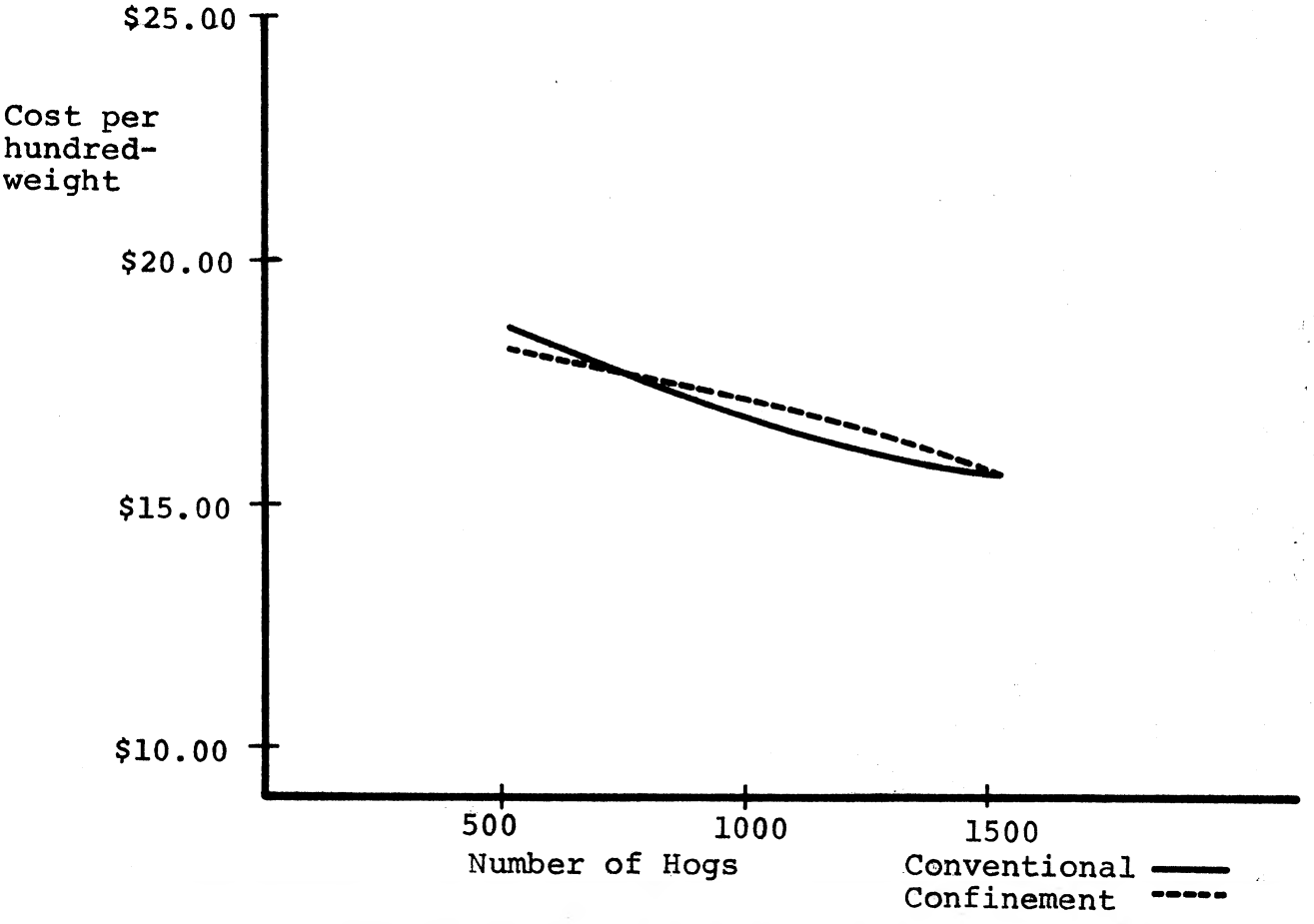

Figure VI-2. Cost Per Hundredweight--Capacity 2, Conventional and Confinement Systems

Table VI-3

Capacity 2--The Physical Operational Differences for the Conventional and Confinement Systems as Farrowing Intensity Changed

Farrowing Level	Conventional	Confinement
2, 4 and 6	Stationary automatic hammer mill--auger wagon	Stationary automatic hammer mill--automatic auger feeding system
	Storage cost generated at .10¢/ bu. of corn and $3.50/ton of soybean meal	Storage cost generated at .10¢/bu of corn and $3.50/ton of soybean meal
	Manure handled as solids	Lagoon and sow farrowing pit pumped commercially
	Farrowing--corner of pen isolated from sow	Farrowing crates
	Tractor and manure spreader	No tractor or manure spreader

the basic cost measures for capacity 2 as described in Table VI-3.

Analysis of Table VI-4 shows the average variable costs continuing to decline primarily because the hours of labor per hog decreased as farrowing intensity increased. Labor per hog for conventional system went from 1.48 hours per hog in the 2 farrowing system to 1.11 hours per hog at the 6 farrowing intensity. Labor per hog also declined from 1.32 hours (2 farrowings) to .94 hour per hog (6 farrowings)

Table VI-4

Cost and Labor Measures of Capacity Level 2 for Conventional (CV) and Confinement (CF) Systems

Item	(CV)	(CF)	(CV)	(CF)	(CV)	(CF)
Number of farrowings	2	2	4	4	6	6
Number of market hogs	504	504	1008	1008	1515	1515
Average variable cost (AVC) per hog	$33.45	$33.09	$31.53	$31.22	$31.00	$30.73
Average fixed cost (AFC) per hog	$ 7.19	$ 7.21	$ 5.56	$ 5.99	$ 4.74	$ 5.01
Average total cost (ATC) per hog	$40.64	$40.30	$37.09	$37.21	$35.74	$35.74
Average total cost (ATC) per cwt.	$18.47	$18.32	$16.86	$16.91	$16.25	$16.25
Labor per hog (hours)	1.48	1.32	1.21	.95	1.11	.94

Source: Based on calculated budgets, Appendix D, Tables D, E and F.

for the confinement system. Fixed costs for both systems declined as farrowing intensity increased, indicating that fixed costs were being spread over more units of production. The average fixed cost declined for the conventional system from $7.19 per hog to $4.74 per hog as the farrowing intensity increased from 2 to 6 farrowings. The average fixed cost for the confinement system decreased from $7.21 per hog to $5.01 per hog as farrowing increased from 2 to 6 litters per year.

Figure VI-2 shows graphically the cost per hundredweight of Table VI-4. The total cost per hundredweight for the conventional and confinement systems declined from $18.47 to $16.25 and $18.32 to $16.25, respectively, as farrowings went from 2 to 6.

Capacity 3

Capacity 3 consists of 1 set of 60 sows farrowed twice, 2 sets of 60 sows with each set farrowed twice, and 3 sets of 60 sows with each set farrowed twice. The number of market hogs at 2, 4 and 6 farrowing levels were 1,008, 2,040, and 3,024, respectively. The physical operation of this capacity is presented in Table VI-5. The major difference occurred in the confinement system with the purchase of a liquid manure spreader to handle the manure for the pits below the farrowing house. The manure from the conventional system is handled by tractor and loader with considerable manual labor involved.

Table VI-5

Capacity 3--The Physical Operational Differences for the Conventional and Confinement Systems as Farrowing Intensity Changed

Farrowing Level	Conventional	Confinement
2, 4, and 6	Mill and processing center	Mill and processing center
	Feed distributed by auger wagon	Feed distributed by automatic feeding system
	All manure handled as solids	Manure--lagoons
	Portion of pen isolated from sow-farrowing	Pits for farrowing commercially pumped
		Farrowing crates
4 and 6		Tank wagon for liquid manure removal

The cost and labor coefficients for capacity 3 are presented in Table VI-6. The confinement system costs per hundredweight for the 2 and 4 farrowing levels were higher than the conventional system. The cost per hundredweight for the 6 farrowing level was almost identical for both systems. The average variable cost per unit remained quite stable and most of the variation over the three levels was explained by the change in labor requirement per hog. The

Table VI-6

Cost and Labor Measures for Capacity 3--Conventional (CV) and Confinement (CF) at 2, 4 and 6 Farrowing Intensities

Item	(CV)	(CF)	(CV)	(CF)	(CV)	(CF)
Number of farrowings	2	2	4	4	6	6
Number of market hogs	1008	1008	2040	2040	3024	3024
Average variable cost (AVC) per hog	$32.45	$31.75	$31.13	$30.60	$31.17	$30.50
Average fixed cost (AFC) per hog	$ 6.36	$ 7.40	$ 5.27	$ 6.19	$ 4.57	$ 5.19
Average total cost (ATC) per hog	$38.81	$39.15	$36.40	$36.79	$35.74	$35.69
Average total cost (ATC) per cwt.	$17.64	$17.80	$16.55	$16.72	$16.25	$16.22
Labor per hog (hours)	1.38	1.00	1.24	.94	1.23	.94

Source: Based on calculated budgets, Appendix D, Tables G, H and I.

average fixed cost per hog decreased as the farrowing intensity increased, but the average fixed cost of the confinement system is higher than the conventional system. The labor declined for the conventional system from 1.38 hours per hog to 1.23 hours per hog as farrowing intensity went from 2 to 6. The confinement system's labor decreased from 1.00 hours to .94 hours per hog.

Figure VI-3 presents the total cost per hundredweight for the conventional and confinement systems. The total cost per hundredweight for the conventional and confinement systems as the farrowing levels went from 2 to 4 to 6 were $17.64 and $17.80, $16.55 and $16.72, and $16.25 and $16.22, respectively.

Capacity 4

Capacity 4 consists of one set of 100 sows farrowed twice, 2 sets of 100 sows with each set farrowed twice, and 3 sets of 100 sows with each set farrowed twice. The number of market hogs at 2, 4 and 6 farrowings were 1,680, 3,360, and 5,040, respectively. Table VI-7 presents for capacity 4 the nature of the physical operation for the conventional and confinement systems.

When capacity 4 is compared with (Table VI-7) capacity 3 (Table VI-5) a significant difference exists between these 2 capacities. At capacity 4 the conventional system becomes almost identical to the confinement system

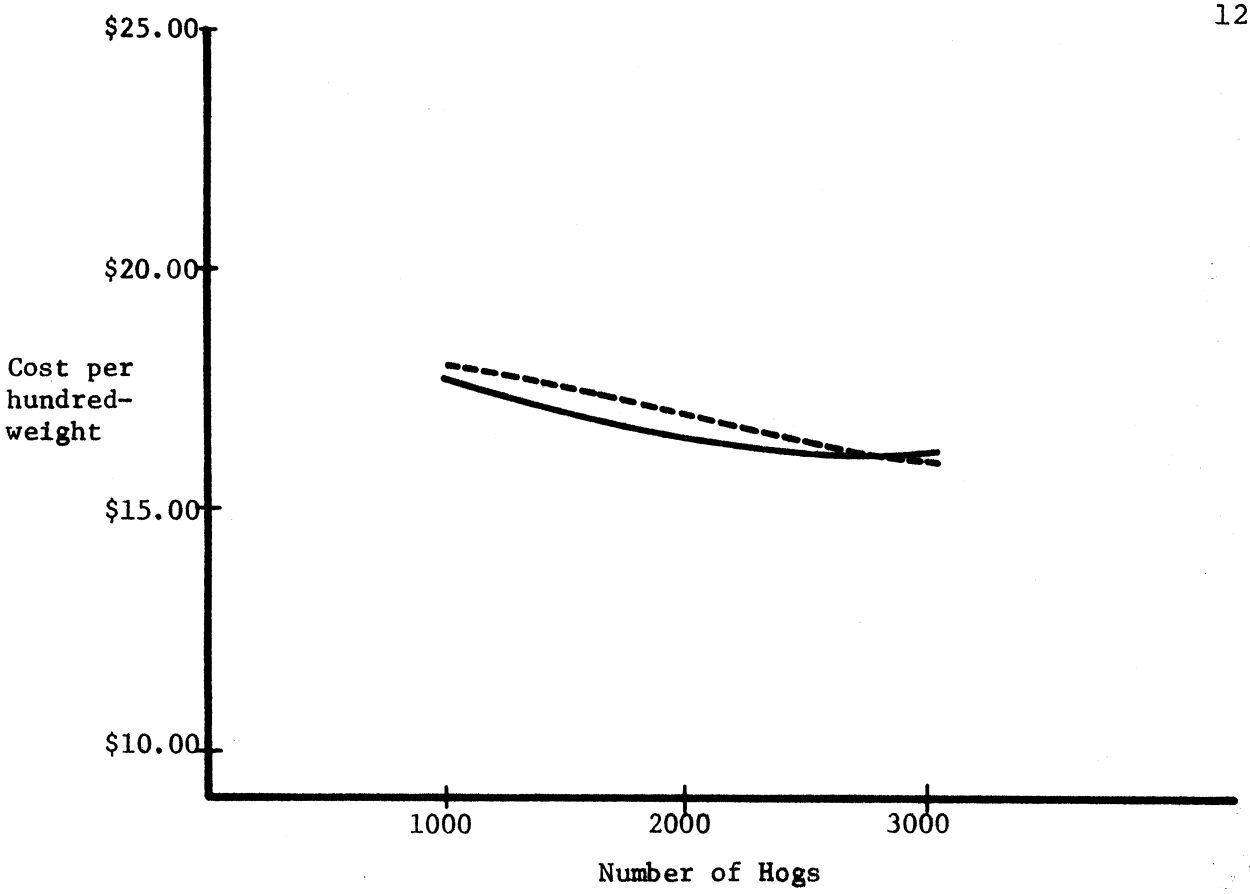

Figure VI-3. Cost Per Hundredweight-- Capacity 3, Conventional and Confinement Systems

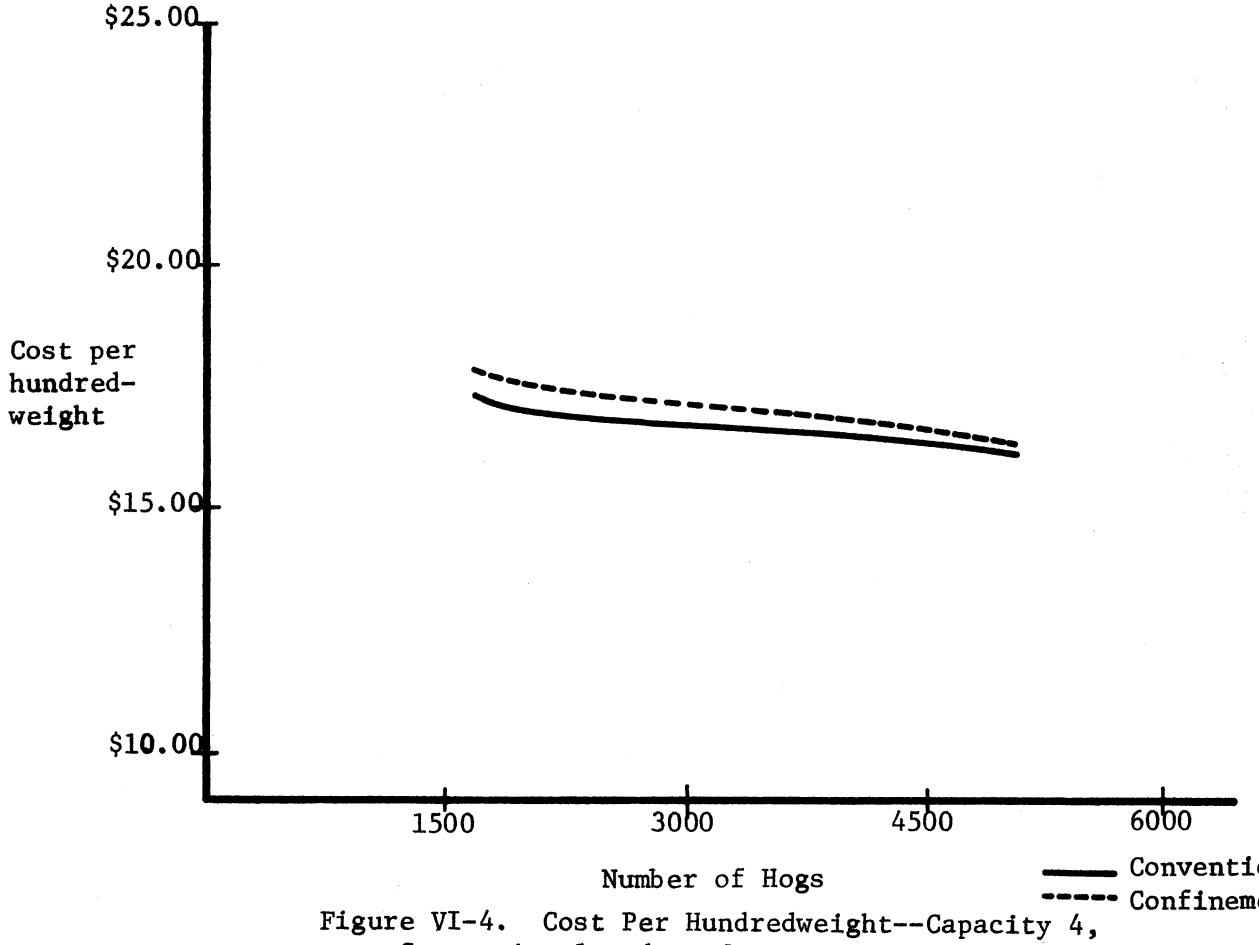

Figure VI-4. Cost Per Hundredweight--Capacity 4, Conventional and Confinement Systems

Table VI-7

Capacity 4--The Physical Operations and Techniques Budgeted for the Conventional and Confinement System--2, 4, and 6 Farrowings

Farrowing Level	Conventional	Confinement
2, 4, and 6	Farrowing-portion of pen isolated from sow	Farrowing crate
	Stationary mill	Stationary mill
	Bulk storage	Bulk storage
	Automatic feeding system	Automatic feeding system
	Manure loader and tractor for manure removal	Lagoon for growing-finishing
	Lagoon for growing-finishing	Pit for farrowing house
	No tank wagon	Tank wagon
	Auger wagon	Auger wagon

with the exception of ventilation. Lagoons are present for both systems in the growing and finishing phases. Automatic feeding systems also have been added as part of the conventional system. Table VI-8 presents the cost and labor data for capacity 4.

The confinement system costs for all 3 levels of farrowing were higher than the conventional systems. The conventional system's labor requirements were much closer to

Table VI-8

Cost and Labor Measures for Capacity 4--Conventional (CV) and Confinement (CF) at 2, 4, and 6 Farrowing Intensities

Item	(CV)	(CF)	(CV)	(CF)	(CV)	(CF)
Number of farrowings	2	2	4	4	6	6
Number of market hogs	1680	1680	3360	3360	5040	5040
Average variable cost (AVC) per hog	$31.51	$31.80	$31.00	$31.22	$30.78	$30.68
Average fixed cost (AFC) per hog	$ 6.66	$ 7.50	$ 5.62	$ 6.23	$ 4.74	$ 5.15
Average total cost (ATC) per hog	$38.17	$39.30	$36.62	$37.45	$35.52	$35.83
Average total cost (ATC) per cwt.	$17.35	$17.86	$16.65	$17.02	$16.16	$16.21
Labor per hog (hours)	1.08	1.05	1.06	1.01	1.11	.95

Source: Based on calculated budgets, Appendix D, Tables J, K and L.

the confinement system reflecting the change in manure handling. The fixed costs were lower in the conventional system basically because the confinement system had investments in ventilation fans and equipment. The average fixed cost for the conventional system went from $6.66 per hog to $4.74 per hog as the farrowing intensity went from 2 to 6. The confinement systems average fixed costs per hog went from $7.50 to $5.15 as the level of farrowings increased from 2 to 6.

The costs per hundredweight in both systems declined as the farrowing level increased. The total cost per hundredweight for the conventional and confinement systems were $17.35, $16.65, and $16.16, and $17.86, $17.02, and $16.21, respectively for 2, 4 and 6 farrowings (Table VI-8 and Figure VI-4).

