EFFICIENT EGG PRODUCTION ORGANIZATIONS: AN ECONOMIC STUDY OF MANAGEMENT AND SIZE

By

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CHAPTER I

INTRODUCTION

Historically, egg production has been a side-line on Oklahoma farms. Farm flocks on these farms have been relatively small (100-300 layers) and the markets for eggs from these sources have been local in nature. For these reasons, not much emphasis has been given to quality or quantity of product by either buyer or seller. Moreover, costs associated with egg production have been considered relatively unimportant on these farms and the relationship between fixed and variable costs are not generally known nor understood.

This historical perspective of the Oklahoma egg-producing industry has little relevance to the present situation. At present, and probably more so in the future, marketing firms are demanding eggs of high quallity and in relatively large quantities. Quality is demanded because the ultimate consumer wants it and is willing to pay for it, and quantity because it reduces marketing costs materially. If the producer does not have quality and quantity, he may be denied entrance into the larger and better organized consumer markets. To meet these demands of quality and quantity, a change in technology is required. Generally, this means a higher investment in buildings and equipment to produce economically.[1]

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[1]The investment per layer may or may not be greater, but the absolute amount of capital will be much greater.

Once these investments are made, alternative uses of the houses and equipment are very few.

Objectives of Study

The specific objective of this study is to develop and analyze the costs associated with alternative processes[2] and sizes of commercial layer enterprises. Specific attention is given to the development of (1) the fixed and operating capital requirements for alternative size flocks and methods of production; (2) the returns to capital and management for alternative flock sizes and methods of production; and (3) the scale of plant associated with specific labor requirements and alternative wage rate levels.

Scope and Method of Study

The budget method is used in this study to indicate the most efficient combination of resources and production practices for layer enterprises of the various processes and sizes. Budgets developed in this study for resource product relationships for specific processes are based on secondary price data.

Egg production may be divided into three distinct but closely related categories; pullet replacement, egg production, and egg marketing. However, this study is concerned with the egg production phase of the poultry enterprise only. The laying period is assumed to be one year (365 days) in length, starting with a 22 week-old pullet.

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[2]Processes are distinct methods of producing eggs. For further details see page

Procedure

Since this study was designed primarily to evaluate the effects of recommended management practices for alternative commercial egg production processes and sizes, no attempt was made to evaluate egg production on general purpose farms. Information was drawn from several sources for the synthesis of "superior" but attainable organizations. An important source of information was scientific research publications. This information was supplemented from personal interviews with active personnel, field men for poultry service organizations, and other workers. In addition, farm inquiries were used to determine how the "best" poultrymen combined their resources for egg production. The majority of the farms from which field data were secured were in the Oklahoma City and Tulsa marketing areas.

On the basis of data collected, four size groups with five processes in each size were selected to be studied. These were a 1500 hen layer flock, a 3000 layer flock, a 6000 layer flock and a 12000 layer flock. These size groups were considered representative of attainable flock sizes under Oklahoma conditions. A "superior" organization for each process at each flock size included a synthesis of the physical and economic models and assumed an attainable organization and level of inputs. This procedure resulted in point estimates of costs with respect to the conceptual framework of economies of size.

Use of Study

An economic evaluation of the layer industry will indicate the returns to productive resources used in the layer industry.

This information can be used by farmers to make decisions regarding what enterprises to add to their business. They will be able to compare this data with data from other enterprise studies that used approximately the same resources.

Also, the information can be used by people connected with the layer industry. Credit institutions and feed manufacturers can use this data in deciding whether to lend money and for what period(s) of time.

CHAPTER II

THE THEORETICAL FRAMEWORK

The physical production function assumed to underly this study was

$Yij = F(X_1, X_{2ij})$, where

Yij = output of eggs associated with the i th production process for the jth class of flock size,

X_1 = a single bundle of variable inputs including feed and pullet replacement in the same fixed proportions for each i and j with supplies and labor in fixed proportions for any given i and j,

X_{2ij} = a single bundle of fixed inputs including houses, fixtures and equipment, whose membership, type and amounts may differ for each process and flock size.

For practical purposes, the production processes, i, were limited to five within each flock size. These were labelled i = A, B, C, D, and E, consistently at each flock size. The major classifying criterion concerned systems of housing and feeding and therefore capital intensity of production. Similarly four classes of flock size were observed at the mid-point, namely: j = 1500, 3000, 6000, and 12000 birds. Each of the twenty possible firms were assumed to be using the best possible organization of production to maximize profits. Figure 1 illustrates the hypothetical situation with respect to two processes and two flock sizes on a factor-factor, output map. As later sections of the study will develop, no attempt was made to determine the whole production function. It was assumed that the method of budgeting successful firms gave factor combinations close to economic optima as illustrated in Figure 1.

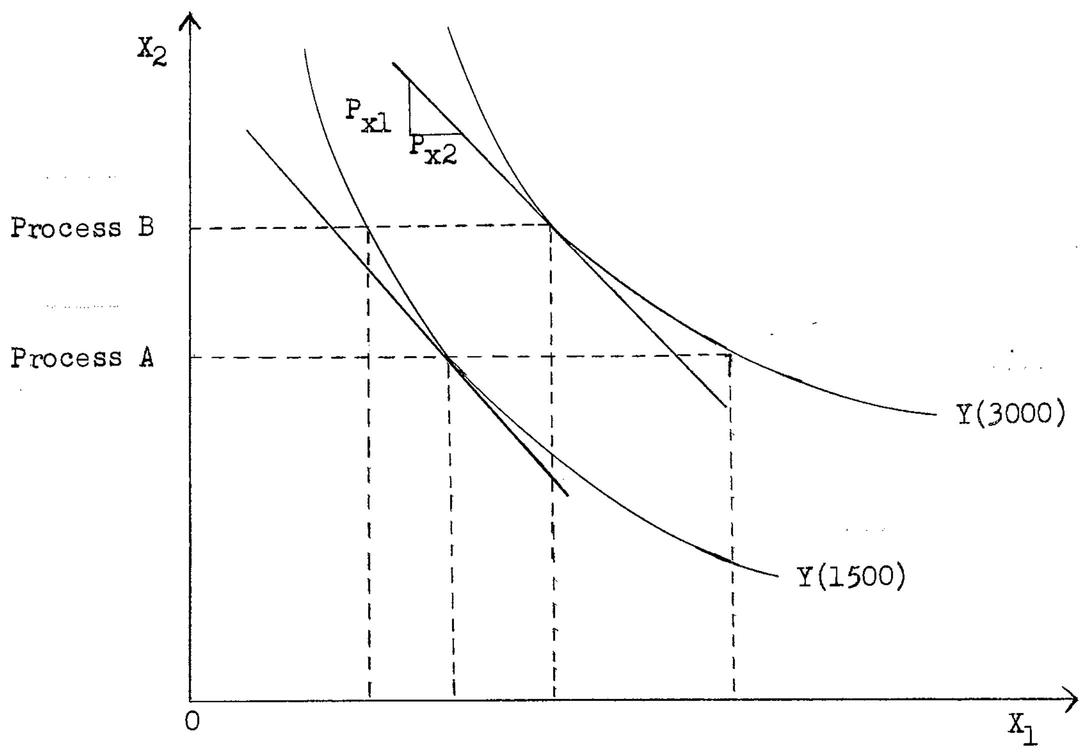

Figure 1

FACTOR-FACTOR RELATIONSHIP FOR TWO PROCESSES AND TWO FLOCK SIZES

Cost Theory

Of more direct relevance to this study, were the short-run and long-run average costs curves of a firm in pure competition which are based on the production function discussed above. The short-run was defined to be a period long enough to permit any desired change in inputs which was technologically possible without altering the fixed inputs which determine the process of operation. Theoretically all inputs are variable in the long-run.[3]

By applying suitable prices to the inputs of a given process at a given size, it is possible to derive a point on the short-run cost curve. Since all inputs are classified in the short-run, the average cost curve will fall at first, due to increasing returns to the fixed factor, and then rise again due to decreasing returns to the fixed factor. Figure 2 presents a graphic model of the short-run cost curve for one flock size.

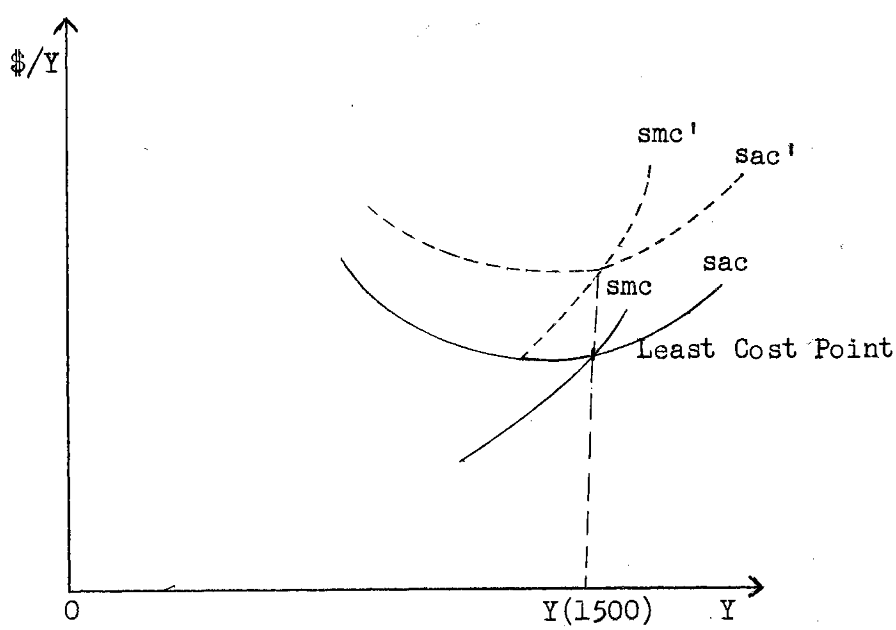

Figure 2

THEORETICAL SHORT-RUN AVERAGE COST CURVES

[3]I. F. Fellows, G. E. Frick, and S. B. Weeks, Production Efficiency on New England Dairy Farms, Bul. 285 (Storrs Agri. Experiment Station, Storrs, Connecticut, Feb., 1952), p. 1.

By budgeting all the processes at a given size level, the derived average unit costs will be represented by a vertical row of points standardized at the average of the class size. Figure 3 presents a graphic example on this.

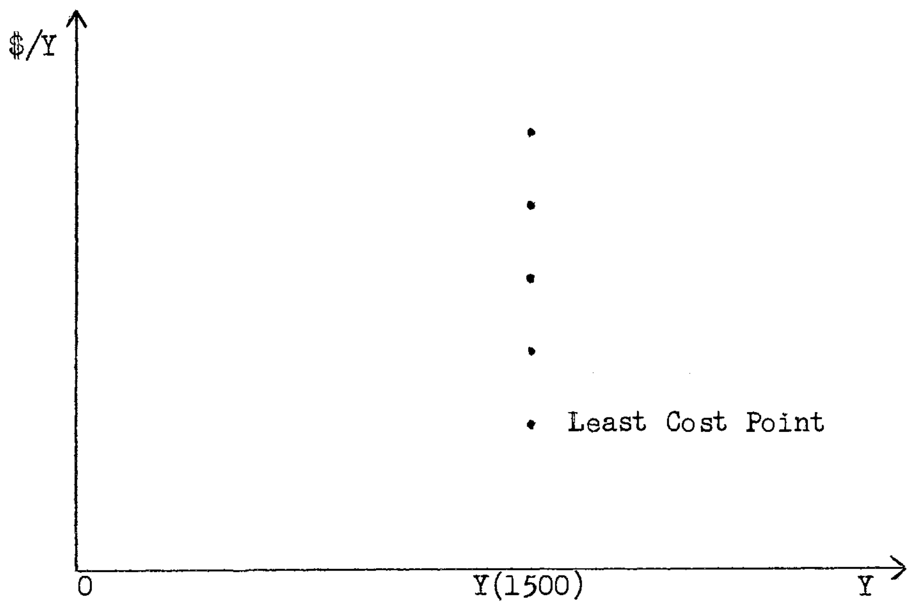

Figure 3

POINTS ON SHORT-RUN AVERAGE COST CURVES AS DEPICTED BY BUDGETS

The lowest point is the most economical process at this level of output; the others representing physically inefficient processes or combinations of resources in this class size. Each of these points is located on a separate average total cost curve, but using budgeting analysis, one would not know the slope of these curves at other points.[4] By choosing "superior" organizations, it is hopefully assumed that the budgeted combination of each process is close to the minimum average cost point.

[4]I. F. Fellows, G. E. Frick, S. B. Weeks, et al., p. 12.

By drawing the average total cost curves for several firms, each of different size and by drawing a curve that was tangent to these, the theoretical long-run average cost curve could be derived. This curve theoretically represents economies of scale (size) for this segment of the agricultural industry. This curve is highly significant since it pictures long-run cost possibilities for the firms of various sizes. This curve has often been called the planning curve because of its importance to the economic interpretation of production problems over time.

Figure 4 presents the theoretical relationship between the short-run and long-run cost curves. The short run cost curves of the farms using optimum processes for each class size are tangent to the long run average cost curve. As an illustration, firm three can produce the product most economically at output OY_3, Figure 4. By using the budget technique, we are not sure that the long-run average cost curve is the theoretical tangent curve. For the decreasing cost segment, the budgeted points are likely to represent a curve somewhat above the theoretical envelope.

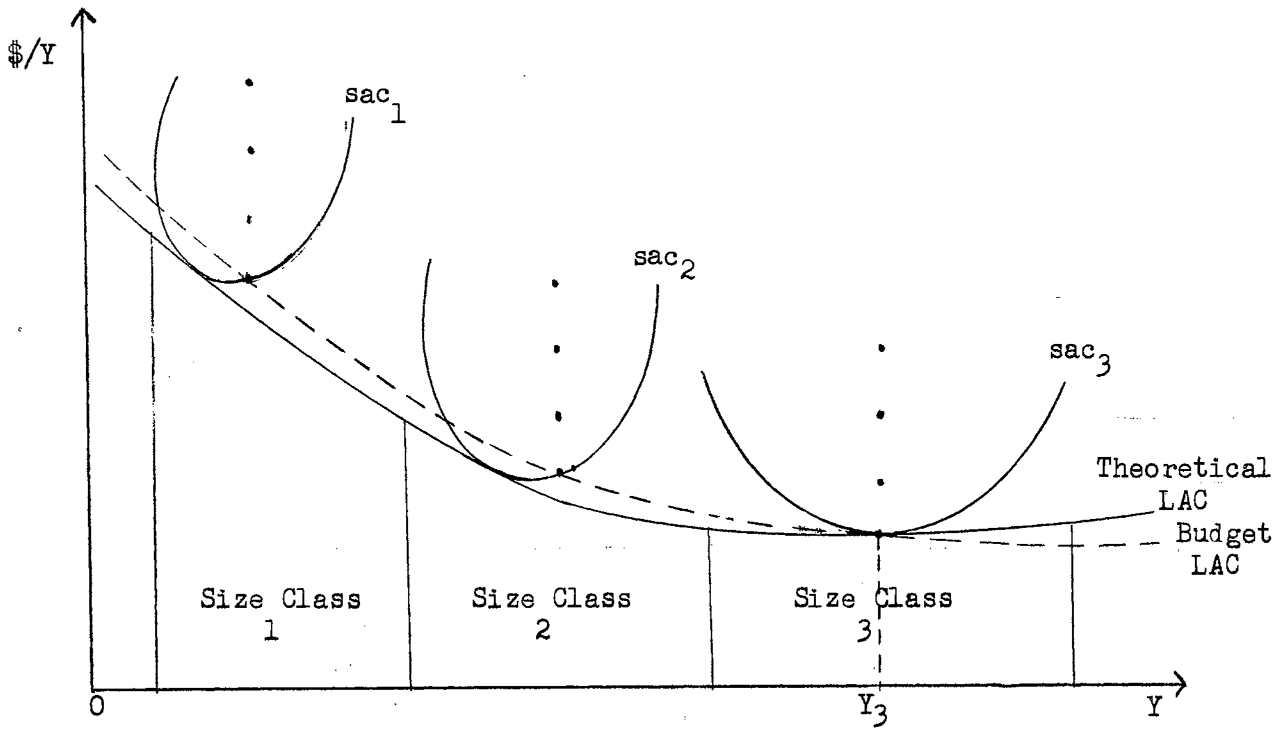

Figure 4

LONG RUN COST ENVELOPE OR PLANNING CURVE

Methods of Estimating Costs

The long-run average cost curve is emphasized in this study. The long-run average cost curve as an expansion curve shows the levels of cost that may be expected from the operations of various size firms.