Capacity 5

Capacity 5 consists of 1 set of 150 sows farrowed twice, 2 sets of 150 sows with each set farrowed twice, and 3 sets of 150 sows with each set farrowed twice. The number of market hogs at 2, 4 and 6 farrowings were 2,520, 5,038, and 7,558, respectively. Table VI-9 presents the nature of the physical operation for the conventional and confinement systems for this capacity.

The basic change of capacity 5 is the addition of an automatic feeding system to the farrowing house.

Table VI-9

Capacity 5--The Physical Operations and Techniques Budgeted for in the Conventional and Confinement Systems--2, 4, and 6 Farrowings

Farrowing Level	Conventional	Confinement
2, 4, and 6	Farrowing-portion of pen isolated from sow Automatic feeding system for farrowing house Automatic feeding system for market hogs Lagoon for grow-finish Manual handling of manure-farrowing house Stationary mill	Farrowing crate Automatic feeding system for farrowing house Automatic feeding system for market hogs Lagoon for grow-finish Pit system used for manure-farrowing house Tank wagon for liquid manure Stationary mill

For all previous capacities the feeders were manually filled. At this level, all housing (farrowing, growing and finishing) has automatic waterers and feeding system.

The cost and labor data for capacity 5 at the 3 farrowing levels are set forth in Table VI-10. The confinement system costs were higher for all 3 farrowings when compared to the conventional system. Labor per hog in the conventional system is not greatly different than the

Table VI-10

Cost and Labor Measures for Capacity 5 - Conventional and Confinement at Two, Four and Six Farrowing Intensities

Item	Conventional	Confinement	Conventional	Confinement	Conventional	Confinement
Number of farrowings	2	2	4	4	6	6
Number of market hogs	2520	2520	5038	5038	7558	7558
Average variable cost (AVC) per hog	$30.45	$30.72	$30.30	$30.33	$29.76	$29.87
Average fixed cost (AFC) per hog	$ 6.80	$ 7.66	$ 5.49	$ 6.13	$ 4.87	$ 5.29
Average total cost (ATC) per hog	$37.25	$38.38	$35.79	$36.46	$34.63	$35.16
Average total cost (ATC) per cwt.	$16.93	$17.45	$16.27	$16.57	$15.74	$15.98
Labor per hog (hours)	.82	.79	.86	.77	.76	.73

Source: Based on calculated budgets, Appendix D, Tables M, N and O.

confinement system, since both systems include lagoons and automatic feeding in the physical operation. Labor in the conventional system remains slightly higher when compared to the confinement system because the manure is washed or shoved into the lagoon. In the confinement system the manure drops directly into the lagoon under and around the hog house. Fixed costs are higher in the confinement system reflecting the added investment in ventilation equipment. The conventional system has an open front and requires little or no ventilation equipment other than vents, doors and windows in the house. Fixed costs for the conventional system decreased from $6.80 per hog in the 2 farrowing system to $4.87 per hog in the 6 farrowing system. Costs for the confinement system also decreased from $7.66 to $5.29 from the 2 to 6 farrowing range.

The costs per hundredweight for the 2, 4 and 6 farrowings in the conventional system were $16.93, $16.27, and $15.74 (Table VI-10 and Figure VI-5). The costs per hundredweight for the confinement system were $17.45, $16.57, $16.91 for the 2, 4 and 6 farrowing levels, respectively.

Capacity 6

Capacity 6 was the largest model under investigation. For the 2, 4 and 6 farrowing levels the number of market hogs produced were 3,360, 6,718, and 10,078,

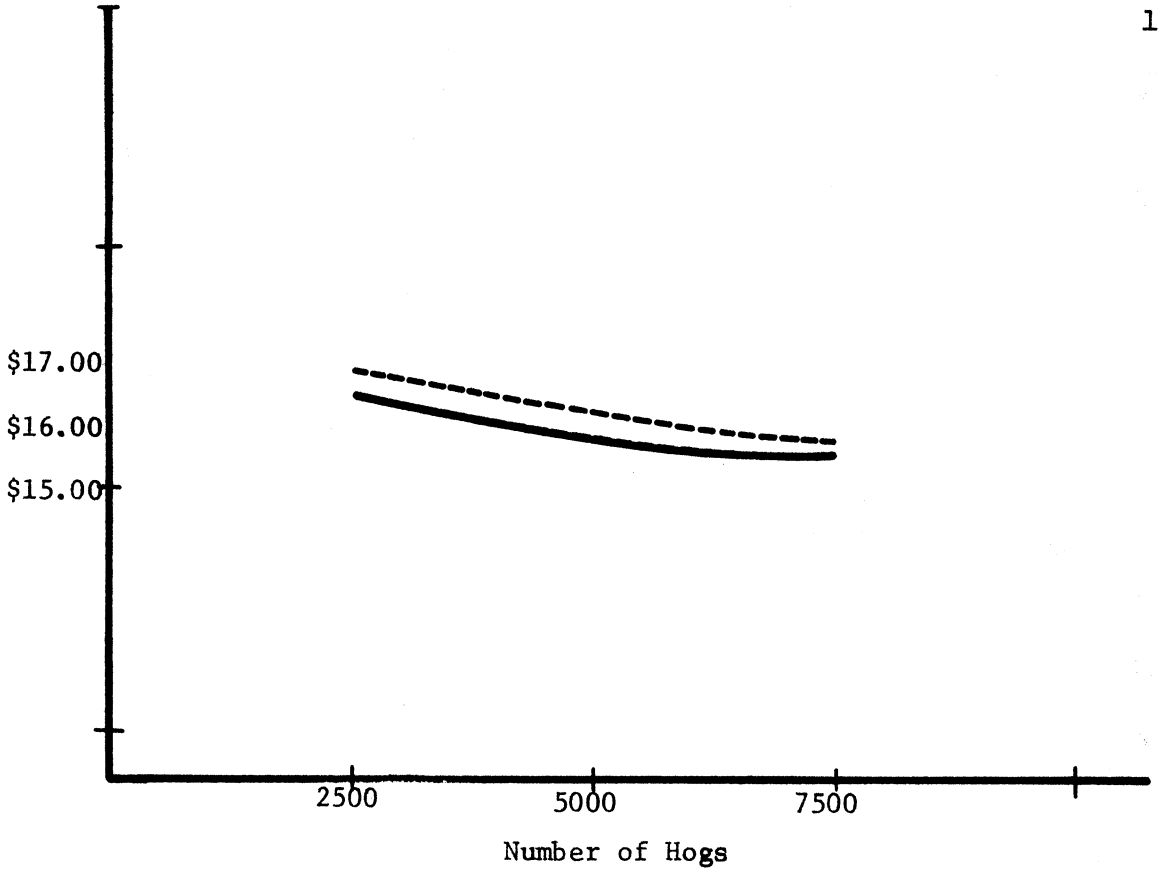

Figure VI-5. Cost Per Hundredweight--Capacity 5, Conventional and Confinement Systems

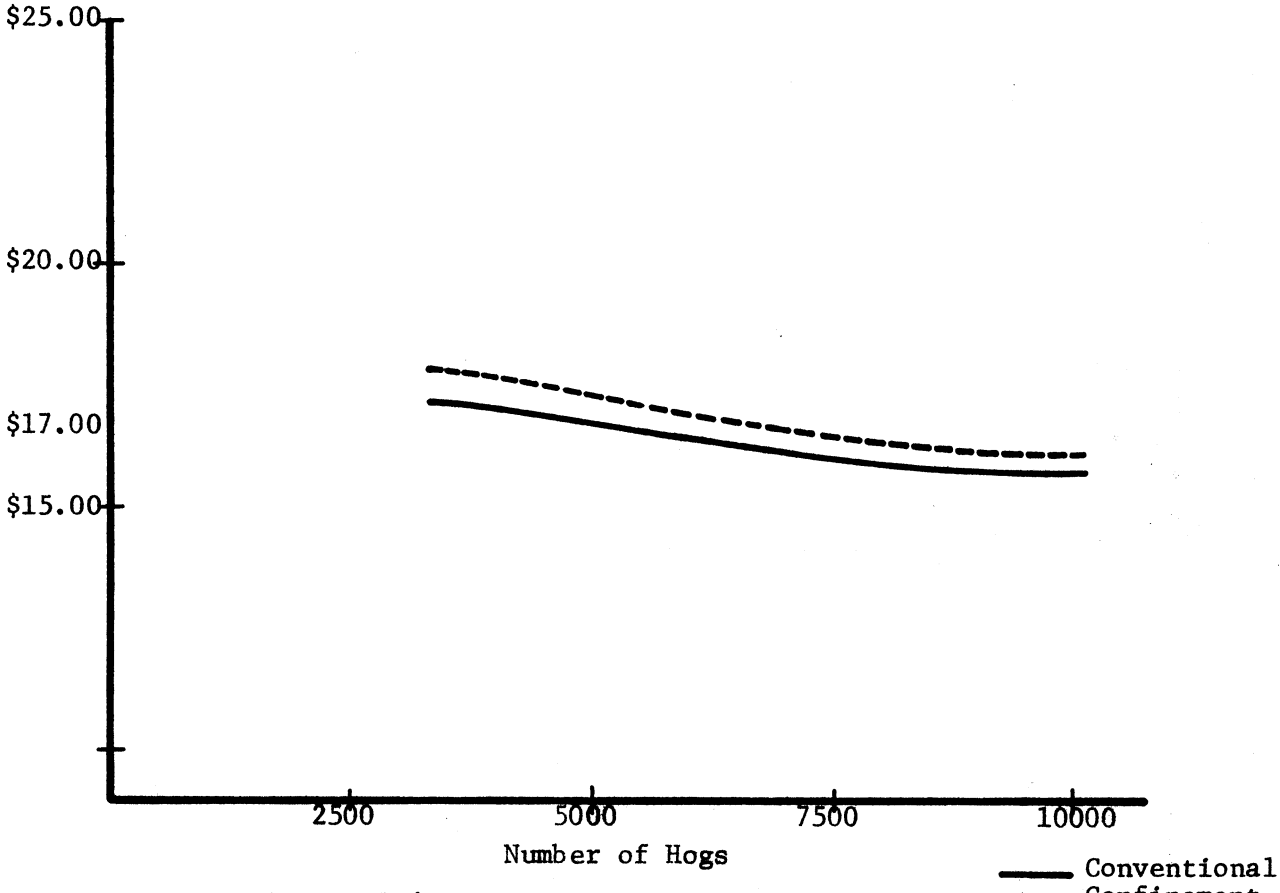

Figure VI-6. Cost Per Hundredweight--Capacity 6, Conventional and Confinement Systems

respectively. Capacity 6 consisted of 1 set of 200 sows farrowed twice, 2 sets of 200 sows with each set farrowed twice, and 3 sets of 200 sows with each set farrowed twice. Table VI-11 presents the nature of the physical operation. Capacity 6 physical operation was identical to capacity 5 except on a larger scale.

Table VI-11

Capacity6--The Physical Operations and Techniques Budgeted for in the Conventional and Confinement Systems--2, 4, and 6 Farrowings

Farrowing Level	Conventional	Confinement
	Farrowing-portion of pen isolated from sow	Farrowing crates
	Automatic feeding system-farrowing house	Automatic feeding system-farrowing house
2, 4, and 6	Automatic feeding system--grow-finish	Automatic feeding system--grow-finish
	Lagoon--growing-finishing phases	Pit for manure-farrowing house
		Lagoon--growing-finishing phases
		Tank wagons for manure

In Table VI-12 the cost and labor data for the 3 farrowing levels for both systems are presented. The

Table VI-12

Cost and Labor Measures for Capacity 6--Conventional (CV) and Confinement (CF) at 2, 4, and 6 Farrowing Intensities

Item	(CV)	(CF)	(CV)	(CF)	(CV)	(CF)
Number of farrowings	2	2	4	4	6	6
Number of market hogs	3360	3360	6718	6718	10078	10078
Average variable cost (AVC) per hog	$30.76	$31.13	$30.40	$30.69	$29.88	$30.08
Average fixed cost (AFC) per hog	$ 6.90	$ 7.84	$ 5.56	$ 6.23	$ 4.75	$ 5.19
Average total cost (ATC) per hog	$37.66	$38.97	$35.96	$36.92	$34.63	$35.27
Average total cost (ATC) per Cwt.	$17.12	$17.71	$16.33	$16.78	$15.74	$16.03
Labor per hog (hours)	.83	.83	.88	.88	.83	.81

Source: Based on calculated budgets, Appendix D, Tables P, Q and R.

confinement system had higher average total cost per hog at the 3 farrowing intensities when compared with the conventional system. The variable costs remained quite constant as farrowing intensity increased. The fixed costs, however, exhibited some variation. The conventional average fixed cost fell from $6.90 per hog at the 2 farrowing level to $4.75 per hog at the 6 farrowing level--a decrease of $2.15 per hog. The confinement systems average fixed cost fell from $7.84 per hog at the 2 farrowing level to $5.19 per hog at the 6 farrowing level--a decrease of $2.65 per hog. Labor for both systems were approximately the same.

The cost per hundredweight for the conventional system for the 2, 4 and 6 farrowings were $17.12, $16.33, and $15.74, respectively (Table VI-12 and Figure VI-6). The costs per hundredweight for the confinement system were $17.71, $16.78, and $16.03 for the 2, 4 and 6 farrowings, respectively.

Summary--Capacities 1-6

From the budgets it may be concluded that the cost and labor coefficients do change significantly with the size of the operation; i.e., from capacity 1 to capacity 6. The cost per hundredweight for the conventional system for 2, 4 and 6 farrowings of capacity 1 were $21,54, $18.48, and $17.85 and for capacity 6, $17.12, $16.33, and $16.74. The confinement system costs per hundredweight for 2, 4 and 6 farrowings for capacity 1 were $18.92, $17.85, and $17.08

and for capacity 6 were $17.71, $16.78, and $16.03. These costs decreased as the number of hogs produced increased, indicating some economies of size present in the enterprise.

The physical labor requirements likewise changed as the number of hogs increased. The labor coefficients per hog for capacity 1, conventional system, for 2, 4 and 6 farrowings were 1.89 hours, 1.53 hours, and 1.52 hours per hog. The labor coefficients for capacity 6 for the conventional system for the same farrowing levels were .83 hour, .88 hour, and .83 hour per hog. The reduction of labor was primarily a result of the substitution of the automatic feeding system and the lagoon for the auger wagon and manual handling of manure. The labor coefficients for the confinement system decreased but not as much as the conventional system. The confinement system for all capacities had automatic feeding and lagoons as part of the operation. Hours of labor per hog in the confinement system were 1.51, 1.16 and 1.22, respectively, for 2, 4 and 6 farrowings. For capacity 6 the hours of labor per hog, confinement, for the 2, 4 and 6 farrowing levels was .83, .88, and .81 (approximately the same as conventional).

In addition to the changes in cost and labor, the nature of the hog operation also varied. The greater the number of hogs fed, the greater the number of labor-saving techniques introduced. This was particularly true in the

case with the conventional system. The manure and feeding systems involved manual handling (tractor-loader) and auger wagon prior to capacity 4; however, for capacities 4, 5 and 6, automatic feed handling and lagoons were part of the system.

ANALYSIS BY FARROWING INTENSITY

Three farrowings systems were analyzed--2, 4 and 6. A question a farmer may ask is what happens to production costs if the number of hogs fed is increased but the number of farrowings per year remains constant? Each farrowing level from capacity 1 through 6 needs to be analyzed to answer such a question. The movement by a producer from capacity 1 through 6 staying with a given farrowing intensity is much more difficult than remaining with a given capacity and increasing the number of farrowings. The concept now becomes one of the long run. That is, in order to increase the number of market hogs, additional buildings, additional equipment, and additional breeding stock must be acquired rather than using the buildings more intensively by increasing the number of farrowings.

2 Farrowings Per Year

The 2 farrowing operation consisted of 6 different sets of sows. The sets in terms of the number of sows were 8, 30, 60, 100, 150 and 200 head. Each sow was farrowed

twice per year and the entire set was farrowed at approximately the same time. Table VI-13 contains the budgeted results for 2 farrowings for the 6 capacities for both the conventional and confinement systems. Each capacity level represents a different mix of resources: different techniques, different dimensions with regard to buildings, feeders, and augers and different equipment. In the 2 farrowing system, all buildings at one time or another were idle. For example, the farrowing house was used only a total of 90 days of the year. The growing-finishing buildings were used a total of 240 days of the year with the growing-finishing phases of production completed in the same building.

The average fixed cost for the conventional system shows some variation but appears to have no significant direction. This indicates that as one moves from capacity 1 to capacity 6, increasing the number of sows, feed equipment, and other fixed items, cost would remain close to a previous level and no real cost decrease per hog would be realized. The confinement systems' average fixed cost increased as one moves from capacity 1 to capacity 6. This infers that larger operation had more invested per hog in terms of depreciable items than the previous smaller capacity(ies). Excess capacity exists in the 2 farrowing system.

Table VI-13

Cost and Labor Coefficients for 2 Farrowings Per Year
Capacities 1-6

Capacity	1		2		3		4		5		6	
Item	CV*	CF**	CV	CF	CV	CF	CV	CF	CV	CF	CV	CF
No. of mkt. hogs	134	134	504	504	1008	1008	1680	1680	2520	2520	3360	3360
Average variable cost per hog	$37.15	$34.96	$33.45	$33.09	$32.45	$31.75	$31.51	$31.80	$30.45	$30.72	$30.76	$31.13
Average fixed cost per hog	10.23	6.67	7.19	7.21	6.36	7.40	6.66	7.50	6.80	7.66	6.90	7.84
Average total cost per hog	47.38	41.63	40.63	40.30	38.81	39.15	38.17	39.30	37.25	38.38	37.66	38.97
Average total cost per cwt.	21.54	18.92	18.47	18.32	17.64	17.80	17.35	17.86	16.93	17.45	17.12	17.71
Labor per hog (hours)	1.89	1.51	1.48	1.32	1.38	1.00	1.08	1.05	.82	.79	.83	.83

*CV refers to Conventional System
**CF refers to Confinement System

The average variable cost declined as the capacity level increased. Part of the decline in variable costs can be explained by lower labor requirements per hog. The conventional and confinement systems of capacity 1 used 1.89 and 1.51 hours of labor per hog respectively. In capacity 6 the labor coefficient dropped to .83 hour of labor per hog for both systems. The variable costs decreased more than the fixed costs increased, hence the total cost per hog decreased as the number increased.

Figure VI-7 shows the cost per hundredweight for the conventional and confinement systems for 2 farrowings per year. Cost per hundredweight for the conventional system decreased from $21.54 in capacity 1 to a low of $16.93 per hundredweight in capacity 5. Capacity 6 cost per hundredweight was $17.12. The confinement system decreased from $18.92 per hundredweight in capacity 1 to a low of $17.45 per hundred weight in capacity 5. Capacity 6 costs per hundredweight was slightly higher at $17.71 per hundredweight. Some diseconomies of size appear to be present after capacity 5 was reached. The labor required per hog increased slightly from capacity 5 to capacity 6. Sanitation and veterinary costs were higher. For example, the hygiene cost was $0.27 in capacity 5 per hog as compared to $0.51 per hog in capacity 6. Electricity was $0.09 higher per hog in capacity 6 compared to capacity 5. The

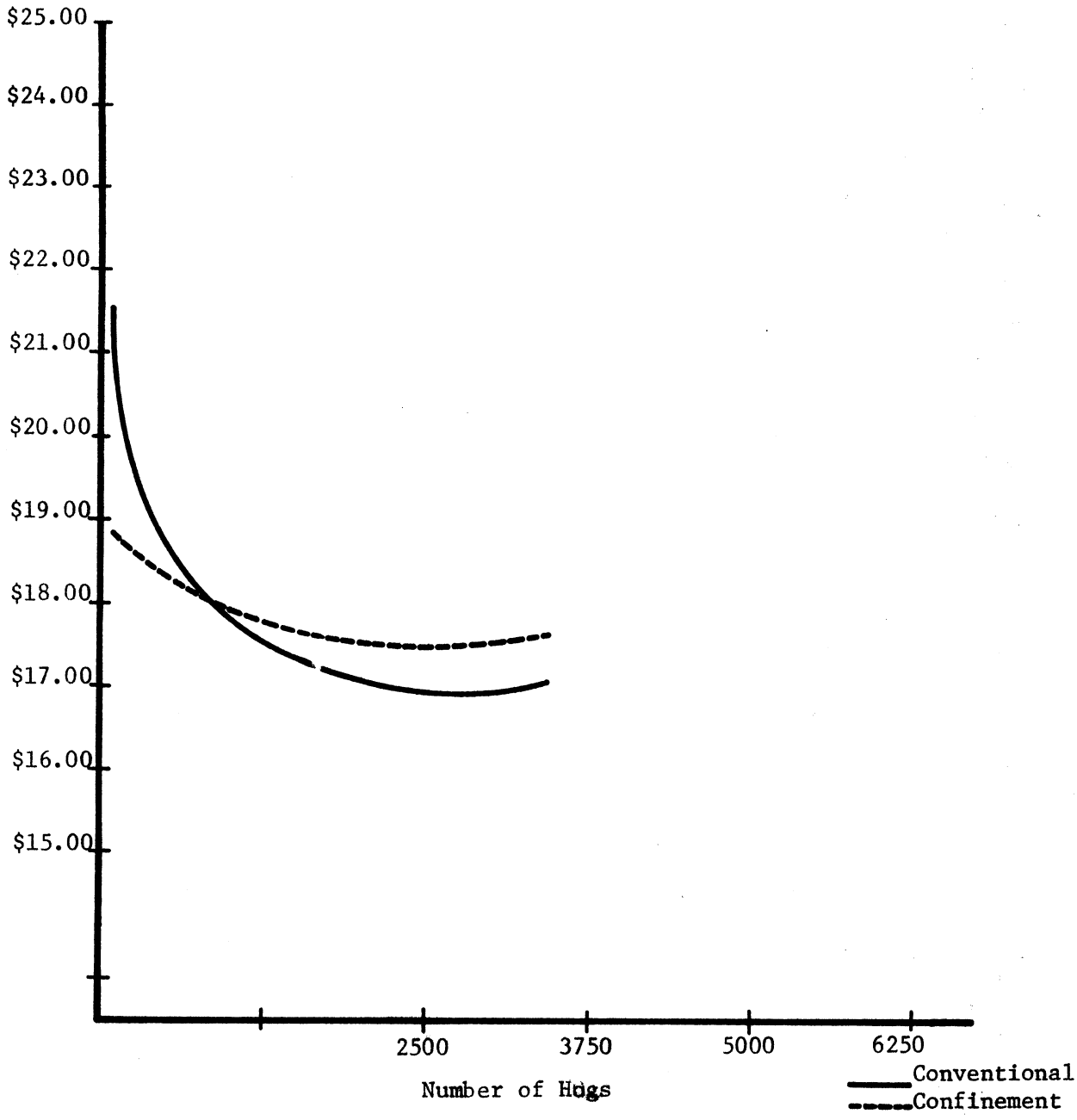

Figure VI-7. Long run Cost Curves for the Conventional and Confinement Systems Based on 8.5 Pigs per Litter--Two Farrowings Per Year.

cost of the boar per market hog was $0.40 in capacity 5 compared to $0.60 per market hog in capacity 6.

4 Farrowings Per Year

The 4 farrowing systems consisted of 2 sets of sows with each set of sows farrowed twice per year at approximately the same time. Capacities 1 to 6 had 2 sets of sows with each set consisting of 8, 30, 60, 100, 150, and 200 head. The number of market hogs went from 268 in capacity 1 to 6,718 in capacity 6. The 4 farrowing systems utilized the same farrowing facilities of the 2 farrowing system. However, extra facilities were needed in the 4 farrowing system for the growing and finishing phases. It was necessary to separate the growing and finishing phases by designating specific buildings as for these purposes.

Table VI-14 presents the labor and cost coefficients for the 4 farrowing systems for the conventional and confinement system. The average fixed cost for the conventional system declines for the first 3 capacities from $6.75 to $5.27. Then slightly higher fixed costs were incurred for capacities 4 to 6. The average fixed cost per hog confinement increased from $5.60 to $6.23 per hog. The average variable cost for the conventional system declined from $33.91 per hog to $30.30 per hog in capacity 5. Costs in capacity 6 were $0.10 higher than capacity 5. The basic

Table VI-14

Cost and Labor Coefficients for the 4 Farrowing System Per Year
Capacities 1 to 6

Capacity	1		2		3		4		5		6	
Item	CV*	CF**	CV	CF	CV	CF	CV	CF	CV	CF	CV	CF
No. of mkt. hogs	268	268	1008	1008	2040	2040	3360	3360	5038	5038	6718	6718
Average variable cost per hog	$33.91	$33.67	$31.53	$31.22	$31.13	$30.60	$31.00	$31.22	$30.30	$30.33	$30.40	$30.69
Average fixed cost per hog	6.75	5.60	5.56	5.99	5.27	6.19	5.62	6.23	5.49	6.13	5.56	6.23
Average total cost per hog	40.66	39.27	37.09	37.21	36.40	36.79	36.62	37.45	35.79	36.46	35.96	36.92
Average total cost per cwt.	18.48	17.85	16.86	16.91	16.55	16.72	16.65	17.02	16.27	16.57	16.33	16.78
Labor per hog (hours)	1.53	1.16	1.21	.95	1.24	.94	1.06	1.01	.86	.77	.88	.88

*CV refers to Conventional System
**CF refers to Confinement System

difference is due to the smaller labor requirements of the larger capacities. In the conventional system the labor coefficient declined to .86 hours per hog in capacity 5 (.02 higher in capacity 6). Likewise the confinement system's labor coefficient declined from 1.16 hours per hog to as low as .77 hour per hog in capacity 5. The average variable cost of the confinement system decreased from $33.67 per hog in capacity 1 to $30.33 per hog in capacity 5 (capacity 6 was $0.36 higher per hog than for capacity 5).

Figure VI-8 presents the cost per hundredweight for the conventional and confinement system for 4 farrowings. The cost per hundredweight for the conventional system went from $18.48 in capacity 1 to approximately $16.30 in capacities 5 and 6. The confinement system went from $17.85 per hundredweight in capacity 1 to $16.78 per hundredweight in capacity 6. From the budgets it was apparent that some economies of size were present.

Comparison of 2 and 4 Farrowings

A comparison of the 2 and 4 farrowing systems for average fixed cost, average variable cost, cost per hundredweight and labor are shown in Table VI-15. The 4 farrowing system uses the farrowing house a total of 180 days of the year. Each growing and finishing building was used 240 days of the year. Since the farrowing house was used 90 days more by the 2 additional farrowings, the average fixed cost per hog for all capacities in the 4 farrowing system was

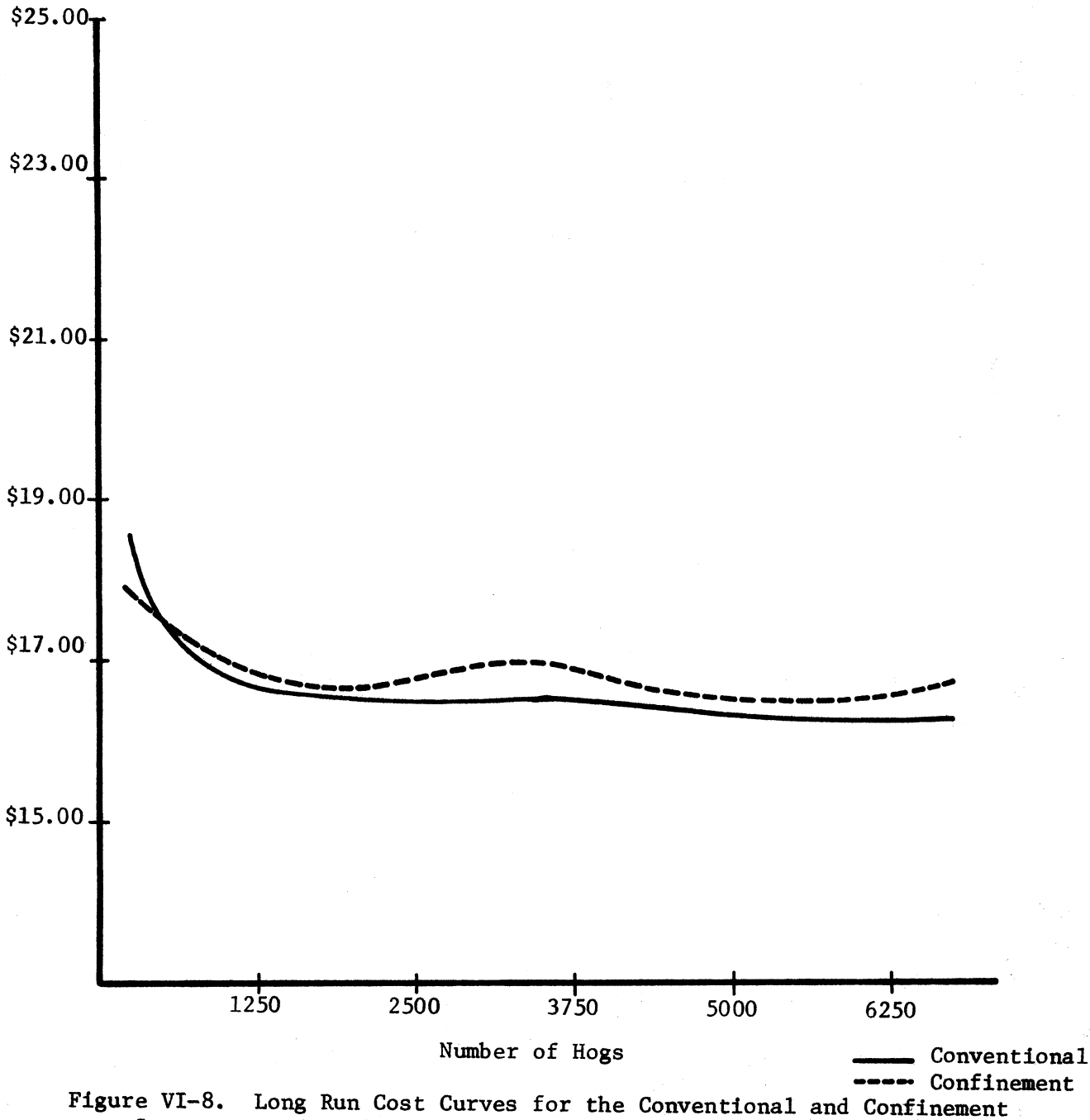

Figure VI-8. Long Run Cost Curves for the Conventional and Confinement Systems Based on 8.5 Pigs per Litter--Four Farrowings Per Year.

Table VI-15

Differences in the Average Fixed Cost, Average Variable Cost, and Cost Per Hundredweight Between the 2 and 4 Farrowing Levels of Intensity for the Conventional (CV) and Confinement (CF) System

Capacity 1 to 6

Capacity	1	2	3	4	5	6
Average fixed cost per hog (CV)	$3.48	$1.63	$1.09	$1.04	$1.31	$1.34
Average fixed cost per hog (CF)	$1.07	$1.22	$1.21	$1.27	$1.53	$1.61
Average variable cost per hog (CV)	$3.24	$1.92	$1.32	$ .51	$ .15	$ .36
Average variable cost per hog (CF)	$1.29	$1.87	$1.15	$ .58	$ .39	$ .44
Average total cost per cwt. (CV)	$2.97	$1.61	$1.09	$ .70	$ .66	$ .79
Average total cost per cwt. (CF)	$1.07	$1.41	$1.08	$ .84	$ .88	$ .93
Labor per hog hours (CV)*	$ .36	$ .27	$ .14	$ .02	$ .04+	$ .05+
Labor per hog hours (CF)*	$ .35	$ .37	$ .06	$ .04	$ .02	$ .05+

*Plus (+) designates 4 farrowing system was higher than 2 farrowing system. No plus sign indicates the 4 farrowing system was lower in the item than 2 farrowing system.

less than for the 2 farrowing system. A producer going from 2 to 4 farrowings in capacity 1, using the conventional method, would reduce his average fixed cost by $3.48 per hog. A producer, in the confinement system capacity 1, would lower his average fixed cost per hog by $1.07 by increasing the farrowing intensity to 4. Likewise, a producer in capacity 6 would lower his average fixed cost by $0.34 per hog and $1.61 per hog for the conventional and confinement systems, respectively. For all six capacities the producer would lower the fixed cost per hog by at least $1.00 regardless of his system of production, by increasing the farrowing intensity to 4 and making the adjustment in the growing-finishing setup.

Average variable costs followed the same pattern as average fixed costs. The average variable costs for the 4 farrowing system were considerably lower for capacities 1, 2 and 3 when compared with the 2 farrowing system. For these 3 capacities the average variable costs were from $1.15 to $3.24 lower per hog. For capacities 4, 5 and 6 the variable costs ranged from $0.15 to $0.58 lower for the 4 farrowings per year compared with the 2 farrowing system. Variable costs were lower in the 4 farrowing system as the labor requirements were less, savings in electricity were realized as the kilowatts used increased, and more effective use was made of the boar.

Since both variable and fixed costs were lower for all 6 capacities for both systems, the total costs per hog and/or the costs per hundredweight for the 4 farrowing level were less when compared with the 2 farrowing system. For the conventional system, capacities 1, 2, 3, 4, 5 and 6 would realize lower cost per hundredweight by $2.97, $1.61, $1.09, $0.70, $0.66, and $0.79, respectively, by changing from 2 to 4 farrowings per year. Capacities 1, 2, 3, 4, 5 and 6 of the confinement system would reduce the cost per hundredweight by $1.07, $1.41, $1.08, $0.84, $0.88, and $0.93, respectively, by changing to 4 farrowings.

6 Farrowings Per Year

The 6 farrowing system consisted of 3 sets of sows with each set of sows farrowed twice per year. Capacities 1 through 6 had 3 sets of sows with each set consisting of 8, 30, 60, 100, 150 and 200 sows. The number of market hogs ranged from 404 to 10,078 head. The 6 farrowing system utilized the same farrowing house and the same number of growing and finishing buildings as the 4 farrowing system. However, pressure on the management increased because this level of intensity requires the sequence or timing of the operation within narrow limits in order to utilize the same facilities as the 4 farrowing level of intensity.

Table VI-16 presents for capacity 1-6, conventional and confinement systems, the cost and labor coefficients.

Table VI-16

Cost and Labor Coefficients for the 6 Farrowing System Per Year
Capacities 1 to 6

Capacity	1		2		3		4		5		6	
Item	CV*	CF**	CV	CF	CV	CF	CV	CF	CV	CF	CV	CF
No. of mkt. hogs	404	404	1515	1515	3024	3024	5040	5040	7558	7558	10,078	10,078
Average variable cost per hog	$33.34	$32.20	$31.00	$30.73	$31.17	$30.50	$30.78	$30.68	$29.76	$29.87	$29.88	$30.08
Average fixed cost per hog	5.92	5.38	4.74	5.01	4.57	5.19	4.74	5.15	4.87	5.29	4.75	5.19
Average total cost per hog	39.26	37.58	35.74	35.74	35.74	35.69	35.52	35.83	34.63	35.16	34.63	35.27
Average total cost per cwt.	17.85	17.08	16.25	16.25	16.25	16.22	16.15	16.21	15.74	15.98	15.74	16.03
Labor per hog (hours)	1.52	1.22	1.11	.94	1.23	.94	1.11	.95	.76	.73	.83	.81

*CV refers to Conventional System
**CF refers to Confinement System

Average fixed costs for the conventional system declined through the first 3 capacities from $5.92 per hog to $4.57 per hog. The average fixed cost per hog for the confinement system was quite close to $5.20 per hog for all capacities (the range was from $5.38 to $5.01 per hog). The conventional system's average fixed costs declined from $5.92 per hog in capacity 1 to $4.57 per hog in capacity 3. The fixed costs per hog in capacities 4, 5 and 6 were $4.74, $4.87, and $4.75 respectively. The increase in average fixed costs from capacity 3 (60 sows base) to capacity 4 (100 sows base) can be explained by $0.09 higher feed equipment costs per hog, $0.18 higher manure handling costs per hog, $0.04 higher depreciation costs per hog for the farrowing house, and $1.01 higher depreciation costs per hog for the growing-finishing houses. Some of the other fixed costs decreased $0.01 to $0.02 and others varied less than $0.01 per hog. The increase for manure handling was the result of lagoons becoming part of the physical operation in addition to the manure spreader and tractor. From capacity 4 to 5, the fixed costs increased $0.13 per hog. This increase was caused by a physiological factor affecting the breeding cost of the boar. The boar cost was $0.24 per hog in capacity 4 and $0.40 per hog in capacity 5. In capacity 6, the boar charge was $0.10 less or $0.30 per hog as the boar was more effectively used in the breeding of sows.

The average variable costs per hog for both systems showed a general decrease as the number of hogs marketed increased. For the conventional system, average variable costs per hog for capacities 1 through 6 was $33.34, $31.00, $31.17, $30.78, $29.76, and $29.88, respectively. The smaller labor requirement for the larger capacities explains the majority of the difference in variable costs. Hours of labor per hog for the conventional system went from 1.52 in capacity 1 down to .76 in capacity 5 (capacity 6 was only slightly higher). For the confinement system, average variable costs per hog declined as capacity went from 1 to 6. The average variable costs per hog were $32.20, $30.73, $30.50, $30.82, $29.87, and $30.08, respectively, for capacities 1 to 6. The hours of labor per hog in the confinement system was 1.22, .94, .95, .73, and .81, respectively, for capacities 1 to 6. For capacity 6, more time was allotted for disinfecting and sanitation. Since the number of hogs produced was near 10,000 head extra care was taken in the sanitation part of the production operation. The drop in hours of labor from .95 to .73 per hog was due to the addition of the automatic feeding system to the farrowing house.

Figure VI-9 shows the cost per hundredweight for the conventional and confinement system for 6 farrowings per year. The costs per hundredweight for the conventional system for capacities 1 to 6 were $17.85, $16.25, $16.25,

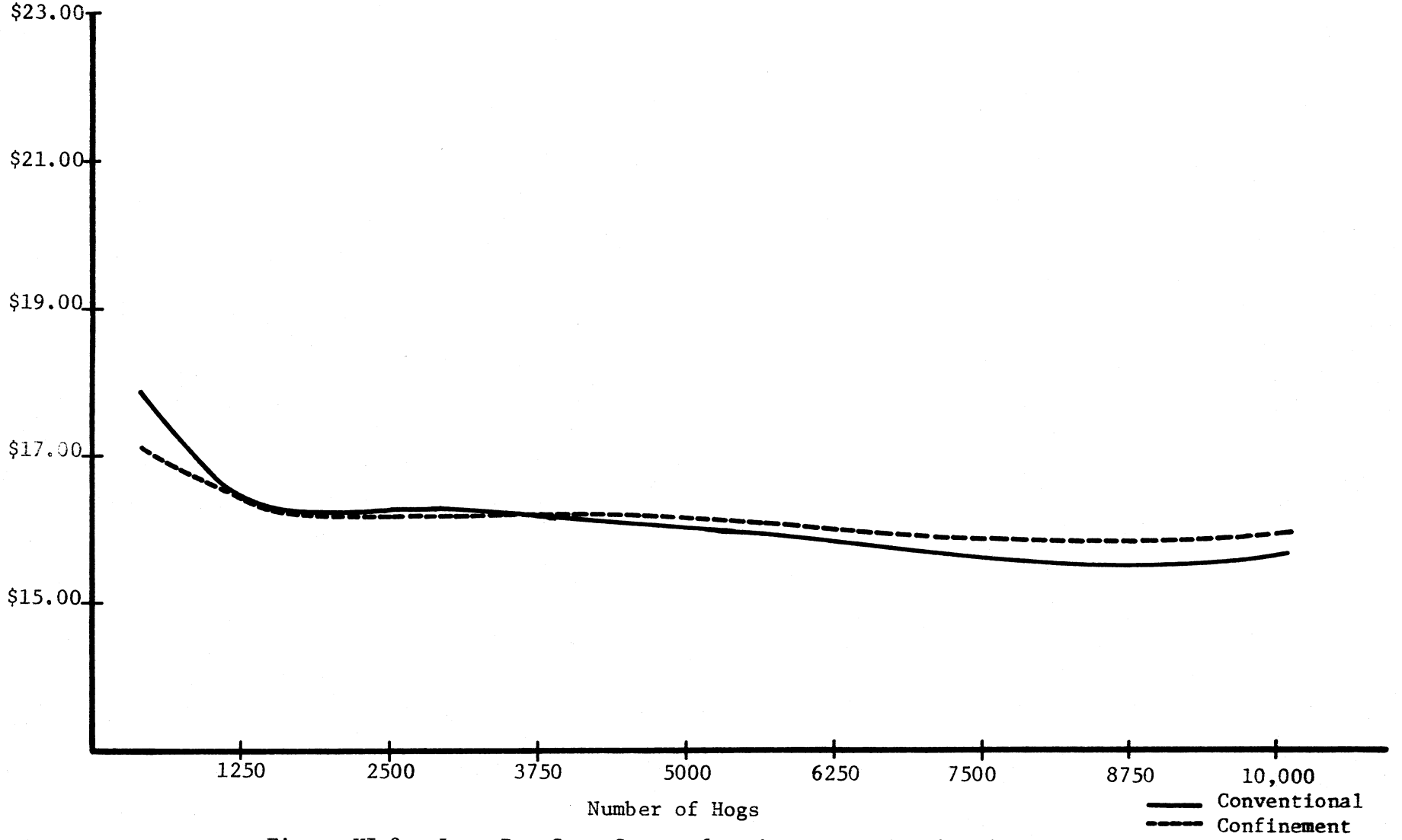

Figure VI-9. Long Run Cost Curves for the Conventional and Confinement Systems Based on 8.5 Pigs per Litter--Six Farrowings Per Year.