Cost Data

Nine components of the total cost of operating a layer enterprise were computed. All costs were standardized on an annual basis. Fixed costs included depreciation and/or obsolescence, interest on investment, taxes, insurance and repairs. Variable costs included pullet replacement, interest on pullet replacement, feed, and other items. Fixed cost plus variable cost was the total annual cost of production. Total cost divided by total annual production of eggs yielded the per dozen costs for the various processes and sizes.

The short-run and long-run average total cost curve used in this study was computed by the budget method. Use of this method permits a comparison of the unit costs for firms of different sizes when these firms are operated with what is assumed to be equal efficiency. As indicated before only point estimates are developed by this method. In egg production, however, many inputs must be combined in fixed proportions even as size of flock increases.

Synthesis of "Superior" Organizations

The nine components of total cost discussed in the previous section were arrived at by a synthesizing process. The synthesizing process simply permits complete freedom to combine production resources and practices so that a similar degree of management efficiency is attained on the small, medium, or large units for given qualities and quantities of resources. The synthesizing was based upon information provided by published physical research, input-output data of random sample egg laying tests, and production practices used by outstanding poultrymen. The physical production processes are synthesized in Chapter III. The prices used for inputs and the annual costs are synthesized in Appendix Tables A-I through D-IV. Prices of these factor inputs were based on answers given by poultry farmers, poultry price catalogues, feed salesmen, and hatcherymen. The answers supported a price for factors differential between class sizes based on volume buying of some of the variable inputs.

For this study it was assumed that the price of variable inputs decreased as flock sizes increased although no statistical technique was used to measure and verify the differential.

Assumptions and General Considerations

Assumptions regarding labor were of prime importance for this study. The number of hours that the industrial worker spends in productive work has been declining. This has increasingly made the farmer aware of his labor time. Increasing numbers of farm entrepreneurs will probably come to the conclusion that if they cannot make a certain money return to labor and capital in a certain number of hours, they will work in other pursuits. This consideration was taken into direct account. It was assumed that the entrepreneur would not work over 2620 hours per year. This is somewhat higher than industry time, but it was assumed that the farmer also has managerial responsibilities. This same assumption of work hours applied to hired labor in those models employing a full-time employee. For this study, sizes and methods of production were analyzed that would require part-time help. If part-time help was used, it was assumed that at least 500 hours of labor would be available for employment. The assumption was made for this reason. The layer enterprises used in this study were organizations that all used a better than average quality of labor. It can be logically argued that this kind of labor is offered and taken in discrete amounts. It is easy to see how the full-time worker can be obtained but probably some explanation is in order for the other assumption. In the area where this study is mainly applicable, namely Tulsa and Oklahoma City marketing areas, there is an old and young population from which poultrymen can draw for part-time labor. For instance, there are men over 65 years of age that are in good physical condition that would like to supplement their social security, or there are high-school boys who prefer work after school and on the weekend. In either case, there are qualified individuals who can, with a little training, do some of the routine work on a layer farm. Most of this routine work is light work such as washing or gathering eggs. With these considerations in mind, it was thought that 500 hours was the minimum time that either the hired man or the employer would want to consider.

In economies of size analysis, the average total cost per unit is measured on the vertical axis and output is measured on the horizontal axis. For this study, the output units on the horizontal axis are in flock size. These flock sizes are 1500, 3000, 6000, and 12000. The flock size can be converted into a dozen output number by multiplying flock size by per bird egg production. Per bird egg production is assumed the same for all processes and sizes of production.

To conclude the study, the budget data were used to compute time and repayment schedules if credit were used. Amounts of operating capital needed and repayment periods were considered for all flock sizes under varying egg price assumptions. A repayment plan for fixed capital was calculated for an operator who would enlarge his flock from 3000 to 12000.

CHAPTER III

EGG PRODUCTION SYSTEMS AND THEIR USE ON OKLAHOMA FARMS

For this study two broad systems of production were used. System One was the floor plan and System Two the cage plan. Under System One, there were two processes or methods of production. System One, Process A, was a labor-intensive process in that hand feeding was used. System One, Process B, used automatic feeding. Under System Two there were three processes or ways of production. System Two, Process C, was the single bird cage plan. System Two, Process D, was the colony (5) bird cage plan. System Two, Process E, was the multiple bird cage plan. Irrespective of the system and process of production, the egg room with its associated equipment was identical for all processes and was considered in that framework.

The distinguishing feature between the floor system and cage system was whether the birds were on or partly on the floor, or completely off the floor. This has brought about much discussion on the good and bad points of either system from a technical standpoint. The cage producers point out as favorable attributes easier culling, full capacity operation, less mortality and uniform labor requirements and costs. Listed as unfavorable are bad odor and greater number of flies, higher initial investment, wire-marked eggs, cage fatigue for hens, and higher replacement costs, especially for smaller flocks. The advantages of the floor system are the reciprocal of disadvantages of cage operation, namely, lower initial investment, elimination of odor and flies. The disadvantages are, more difficult culling, operating for one-half the year at less than full capacity, and higher mortality.

The use of these production systems and processes on Oklahoma farms was discussed in the framework of combining all the resources in the most optimum way at each size group. The resources that are combined and that go into determining the total cost of producing a dozen eggs are housing, equipment, feed, pullet replacement, labor, and other. Resources for four flock sizes (1500, 3000, 6000, and 12000) were combined and budgeted for each process.

Systems of Production

There are at least five distinct processes of production, which are used on layer farms in Oklahoma. Essential technological factors associated with these particular processes are briefly discussed below.

System One, Processes A and B

Process A was characterized by low housing as well as equipment cost, but high labor requirements. A pole-type building with a metal roof was the essential need. Ventilation was furnished by natural methods. All water equipment was automatic. Hand feeders and in particular the tube-type of hand feeder were used. Individual nests were needed for this method of production. Roosts were also required for this process. Litter material was a requirement of this process of production.

Process B was identical to Process A, except that automatic feeders were substituted for the hand feeders. The substitution of capital for labor made this process relatively more capital intensive than Process A.

System Two, Processes C and D

Process C used a single cage for each bird. This cage was ordinarily in the dimensions of 8 to 10 inches wide and 12 to 14 inches in length. The cages were placed in a double row with a 2 1/2 to 3-foot walkway between each double row of cages. A continuous water trough ran between each double row of cages. A continuous feed trough was on the outside of each row of cages. The cage served as a nest and roost for the bird. A better-constructed house was used for this process of production, since the individual bird was not able to move in order to avoid drafts, wind, and so forth.

Process D was similar to Process C. The only difference was that instead of a single bird being in one cage, several birds were put into a larger cage, 24 inches by 18 inches. The cage still served as the nest and roost. Feed and water troughs were still in the same place. In essence this process reduced fixed cost as compared to Process C. This process of production was known in the trade as a colony-type plan.

System Two, Process E

This system of production was the most capital intensive, labor extensive in the Oklahoma layer industry. The birds were put on slatted floors, and the droppings were removed periodically without disturbing the birds. One bird per square foot was all the floor space required by putting the birds on the slatted floors. The feeding and watering equipment were identical to that of Process B (automatic feeders and continuous water troughs). Nests were required as in Processes A or B. This process was classified as cage because the birds were kept out of 80 to 90 percent of their droppings.

Synthesis of the Technological Systems

Tables I, II, and III present the arrangement, type, number, and so forth of obtainable egg production processes in Oklahoma. An attempt was made to synthesize the efficient combination for each process and size. The inputs were analyzed under six categories--housing, equipment, feed, pullet replacement, labor, and other. Inputs that are identical for all processes are discussed in the section "Inputs, Characteristic of All Processes". Inputs not identical for all processes are discussed specifically for each process.

Inputs Characteristic of All Processes

Many of the inputs were the same for all processes, especially the variable factors of production. Discussed below are these inputs.

Housing

Adequate drainage was the first prerequisite of a sound housing program. A second condition of proper housing was the distance and direction of the layer house(s) from the dwelling house. The layer house(s) was at least two hundred feed from the dwelling house and preferably situated as to prevailing winds.

The location of the layer house(s) in relation to each other and the egg room was a consideration of prime importance. The number of buildings was kept to a minimum to minimize on all costs. The layer houses were at least 100 feet apart to help minimize spread of disease. The egg room was located so as to minimize time needed to bring eggs from the layer house(s).

Equipment

Equipment needs are discussed under specific inputs.