$16.15, $15.74, and $15.74, respectively. The confinement system costs per hundredweight were $17.08, $16.25, $16.22, $16.21, $15.93, and $16.03 for capacities 1 to 6, respectively. A large drop in costs occurred from capacity 1 to 2, then leveled out and remained quite constant for the remaining 4 capacities. Most of the economies of size were realized at 1,500 market hogs with the 6 farrowing system after which few economies were apparent. There was a slight indication of diseconomies appearing in the confinement system from capacity 5 to capacity 6. At capacity 2, the cost per hundredweight was identical for both systems of production. For capacity 2 a producer would be indifferent as to which system should be used to produce the 1,515 market hogs. The choice would depend on the availability of capital and labor to the producer. The conventional system requires more labor while the confinement system requires more capital. Above the 1,515 market hog level of production the conventional system had lower costs per market hog. Using the volume concept and multiplying the amount of the lower cost per market hog produced by capacities 3, 4, 5 and 6, a significant reduction in cost is possible using the conventional system.

Comparison of 4 and 6 Farrowings

Differences in costs and labor requirements between the 6 farrowing system and the 4 farrowing system are shown in Table VI-17.

Table VI-17

Differences in the Average Fixed Cost, Average Variable Cost, and Cost Per Hundredweight Between the 4 and 6 Farrowing Systems for Conventional (CV) and Confinement (CF) Systems

Capacities 1 to 6

Capacity	1	2	3	4	5	6
Average fixed cost per hog (CV)	$ .83	$ .82	$ .70	$ .88	$ .62	$ .81
Average fixed cost per hog (CF)	$ .22	$ .98	$1.00	$1.08	$ .84	$1.04
Average variable cost per hog (CV)*	$ .57	$ .53	$ .04+	$ .22	$ .54	$ .52
Average variable cost per hog (CF)	$1.47	$ .49	$ .10	$ .54	$ .46	$ .61
Average total cost per cwt. (CV)	$ .63	$ .61	$ .30	$ .50	$ .53	$ .59
Average total cost per cwt. (CF)	$ .77	$ .66	$ .50	$ .81	$ .59	$ .75
Labor per hog (CV)* hours	$ .01	$ .10	$ .01	$ .05+	$ .10	$ .05
Labor per hog (CF)* hours	$ .06+	$ .01	--	$ .06	$ .04	$ .07

*Plus (+) designates 6 farrowing system was higher than 4 farrowing system. No plus sign indicates that 6 farrowing system was lower for the item than the 4 farrowing system

The 6 farrowing system uses the farrowing house a total of 270 days of the year. Each growing and finishing house was used 360 days of the year. Since the farrowing house was used 90 days more in the 6 farrowing system than in the 4 farrowing system and the growing and finishing house 120 days more, the average fixed costs per hog for all capacities was less. A hog producer going from 4 to 6 farrowings in either system could reduce his fixed costs from $0.22 to as much as $1.08 per hog. The average fixed costs in the conventional system could be lowered by $0.83, $0.82, $0.70, $0.88, $0.62, and $0.81 from capacities 1 to 6, respectively, by increasing the farrowing level from 4 to 6. The average fixed costs for the confinement system could be reduced by increasing the farrowing intensity from 4 to 6 for capacities 1 to 6 by $0.22, $0.98, $1.00, $1.08, $0.84, and $1.04, respectively. Hence, a producer could reduce his fixed cost by using his facilities more intensively; i.e., increase the number of farrowings.

Average variable costs per hog followed the same downward trend as average fixed costs per hog as farrowing intensity increased from 4 to 6 per year. The variable costs did not change as much when a producer moved from the 4 to 6 farrowing level, as compared with the change in variable costs when the producer moved from 2 to 4 farrowings per year. The labor requirements per hog did not change much as the farrowing intensity increased from 4 to

6 per year. Average variable costs were approximately $0.50 less per hog due to a slightly smaller labor requirement, a lower electrical cost and opportunity interest charged on a smaller total variable cost figure.

By increasing the farrowing level from 4 to 6, the costs per hundredweight decreased in the confinement system by $0.77, $0.66, $0.50, $0.81, $0.59, and $0.75 for capacities 1 to 6, respectively. For the conventional system, decreases in the costs per hundredweight were $0.63, $0.61, $0.30, $0.50, $0.53, and $0.59 for capacities 1 to 6. No change in buildings was required between the 4 and 6 farrowing levels of intensity.

LABOR REQUIREMENTS PER HOG (8.5 PIGS PER LITTER)

The labor required per hog varied with the farrowing intensity and with the number of hogs produced by a given farrowing system. Changes in the labor requirement per hog for a given farrowing level as the number of hogs increased in either the conventional or confinement system could be important to individual producers. If these changes are substantial, then some estimate of the capital-labor substitution ratio would be useful as more capital or labor saving devices were adopted in each system. A comparison of the labor required per hog for the conventional system (capacities 1 to 6) with the confinement system (capacities 1 to 6) for the 3 farrowing intensities revealed some important differences.

Table VI-18 shows the labor required per market hog for the conventional and confinement systems of production, at 2, 4 and 6 farrowings with the number of pigs per litter at 8.5 for capacities 1 to 6. The labor coefficient generally decreased as the producer went from capacity 1 to capacity 5. Capacity 6 was slightly higher than capacity 5 for all cases, due to extra care with respect to sanitation and time involved with handling additional hogs. For the 2 farrowing conventional system, 8.5 pigs per litter, the hours of labor required per hog were 1.89, 1.48, 1.38, 1.08, .82, and .83 for capacities 1 to 6, respectively. As a producer moved from capacity 1 to capacity 6, changes in the technique of production were made. Among the changes were automatic feeding systems and lagoons for the conventional system. Increased use of capital reduced the amount of labor required by 1.06 hours per hog from capacity 1 to 6. For the 2 farrowing level, confinement system, 8.5 pigs per litter, the hours of labor per hog for capacities 1 to 6 were 1.51, 1.32, 1.00, 1.05, .79, and .83, respectively. With the addition of capital the labor coefficient was reduced; the difference from capacity 1 to 6 being .68 hours per hog. The confinement system for all capacities included the automatic feeding system and lagoon. Part of the explanation for the labor reduction was the addition of the automatic feeding equipment in the farrowing house. For capacities 4, 5 and 6 the labor coefficients for the

Table VI-18

Hours of Labor Per Market Hog for Conventional (CV) and Confinement (CF) Systems of Production, 2-4-6 Farrowings, Capacities 1-6 and Litter Size of 8.5 Pigs and 7.0 Pigs

Farrowing Systems	Capacity 1 Hours Per Hog	Capacity 2 Hours Per Hog	Capacity 3 Hours Per Hog	Capacity 4 Hours Per Hog	Capacity 5 Hours Per Hog	Capacity 6 Hours Per Hog
2 Farrow CV, 8.5 pigs/litter	1.89	1.48	1.38	1.08	.82	.83
2 Farrow CF, 8.5 pigs/litter	1.51	1.32	1.00	1.05	.79	.83
4 Farrow CV, 8.5 pigs/litter	1.53	1.21	1.24	1.06	.86	.88
4 Farrow CF, 8.5 pigs/litter	1.16	.95	.94	1.01	.77	.88
6 Farrow CV, 8.5 pigs/litter	1.52	1.11	1.23	1.11	.76	.83
6 Farrow CF, 8.5 pigs/litter	1.22	.94	.95	.95	.73	.81
2 Farrow CV, 7.0 pigs/litter	2.22	1.76	1.64	1.28	.96	.98
2 Farrow CF, 7.0 pigs/litter	1.76	1.56	1.18	1.25	.94	.97
4 Farrow CV, 7.0 pigs/litter	1.83	1.44	1.69	1.25	1.02	1.03
4 Farrow CF, 7.0 pigs/litter	1.37	1.12	1.10	1.19	.91	.96
6 Farrow CV, 7.0 pigs/litter	1.74	1.32	1.47	1.31	.89	.97
6 Farrow CF, 7.0 pigs/litter	1.38	1.11	1.12	1.15	.85	.95

conventional and confinement systems were about the same. For these 3 capacities the techniques of production and equipment were nearly the same.

Figure VI-10 presents the labor required for the 2 farrowing system for the confinement and conventional systems as the size of operation increased from capacity 1 to capacity 6. The confinement system has lower labor requirements than the conventional system for all production levels except for capacity 6. For capacity 6 the labor requirement was identical for the conventional and confinement methods of production. Within the confinement system, capacities 3 and 4 had nearly identical labor requirements. In capacity 4, additional labor was allotted over and above the amount required per hog in capacity 3 for sanitation and cleaning. The farrowing houses of capacity 4 were in multiples of 50 sows instead of the previous 30 sow units and other buildings were also larger, requiring the extra care in disinfecting and sanitation. Likewise, some additional time per building was required for feeding and walking to and through the larger buildings. Labor in the conventional system dropped significantly from capacity 3 to 4 because of the addition of lagoons into the hog facilities.

The 4 farrowing level's labor per hog followed the same pattern as the 2 farrowing level, as the farrowing intensity increased for a given capacity and the number of

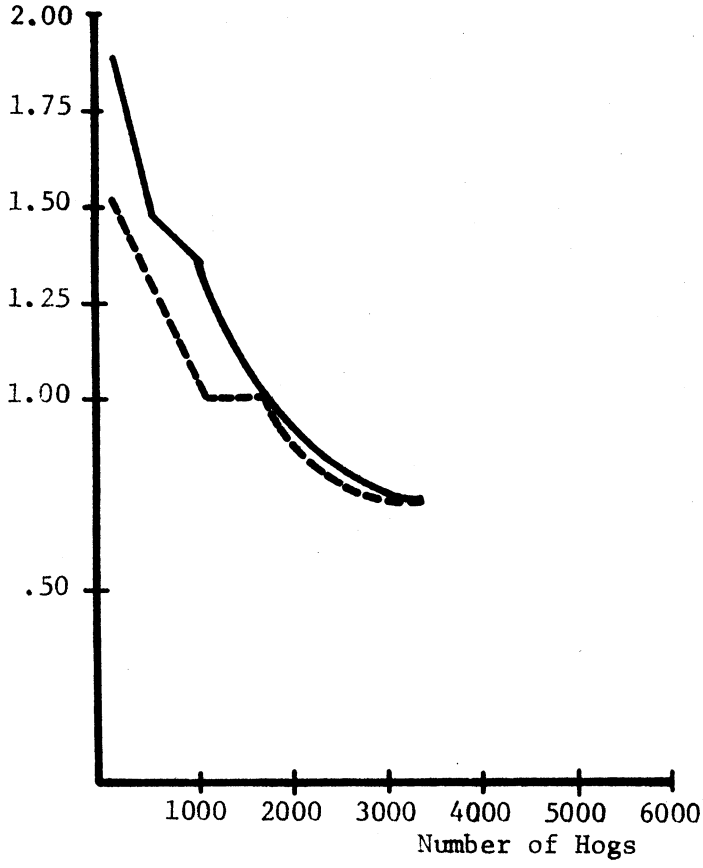

Figure VI-10. Labor Per Hog--Two Farrowings--Conventional--Confinement--8.5 Pigs Per Litter

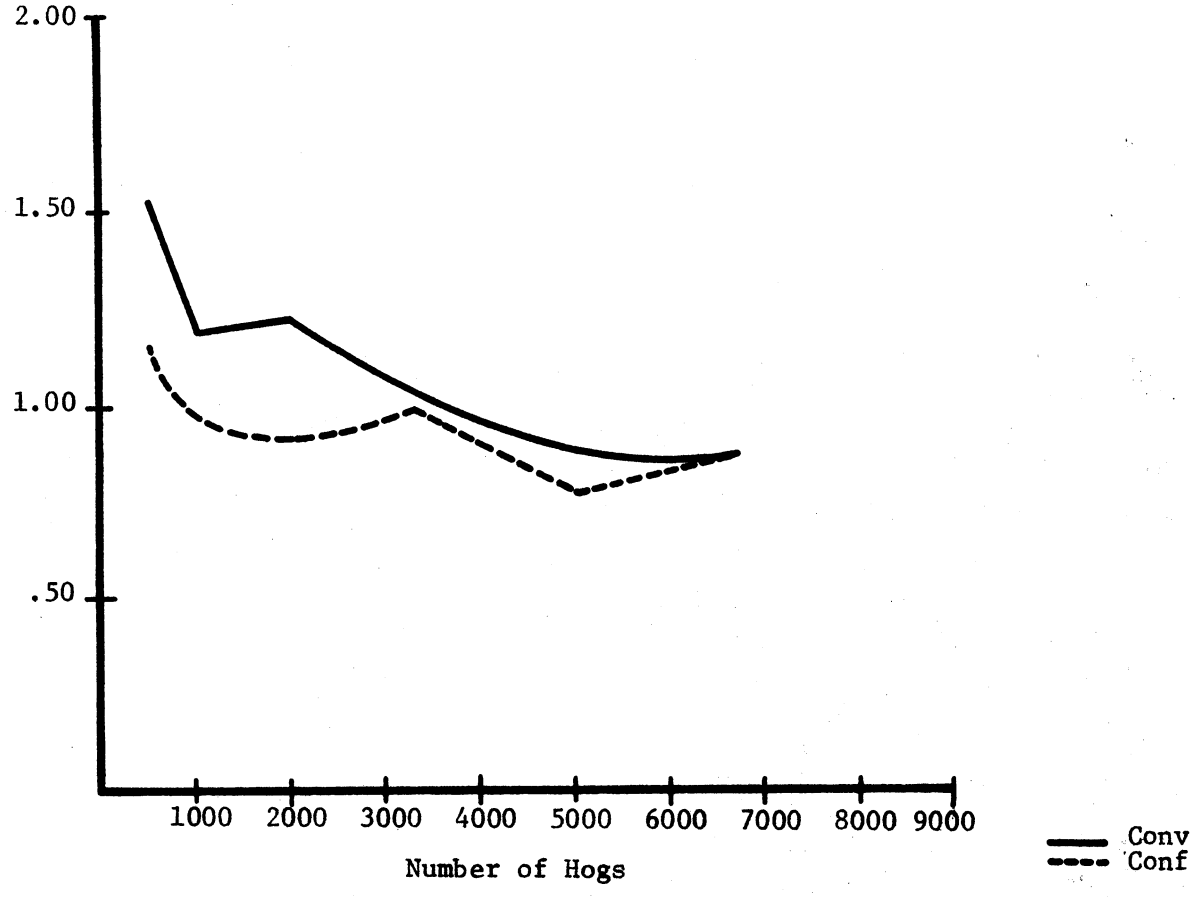

Figure VI-11. Labor Per Hog--Four Farrowings--Conventional--Confinement--8.5 Pigs Per Litter

hogs fed increased; except that the range in labor required per hog was smaller. Thus adjustments in the handling of feed and manure were made to reduce the physical labor requirements. The 4 farrowing conventional system, 8.5 pigs per litter, required 1.53, 1.21, 1.24, 1.06, .86, and .88 hours per hog for capacities 1 to 6, respectively. Labor per hog was reduced by approximately .65 hour per hog from capacity 1 to 6. The confinement system's labor per hog for capacities 1 to 6 were 1.16, .95, .94, 1.01, .77 and .88 hours, respectively. The labor per hog was only .28 hours less per hog for capacity 6 when compared with capacity 1, indicating that most of the labor saving techniques were utilized for the 6 capacities.

Figure VI-11 represents the labor required per hog for the 4 farrowing system for the conventional and confinement method of production. The confinement system's labor requirement was lower for the first 5 capacities but remained unchanged from capacity 5 to capacity 6 when compared with the conventional system. The confinement systems' labor per hog increased from capacity 3 to capacity 4. The results of the analysis for capacities 3 and 4 were about the same as shown for these capacities in Figure VI-10.

The labor coefficients per hog for the conventional and confinement systems, 6 farrowings per year, showed little difference when compared with the 4 farrowing system.

In some instances the labor coefficient was slightly higher and in others, slightly lower. Comparing the confinement and conventional system, 6 farrowing, capacities 1 and 3 have .30 and .28 hour differences per hog. Comparing capacities 2, 4, 5 and 6 for the confinement and conventional systems, the labor coefficients were about the same. For capacities 4, 5 and 6 the labor saving techniques were used in both systems, since the number of hogs fed justified their installation. Hence, the labor requirements were nearly identical. Capacities 1, 2 and 3 at the 6 farrowing intensity had modifications in production involving labor due to the larger number of hogs fed when compared with the 2 farrowing system. Thus, the labor coefficients are below the 2 farrowing system for these 3 capacities.

Figure VI-12 presents the labor coefficients for the 6 farrowing levels for the confinement and conventional system and for capacities 1 to 6. The conventional system had slightly higher labor requirements for all capacities when compared with the confinement system. The conventional system had an increase in the labor coefficient from 1.11 to 1.23 hour per pig from capacity 2 to capacity 3. Labor requirements for capacity 3 were higher for gestation observation, feeding during lactation, manure handling and disinfecting, when compared with capacity 2 and also when compared with capacity 4.