Feed

Feed consumption, as a factor affecting cost per dozen eggs, was important because of the high proportion that feed cost was of the total cost of production. This proportion ranged from 60 to 75 percent, depending on the assumptions regarding pullet replacement. These assumptions are discussed in detail under pullet replacement. Based on these assumptions 4.5 pounds of feed per dozen eggs was required if egg production was 65 percent for 365 days. Requirement per bird was 90 pounds of feed. An all-mash ration was used to assure a balanced ration and to use labor-saving feed equipment (bulk feed tank, mechanical feeder, etc.) more advantageously.

Uniformity of the ingredients of the all-mash ration was assumed. If the protein content varied or the oils and fats turned rancid, production could not be maintained. To get this uniform feed, delivery was made every two weeks in the summer time and every three weeks in winter time.

For this study, a 15 percent protein feed was used for the floor system and a 17 percent protein mash for the cage system. This decision was based on what the interviewees were doing and the recommendations of feed companies. The cage layer needed the extra protein for two reasons. It helped to keep droppings dryer and the cage bird required a more direct source of energy since it must get its heat energy from the feed.

Cost of feed per ton was just as important as pounds of feed consumption per dozen eggs in arriving at a feed cost per dozen eggs. A cent a pound change in the price of feed affected the cost per dozen eggs by 4.5 cents. For this study, feed prices were scaled from a high price of $86.00 per ton to a low of $68.80 per ton for the 15 percent feed. The 17 percent protein mash cost two dollars more per ton at each level. The reason for the scaled prices was based on evidence that the interviewees gave. All evidence pointed to the fact that the larger flock owners were acutely aware of feed costs.

Pullet Replacement

Pullet replacement as an input factor affected total cost the same for all processes. One of the assumptions of the study was that pullet replacement was a fixed factor in the sense that alternative programs for pullet replacement were not considered. Data on pullet replacement was largely drawn from the 1958 and 1959 random sample laying tests.[5] The interviewees stressed the point that efficient use of the other input factors depended on the right pullet being put into the house.

Bird Type. The breed or variety of bird assumed was a strain cross or hybrid. Ten to fifteen of these varieties consistently place very high in the random sample tests. At 22 weeks of age these birds weigh 3.5 to 3.75 pounds. After 52 weeks of lay these birds will weigh approximately 4 to 4.5 pounds per bird. The average weight per bird of 4 pounds was essential for the square feet of floor space assumed for each process.

Rate of Lay. The random sample tests indicated that these varieties will average approximately 240 eggs in 52 weeks of lay. This rate of lay (65 percent) combined with a small bird required only 4.5 pounds of feed per dozen eggs.

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[5] All Official U. S. Random Sample Laying Tests Ending in 1958 and 1959 (Des Moines, Iowa, 1959), pp. 2-24.

Health and Mortality. It was assumed that a complete vaccination, medication and sanitation program was followed in growing out these pullets. They were wormed and vaccinated for small pox before being put into the layer house. The birds were debeaked at one day of age to reduce mortality from "pick outs". The "superior" management assumption assumed constant watch for disease and prompt remedial action. With these standards, it was assumed that mortality would be ten percent for the 52 weeks of lay.

Cost of Pullet Replacements. It was assumed that cost per replacement decreased as larger quantities were bought.[6] This was due to economies in buying large quantities or in raising large quantities.

Labor

Data from farm interviews and from other sources[7] were studied to determine time requirements for the various chores as flock size increased. The data indicated that there was a reduction in time requirements for the routine chores[8] of egg production as flock size increased. These routine chores were different for each process except for egg washing. Egg washing time was one hour for the 1500 size flocks and 4 3/4 hours for the 12000 size flocks.

Labor time for overseeing and management was the same for any pro-

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[6] Gene Arthur Mathia, Management Practices and Problems of Commercial Egg Production on Oklahoma Farms, (unpub. M. S. Thesis, Oklahoma State University, 1958), pp. 54-65.

[7] Ibid, p. 45.

[8] Routine chores include egg gathering, egg washing, and feeding.

cess. Overseeing and management included record keeping, staying abreast of market forecasts and industry changes, purchasing of resources and careful watch of the birds. For flock sizes of 1500 this amounted to one-quarter of an hour daily and for the 12000 flock size, it amounted to 1.5 hours daily.

Other

Costs of veterinary supplies, egg room supplies and miscellaneous supplies were proportionately the same for all processes.

Daylight time was kept to a minimum of 12 to 14 hours for the entire 52 weeks. If needed, one-half hour of artificial light was added per month so that the birds ended up their laying period with 18 hours of daylight.

A truck, tractor and manure spreader were used by all processes. The use and aforementioned cost of this equipment to the layer business depended on flock size. For instance, the 12000 size flock used one-half time of the truck, one-fourth time of the tractor, and full-time of the manure spreader.

Specific Inputs, Processes A and B

Processes A and B were floor type processes. Inputs for these processes were the same except for equipment differences and labor requirements. These differences are pointed out in the analysis and in Table I.

Housing and Equipment

Adequate housing was provided by A or B processes at relatively low cost per bird. Two square feet of floor space per bird was adequate if

TABLE I

PRODUCTION AND MANAGEMENT PRACTICES ASSOCIATED WITH PROCESSES A AND B

	Housing				Equipment								
											Process A Feed Equipment		
Flock Size	Floor Space Per Bird	Total Number Of Houses	Dimensions of House	Construction Type	Water Well and Pump Number	Water Equipment	Nest Equipment	Egg Gather Equipment	Placement of Egg Equipment	Egg Basket Type and Number	Type and Number of Feeder	Placement of Feeders	Bulk Feed Number and Capacity
1500	2 sq. ft.	1	80'x40'	Pole, dirt floor, "A" type roof, ridge ventilation, metal roof, two large end doors	1	Continuous "U" trough, 2 linear inches per bird, 1 medicine tank	One 8"x10"x10" nest per 5 birds, metal construction, 3 tier high by 5 tier long	Carry track length of house, platform capacity 6 cases	Nests back-to-back, 3 1/2' apart, eggs gather from rear, egg track down middle of isle	15 dozen collapsible egg basket with plastic flats 11	25# capacity suspended self-feeder 60	3 rows feeders at least 10' apart	1 6 ton
3000	2 sq. ft.	1	155'x40'	Pole, dirt floor, "A" type roof, ridge ventilation, metal roof, two large end doors	1	Continuous "U" trough, 2 linear inches per bird, 1 medicine tank	One 8"x10"x10" nest per 5 birds, metal construction, 3 tier high by 5 tier long	Carry track length of house, platform capacity 6 cases	Nests back-to-back, 3 1/2' apart, eggs gather from rear, egg track down middle of isle	15 dozen collapsible egg basket with plastic flats 22	25# capacity suspended self-feeder 120	3 rows feeders at least 10' apart	1 6 ton
6000	2 sq. ft.	1	310'x40'	Pole, dirt floor, "A" type roof, ridge ventilation, metal roof, two large end doors	1	Continuous "U" trough, 2 linear inches per bird, 2 medicine tanks	One 8"x10"x10" nest per 5 birds, metal construction, 3 tier high by 5 tier long	Carry track length of house, platform capacity 6 cases	Nests back-to-back, 3 1/2' apart, eggs gather from rear, egg track down middle of isle	15 dozen collapsible egg basket with plastic flats 44	25# capacity suspended self-feeder 240	3 rows feeders at least 10' apart	2 6 ton
12000	2 sq. ft.	2	310'x40'	Pole, dirt floor, "A" type roof, ridge ventilation, metal roof, two large end doors	2	Continuous "U" trough, 2 linear inches per bird, 4 medicine tanks	One 8"x10"x10" nest per 5 birds, metal construction, 3 tier high by 5 tier long	Carry track length of house, platform capacity 6 cases	Nests back-to-back, 3 1/2' apart, eggs gather from rear, egg track down middle of isle	15 dozen collapsible egg basket with plastic flats 88	25# capacity suspended self-feeder 480	3 rows feeders at least 10' apart	4 6 ton

TABLE I (Continued)

Equipment: Process B Feed Equipment: Type of Feeder	Equipment: Process B Feed Equipment: Placement of Feeder	Equipment: Process B Feed Equipment: Bulk Feed Number and Capacity	Feed: Tons, Type Protein Percent	Feed: Features of Feed	Feed: Other Feed	Pullet Replacement: Type, Age, Initial Weight End Weight	Pullet Replacement: Average Egg Production for 52 weeks	Pullet Replacement: Feed Conversion Ratio	Pullet Replacement: Health of Pullets at 22 weeks	Pullet Replacement: Mortality	Labor: Total Labor Process A	Labor: Total Labor Process B	Other: Litter Material	Other: Roost Space	Other: Number of House Cleanings
Mechanical trough length 4", 2 linear inches per bird	Hopper in storage room, trough 8' to 10' from wall	1 6 ton	67.5 All-mash 15%	Fresh, Received in bulk every 2 to 3 weeks	Grit, Oyster shells	Strain, cross or hybrid, 22 weeks, 3.5-3.75# 4.0-4.25#	65%	4.5 pounds per dozen eggs	Vaccinated, wormed and debeaked	10%	1400 hours	1100 hours	Shavings added to maintain dry floors	3 linear inches per bird	1 time per year
Mechanical trough length 4" 2 linear inches per bird	Hopper in storage room, trough 8' to 10' from wall	1 6 ton	135 All-mash 15%	Fresh, Received in bulk every 2 to 3 weeks	Grit, Oyster shells	Strain, cross or hybrid, 22 weeks, 3.5-3.75# 4.0-4.25#	65%	4.5 pounds per dozen eggs	Vaccinated, wormed and debeaked	10%	2500 hours	1900 hours	Shavings added to maintain dry floors	3 linear inches per bird	1 time per year
Mechanical trough length 4" 2 linear inches per bird	Hopper in storage room, trough 8' to 10' from wall	1 10 ton	270 All-mash 15%	Fresh, Received in bulk every 2 to 3 weeks	Grit, Oyster shells	Strain, cross or hybrid, 22 weeks, 3.5-3.75# 4.0-4.25#	65%	4.5 pounds per dozen eggs	Vaccinated, wormed and debeaked	10%	4500 hours	3600 hours	Shavings added to maintain dry floors	3 linear inches per bird	1 time per year
Mechanical trough length 4" 2 linear inches per bird	Hopper in storage room, trough 8' to 10' from wall	2 10 ton	540 All-mash 15%	Fresh, Received in bulk every 2 to 3 weeks	Grit, Oyster shells	Strain, cross or hybrid, 22 weeks, 3.5-3.75# 4.0-4.25#	65%	4.5 pounds per dozen eggs	Vaccinated, wormed and debeaked	10%	7500 hours	5700 hours	Shavings added to maintain dry floors	3 linear inches per bird	1 time per year

management practices were watched closely. To reduce construction cost, one building was used for 6000 birds or less. Two buildings were used for the 12000 size flock. For efficient use of equipment, the houses were 40 feet wide. Width also helped to reduce construction cost. In a layer house of 40 feet width, a single feeder track, one continuous waterer and a double row of nests were arranged and used most economically. Length of the house reduced construction cost, but more important, length reduced investment cost in equipment.

In this study a house of the dimension 310 feet by 40 feet was considered technically the most efficient. In the middle of this house was located a 10 feet by 40 feet storage-feeder room. This housed the automatic feeder, grit, egg carrying cart, and medicine tank. On either side of the storage room was a 150 feet by 40 feet pen. This pen was divided into two pens by a one-half inch wire mesh to reduce flightiness of the birds and to reduce the "pick outs".

This building featured the semi-pole type construction. Poles were used for interior bracing and concrete blocks were used for the "outside" footing and bracing. An "A" type roof was used with ridge ventilation. The house had a metal roof, a double row of inexpensive windows on north and south sides, and large end doors so that equipment (tractor, truck) could move in and out. The construction cost of this building was 50 cents per square foot.

Functional housing requirements and efficient use of equipment and labor are interrelated.

<u>Feed Equipment Process A</u>. A six ton bulk tank and auger was used for each 150 feet by 40 feet section of house. This reduced feeding time, since

it reduced walking time by about one-half for feeding. A 25 pound suspended self-feeder was used per 25 birds. This was sufficient to allow a minimum of two linear inches of feeder space per bird. The feeders were placed into three rows and at least ten feet was allowed between feeders. These requirements were important from the technical standpoint in that a layer did not walk over ten feet for mash.

Feed Equipment Process B. A six ton bulk tank was used for the flock sizes 1500 and 3000 but a ten ton bulk tank was used for the 310 by 40 foot house. Only one tank was needed since all feed was fed from the mechanical feed hopper. A single track of feeder trough was adequate to provide the minimum two linear inches of trough space per bird. This trough was four inches deep and was designed to prevent birds from billing the feed out. A time clock was used to start and stop the mechanical feeder. The time intervals were far enough apart to keep a minimum amount of feed in the trough and also often enough to stimulate the layers to eat more. The feed trough was placed eight to ten feet from the outside wall to prevent blowing rains from dampening feed and to reduce the distance a bird walked for feed. The total fixed cost of a mechanical feeder decreased as flock size increased due to the fact that only additional trough, chain and legs were needed to increase feeding capacity.

Water Equipment. Processes A and B utilized the same type of watering equipment. One deep well and one water pump was used for flock sizes 1500 - 6000. Two wells and two pumps were used for the large size. This was a safety device. One well and two pumps were sufficient when the water supply was unlimited.

A continuous "U" type waterer was used. It was four inches deep so as to eliminate "billing" out. It was placed on an elevated platform with perches. A faucet at one end was partly opened and the water ran continuously, the waste water drained off outside the house. Continuous watering had the advantages of cleanliness, a low freezing point, and less spillage. If water was a limiting factor, an automatic float was installed in the trough.

An important auxiliary piece of watering equipment was the medication tank. Most medicines are administered more cheaply through the water than through the feed. To medicate through the water, the watering system was connected to a 50-gallon tank. When this tank was filled with medicated water, it was only necessary to connect to the water line and trough. This tank was elevated three to four feet above the trough to assure plenty of pressure. A minimum of one linear inch of water space was assumed per bird.

Egg Equipment. One bird per five nests was assumed for this study. The nests were an eight by ten inch cubic, so as to eliminate double nesting. A metal nest was used to minimize lice and mites and to facilitate cleaning. A three-tier high and five-tier long nest minimized labor time for gathering and allowed more efficient use by the layers. The nests were placed back-to-back and the eggs were gathered from the rear of the nest. This was advantegeous for several reasons. A track and cart was installed and used in the three foot aisle. This reduced labor time since several cases of eggs were gathered at one time instead of one case. Also gathering eggs from the rear disturbed the birds less and thus caused less breakage of eggs. The collapsible 15 dozen egg basket was used. Plastic flats which separated the eggs were used in the baskets. This reduced breakage both in gathering and washing.

Feed, Pullet Replacement, Labor, Other

Processes A and B used the 15 percent protein ration. All other features of the feed input were explained in the previous section. Pullet replacement was also explained in the previous section.

Total labor requirements of Processes A and B differed due to feeding time. The difference between total labor requirements in Table I is the differential in feeding time between Processes A and B.

Other features peculiar to Processes A and B were litter for the floor and roosting perches. Litter can be various materials such as shavings, peat moss, sand, depending on the locality and cost. Litter was applied often enough to keep the floor dry. Roosting perches were a part of the house construction cost. A three-tier high and three-tier wide roost cut down on space. This roost was moved every week or two. The house was cleaned out only after the birds were disposed.

Specific Inputs, Processes C and D

Processes C and D were two of the three cage processes. These two processes used similar inputs, the difference being in the intensity of fixed resource use. The inputs are described in Table II.