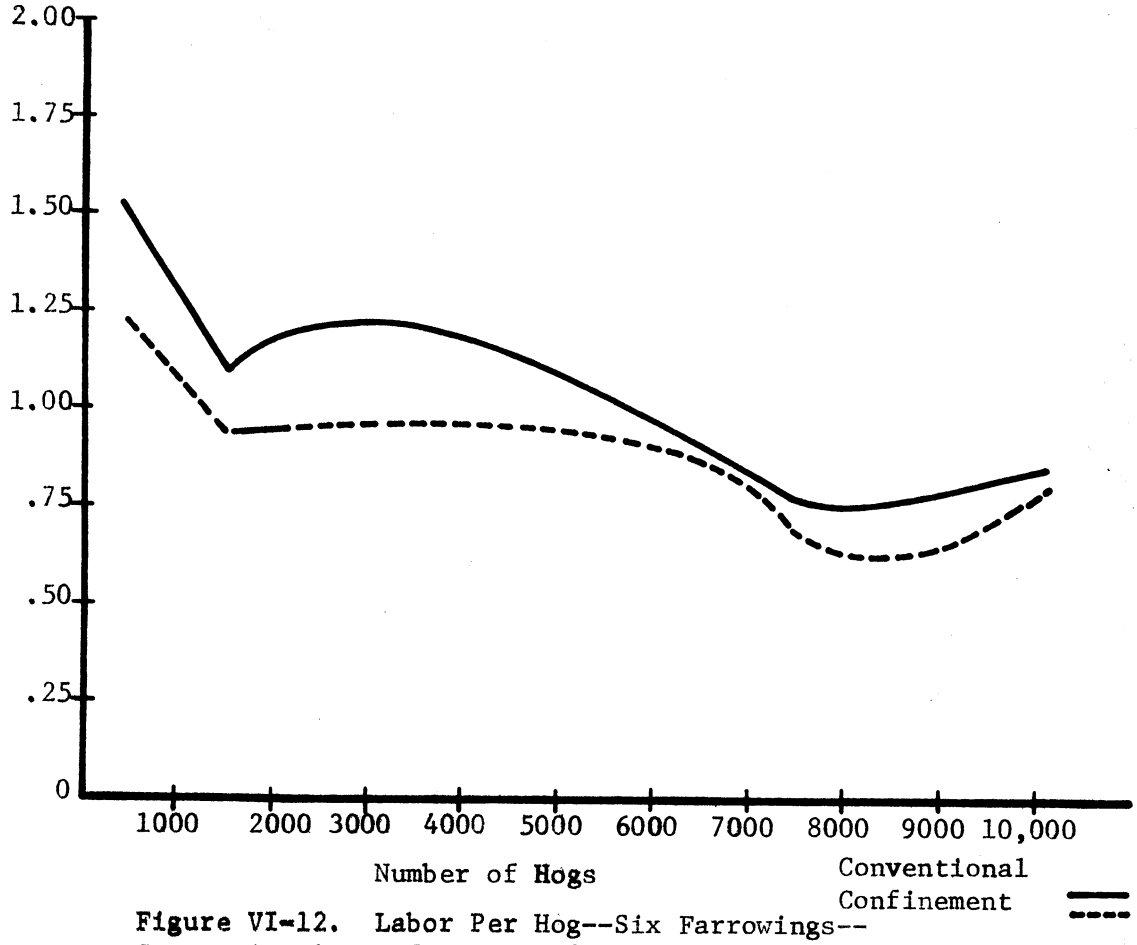

Figure VI-12. Labor Per Hog--Six Farrowings--Conventional--Confinement--8.5 Pigs Per Litter

LABOR COEFFICIENT PER HOG (7.0 PIGS PER LITTER)

The bottom portion of Table VI-18 contains the labor requirements for the confinement and conventional systems, capacities 1 to 6, for an average of 7.0 pigs per litter. The same physical plants were assumed for the 7.0 pigs per litter as in the 8.5 pigs per litter. Hence, a question is posed: with a hog operation designed and constructed for 8.5 pigs per litter how are the labor costs affected if only a litter size of 7.0 pigs was the actual level of output per sow? Many, if not most, of the labor using jobs will require the same amount of time and effort. These include the cleaning, bedding, washing of the sow, feeding the sow during gestation, lactation, and the breeding period, feeding the boar, records, repairs and maintenance, and observation during lactation and gestation. Total labor for a given capacity will be reduced only slightly in the feeding of the growing and finishing hogs, cleaning of growing and finishing facilities, and in the observation of the growing and finishing phases of production. The total labor for a given capacity will be less for castration, iron shot, needle teeth, vaccination, and sorting and loading of market hogs. With the labor recalculated for the smaller litter size, the labor per market hog was higher than the 8.5 pigs per litter by .33 hour (capacity 1, 2 farrowings, conventional) to .12 hour

per hog (capacity 5, 6 farrowings, confinement). If a producer has sows that will produce an extra 1.5 pig per litter, these pigs require much less labor per pig than an operation in which the sows farrow a smaller size litter, indicating economies in labor.

PRODUCTION COST FOR 7.0 PIGS PER LITTER USING THE FACILITIES DESIGNED FOR 8.5 PIGS PER LITTER

What would happen to production costs if the system was used at less than 100 percent of capacity due to circumstances resulting in 1.5 fewer pigs per litter? Labor has been examined in a previous section with the conclusion that the labor per hog will be from .12 to .33 hour per hog higher depending on the system and capacity level. Thus, labor costs per hog will be higher with the smaller number of pigs farrowed per litter.

Analyzing costs by variable and fixed costs will give an indication of how the production costs change. The total fixed costs remain the same regardless of the number of hogs fed. However, this fixed amount is divided by a smaller number of hogs produced and, hence, fixed costs per hog increase.

Some of the total variable costs remain about the same. The amount spent for electricity, repairs and maintenance, feed for the breeding stock, heat bulbs, bedding, and disinfectant will remain identical for 7.0 pigs per litter and 8.5 pigs per litter. The total amount

spent on feed for market hogs, storage costs, and certain items used in sanitation will be less, reflecting the smaller number of hogs produced.

Table VI-19 compares the costs per hundredweight of 7.0 pigs per litter to 8.5 pigs per litter for the conventional and confinement systems for 6 different capacities and 3 farrowing levels. The cost per hundredweight was increased by approximately $1.50 per hundredweight or approximately $3.30 per hog due to smaller litter size. The range was from $0.84 cents to $2.50 per hundredweight. These differences point up the important feature that management should select sows on the basis of producing large litters,and then, once the pigs are born, management should make every effort to save as many pigs as possible.

Table VI-20 is a summary table presenting the variable costs, fixed costs, total costs per hog, total costs per hundredweight, and labor per market hog for the 6 capacities, 3 farrowing intensities, and 2 litter sizes for the conventional and confinement systems. In addition to Table VI-20, appendix C contains the variable and fixed costs for each capacity and farrowing level. (Table A through Table R). Table S of appendix C presents the capital needed for buildings, equipment, fences, and breeding stock.

Table VI-19

Comparison of the Cost Per Hundredweight of 7.0 Pigs Per Litter to 8.5 Pigs Per Litter--Conventional (CV) and Confinement (CF) Systems, Capacities 1 to 6 for 2-4-6 Farrowing Levels

	2 a) Farrow b) Difference		4 a) Farrow b) Difference		6 a) Farrow b) Difference	
	a	b	a	b	a	b
Capacity 1						
CV 8.5	$21.54		$18.48		$17.85	
CV 7.0	24.04	$2.50	20.21	$1.73	19.15	$1.30
CF 8.5	18.92		17.85		17.08	
CF 7.0	20.85	1.93	18.69	.84	18.54	1.46
Capacity 2						
CV 8.5	18.47		16.89		16.25	
CV 7.0	20.30	1.83	18.33	1.44	17.65	1.40
CF 8.5	18.32		16.91		16.25	
CF 7.0	20.11	1.79	18.40	1.49	17.65	1.40
Capacity 3						
CV 8.5	17.64		16.55		16.25	
CV 7.0	19.28	1.64	17.99	1.44	17.60	1.35
CF 8.5	17.80		16.72		16.22	
CF 7.0	19.47	1.67	18.20	1.48	17.57	1.35
Capacity 4						
CV 8.5	17.35		16.65		16.15	
CV 7.0	18.96	1.61	18.07	1.42	17.47	1.32
CF 8.5	17.86		17.02		16.35	
CF 7.0	19.58	1.72	18.53	1.51	17.72	1.37
Capacity 5						
CV 8.5	16.93		16.27		15.74	
CV 7.0	18.45	1.52	17.62	1.35	16.91	1.17
CF 8.5	17.45		16.57		15.98	
CF 7.0	19.08	1.63	17.99	1.42	17.28	1.30
Capacity 6						
CV 8.5	17.12		16.33		15.74	
CV 7.0	18.67	1.55	17.69	1.36	16.98	1.24
CF 8.5	17.71		16.78		16.03	
CF 7.0	19.39	1.68	18.22	1.44	17.33	1.30

Table VI-20

Variable Cost, Fixed Cost, Total Cost, Cost Per Hog, Cost Per Hundredweight and Labor Per Market Hog for 6 Capacities for 3 Farrowing Levels, 2 Litter Sizes and 2 Production Systems--Confinement and Conventional

	1 set of 8 sows 16 litters - 2 farrowings				2 sets of 8 sows 32 litters - 4 farrowings				3 sets of 8 sows 48 litters - 6 farrowings			
	Conventional		Confinement		Conventional		Confinement		Conventional		Confinement	
Capacity 1	134	110	134	110	268	222	268	222	404	332	404	332
Total variable cost	$ 4977.99	4447.34	4684.91	4151.14	9088.20	8063.47	9025.71	7627.21	13469.00	11595.57	13009.08	11369.90
Total fixed cost	$ 1370.81	1370.81	893.79	893.79	1809.81	1809.81	1499.53	1499.53	2390.28	2390.28	2171.88	2171.88
Total cost	$ 6348.80	5818.15	5578.70	5044.93	10898.01	9873.28	10525.24	9126.74	15859.28	13985.85	15180.96	13541.78
Cost per hog	$ 47.38	52.89	41.63	45.86	40.66	44.47	39.27	41.11	39.26	42.13	37.58	40.79
Cost per hundredweight	$ 21.54	24.04	18.92	20.85	18.48	20.21	17.85	18.69	17.85	19.15	17.08	18.54
Labor per marketed hog (hrs.)	1.89	2.22	1.51	1.76	1.53	1.83	1.16	1.37	1.52	1.74	1.22	1.38
	1 set of 30 sows 60 litters - 2 farrowings				2 sets of 30 sows 120 litters - 4 farrowings				3 sets of 30 sows 180 litters - 6 farrowings			
	Conventional		Confinement		Conventional		Confinement		Conventional		Confinement	
Capacity 2	504	415	504	415	1008	830	1008	830	1515	1240	1515	1240
Total variable cost	$ 16860.46	14908.02	16677.91	14723.17	31778.34	27870.69	31463.21	27555.56	46958.01	40967.12	46542.90	40552.01
Total fixed cost	$ 3621.95	3621.95	3634.66	3634.66	5606.59	5606.59	6040.01	6040.01	7184.82	7184.82	7598.96	7598.96
Total cost	$ 20482.41	18529.97	20312.57	18357.83	37384.93	33477.28	37503.22	33595.57	54142.83	48151.94	54141.86	48150.97
Cost per hog	$ 40.64	44.65	40.30	44.24	37.09	40.33	37.21	40.48	35.74	38.83	35.74	38.83
Cost per hundredweight	$ 18.47	20.30	18.32	20.11	16.86	18.33	16.91	18.40	16.25	17.65	16.25	17.65
Labor per marketed hog (hrs.)	1.48	1.76	1.32	1.56	1.21	1.44	.95	1.12	1.11	1.32	.94	1.11
	1 set of 60 sows 120 litters - 2 farrowings				2 sets of 60 sows 240 litters - 4 farrowings				3 sets of 60 sows 360 litters - 6 farrowings			
	Conventional		Confinement		Conventional		Confinement		Conventional		Confinement	
Capacity 3	1008	830	1008	830	2040	1680	2040	1680	3024	2490	3024	2490
Total variable cost	$ 32711.12	28796.47	32013.04	28098.08	63502.63	55729.07	62412.42	54639.19	94259.61	82612.31	92233.16	80585.86
Total fixed cost	$ 6407.66	6407.66	7454.87	7454.87	10756.03	10756.03	12634.12	12634.12	13804.67	13804.67	15685.40	15685.40
Total cost	$ 39118.78	35204.13	39467.91	35552.95	74258.66	66485.10	75046.54	67273.31	108064.28	96416.98	107918.56	96271.26
Cost per hog	$ 38.81	42.42	39.15	42.83	36.40	39.57	36.79	40.04	35.74	38.72	35.69	38.66
Cost per hundredweight	$ 17.64	19.28	17.80	19.47	16.55	17.99	16.72	18.20	16.25	17.60	16.22	17.57
Labor per marketed hog (hrs.)	1.38	1.64	1.00	1.18	1.24	1.69	.943	1.10	1.23	1.47	.945	1.12

Table VI-20 (continued)

Capacity 4	1 set of 100 sows 200 litters - 2 farrowings				2 sets of 100 sows 400 litters - 4 farrowings				3 sets of 100 sows 600 litters - 6 farrowings			
	Conventional		Confinement		Conventional		Confinement		Conventional		Confinement	
	1680	1382	1680	1382	3360	2766	3360	2766	5040	4150	5040	4150
Total variable cost	$ 52935.88	46450.88	53413.85	46928.37	104133.59	91069.70	104889.19	91826.24	155083.57	135604.41	154621.52	134588.03
Total fixed cost	$ 11193.02	11193.02	12606.95	12606.95	18899.57	18899.57	20936.73	20936.73	23913.01	23913.01	25961.68	25961.68
Total cost	$ 64128.90	57643.90	66020.80	59535.32	123033.16	109969.27	125825.92	112762.97	178996.58	159517.42	180583.20	160549.71
Cost per hog	$ 38.17	41.71	39.30	43.08	36.62	39.76	37.45	40.77	35.52	38.44	35.83	38.69
Cost per hundredweight	$ 17.35	18.96	17.86	19.58	16.65	18.07	17.02	18.53	16.15	17.47	16.21	17.59
Labor per marketed hog (hrs.)	1.08	1.28	1.05	1.25	1.06	1.25	1.01	1.19	1.11	1.31	.95	1.15

Capacity 5	1 set of 150 sows 300 litters - 2 farrowings				2 sets of 150 sows 600 litters - 4 farrowings				3 sets of 150 sows 900 litters - 6 farrowings			
	Conventional		Confinement		Conventional		Confinement		Conventional		Confinement	
	2520	2074	2520	2074	5038	4150	5038	4150	7558	6224	7558	6224
Total variable cost	$ 76754.00	67027.32	77428.52	67739.45	152640.87	133244.86	152763.25	133367.24	224873.96	195737.47	225723.75	196587.27
Total fixed cost	$ 17126.18	17126.18	19297.52	19297.52	27644.55	27644.55	30897.91	30897.91	36829.46	36829.46	39997.77	39997.77
Total cost	$ 93880.18	84153.50	96726.04	87036.97	180285.42	160889.41	183661.16	164265.15	261703.42	232566.93	265721.52	236585.04
Cost per hog	$ 37.25	40.58	38.38	41.97	35.79	38.77	36.46	39.58	34.63	37.21	35.16	38.01
Cost per hundredweight	$ 16.93	18.45	17.45	19.08	16.27	17.62	16.57	17.99	15.74	16.91	15.98	17.28
Labor per marketed hog (hrs.)	.82	.96	.79	.94	.86	1.02	.773	.91	.76	.89	.73	.85

Capacity 6	1 set of 200 sows 400 litters - 2 farrowings				2 sets of 200 sows 800 litters - 4 farrowings				3 sets of 200 sows 1200 litters - 6 farrowings			
	Conventional		Confinement		Conventional		Confinement		Conventional		Confinement	
	3360	2766	3360	2766	6718	5530	6718	5530	10078	8300	10078	8300
Total variable cost	$103354.57	90402.66	104613.30	91661.39	204243.77	177819.51	206202.28	179893.67	301144.66	262207.72	303113.69	264176.75
Total fixed cost	$ 23190.68	23190.68	26330.65	26330.65	37357.33	37357.33	41820.99	41820.99	47846.40	47846.40	52325.91	52325.91
Total cost	$126545.25	113593.34	130943.95	117992.04	241601.10	215176.84	248023.27	221714.66	348991.06	310054.12	355439.60	316502.66
Cost per hog marketed	$ 37.66	41.07	38.97	42.66	35.96	38.91	36.92	40.09	34.63	37.36	35.27	38.13
Cost per hundredweight	$ 17.12	18.67	17.71	19.39	16.33	17.69	16.78	18.22	15.74	16.98	16.03	17.33
Labor per marketed hog (hrs.)	.83	.98	.83	.97	.88	1.03	.88	.96	.826	.967	.814	.953

CHAPTER VII

SUMMARY AND CONCLUSIONS

The swine enterprise is one of the principle livestock enterprises in the state of Missouri. Swine producers are operating in an environment of changes in input costs, technology, and output prices. Information is needed to determine the cost of production per market hog using the latest production practices, to compare the cost of conventional and confinement systems, and to determine if economies of size are present in the swine enterprise.

The objectives of this study were as follows: (1) to study the cost-size relationships for the conventional and confinement systems as producers change from two to four to six farrowing levels of intensity per year, (2) to study the cost-size relationships for the conventional and confinement systems if a producer increases the number of hogs fed, but stays with a given farrowing intensity, and (3) to analyze the effect of 1.5 fewer pigs per litter (a 7.0 litter size) on the cost per hundred weight of those hogs actually marketed, using the same facilities as for the 8.5 litter size.

The procedure included a review of literature regarding various economies of size and scale research. The theoretical framework for economies of size studies was also

examined. Model plants were designed to represent typical hog setups in Missouri. It was recognized that these models represented only a few of the possible ways of producing market hogs. Six basic capacities, three farrowing levels, two litter sizes, and two systems of production were considered. The budgeted costs were determined by calculating the number of inputs necessary to produce a given number of market hogs. Prices for these inputs were obtained from farm supply catalogs, merchant suppliers, manufacturers of hog equipment, and local merchants located in central Missouri.

The basic assumption of this research was that the budgeting technique provides feasible and realistic cost estimates for different levels of production for the conventional and confinement systems. The separate budgets for the six capacities, three farrowing intensities, and two litter sizes are developed and included in this budgeting process. More specific assumptions were made with regards to costs and management.

PRODUCTION COSTS WITHIN A GIVEN PHYSICAL CAPACITY, WITH THE FARROWING INTENSITIES MOVING FROM TWO TO FOUR TO SIX PER YEAR

Capacity 1

As the farrowing intensity increased from two to six, the costs per hundred weight for the conventional and confinement system decreased $3.69 and $1.84 respectively.

The conventional system had higher costs than the confinement system for two reasons: (1) higher labor coefficients and (2) higher fixed costs per hog. Items such as a manure spreader and tractor resulted in higher fixed costs in the conventional system when compared with the construction of a lagoon in the confinement system.

Capacity 2

As the number of farrowings increased from two to six, the costs per hundred weight decreased from $18.47 to $16.25 for the conventional system and from $18.32 to $16.25 for the confinement system. The higher labor coefficient for the conventional system explains in part the higher costs for this system. Fixed costs per hog were slightly lower in the conventional system when compared with the fixed costs per hog in the confinement system.

Capacity 3

The costs per hundred weight for the conventional and confinement systems as the farrowing level increased from two to six were $17.64 and $17.80, $16.55 and $16.72, and $16.25 and $16.22 respectively. The conventional system had slightly lower production costs for the two and four farrowing levels. The labor coefficients for the two systems of production were not as far apart as in the first two capacities. The average fixed costs per hog were $0.62 to $1.04 per hog lower in the conventional system than in the confinement system, at the two and six farrowing intensity levels.

Capacity 4

The confinement system costs for all three levels of farrowing were higher than for the conventional system. Lagoons became a part of the conventional system at this capacity level, reducing the labor to a level comparable to the confinement system. The costs per hundred weight for the conventional and confinement systems as the farrowing level increased from two to six were $17.35 and $17.86, $16.65 and $17.02, and $16.15 and $16.21 respectively. Fixed costs for the conventional system decreased from $6.66 to $4.74 per hog and for the confinement system, decreased $7.50 to $5.15 per hog as the farrowing level increased from two to six farrowings per year.

Capacity 5

Fixed costs for the conventional system decreased from $6.80 per hog in the two farrowing system to $4.87 per hog in the six farrowing system. For the confinement system, fixed costs decreased from $7.66 to $5.29 per hog as the farrowing intensity increased from two to six. The costs per hundred weight for the two, four and six farrowings in the conventional system were $16.93, $16.27, and $15.74. The costs per hundred weight for the confinement system were $17.45, $16.57, and $16.91 for two, four and six farrowings per year, respectively.

Capacity 6

The labor coefficients were approximately the same for both systems of production. The fixed costs per hog decreased from $6.90 at the two farrowing level to $4.75 at the six farrowing level for the conventional system. For the confinement system, fixed costs decreased from $7.84 at the two farrowing level to $5.19 per hog at the six farrowing level. The costs per hundred weight for the conventional for the two, four and six farrowings were $17.12, $16.33, and $15.74 respectively. The costs per hundred weight for the confinement system were $17.71, $16.78, and $16.03 respectively for the two, four and six farrowing levels of intensity.

Capacities 1-6

Costs and labor coefficients change with the size of the operation. The costs per hundred weight for the conventional system at two, four, and six farrowings for capacity 1 were $21.54, $18.48 and $17.85, and for capacity 6, $17.12, $16.33 and $15.74. The confinement system costs per hundred weight for two, four and six farrowings for capacity 1 were $18.92, $17.85, and $17.08; and for capacity 6, the costs per hundred weight were $17.71, $16.78 and $16.03. The costs of production per hog decreased as the number of hogs produced increased, indicating some economies of size present in the hog enterprise as specified in these budgets.

Labor coefficients per hog for capacity 1, conventional system, for two, four and six farrowings were 1.89, 1.53, and 1.52 hours respectively. The labor coefficients for capacity 6 for the conventional system for the same farrowing levels were .83, .88, and .83 hours per hog. The hours of labor per hog in the confinement system was 1.51, 1.16, and 1.22 for capacity 1 at the farrowing levels of two, four and six respectively. For capacity 6 the hours of labor per hog, confinement system, for two, four, and six farrowings were .83, .88, and .81 respectively.

On the basis of the capacity levels used in this analysis, lower production costs per hog appears to result from the more intensive farrowing levels. It also appears that some economies in labor exist as the farrowing level increased from two to six per year.

PRODUCTION COSTS WITHIN GIVEN FARROWING LEVELS, MOVING FROM CAPACITY 1 THROUGH 6

Two Farrowings Per Year

The average fixed costs for the conventional system shows some variation but appeared to have no significant direction as the number of hogs fed increased. The confinement systems' average fixed costs increased as the capacity level went from 1 through 6 from $6.67 to $7.84 per hog. However, the average variable costs declined as the capacity level increased, reflecting the lower labor requirements. Variable costs decreased more than fixed

costs increased. The costs per hundred weight for the conventional system for capacity 1, 5 and 6 were as follows: $21.54, $16.93, and $17.12. The costs per hundred weight for the confinement system for capacity 1, 5 and 6 were $18.92, $17.45 and $17.71 respectively. There were economies of size for both systems up to capacity 5. There was an indication that some diseconomies of size were present in capacity 6.

Four Farrowings Per Year

The average fixed costs for the conventional system declined for the first three capacities from $6.75 to $5.27 with the largest three capacities having slightly higher fixed costs. The average fixed costs increased from $5.60 to $6.23 per hog from capacity 1 to capacity 6. The fixed costs per hog for the four farrowing system, were lower than the fixed costs of the two farrowing system. The average variable cost, conventional system, declined from $33.91 per hog to $30.30 per hog in capacity 5. For capacity 6, variable costs were $30.40 per hog. The average variable costs for the confinement system decreased from $33.67 in capacity 1 to $30.33 per hog in capacity 5; with capacity 6 at $30.69 per hog. The conventional system costs per hundred weight went from $18.48 in capacity 1 to approximately $16.30 in capacities 5 and 6. The confinement system costs per hundred weight went from $17.85 in capacity 1 to $16.78 in capacity 6.

The four farrowing system exhibits economies of size as the number of hogs fed increases for both systems of production. In relation to the two farrowing system the four farrowing system has lower production costs as the facilities were used more intensively. For the conventional system, capacities 1 to 6 would realize lower costs per hundred weight by $2.97, $1.61, $1.09, $0.70, $0.66, and $0.79 respectively by increasing the number of farrowings per year from two to four. Capacities 1 to 6 of the confinement system would reduce the cost per hundred weight by $1.07, $1.41, $1.08, $0.84, $0.88, and $0.93 respectively by changing to four farrowings.

Six Farrowings Per Year

The average fixed costs for the conventional system declined through the first three capacities from $5.92 to $4.57 per hog. Capacities 4, 5 and 6 were slightly higher at $4.74, $4.87, and $4.75 per hog respectively. The confinement systems' average fixed cost for all capacities was approximately $5.20 per hog. For the conventional system, average variable costs per hog for capacities 1-6 were $33.34, $31.00, $31.17, $30.34, $29.76, and $29.88 respectively. For the confinement system, average variable costs per hog were $32.20, $30.73, $30.50, $30.82, $29.87, and $30.08 respectively for capacities 1 to 6. Labor accounted for the majority of the variation in the variable costs. The costs per hundred weight for the conventional

system for capacities 1 to 6 were $17.85, $16.25, $16.25, $16.15, $15.74, and $15.74 respectively. For the confinement system, costs per hundred weight were $17.08, $16.25, $16.22, $16.21, $15.98, and $16.03 for capacities 1 to 6 respectively. Costs per hundred weight decreased from capacity 1 to 2 considerably and then leveled out and remained quite constant. There was an indication that diseconomies were appearing in the confinement system from capacity 5 to capacity 6.

By increasing the farrowing level from four to six costs per hundred weight would decrease in the conventional system $0.63, $0.61, $0.30, $0.50, $0.53 and $0.59 for capacities 1 to 6 respectively. Likewise, the confinement system costs would be $0.77, $0.66, $0.50, $0.81, $0.59 and $0.75 lower per hundred weight, for capacities 1 to 6 respectively.

SUMMARY OF THE LABOR REQUIREMENT PER HOG--8.5 PIGS PER LITTER

For the two, four and six farrowings the labor coefficients generally decreased as the producer went from capacity 1 to 5. Capacity 6 was slightly higher than capacity 5 for all cases. For the two farrowing system the substitution of capital reduced the labor per hog by 1.06 hours from capacity 1 to capacity 6. For the two farrowing confinement system, the labor was reduced .68 hours per hog from capacity 1 to 6 by the substitution of capital in the

form of labor saving devices. For capacities 4, 5 and 6 the labor coefficients for the conventional and confinement systems were practically the same. For the conventional system, labor per hog was higher for capacities 1 to 3.

The four farrowing level followed the same pattern as the two farrowing level. Labor per hog was reduced by approximately .65 hours per hog over the six capacities in the conventional system. The labor per hog for the confinement system was only .28 hours less for capacity 6 when compared with capacity 1. The confinement system's labor requirement was lower for the first five capacities and the same for capacity 6 when compared with the conventional system.

The labor coefficients for six farrowings per year showed little differences when compared with the four farrowing system for both confinement and conventional systems of production. The conventional system had slightly higher labor requirements for all capacities when compared with the confinement system.

SUMMARY OF THE LABOR REQUIREMENT PER HOG--7.0 PIGS PER LITTER

There were economies in labor if an extra 1.5 pig per litter was realized. For a system designed for 8.5 pigs per litter, but only 7.0 pigs per litter size are realized, the labor per hog would increase from .14 to .33 hours per hog depending on the system and capacity. For many jobs

the total time requirement remained the same regardless of the number of pigs per litter. These jobs included cleaning, bedding, and washing of the sow; feeding the sow during gestation, lactation, and the breeding period; feeding the boar, keeping records, repairs and maintenance, and general observation time during gestation and lactation.

PRODUCTION COSTS FOR 7.0 PIGS PER LITTER USING THE SYSTEM DESIGNED FOR 8.5 PIGS PER LITTER

Fixed costs remained the same regardless of the number of pigs farrowed per litter. For the 7.0 litter size, many of the variable costs also remained about the same. Labor, a variable cost, as indicated in the previous section, increased .14 to .33 hours per hog. Other variable costs remained about the same per hog. The total costs of production were not reduced significantly by farrowing only 7.0 pigs per litter with a smaller number of market hogs, total costs increased approximately $1.50 per hundred weight, or approximately $3.30 per hog.

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APPENDICES

APPENDIX A

Table A

Pork Production, Civilian Pork Consumption, and Per Capita Consumption of Pork in the United States, 1945-1967

Pork Year	Production Total million pounds	Civilian Consumption Total million pounds	Per Capita
1945	10,697	8,598	66.6
1950	10,714	10,390	69.2
1955	10,990	10,833	66.8
1960	11,614	11,573	64.9
1961	11,420	11,237	62.0
1962	11,844	11,688	63.3
1963	12,447	12,220	65.4
1964	12,531	12,379	65.4
1965	11,173	11,267	58.7
1966	11,328	NA	58.0
1967	12,556	NA	62.5
1968			65.8

NA - Not available

*Production of pork comprises weight of dressed hog carcass less head and bones and less all carcass fat rendered into lard.

Source: U. S. Bureau of the Census, Statistical Abstract of the United States: 1968, (89th Annual Edition), Washington, D. C., 1968.

Table B

Farms, Hogs and Pigs Sold, By Number of Hogs and Pigs Sold Per Farm, For the United States: 1954 to 1964 (Alaska and Hawaii Not Included)

Farms by number of hogs and pigs sold	Number of Farms			Number Sold 1964 (1,000)
	1964	1959	1954	
Total	802,620	1,273,365	1,438,133	83,537
1-9	107,930	277,182	471,802	481
10-49	280,937	538,513	610,683	7,543
50-99	158,342	202,962	200,958	11,091
100-199	139,237	161,611	111,922	19,130
> 200	116,174	93,097	42,768	45,292
200-499	94,680	81,572	NA	27,428
500-599	17,394	9,983	NA	11,271
over 1,000	4,100	1,542	NA	6,593

NA - Not available

Source: U. S. Bureau of the Census, Census of Agriculture, 1964. Statistics by Subjects - Chapter 2, Livestock, Poultry, and Livestock and Poultry Products, U. S. Government Printing Office, Washington, D. C., 1967.

Table C

The Number of Farms With Hogs and Pigs, the Number of Hogs and Pigs On Farms, and Hogs and Pigs Sold For Selected Years, 1930-1964

Year	Farms With Hogs and Pigs (million)	Hogs and Pigs On Farms (million)	Hogs and Pigs Sold (million)
1964	1.1	54.1	83.5
1959	1.8	67.9	80.9
1954	2.4	57.1	57.4
1950	3.0	NA	NA
1945	3.3	55.8	65.6
1940	3.8	34.1	49.2
1930	3.5	----	----

NA - Not available

Source: Same as Table B.

Table D

Sows and Gilts Farrowing, 1945, 1950, 1954, 1959, and 1964

Census Date	Census Item	Number Farms	Number Hogs
1964	Sows and gilts farrowing (total litter)	749,714	10,655,597
1959	Sows and gilts farrowing (total litter)	1,142,373	12,352,001
1954	Sows and gilts farrowing (total litter)	1,273,798	10,832,737
1950*	Sows and gilts for spring farrowing	1,691,004	9,597,556
1945*	Sows and gilts for spring farrowing	1,839,458	8,482,031

* - 1954 change in Census Measure

Source: Same as Table B.

Table E

Hogs and Pigs By Size Group - Farms and Number, For Farms Classified By Number On the Farm, In Missouri, 1964

Number of Hogs and Pigs Per Farm	Hogs and Pigs on the Farm							
	Total		Used or to be Used For Breeding Purposes		All Other Hogs and Pigs		Hogs and Pigs Sold	
	Farms	Number	Farms	Number	Farms	Number	Farms	Number
1 to 9	16,177	66,696	8,737	24,318	12,087	42,378	9,830	292,180
10 to 24	11,834	189,966	8,958	40,750	11,256	149,216	10,183	444,143
25 to 99	22,882	1,202,474	18,946	166,347	22,792	1,036,127	22,325	1,941,682
100 to 199	8,022	1,074,219	7,121	131,018	8,012	943,201	7,967	1,505,891
200 to 499	3,529	978,034	3,138	112,381	3,527	865,653	3,513	1,296,241
500 to 999	390	247,126	344	30,139	389	216,987	389	328,282
> 1,000	61	95,189	53	14,667	60	80,522	61	140,248
Missouri	62,895	3,853,704	47,297	519,620	58,123	3,334,084	54,268	5,948,667

Source: Same as Table B.

APPENDIX B

Table A

Literature and Planning Materials Consulted for Design, Technique and General Information

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Table B

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APPENDIX C

TABLE A

CAPACITY 1, DETAILED COSTS FOR 16 LITTERS OR
1 SET OF 8 SOWS FARROWED TWICE

Item		Conventional 136 Market Hogs 8.5 Pigs/Litter	Conventional 112 Market Hogs 7.0 Pigs/Litter	Confinement 136 Market Hogs 8.5 Pigs/Litter	Confinement 112 Market Hogs 7.0 Pigs/Litter
Variable Cost	Feed Market Hogs	$ 2,634.62	$ 2,166.38	$ 2,634.62	$ 2,166.38
	1 - Boar	62.04	62.04	62.04	62.04
	8 - Sows	526.72	526.72	526.72	526.72
	Heat Bulbs	2.27	2.27	2.27	2.27
Feed Processing	Commercial Service	185.50	170.62	185.50	170.62
Scoop & forks bedding		36.85	36.85	15.85	15.85
Repairs	Fences	11.32	11.32	8.33	8.33
	Equipment	303.85	303.85	108.72	108.72
	Building	73.06	73.06	108.89	108.89
	Fuel & Oil	27.00	27.00	9.00	9.00
	Hygiene	85.34	70.22	85.34	70.22
	Electricity	69.36	69.36	151.44	151.44
	Labor	759.00	747.00	606.00	591.00
	Opportunity Interest	191.46	171.05	180.19	159.66
	Hours of Labor per Pig	1.89	2.22	1.51	1.76
Fixed Cost	Feed Equipment for Market Hogs, Sows, and Boars	40.47	40.47	107.19	107.19
	Well	48.73	48.73	48.73	48.73
	Manure	420.00	420.00	-------	-------
	Lagoon	-------	-------	24.88	24.88
	Stock	380.00	380.00	380.00	380.00
	Land Change	43.20	43.20	43.20	43.20
	Insurance	59.48	59.48	48.18	48.18
	Building G-F	108.23	108.23	174.01	174.01
	Boar	5.33	5.33	5.33	5.33
	Farrowing	112.75	112.75	112.75	112.75
	Gestation	13.33	13.33	13.33	13.33
	Fences	37.75	37.75	25.90	25.90
	Opportunity Interest	101.54	101.54	66.21	66.21

TABLE 3

CAPACITY 1, DETAILED COSTS FOR 32 LITTERS OR
2 SETS OF 8 SOWS FARROWED TWICE

Item			Conventional 268 Market Hogs 8.5 Pigs/Litter	Conventional 222 Market Hogs 7.0 Pigs/Litter	Confinement 268 Market Hogs 8.5 Pigs/Litter	Confinement 222 Market Hogs 7.0 Pigs/Litter
Variable Cost	Feed	Market Hogs	$ 5,269.24	$ 4,351.50	$ 5,629.24	$ 4,351.50
		Boar	62.04	62.04	62.04	62.04
		Sows	1,053.44	1,053.44	1,053.44	1,053.44
	Heat Bulbs		4.53	4.53	4.53	4.53
	Feed Processing		367.50	339.50	367.50	339.50
	Scoop & Forks		36.85	36.85	15.85	15.85
	Bedding		19.20	19.20	-------	-------
	Repairs	Fences	8.70	8.70	8.16	8.16
		Equipment	319.33	319.33	104.90	104.90
		Building	85.67	85.67	109.46	109.46
	Hygiene		118.65	97.68	126.15	105.13
	Electricity		111.00	111.00	250.80	250.80
	Fuel & Oil		48.90	48.90	16.50	16.50
	Labor Cost		1,233.60	1,215.00	930.00	912.00
	Opportunity Interest		349.55	310.13	347.14	293.35
	Labor/Pig Marketed		1.53	1.83	1.16	1.37
Fixed Cost	Feed Equipment		78.73	78.73	149.58	149.58
	Well		50.37	50.37	50.37	50.37
	Manure Equipment		420.00	420.00	-------	-------
	Lagoon		-------	-------	40.80	40.80
	Stock (Breeding)		660.00	660.00	660.00	660.00
	Land Charge		86.40	86.40	86.40	86.40
	Insurance		69.53	69.53	53.90	53.90
	Building	Grow-Finish	150.29	150.29	156.39	156.39
		Boar	5.33	5.33	5.33	5.33
		Gestation	13.33	13.33	13.33	13.33
		Farrow	112.75	112.75	145.15	145.15
	Fences		29.02	29.02	27.20	27.20
	Opportunity Interest		134.06	134.06	111.08	111.08

TABLE 9

CAPACITY 1, DETAILED COSTS FOR 48 LITTERS OF
3 SETS OF 8 SOWS FARROWED TWICE

Item		Conventional 404 Market Hogs 8.5 Pigs/Litter	Conventional 332 Market Hogs 7.0 Pigs/Litter	Confinement 404 Market Hogs 8.5 Pigs/Litter	Confinement 332 Market Hogs 7.0 Pigs/Litter
Variable Cost					
Feed	Market Hogs	$ 7,922.60	$ 6,307.46	$ 7,922.60	$ 6,307.46
	Boar	62.04	62.04	62.04	62.04
	Sows	1,580.16	1,580.16	1,580.16	1,580.16
Heat Bulbs		6.80	6.80	6.80	6.80
Storage	Corn	440.00	459.71	440.00	459.71
	Soybeans	65.21		65.21	
Scoop & Forks		36.85	36.85	-------	-------
Bedding		28.80	28.80	-------	-------
Repair	Fences	14.32	14.32	8.58	8.58
	Equipment	436.70	436.70	223.07	223.07
	Building	89.67	89.67	141.15	141.15
Hygiene		194.01	161.28	201.51	168.78
Fuel & Oil		80.00	80.00	30.00	30.00
Electricity		149.40	149.40	334.56	334.56
Labor Cost		1,844.40	1,736.40	1,477.20	1,370.40
Opportunity Interest		518.04	445.98	500.35	428.34
Labor/Pig Marketed		1.52	1.74	1.22	1.38
Fixed Cost					
Feed Equipment		252.88	252.88	324.58	324.58
Well		49.80	49.80	49.80	49.80
Manure Equipment		420.00	420.00	-------	-------
Lagoon		-------	-------	40.80	40.80
Breeding Stock		940.00	940.00	940.00	940.00
Land Charge		118.34	118.34	118.34	118.34
Insurance		86.09	86.09	79.74	79.74
Building	Grow-Finish	150.29	150.29	248.66	248.66
	Boar	5.33	5.33	5.33	5.33
	Gestation	112.75	112.75	145.15	145.15
	Fences	47.75	47.75	28.60	28.60
Opportunity Interest		177.05	177.05	160.88	160.88

TABLE D

CAPACITY 2, DETAILED COSTS FOR 60 LITTERS OR
1 SET OF 30 SOWS FARROWED TWICE

Item		Conventional 504 Market Hogs 8.5 Pigs/Litter	Conventional 415 Market Hogs 7.0 Pigs/Litter	Confinement 504 Market Hogs 8.5 Pigs/Litter	Confinement 415 Market Hogs 7.0 Pigs/Litter
Variable Cost					
Feed	Market Hogs	$ 9,893.88	$ 8,144.89	$ 9,893.88	$ 8,144.49
	Boar	124.00	124.00	124.00	124.00
	Sows	1,975.20	1,975.20	1,975.20	1,975.20
Heat Bulbs		8.50	8.50	8.50	8.50
Storage Costs	Corn	548.90	587.47	548.90	587.47
	Soybeans	94.57		94.57	
Scoop & Forks		36.85	36.85	15.85	15.85
Bedding or Lagoon Pumping		36.85	36.00	-------	-------
Repairs	Fences	18.08	18.08	15.18	15.18
	Equipment	504.62	504.62	330.75	330.75
	Buildings	267.97	267.97	358.51	358.51
Hygiene		208.16	171.35	215.66	177.54
Electricity		204.00	204.00	328.80	328.80
Fuel & Oil		61.20	61.20	27.60	27.60
Labor Cost		2,230.05	2,194.50	1,999.05	1,963.00
Opportunity Interest		648.48	573.39	641.46	566.28
Labor/Pig Marketed		1.48	1.76	1.32	1.56
Fixed Cost					
Feed Equipment		373.76	373.76	508.86	508.86
Well Equipment		57.71	57.71	57.71	57.71
Manure Equipment		420.00	420.00	-------	-------
Lagoons		-------	-------	76.50	76.50
Breeding Stock		1,250.00	1,250.00	1,250.00	1,250.00
Land Charge		154.08	154.08	154.08	154.08
Insurance		148.48	148.48	153.00	153.00
Depreciation Buildings					
	Grow-Finish	290.42	290.42	495.82	495.82
	Boar	10.67	10.67	10.67	10.67
	Gestation	20.00	20.00	20.00	20.00
	Farrowing	568.27	568.27	588.19	588.19
	Fences	60.27	60.27	50.60	50.60
Opportunity Interest		268.29	268.29	269.23	269.23