Housing

About 2.45 square feet of floor space per bird was used by Process C and 2.2 square feet of floor space per bird was used by Process D. One

TABLE II

PRODUCTION AND MANAGEMENT PRACTICES ASSOCIATED WITH PROCESSES C AND D

	Housing Process C				Housing Process D				Equipment							
Flock Size	Floor Space Per Bird	Total Number of Houses	Dimensions of House	Construction Type	Floor Space Per Bird	Total Number of Houses	Dimensions of House	Construction Type	Water Well and Pump Number	Bulk Feed Number and Capacity	Cage Size Process C	Cage Size Process D	Placement of Cages	Egg Gather and Number	Egg Basket Type and Number	Feed Cart Number
1500	2.45 sq. ft.	1	22'x176'	Truss bracing, dirt floor, "A" type roof, metal roof	2.2 sq. ft.	1	22'x159'	Truss bracing, dirt floor, "A" type roof, metal roof	1	1 6 ton	8"x18"	24"x18"	Walkway of 3' between double row of cages, break every 50' of cages	Egg Cart 1	15 dozen collapsible egg basket with plastic flats 11	1
3000	2.45 sq. ft.	1	22'x362'	Truss bracing, dirt floor, "A" type roof, metal roof	2.2 sq. ft.	1	22'x308'	Truss bracing, dirt floor, "A" type roof, metal roof	1	1 6 ton	8"x18"	24"x18"	Walkway of 3' between double row of cages, break every 50' of cages	Egg Cart 1	15 dozen collapsible egg basket with plastic flats 22	1
6000	2.45 sq. ft.	2	22'x362'	Truss bracing, dirt floor, "A" type roof, metal roof	2.2 sq. ft.	2	22'x308'	Truss bracing, dirt floor, "A" type roof, metal roof	1	4 6 ton	8"x18"	24"x18"	Walkway of 3' between double row of cages, break every 50' of cages	Egg Cart 2	15 dozen collapsible egg basket with plastic flats 44	2
12000	2.45 sq. ft.	4	22'x362'	Truss bracing, dirt floor, "A" type roof, metal roof	2.2 sq. ft.	4	22'x308'	Truss bracing, dirt floor, "A" type roof, metal roof	2	8 6 ton	8"x18"	24"x18"	Walkway of 3' between double row of cages, break every 50' of cages	Egg Cart 4	15 dozen collapsible egg basket with plastic flats 88	4

TABLE II (Continued)

Feed			Pullet Replacement	Labor		Other
Tons, Type Protein Percent	Features of Feed	Other Feed		Total Labor Process C	Total Labor Process D	Manure Control
67.5 All mash 17%	Fresh, Received in bulk every 2 or 3 weeks	Grit, oyster shells	See Table __	1400	1200	Spray for flies every 2 or 3 weeks, manure removed 3 to 4 times a year
135 All mash 17%	Fresh, Received in bulk every 2 or 3 weeks	Grit, oyster shells	See Table __	2500	2200	Spray for flies every 2 or 3 weeks, manure removed 3 to 4 times a year
270 All mash 17%	Fresh, Received in bulk every 2 or 3 weeks	Grit, oyster shells	See Table __	4300	3900	Spray for flies every 2 or 3 weeks, manure removed 3 to 4 times a year
540 All mash 17%	Fresh, Received in bulk every 2 or 3 weeks	Grit, oyster shells	See Table __	6500	6200	Spray for flies every 2 or 3 weeks, manure removed 3 to 4 times a year

house was used for flock sizes 1500 or 3000. The 6000 flock size used two houses and the 12000 flock size used four houses. For efficient use of equipment, the houses were 22 feet wide. A house 22 feet wide permitted three double rows of cages with a three foot aisle between each row of cages. The length of the house depended on the process but in no case was a house over 362 feet long used. Length of house reduced construction cost, but labor was not used as efficiently. In the middle of a house, a storage room was constructed. This was used to store grit, oyster shells, and unload eggs.

Since the buildings were only 22 feet in width, truss construction was used. Truss construction was more expensive, but the elimination of pole bracing allowed more efficient use of equipment and labor. An "A" type metal roof with ridge ventilation was used. The sides of the house were covered with the same kind of metal as the roof. The windows were covered with a glass substitute. Large doors at either end of the house were used so that equipment could be moved in and out easily. Also several entrance doors were constructed so as to facilitate the removal of the manure. Construction cost was about 70 cents per square foot for both process groups.

Equipment

Feed was handled in bulk. One six ton bulk tank and auger was used for each section of the 362 foot by 22 foot house for the 6000 and 12000 flock sizes. A feed cart that held between 200 and 300 pounds of feed was used in each house.

One well and pump was used for flock sizes of to and including 6000. Two wells and pumps were used for the 12000 flock size operation to reduce risk of a critical water shortage. The water trough was a part of the complete cage. The water trough was placed down the middle of the double row of cages. Water ran continuously in these troughs. A 50 gallon medication tank was connected to the water system of each section of a house.

The 15 dozen collapsible egg baskets with plastic flats were used. An egg cart that held three to four cases of eggs was used in each house to facilitate in the egg gathering.

Cages. Process C used an 8 by 18 inch cage that caged only one bird. Process D used a 24 by 18 inch cage that caged five birds. A cage included the nest, roost, waterer and feeder. Three double rows of cages were used for the 22 foot house. Each double row required 40 inches of width, thus leaving three-foot aisles. There was a break in the cages every 50 feet to facilitate feeding and egg gathering. The cages were hung on a slight angle so that the eggs would roll out.

Feed, Pullet Replacement, Labor, Other

Processes C and D used the all-mash, 17 percent protein ration. All other features of the feed input were explained in the general input section. Pullet replacements were also adequately explained in that section.

The difference in total labor time between Processes C and D as explained in Table II was due to the concentration of birds in Process D. Actually in Process D, there are five birds where there are three birds in Process C.

Manure was sprayed for flies at least every other week in the summer time for both processes. Manure was removed four or five times a year.

Specific Inputs, Process E

Process E was also considered a cage process. As mentioned earlier in the study, this process was classified as cage because the birds were kept out of 80 to 90 percent of the droppings. Table III summarizes the information of this process.

Housing

One square foot per bird was used for Process E. One house was sufficient for all sizes. The house for the 12000 size flock was 320 by 40 feet. Construction of this house incorporated the use of concrete blocks, insulating material, exhaust fans, pane windows, and a light concrete slab under the 20 foot slatted roost. In the middle of this house was a storage room, the size depending on the flock size. Construction cost was about one dollar per square foot.

Equipment

In the 40-foot width house, a slat or wire platform was built three feet above the concrete floor. This slat platform, 20 feet wide, was sealed off. On top of this platform was put the automatic feeder track and the continuous water trough. The birds ate, drank, and roosted on this platform, thus about 80 percent of the manure was caught and sealed off by this platform. One exhaust fan was used per 2,000 square feet of floor space.

Roost Equipment. A cleaning blade with a portable motor was used to remove the manure weekly or bi-weekly. The essential feature was a blade that worked off a cable and motor. The manure was pulled to one

TABLE III

PRODUCTION AND MANAGEMENT PRACTICES ASSOCIATED WITH PROCESS E

	Housing				Equipment			Feed	Pullet Replacement	Labor	Other	
Flock Size	Floor Space Per Bird	Total Number of Houses	Dimensions of Houses	Construction Type	Feed, Nest, Water	Type of Roost	Type of Fan			Total Labor Required	Litter Material	Number of House Cleanings
1500[1]												
3000	1 sq. ft.	1	40'x80'	Light concrete floor under roost, concrete block siding, insulating material used on ceiling	Same as Process B, Table __	Slatted floor, cleaning blade, motor and pulley	1 exhaust fan per 2000 sq. ft. of floor space, moves 3000 cu. ft. of air per minute	See Table __	See Table __	1500	Shavings added to maintain dry floor	About one every two weeks under roosts
6000	1 sq. ft.	1	40'x160'	Light concrete floor under roost, concrete block siding, insulating material used on ceiling	Same as Process B, Table __	Slatted floor, cleaning blade, motor and pulley	1 exhaust fan per 2000 sq. ft. of floor space, moves 3000 cu. ft. of air per minute	See Table __	See Table __	2600	Shavings added to maintain dry floor	About one every two weeks under roosts
12000	1 sq. ft.	1	40'x320'	Light concrete floor under roost, concrete block siding, insulating material used on ceiling	Same as Process B, Table __	Slatted floor, cleaning blade, motor and pulley	1 exhaust fan per 2000 sq. ft. of floor space, moves 3000 cu. ft. of air per minute	See Table __	See Table __	4600	Shavings added to maintain dry floor	About one every two weeks under roosts

[1]The 1500 flock size was not considered. Initial investment cost would make annual fixed costs excessive for this size group in this process.

end of the house and loaded onto the manure spreader by hand.

Feed Equipment. A mechanical feeder was used in this process. The trough was placed on the slatted floor. A minimum of two linear inches was alloted per bird; thus, a double row of trough was required. A six ton bulk feed tank was used for the 3000 and 6000 flock size. Two six ton bulk feed tanks were used for the 12000 flock size because two automatic feeders were used.

Water Equipment. One water well and pump were used for flock size 3000 and 6000. Two water wells and pumps were used for the 12000 size flock. The continuous "U" type waterer was used. It was placed over the slatted floor. This helped to keep the floor dry.

Egg Equipment. The egg equipment was the same as Process B. Namely, one nest per five birds, overhead track and platform, nests arranged back-to-back with three foot aisle between and the 15 dozen collapsible egg basket was used.

Feed, Pullet Replacement, Labor, Other

Feed was the 17 percent protein ration. All other features of the feed and also of the pullet replacement program were explained in a previous section.

Labor time for this process is less than for the other processes. More capital labor saving equipment was used in this process.

A litter material was used on the floor space not covered by the roost. Other inputs were explained adequately in a previous section.

Egg Room Building and Equipment

The egg room and the equipment used in it function as a unit; therefore, they were discussed and analyzed together. Since the production processes do not materially influence the type of egg room and equipment, the resource combination was adaptable to either of the processes. From the standpoint of time involved in the egg production process, the egg room was the second most important work area. No less than 40 percent of the total work time was spent in this area. This points out the necessity of using an appropriate building and labor saving equipment for the handling of eggs. Table IV presents a list of building and equipment used in processing eggs.

Building

The location of the egg room relative to the layer houses was of first importance. By strategically locating the egg room, labor time required for hauling eggs from the layer house(s) to the egg room was reduced. A typical layout would find the egg room situated as in the following Figure:

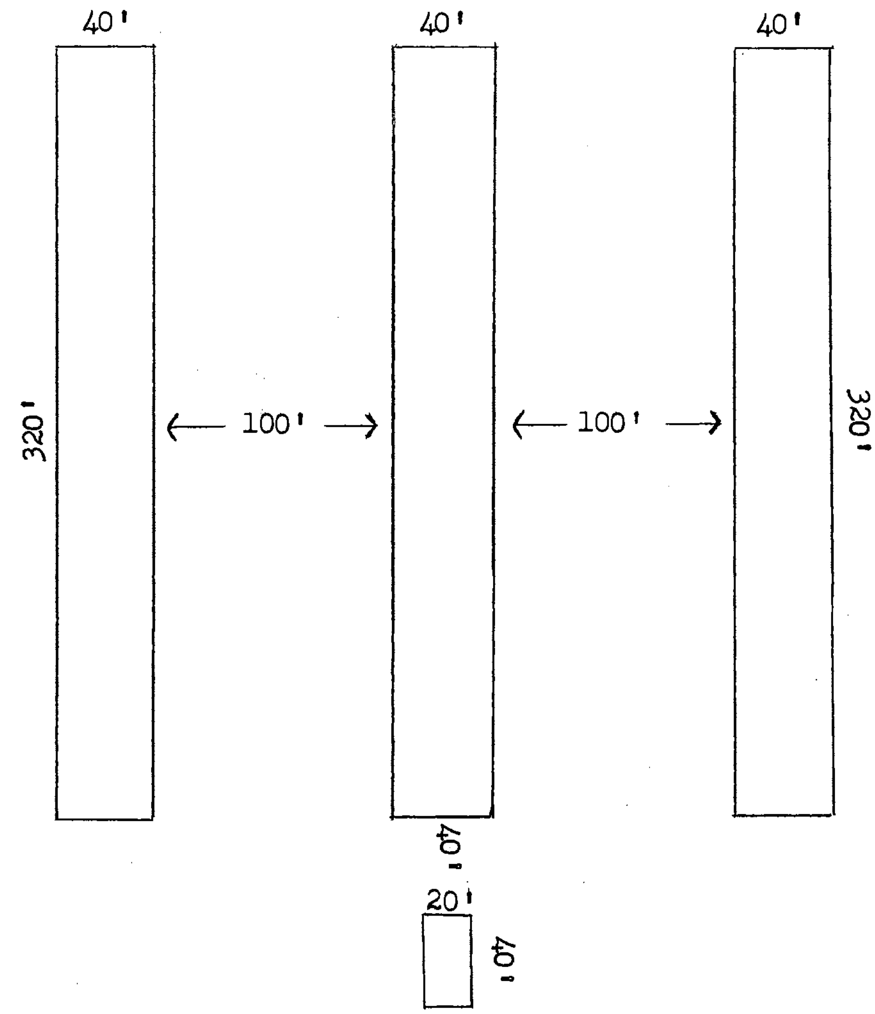

Figure 5

TYPICAL LAYING HOUSE(S) AND EGG ROOM LAYOUT

There are other layout possibilities, but this one will minimize labor time for a large operation (10000 plus).

The egg room building had 525 square feet of floor space for the 1500 and 3000 size flocks and 800 square feet for the 6000 and 12000 size flocks. This amount of floor space provided ample working and storage for the flock sizes indicated.

Construction

Several features were incorporated into the design of the egg room to make for efficiency. Since water was used in cleaning the eggs, a concrete floor with sufficient slope to a central drain was required, which allowed quick and easy removal of all water. Windows were placed to maximize light admittance. The building was constructed with concrete block. Concrete blocks made a cooler and probably a stronger building. Metal (galvanized) was used to cover the roof. To make the building cooler in the summer and warmer in the winter an insulated ceiling was used. The estimated cost of this building was $2.10 per square foot (Appendix Table A-I).

The egg room was divided into a work area and a refrigerated or storage area. The refrigerated area was constructed inside the original egg room area. Special building material was needed to insulate the refrigerated area. An additional $2.00 per square foot was assumed for construction of this refrigerated area. The 525 square-foot building had 125 square feet of refrigerated area and the 800 square-foot building had 200 square feet of refrigerated area.

A special door was used to seal off the refrigerated area. A 3/4 ton cooler motor was used to cool the cooler room for the 1500 and 3000 flock sizes and a ton cooler motor was used for the larger flock sizes. The one ton machine will cool 1,350 cubic feet adequately. The coolers kept the humidity at 85 percent and the temperature 55-60 degrees Fahrenheit in the refrigerated area (Table IV).

Equipment

The type of mechanical egg washer used was the new plastic filler-

TABLE IV

RESOURCES USED IN THE EGG ROOM

	Building				Equipment					Labor
Flock Size	Sq. Ft. Egg Room	Sq. Ft. Cooler Room	Total Cost	Construction Type and Dimension	Washer No.	Total Cost of Washer(s)	Fans No.	Cooler Motor Size Cost	Roller Cart No.	Total Labor Used in Egg Room
1500	400	125	$1202.00	Concrete Blocks 26.25' x 20'	1	$200.00	1	3/4 Ton $420.00	1	365 hrs.
3000	400	125	$1202.00	Concrete Blocks 26.25' x 20'	1	$480.00	1	3/4 Ton $420.00	2	584 hrs.
6000	600	200	$1884.00	Concrete Blocks 26.66' x 30'	1	$480.00	1	1 Ton $516.00	4	1069 hrs.
12000	600	200	$1884.00	Concrete Blocks 26.66' x 30'	2	$960.00	2	1 Ton $516.00	8	1737 hrs.

Source: Appendix Tables, A-I thru D-IV.

flat washer. This machine was designed to wash the eggs in the plastic trays of the collapsible baskets. This method reduced breakage since the eggs did not touch each other. Also if the clean and dirty eggs were separated as they were gathered, washing time was reduced. The washer was wired to a 220 electric line. The 220-Volt line kept the wash water at the washing temperature of 105-120 Fahrenheit easily except in extremely cold weather. The egg washer came in several sizes. One designed to wash two 15-dozen trays was used in this study. The number of washers depended on flock size. The large machine which costs about $480.00 washed a case of eggs (30 dozen) in approximately six minutes. One man could operate either one or two machines efficiently thus for the 12000 size flock two machines were used to save labor time.

A piece of equipment complementary to the egg washer(s) was a hot water heater. A hot water heater was not absolutely necessary, but for an investment of about $100.00, several minutes were saved each day. The egg washer itself can heat the water, but by starting with hot water, time was saved both initially and in maintaining the water temperature. A 30-gallon hot water tank was sufficient for flock sizes up to the limit of the study (12000 birds).

After the eggs were washed, six to eight cases were stacked on a roller cart and placed in front of the fan to dry. Drying the eggs took the initial heat off quickly, thus insuring a better product.

After the eggs were dry, the eggs were rolled to the packing table. Here the eggs were packed in the 30 dozen egg cases and then restacked on the roller carts. The eggs were then rolled into the cooler room and left on the roller carts. The eggs at this point were ready for the market.