TABLE 2

CAPACITY 2, DETAILED COSTS FOR 120 LITTERS OR
2 SETS OF 30 SOWS FARROWED TWICE

Item		Conventional 1008 Market Hogs 8.5 Pigs/Litter	Conventional 830 Market Hogs 7.0 Pigs/Litter	Confinement 1008 Market Hogs 8.5 Pigs/Litter	Confinement 830 Market Hogs 7.0 Pigs/Litter
Variable Cost					
Feed Cost	Market Hogs	$ 19,787.76	$ 16,294.70	$ 19,787.76	$ 16,294.70
	Boars	186.00	186.00	186.00	186.00
	Sows	3,950.40	3,950.40	3,950.40	3,950.50
Heat Lamp Bulbs		16.83	16.83	16.83	16.83
Storage Cost	Corn	1,096.60	1,173.60	1,096.60	1,173.60
	Soybeans	189.00		189.00	
Scoops & Forks		36.85	26.85	15.85	15.85
Lagoon Puming		-------	------	200.00	200.00
Bedding		72.00	72.00	-------	-------
Repair	Fences	36.16	36.16	30.36	30.36
	Equipment	306.10	306.10	441.25	441.25
	Building	370.40	370.40	498.58	498.58
Hygiene		357.56	295.26	365.06	302.76
Oil & Fuel		132.00	132.00	50.00	50.00
Electricity		337.44	337.44	539.40	539.40
Labor Cost		3,681.00	3,591.00	2,886.00	2,796.00
Opportunity Interest		1,222.24	1,071.95	1,210.12	1,059.83
Labor/Pig Marketed		1.21	1.44	.95	1.12
Fixed Cost					
Feed Equipment		463.94	463.94	680.23	680.23
Well & Equipment		60.29	60.29	60.29	60.29
Manure Equipment		420.00	420.00	-------	-------
Lagoon Cost		-------	-------	153.00	153.00
Breeding Stock		2,400.00	2,400.00	2,400.00	2,400.00
Land Charge		312.48	312.48	312.48	312.48
Insurance		183.25	183.25	227.36	227.36
Depreciation Building	Grow-Finish	580.85	580.85	970.36	970.36
	Boar	16.00	16.00	16.00	16.00
	Gestation	60.00	60.00	60.00	60.00
	Farrowing	573.95	573.95	611.68	611.68
	Fences	120.52	120.53	101.20	101.20
Opportunity Interest		415.30	415.30	447.41	447.41

TABLE F

CAPACITY 2, DETAILED COSTS FOR 180 LITTERS OR
3 SETS OF 30 SOWS FARROWED TWICE

Item		Conventional 1515 Market Hogs 8.5 Pigs/Litter	Conventional 1240 Market Hogs 7.0 Pigs/Litter	Confinement 1515 Market Hogs 8.5 Pigs/Litter	Confinement 1240 Market Hogs 7.0 Pigs/Litter
Variable Cost					
Feed Cost	Market Hogs	$ 29,702.77	$ 24,353.84	$ 29,702.77	$ 24,353.84
	Boars	248.00	248.00	248.00	248.00
	Sows	5,925.60	5,925.60	5,925.60	5,925.60
Heat Lamps		25.50	25.50	25.50	25.50
Storage Cost	Corn	1,644.20	1,754.45	1,644.20	1,754.45
	Soybeans	283.50		283.50	
Scoop & Forks		36.85	36.85	15.85	15.85
Lagoon Pumping		-------	-------	300.00	300.00
Bedding		108.00	108.00	-------	-------
Repairs	Fences	41.02	41.02	35.22	35.22
	Equipment	599.25	599.25	471.93	471.93
	Building	370.82	370.82	501.34	501.34
Hygiene		486.34	398.05	493.84	405.55
Fuel & Oil		162.00	162.00	60.00	60.00
Electricity		454.08	454.08	755.04	755.04
Labor Cost		5,064.00	4,914.00	4,290.00	4,140.00
Opportunity Interest		1,806.08	1,575.66	1,790.11	1,559.69
Labor/Pig Marketed		1.11	1.32	.94	1.11
Fixed Cost					
Feed Equipment		504.90	504.90	721.19	721.19
Well & Equipment		106.26	106.26	106.26	106.26
Manure Cost & Equipment		420.00	420.00	153.00	153.00
Breeding Stock	Boar	400.00	400.00	400.00	400.00
	Gilts	3,150.00	3,150.00	3,150.00	3,150.00
Land Charge		468.00	468.00	468.00	468.00
Insurance		238.38	238.38	256.83	256.83
Depreciation Building	Grow-Finish	566.21	566.21	970.37	970.37
	Boar	21.33	21.33	21.33	21.33
	Gestation	60.00	60.00	60.00	60.00
	Farrowing	580.80	580.80	611.68	611.68
	Fences	136.73	136.73	117.41	117.41
Opportunity Interest		532.21	532.21	562.89	562.89

TABLE 3

CAPACITY 3, DETAILED COSTS FOR 120 LITTERS OR
1 SET OF 60 SOWS FARROWED THICE

Item		Conventional 1008 Market Hogs 8.5 Pigs/Litter	Conventional 830 Market Hogs 7.0 Pigs/Litter	Confinement 1003 Market Hogs 8.5 Pigs/Litter	Confinement 830 Market Hogs 7.0 Pigs/Litter
Variable Cost					
Feed Cost	Market Hogs	$ 19,787.76	$ 16,294.70	$ 19,787.76	$ 16,294.70
	Boars	186.00	186.00	186.00	186.00
	Sows	3,950.40	3,950.40	3,950.40	3,950.40
Heat Lamp		17.00	17.00	17.00	17.00
Storage	Corn	1,096.00	1,173.60	1,096.00	1,173.60
	Soybeans	189.00	189.00	189.00	189.00
Scoops & Forks		36.85	36.85	15.85	15.85
Bedding or Lagoon Pumping		72.00	72.00	200.00	200.00
Repairs	Fences	32.30	32.30	35.56	35.56
	Equipment	621.85	621.85	809.10	809.10
	Building	549.48	549.48	687.08	687.08
Hygiene		309.36	254.73	316.86	262.23
Electricity		324.00	324.00	429.36	429.36
Fuel & Oil		96.00	96.00	28.50	28.50
Labor Cost		4,185.00	4,080.00	3,033.30	2,928.00
Opportunity Interest		1,258.12	1,107.56	1,231.27	1,080.70
Labor/Pig Marketed		1.38	1.64	1.00	1.18
Fixed Cost					
Feed Equipment		549.13	549.13	850.72	850.72
Well & Equipment		67.35	67.35	67.35	67.35
Manure Equipment		420.00	420.00	153.00	153.00
Breeding Stock	Boar	300.00	300.00	300.00	300.00
	Gilts	2,100.00	2,100.00	2,100.00	2,100.00
Land Charge		312.48	312.48	312.48	312.48
Insurance		258.63	258.63	312.58	312.58
Depreciation	Building G-F	630.38	630.38	1,008.42	1,008.42
	Boar	16.00	16.00	16.00	16.00
	Gest.	30.00	30.00	30.00	30.00
	Farr.	1,141.35	1,141.35	1,222.01	1,222.01
	Fences	107.70	107.70	118.53	118.53
	Tractor*	-------	-------	360.00	360.00
	Auger Wagon*	-------	-------	51.60	51.60
Opportunity Interest		474.64	474.64	552.21	552.21

*Tractor and Auger Wagon, conventional system is in with the equipment listed previously.

TABLE H

CAPACITY 3, DETAILED COSTS FOR 240 LITTERS OR
2 SETS OF 60 SOWS FARROWED TWICE

Item		Conventional 2040 Market Hogs 8.5 Pigs/Litter	Conventional 1680 Market Hogs 7.0 Pigs/Litter	Confinement 2040 Market Hogs 8.5 Pigs/Litter	Confinement 1680 Market Hogs 7.0 Pigs/Litter
Variable Cost					
Feed Cost	Market Hogs	$ 39,575.52	32,589.40	$ 39,575.52	32,589.40
	Boar	372.00	372.00	372.00	372.00
	Sows	7,900.80	7,900.80	7,900.80	7,900.80
Heat Lamps		34.00	34.00	34.00	34.00
Storage	Corn	2,193.10	2,343.60	2,193.10	2,343.60
	Soybeans	278.00		378.00	
Scoop & Forks		37.00	37.00	15.85	15.85
Bedding		144.00	144.00	-------	-------
Repairs	Fences	80.48	80.48	70.36	70.36
	Equipment	775.05	775.05	1,117.50	1,117.50
	Buildings	766.56	766.56	1,019.58	1,019.58
Hygiene		626.52	515.93	643.07	523.43
Fuel & Oil		147.50	147.50	46.50	46.50
Electricity		555.48	555.48	950.16	950.60
Labor Cost		7,470.00	7,320.00	5,704.50	5,554.50
Opportunity Interest		2,442.62	2,143.27	2,400.48	2,101.51
Labor/Pig Marketed		1.24	1.69	.943	1.19
Fixed Cost					
Feed Equipment		780.61	780.61	1,176.01	1,176.01
Well & Equipment		120.08	120.08	120.08	120.08
Manure & Equipment		420.00	420.00	454.00	454.00
Breeding Stock	Boar	600.00	600.00	600.00	600.00
	Gilts	4,200.00	4,200.00	4,200.00	4,200.00
Land Charge		624.96	624.96	624.96	624.96
Insurance		391.27	391.27	486.22	486.22
Depreciation	Building C-F	1,260.76	1,260.76	2,016.85	2,016.85
	Boar	32.00	32.00	32.00	32.00
	Gestation	120.00	120.00	120.00	120.00
	Farrowing	1,141.35	1,141.35	1,222.01	1,222.01
	Fences	268.26	268.26	234.53	234.53
Tractor*		-------	-------	360.00	360.00
Auger Wagon*		-------	-------	51.60	51.60
Opportunity Interest		796.74	796.74	935.86	935.86

*Tractor and Auger Wagon, conventional system is in with the equipment listed previously.

TABLE I

CAPACITY 3, DETAILED COSTS FOR 360 LITTERS OR
3 SETS OF 60 SOWS FARROWED TWICE

Item		Conventional 3024 Market Hogs 8.5 Pigs/Litter	Conventional 2490 Market Hogs 7.0 Pigs/Litter	Confinement 3024 Market Hogs 8.5 Pigs/Litter	Confinement 2490 Market Hogs 7.0 Pigs/Litter
Variable Cost					
Feed Cost	Market Hogs	$ 59,363.28	$ 48,884.10	$ 59,363.28	$ 48,884.10
	Boar	496.00	496.00	496.00	496.00
	Sows	11,851.20	11,851.20	11,851.20	11,851.20
Heat Lamps		51.00	51.00	51.00	51.00
Storage	Corn	3,288.30	3,536.80	3,288.30	3,536.80
	Soybeans	584.50		584.50	
Scoop & Forks		37.00	37.00	15.85	15.85
Bedding		216.00	216.00	-------	-------
Repair	Fences	88.57	88.57	78.46	78.46
	Equipment	803.35	803.35	1,145.80	1,145.80
	Buildings	788.90	788.90	1,041.94	1,041.94
Hygiene		900.42	741.27	907.92	748.77
Fuel & Oil		213.00	213.00	84.00	84.00
Electricity		750.72	750.72	1,203.48	1,203.48
Labor Cost		11,202.00	10,977.00	8,574.00	8,349.00
Opportunity Interest		3,625.37	3,177.40	3,547.43	3,099.46
Labor/Pig Marketed		1.23	1.47	.945	1.12
Fixed Cost					
Feed Equipment		812.21	812.21	1,259.18	1,259.18
Well & Equipment		165.33	165.33	165.33	165.33
Manure Equipment		420.00	420.00	814.10	814.10
Breeding Stock	Boars	800.00	800.00	800.00	800.00
	Gilts	6,300.00	6,300.00	6,300.00	6,300.00
Land Charge		936.00	936.00	936.00	936.00
Insurance		428.56	428.56	526.06	526.06
Depreciation	Fences	295.23	295.23	261.33	261.33
	Grow-Finish	1,260.76	1,260.76	2,016.85	2,016.85
	Boar	42.66	42.66	42.66	42.66
	Gestation	180.00	180.00	180.00	180.00
	Farrowing	1,141.35	1,141.35	1,222.01	1,222.01
Opportunity Interest		1,022.57	1,022.57	1,161.88	1,161.88

TABLE J

CAPACITY 4, DETAILED COSTS FOR 200 LITTERS OR
1 SET OF 100 SOWS FARROWED TWICE

Item		Conventional 1680 Market Hogs 8.5 Pigs/Litter	Conventional 1382 Market Hogs 7.0 Pigs/Litter	Confinement 1680 Market Hogs 8.5 Pigs/Litter	Confinement 1382 Market Hogs 7.0 Pigs/Litter
Variable Cost					
Feed Cost	Market Hogs	$ 32,979.60	$ 27,145.34	$ 32,979.60	$ 27,145.34
	Boars	310.00	310.00	310.00	310.00
	Sows	6,585.00	6,585.00	6,585.00	6,585.00
Heat Lamps		56.67	56.67	56.67	56.67
Storage	Corn	1,827.50		1,827.50	
	Soybeans	315.00	1,953.50	315.00	1,953.50
Scoops & Forks		27.00	27.00	27.00	27.00
Bedding		120.00	120.00	-------	-------
Repairs	Fences	63.87	63.87	42.78	42.78
	Building	1,070.78	1,070.78	1,303.16	1,303.16
	Equipment	1,023.95	1,023.95	1,348.75	1,348.75
Hygiene		489.19	402.41	496.69	409.91
Fuel & Oil		72.00	72.00	33.00	33.00
Electricity		514.32	514.32	739.32	739.32
Labor Cost		5,445.00	5,319.00	5,295.00	5,169.00
Opportunity Interest		2,036.00	1,786.55	2,054.38	1,804.94
Labor/Pig Marketed		1.08	1.28	1.05	1.25
Fixed Cost					
Feed Equipment		1,154.02	1,154.02	1,585.62	1,585.62
Well & Equipment		122.41	122.41	122.41	122.41
Manure Equipment		675.00	675.00	763.00	763.00
Breed Stock	Boar	500.00	500.00	500.00	500.00
	Gilts	3,500.00	3,500.00	3,500.00	3,500.00
Land Charge		422.00	422.00	422.00	422.00
Insurance		471.06	471.06	556.36	556.36
Depreciation	Fences	212.90	212.90	142.60	142.60
	G-F	1,105.27	1,105.27	1,635.73	1,635.73
	Boar	26.66	26.66	26.66	26.66
	Gestation	66.67	66.67	66.67	66.67
	Farrowing	2,107.92	2,107.92	2,351.05	2,352.05
Opportunity Interest		829.11	829.11	933.85	933.85

TABLE K

CAPACITY 4, DETAILED COSTS FOR 400 LITTERS OR
2 SETS OF 100 SOWS FARROWED TWICE

Item		Conventional		Confinement	
		3360 Market Hogs 8.5 Pigs/Litter	2766 Market Hogs 7.0 Pigs/Litter	3360 Market Hogs 8.5 Pigs/Litter	2766 Market Hogs 7.0 Pigs/Litter
Variable Cost					
Feed Cost	Market Hogs	$ 65,959.20	$ 54,309.42	$ 65,959.20	$ 54,309.42
	Boars	620.00	620.00	620.00	620.00
	Sows	13,168.00	13,168.00	13,168.00	13,168.00
Heat Lamp		113.33	113.33	113.33	113.33
Storage	Corn	3,655.10	3,910.60	3,655.10	3,910.60
	Soybeans	630.00		630.00	
Scoop & Forks		27.00	27.00	27.00	27.00
Bedding		240.00	240.00	240.00	240.00
Repairs	Fences	117.90	117.90	88.32	88.32
	Building	1,473.60	1,473.60	1,887.22	1,887.22
	Equipment	1,445.40	1,445.40	1,770.20	1,770.20
Hygiene		995.54	819.29	1,010.54	834.29
Fuel & Oil					
Electricity		948.48	948.48	1,459.08	1,459.08
Labor Cost		10,734.90	10,372.00	10,227.00	9,867.00
Opportunity Interest		4,005.14	3,502.68	4,034.20	3,531.78
Labor/Pig Marketed		1.06	1.25	1.01	1.19
Fixed Cost					
Feed Equipment		1,776.24	1,776.24	2,207.84	2,207.84
Well & Equipment		219.71	219.71	219.71	219.71
Manure Equipment		930.00	930.00	930.00	930.00
Breed Stock	Boars	1,000.00	1,000.00	1,000.00	1,000.00
	Gilts	7,000.00	7,000.00	7,000.00	7,000.00
Land Charge		1,039.68	1,039.68	1,039.68	1,039.68
Insurance		712.42	712.42	840.91	840.91
Depreciation	Fences	393.00	393.00	294.40	294.40
	G-F	2,178.66	2,178.66	3,270.60	3,270.60
	Boar	42.67	42.67	42.67	42.67
	Gestation	100.00	100.00	100.00	100.00
	Farrowing	2,107.22	2,107.22	2,352.05	2,352.05
Opportunity Interest		1,399.97	1,399.97	1,550.87	1,550.87

TABLE L

CAPACITY 4, DETAILED COSTS FOR 600 LITTERS OR
3 SETS OF 100 SOWS FARROWED TWICE

Item		Conventional 5040 Market Hogs 8.5 Pigs/Litter	Conventional 4150 Market Hogs 7.0 Pigs/Litter	Confinement 5040 Market Hogs 8.5 Pigs/Litter	Confinement 4150 Market Hogs 7.0 Pigs/Litter
Variable Cost					
Feed Cost	Market Hogs	$ 98,938.80	$ 81,473.50	$ 98,938.00	$ 81,473.50
	Boars	744.00	744.00	744.00	744.00
	Sows	19,752.00	19,752.00	19,752.00	19,752.00
Heat Lamps		170.00	170.00	170.00	170.00
Storage	Corn	5,478.90	5,863.90	5,478.90	5,863.90
	Soybeans	945.00		945.00	
Scoop & Forks		27.00	27.00	27.00	27.00
Bedding		360.00	360.00	-------	-------
Repairs	Fences	130.86	130.86	101.28	101.28
	Equipment	1,459.15	1,459.15	1,792.05	1,792.05
	Building	1,553.98	1,553.98	1,954.80	1,954.80
Hygiene		1,443.57	1,188.65	1,458.57	1,203.65
Fuel & Oil		144.00	144.00	108.00	108.00
Electricity		1,213.56	1,213.56	1,925.40	1,925.40
Labor Cost		16,758.00	16,308.00	15,948.00	15,498.00
Opportunity Interest		5,964.75	5,215.54	5,973.72	5,224.54
Labor/Pig Marketed		1.11	1.31	1.05	1.25
Fixed Cost					
Feed Equipment		1,794.51	1,794.51	2,216.11	2,216.11
Well & Equipment		269.76	269.76	269.76	269.76
Manure Equipment		930.00	930.00	1,031.04	1,031.04
Breeding Stock	Boars	1,200.00	1,200.00	1,200.00	1,200.00
	Gilts	10,500.00	10,500.00	10,500.00	10,500.00
Land Charge		1,555.20	1,555.20	1,555.20	1,555.20
Insurance		816.13	816.13	942.23	942.23
Depreciation	Fences	436.20	436.20	337.60	337.60
	Grow-Finish	2,178.66	2,178.66	3,270.60	3,270.60
	Boar	64.00	64.00	64.00	64.00
	Gestation	300.00	300.00	300.00	300.00
	Farrowing	2,107.22	2,107.22	2,352.05	2,352.05
Opportunity Interest		1,771.33	1,771.33	1,923.09	1,923.09

TABLE 1

CAPACITY 5, DETAILED COSTS FOR 300 LITTERS OR
1 SET OF 150 SOWS FARROWED TWICE

Item		Conventional 2520 Market Hogs 8.5 Pigs/Litter	Conventional 2074 Market Hogs 7.0 Pigs/Litter	Confinement 2520 Market Hogs 8.5 Pigs/Litter	Confinement 2074 Market Hogs 7.0 Pigs/Litter
Variable Cost					
Feed Cost	Market Hogs	$ 49,469.40	$ 40,727.38	$ 49,469.40	$ 40,727.38
	Boars	620.00	620.00	620.00	620.00
	Gilts	9,876.00	9,876.00	9,876.00	9,876.00
Heat Lamps		85.00	85.00	85.00	85.00
Storage	Corn	2,471.50	2,664.00	2,471.50	2,664.00
	Soybeans	472.50		472.50	
Scoop & Forks		27.00	27.00	27.00	27.00
Bedding		180.00	180.00	-------	-------
Repairs	Fences	95.66	95.66	73.36	73.36
	Equipment	1,453.45	1,453.45	1,736.35	1,736.35
	Building	1,619.62	1,619.62	1,986.22	1,986.22
Hygiene		681.15	560.60	688.65	568.10
Electricity		434.64	434.64	790.68	790.68
Fuel & Oil		112.00	112.00	112.00	111.00
Labor Cost		6,204.00	5,994.00	6,078.00	5,868.00
Opportunity Interest		2,952.08	2,577.97	2,951.86	2,665.36
Labor/Pig Marketed		.82	.96	.794	.94
Fixed Cost					
Feed Equipment		1,815.22	1,815.22	2,462.62	2,462.62
Well & Equipment		172.12	172.12	172.12	172.12
Manure Cost		802.50	802.50	903.54	903.54
Breeding Stock	Boar	1,000.00	1,000.00	1,000.00	1,000.00
	Gilts	5,250.00	5,250.00	5,250.00	5,250.00
Land Charge		777.60	777.60	777.60	777.60
Insurance		716.67	716.67	821.03	821.03
Depreciation	Fences	318.85	318.85	394.59	394.59
	Boar	53.33	53.33	53.33	53.33
	Gestation	150.00	150.00	184.00	184.00
	Farrowing	3,161.88	3,161.88	3,894.00	3,894.00
	Grow-Finish	1,639.40	1,639.40	2,018.58	2,018.58
Opportunity Interest		1,268.61	1,268.61	1,556.49	1,556.49

TABLE N

CAPACITY 5, DETAILED COSTS FOR 600 LITTERS OR
2 SETS OF 150 SOWS FARROWED TWICE

Item		Conventional 5038 Market Hogs 8.5 Pigs/Litter	Conventional 4150 Market Hogs 7.0 Pigs/Litter	Confinement 5038 Market Hogs 8.5 Pigs/Litter	Confinement 4150 Market Hogs 7.0 Pigs/Litter
Variable Cost					
Feed Cost	Market Hogs	$ 98,920.26	$ 81,473.50	$ 98,920.26	$ 81,473.50
	Boars	930.00	930.00	930.00	930.00
	Sows	19,752.00	19,752.00	19,752.00	19,752.00
Heat Lamps		170.00	170.00	170.00	170.00
Storage	Corn	5,482.70	5,867.70	5,482.70	5,867.00
	Soybeans	945.00		945.00	
Scoop & Forks		36.00	36.00	36.00	36.00
Bedding		360.00	360.00	-------	-------
Repairs	Fences	169.84	169.84	143.82	143.82
	Equipment	1,889.05	1,889.05	2,394.30	2,394.30
	Building	2,251.50	2,251.50	2,874.84	2,874.84
Hygiene		1,436.00	1,182.75	1,458.50	1,205.25
Fuel & Oil		111.60	111.60	111.60	111.60
Electricity		1,269.12	1,296.12	1,980.72	1,980.72
Labor Cost		12,047.00	12,657.00	11,688.00	11,298.00
Opportunity Interest		5,870.80	4,124.80	5,875.51	5,129.51
Labor/Pig Marketed		.86	1.02	.773	.91
Fixed Cost					
Feed Equipment		2,499.18	2,499.18	3,146.58	3,146.58
Well & Equipment		269.26	269.26	269.26	269.26
Manure Cost		1,185.00	1,185.00	1,346.00	1,346.00
Breeding Stock	Boar	1,500.00	1,500.00	1,500.00	1,500.00
	Gilts	10,500.00	10,500.00	10,500.00	10,500.00
Land Charge		1,555.20	1,555.20	1,555.20	1,555.20
Insurance		1,049.24	1,049.24	1,249.10	1,249.10
Depreciation	Fences	318.25	318.25	244.55	244.55
	Boar	80.00	80.00	80.00	80.00
	Gestation	200.00	200.00	200.00	200.00
	Farrowing	3,161.88	3,161.88	3,528.09	3,528.09
	Grow-Finish	3,278.80	3,278.80	4,990.40	4,990.40
Opportunity Interest		2,047.74	2,047.74	2,288.73	2,288.73

TABLE O

CAPACITY 5, DETAILED COSTS FOR 900 LITTERS OR
3 SETS OF 150 SOWS FARROWED TWICE

Item		Conventional 7558 Market Hogs 8.5 Pigs/Litter	Conventional 6224 Market Hogs 7.0 Pigs/Litter	Confinement 7558 Market Hogs 8.5 Pigs/Litter	Confinement 6224 Market Hogs 7.0 Pigs/Litter
Variable Cost					
Feed Cost	Market Hogs	$ 148,389.46	$ 122,200.88	$ 148,389.46	$ 122,200.00
	Boars	1,860.00	1,860.00	1,860.00	1,860.00
	Sows	29,628.00	29,628.00	29,628.00	29,628.00
Heat Lamps		255.00	255.00	255.00	255.00
Storage	Corn	8,233.40	8,811.95	8,233.40	8,811.95
	Soybeans	1,418.55		1,418.55	
Scoop & Forks		36.00	36.00	36.00	36.00
Bedding		540.00	540.00	-------	-------
Repairs	Fences	215.69	215.69	171.36	171.36
	Equipment	2,001.95	2,001.95	2,406.55	2,406.55
	Buildings	2,308.98	2,308.98	2,932.32	2,932.32
Hygiene		2,308.98	1,806.70	2,216.47	1,829.20
Fuel & Oil		140.40	140.40	140.40	140.40
Electricity		1,786.56	1,786.56	2,854.56	2,854.56
Labor Cost		17,217.00	16,617.00	16,500.00	15,900.00
Opportunity Interest		8,649.00	7,528.36	8,681.68	7,561.05
Labor/Pig Marketed		.7558	.889	.727	.85
Fixed Cost					
Feed Equipment		2,575.18	2,575.18	3,222.58	3,222.58
Well & Equipment		412.62	412.62	412.62	412.62
Manure Cost		1,185.00	1,185.00	1,346.00	1,346.00
Breeding Stock	Boar	3,000.00	3,000.00	3,000.00	3,000.00
	Gilts	15,750.00	15,750.00	15,750.00	15,750.00
Land Charge		2,340.00	2,340.00	2,340.00	2,340.00
Insurance		1,228.87	1,228.87	1,414.08	1,414.08
Depreciation	Fences	719.00	719.00	571.20	571.20
	Gestation	300.00	300.00	300.00	300.00
	Boar	160.00	160.00	160.00	160.00
	Farrowing	3,161.88	3,161.88	3,528.09	3,528.09
	Grow-Finish	3,278.80	3,278.80	4,990.40	4,990.40
Opportunity Interest		2,728.11	2,728.11	2,962.80	2,962.80

TABLE P

CAPACITY 6, DETAILED COSTS FOR 400 LITTERS OR
1 SET OF 200 SOWS FARROWED TWICE

Item		Conventional 3360 Market Hogs 8.5 Pigs/Litter	Conventional 2766 Market Hogs 7.0 Pigs/Litter	Confinement 3360 Market Hogs 8.5 Pigs/Litter	Confinement 2766 Market Hogs 7.0 Pigs/Litter
Variable Cost					
Feed Cost	Market Hogs	$ 65,959.20	$ 54,309.42	$ 65,959.20	$ 54,309.42
	Boar	1,240.00	1,240.00	1,240.00	1,240.00
	Sows	13,168.00	13,168.00	13,168.00	13,168.00
Heat Lamps		155.33	155.33	155.33	155.33
Storage	Corn	3,667.00	3,922.50	3,667.00	3,922.50
	Soybeans	630.00		630.00	
Scoop & Forks		27.00	27.00	27.00	27.00
Bedding		240.00	240.00	-------	-------
Repairs	Fences	122.76	122.76	93.18	93.18
	Building	2,150.16	2,150.16	2,668.46	2,668.46
	Equipment	1,722.10	1,722.10	2,261.60	2,261.60
Hygiene		902.08	742.60	909.58	750.10
Electricity		887.76	887.76	1,362.36	1,362.36
Fuel & Oil		96.00	96.00	96.00	96.00
Labor Cost		8,412.00	8,412.00	8,352.00	8,082.00
Opportunity Interest		3,975.18	3,477.03	4,023.59	3,525.44
Labor/Pig Marketed		.8345	.98	.829	.973
Fixed Cost					
Feed Equipment		2,280.94	2,280.94	3,144.14	3,144.14
Well & Equipment		237.24	237.24	237.24	237.24
Manure Equipment and Cost		930.00	930.00	1,168.28	1,168.28
Breeding Stock	Boar	2,000.00	2,000.00	2,000.00	2,000.00
	Gilts	7,000.00	7,000.00	7,000.00	7,000.00
Land Charge		1,044.00	1,044.00	1,044.00	1,044.00
Insurance		930.44	930.44	1,106.57	1,106.57
Depreciation	Fences	409.20	409.20	310.60	310.60
	Gestation	133.33	133.33	133.33	133.33
	Boar	106.66	106.66	106.66	106.66
	Farrowing	4,215.84	4,215.84	4,704.12	4,704.12
	Grow-Finish	2,185.20	2,185.20	3,425.29	3,425.29
Opportunity Interest		1,717.83	1,717.83	1,950.42	1,950.42

TABLE Q

CAPACITY 6, DETAILED COSTS FOR 800 LITTERS OR
2 SETS OF 200 SOWS FARROWED TWICE

Item		Conventional 6718 Market Hogs 8.5 Pigs/Litter	Conventional 5530 Market Hogs 7.0 Pigs/Litter	Confinement 6718 Market Hogs 8.5 Pigs/Litter	Confinement 5530 Market Hogs 7.0 Pigs/Litter
Variable Cost					
Feed Cost	Market Hogs	$ 131,899.66	$ 108,295.18	$ 131,899.66	$ 108,295.18
	Boar	1,240.00	1,240.00	1,240.00	1,240.00
	Gilts	26,336.00	26,336.00	26,336.00	26,336.00
Heat Bulbs		226.66	226.66	226.66	226.66
Storage	Corn	7,535.20	8,042.20	7,535.20	8,042.20
	Soybeans	1,256.50		1,256.50	
Scoop & Forks		27.00	27.00	27.00	27.00
Bedding		480.00	480.00	-------	-------
Repairs	Fences	243.90	243.90	184.74	184.74
	Equipment	2,444.80	2,444.80	2,984.30	2,984.30
	Buildings	3,042.38	3,042.38	3,932.54	3,932.54
Hygiene		1,939.42	1,596.46	1,954.42	1,611.46
Fuel & Oil		252.00	252.00	252.00	252.00
Electricity		1,653.72	1,653.72	2,721.60	2,721.60
Labor Cost		17,811.00	17,100.00	17,721.00	17,121.00
Opportunity Interest		7,855.53	6,839.21	7,930.86	6,918.99
Labor/Pig Marketed		.8837	1.03	.879	.958
Fixed Cost					
Feed Equipment Cost		3,370.88	3,370.88	4,234.08	4,234.08
Well Equipment		384.36	384.36	384.36	384.36
Manure Equipment		1,440.00	1,440.00	1,678.20	1,678.20
Breeding Stock	Boars	2,000.00	2,000.00	2,000.00	2,000.00
	Gilts	14,000.00	14,000.00	14,000.00	14,000.00
Land Charge		2,081.60	2,081.60	2,081.60	2,081.60
Insurance		1,406.05	1,406.05	1,667.75	1,667.75
Depreciation	Fences	813.00	813.00	615.80	615.80
	Boar	106.66	106.66	106.66	106.66
	Gestation	400.00	400.00	400.00	400.00
	Farrowing	4,215.84	4,215.84	4,704.12	4,704.12
	Grow-Finish	4,371.73	4,371.73	6,850.57	6,850.57
Opportunity Interest		2,767.21	2,767.21	3,097.85	3,097.85

TABLE R

CAPACITY 6, DETAILED COSTS FOR 1200 LITTERS OR
3 SETS OF 200 SOWS FARROWED TWICE

Item		Conventional		Confinement	
		10078 Market Hogs 8.5 Pigs/Litter	8300 Market Hogs 7.0 Pigs/Litter	10078 Market Hogs 8.5 Pigs/Litter	8300 Market Hogs 7.0 Pigs/Litter
Variable Cost					
Feed Cost	Market Hogs	$ 197,858.86	$ 162,947.00	$ 197,858.86	$ 162,947.00
	Boars	1,860.00	1,860.00	1,860.00	1,860.00
	Gilts	39,504.00	39,504.00	39,504.00	39,504.00
Heat Lamps		340.00	340.00	340.00	340.00
Storage	Corn	10,965.30	11,724.80	10,965.30	11,724.80
	Soybeans	1,879.50		1,879.50	
Scoop & Forks		27.00	27.00	27.00	27.00
Bedding		720.00	720.00	-------	-------
Repairs	Fences	274.68	274.68	215.52	215.52
	Equipment	2,487.35	2,487.35	3,175.75	3,175.75
	Building	3,121.88	3,121.88	4,012.02	4,012.02
Hygiene		2,876.32	2,368.82	2,906.32	2,398.82
Fuel & Oil		324.00	324.00	324.00	324.00
Electricity		2,339.28	2,339.28	3,763.20	3,763.20
Labor Cost		24,984.00	24,084.00	24,624.00	23,724.00
Opportunity Interest		11,582.49	10,084.91	11,658.22	10,160.64
Labor/Pig Marketed		.826	.967	.814	.953
Fixed Cost					
Feed Equipment Cost		3,362.44	3,362.44	4,225.64	4,225.64
Well Equipment		518.33	518.33	518.33	518.33
Manure Equipment		1,440.00	1,440.00	1,678.00	1,678.00
Breeding Stock	Boar	3,000.00	3,000.00	3,000.00	3,000.00
	Gilts	21,000.00	21,000.00	21,000.00	21,000.00
Land Charge		3,110.40	3,110.40	3,110.40	3,110.40
Insurance		1,607.88	1,607.88	1,884.46	1,884.46
Depreciation	Fences	915.60	915.60	718.40	718.40
	Boar	160.00	160.00	160.00	160.00
	Gestation	600.00	600.00	600.00	600.00
	Farrowing	4,215.84	4,215.84	4,704.12	4,704.12
	Grow-Finish	4,371.73	4,371.73	6,850.57	6,850.57
Opportunity Interest		3,544.18	3,544.18	3,875.99	3,875.99

Capital

Table S contains the capital needed for buildings, equipment, fences, and breeding stock for the six capacities, three farrowing levels, and the two production systems. A producer knowing the type of system, the level of farrowing intensity, and the number of market hogs he would like to produce would receive an indication of the investment needed. The budgeted amounts of capital ranged from approximately $10,000 for capacity 1, two farrowings, to over $375,000 for capacity 6, six farrowings.

Table S

Investment in Building, Equipment,* Fences, and Breeding Stock
For the 6 Capacities, 3 Farrowing Levels,
and 2 Systems of Production

	2 Farrowings		4 Farrowings		6 Farrowings	
	CV	CF	CV	CF	CV	CF
Capacity 1						
B	3,653	5,444	4,225	6,186	4,484	7,058
E	6,077	2,174	6,386	2,098	8,734	4,461
F	566	389	635	408	716	489
S	1,600	1,600	2,800	2,800	4,000	4,000
Total	11,896	9,607	14,046	11,492	17,934	16,008
Capacity 2						
B	13,398	17,926	18,520	24,928	18,541	25,067
E	10,092	6,615	11,371	8,825	11,985	9,439
F	904	759	1,808	1,518	2,051	1,761
S	5,300	5,300	10,200	10,200	15,100	15,100
Total	29,694	30,600	41,899	45,471	47,677	51,367
Capacity 3						
B	27,474	34,354	38,328	50,979	39,445	52,097
E	12,437	16,182	15,501	22,350	16,067	22,916
F	2,031	1,778	4,042	3,518	4,429	3,923
S	10,200	10,200	20,400	20,400	30,200	30,200
Total	52,142	62,514	78,271	97,247	90,141	109,136

Table S (continued)

	2 Farrowings		4 Farrowings		6 Farrowings	
	CV	CF	CV	CF	CV	CF
Capacity 4						
B	53,539	65,158	73,681	94,361	77,699	97,740
E	20,479	26,975	28,908	35,404	29,183	35,841
F	3,194	2,139	5,895	4,416	6,543	5,064
S	17,000	17,000	34,000	34,000	49,800	49,800
Total	94,212	111,272	142,484	168,181	163,225	188,445
Capacity 5						
B	80,981	99,311	112,575	143,742	115,449	146,616
E	29,069	34,727	37,781	47,886	40,039	48,131
F	4,783	3,668	8,492	7,191	10,785	8,568
S	26,500	26,500	51,000	51,000	79,500	79,500
Total	141,333	164,206	209,848	249,819	245,773	282,815
Capacity 6						
B	107,508	133,423	152,119	196,627	156,094	200,601
E	34,442	45,232	48,896	59,686	49,747	63,515
F	6,138	4,659	12,195	9,237	13,734	10,776
S	38,000	38,000	68,000	68,000	102,000	102,000
Total	186,088	221,314	281,210	333,550	321,575	376,892

CV = Conventional, CF = Confinement, B = Buildings, E = Equipment, F = Fences, S = Stock

*Equipment for the conventional system, capacities 1 and 2, for the 2, 4, and 6 farrowing level has a $4500 tractor and a $750 manure spreader which was not included in the confinement system until capacity 3.

VITA

Robert Retzlaff was born [redacted] in Lincoln, Nebraska. Most of his life experiences centered about a grain and livestock farm five miles southeast of Lincoln, Nebraska. He was graduated from Walton (Nebraska) High School in May of 1961, and enrolled in the University of Nebraska in September of 1961.

He received the Bachelor of Science degree in Agriculture, majoring in Agricultural Economics, in January of 1966. In September of 1965 he accepted a research assistantship for graduate work in Agricultural Economics at the University of Nebraska. In January of 1968, he received the Master of Science degree in Agricultural Economics specializing in the area of production. His thesis title was "An Analysis of Cost-Size Relationships in Wheat Production, Nebraska Panhandle."

In September of 1967, he accepted a research assistantship in Agricultural Economics at the University of Missouri to work toward the Ph.D. degree. On September 14, 1970, he resigned the research assistantship to accept a position as Assistant Professor in the Agriculture Department at Central Missouri State College in Warrensburg, Missouri--a position he currently occupies.

He is a member of Gamma Sigma Delta and Sigma Xi.

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