Within Process Comparison of the "Superior" Management Organization and "Average" Management Organization

Table V presents in summary form some of the major differences in resource use and returns for the "superior" and an "average" organizations. A 6000 size floor flock with mechanical feeders was used for this comparison (Process B).

TABLE V

SOME MAJOR CONTRASTS OF THE SUPERIOR PRODUCTION PROCESS WITH AN AVERAGE PRODUCTION PROCESS

Item	Unit	Superior[1]	Average[2]	Additional Requirements Per Bird
Floor Space	Sq. Ft.	2	2.5	$.25[3]
Labor	Hour	3,600	4,600	.17
Feed	Lbs/doz.	4.5	5.0	.35
Replacement	Cents/bird	1.71	1.90	.19
Total				$.735

[1]Based on data in Appendix Tables B-II, D-II, and C-III.

[2]Typical production relationship

[3]Ten percent of this used in computation of the total cost

Process B for this study used two square feet of floor space per bird. If an "average" organization used 2.5 square feet of floor space, costs increased 2.5 cents annually per bird. The "average" organization used an additional .5 pounds of feed per dozen eggs which amounted to 35 cents annually. The additional 1,000 hours increased annual cost per bird 17 cents.

There was a 3.6 cent spread in cost per dozen eggs, between the "superior" and "average" organizations although they produced the same number of eggs. If the birds in the "average" organization laid only 18 dozen eggs, costs were increased about 4.6 cents per dozen compared with the "superior" organization.

It was readily apparent that the "average" management's use of these resources, increased significantly the cost per dozen to produce eggs. The same type of comparison could conceivably be made for the other processes, but it was unnecessary because they would reflect the same type of comparison.

CHAPTER IV

COSTS OF EQUIPPING AND OPERATING THE FIVE PROCESSES AND FOUR SIZES FOR EGG PRODUCTION IN OKLAHOMA

In considering egg production, poultrymen are interested in cost information associated with initial investment requirements and annual operating costs for the specific processes and sizes of operation. Detailed data were necessary to provide these cost estimates for the various processes and sizes. Poultry equipment catalogues, firms engaged in selling equipment and the interviewees furnished the initial investment data.

Initial Investment Cost

The initial investment for any process was the cost of land, buildings, and equipment. The initial investment costs for all processes and sizes are sumarized in Table VI.[9] Results of this study indicated that initial investment costs were affected by processes as well as the increase in scale. There was about a $1.25 per bird difference in initial investment cost due to process alone for the 1500 flock size. This relationship continued through all size groups. However, initial investment cost per bird decreased as flock size increased irrespective of process.

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[9]See Appendix B.

TABLE VI

TOTAL CAPITAL INVESTMENT AND INVESTMENT PER BIRD IN INITIAL RESOURCES FOR DIFFERENT PROCESSES OF PRODUCTION FOR ALTERNATIVE FLOCK SIZES[1]

Size of Enterprise by Flock Number		Process of Production A	B	C	D	E
				- dollars -		
1500						
Land &						
Building:	Laying House	1,973.00	1,972.00	2,981.25	2,723.00	
	Egg Room	1,202.00	1,202.00	1,202.00	1,202.00	
Equipment:	Laying House	1,182.50	1,848.10	2,133.01	1,502.51	2
	Egg Room	772.50	772.50	772.50	772.50	
Other[3]		930.41	930.41	930.41	930.41	———
Total Investment		6,059.49	6,725.09	8,019.17	7,130.42	
Per Bird Investment		4.04	4.48	5.31	4.75	
3000						
Land &						
Building:	Laying House	3,532.00	3,532.00	5,517.50	5,000.00	3,572.00
	Egg Room	1,202.00	1,202.00	1,202.00	1,202.00	1,202.00
Equipment:	Laying House	1,925.17	2,589.97	3,787.48	2,527.48	3,787.03
	Egg Room	1,052.50	1,052.50	1,052.50	1,052.50	1,052.50
Other[3]		930.41	930.41	930.41	930.41	930.41
Total Investment		8,642.08	9,306.88	12,489.89	10,712.39	10,543.94
Per Bird Investment		2.88	3.10	4.16	3.57	3.51
6000						
Land &						
Building:	Laying House	6,760.00	6,760.00	10,731.00	9,696.00	6,840.00
	Egg Room	1,884.00	1,884.00	1,884.00	1,884.00	1,884.00
Equipment:	Laying House	3,678.84	4,322.34	7,944.04	5,424.04	6,197.20
	Egg Room	1,148.50	1,148.50	1,148.50	1,148.50	1,148.50
Other[3]		1,860.82	1,860.82	1,860.82	1,860.82	1,860.82
Total Investment		15,332.16	15,975.66	23,568.36	20,013.36	17,930.52
Per Bird Investment		2.56	2.66	3.93	3.34	2.99
12000						
Land &						
Building:	Laying House	13,508.00	13,508.00	21,550.00	19,380.00	13,668.00
	Egg Room	1,884.00	1,884.00	1,884.00	1,884.00	1,884.00
Equipment:	Laying House	7,339.68	8,626.48	15,888.08	10,848.08	11,995.00
	Egg Room	1,678.50	1,678.50	1,678.50	1,678.50	1,678.00
Other[3]		1,860.82	1,860.82	1,860.82	1,860.82	1,860.82
Total Investment		26,271.00	27,557.80	42,861.40	35,651.40	31,085.82
Per Bird Investment		2.19	2.30	3.57	2.97	2.59

[1]Source of data: Appendix B.

[2]See footnote 1, Table III.

[3]Includes truck, manure spreader, and tractor.

Land and Building

Investments in land and buildings were divided to facilitate analysis into investments used for laying houses[10] and investments used for the egg room.[11] The variations in land and building investments for any given size were due to the basic differences in housing requirements of the processes. Processes A and B had the lowest level of investments followed by Processes C and D. Process E had the highest level of investments in land and buildings.[12] Investments in land and building were the same for the egg room for any given process at any given flock size.

Equipment

Equipment investments were divided into investments associated with the laying houses[13] and investments associated with the egg room.[14] Variations in the level of equipment investment for any given size were explained by the differences in equipment requirements for the various processes.[15] Process A, the labor intensive organization, had the lowest equipment investment and Process C had the highest level of investment in equipment. Processes E and D had intermediatary levels of equipment

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[10]Total cost of site, water well, disposal pit, and layer house, see Appendix B.

[11]Total cost of egg room and refrigerated area, see Appendix B.

[12]Tables I, II, and III in Chapter III explain why the processes ranked in this order as to initial investment cost in land and buildings.

[13]Total cost of cage, self-feeder, shell-feeder, mechanical feeder, bulk tank and auger, feed cart, pump pipping, automatic waterer, medicine tank, nests, baskets, flats, gatherer, slatted roosts, and cleaning equipment, see Appendix B.

[14]Total cost of cooler motor, water heater, egg washer, and other egg room equipment, see Appendix B.

[15]Explained in Tables I, II, and III of Chapter III.

investment. In round numbers equipment investment made up 35 to 45 percent of the total investment of any process. These levels may indicate either different levels of labor employment on the farms or different levels of capital accumulation. Both may affect the capital structure. Investment in egg room equipment was the same for a given flock size, irrespective of the process.

Other Investment

Investment in other equipment used partly or wholly in the egg production operation amounted to about ten percent of the total investment.

Total Investment

Total initial investment in permanent assets depended on the process and flock size. Process A required about $6,000.00 initial investment while Process C required around $8,000.00 for a flock size of 1500. The difference in investment between the processes increased as the scale of operation increased. Total initial investment increased from about $26,000.00 for Process A to $43,000.00 for Process C for flock size 12000. Total initial investment in the various processes varied due to the fact that fixed costs were more readily spread in some processes than others. However, for all processes the initial investment per bird declined as flock size increased. There was at least a 75 cent per bird decrease in investment as flock size increased to 12000 birds.

Annual Costs

The total annual cost associated with a process of production, must be computed with reference to a specific period of time and in relation to a specific flock size and process of production. Egg production costs were computed on both an annual basis for each process and size, and in terms of cost per dozen. Factors which determined total annual cost of operating any process were divided into variable and fixed. Fixed costs were incurred whether production took place or not and variable costs occurred as production took place.

Fixed Costs

Once a poultryman made the initial investment certain costs were incurred which were fixed. These annual fixed costs were, (1) depreciation and/or obsolescence, (2) interest on investment, and (3) taxes, insurance, and repairs (Table VII).[16]

Depreciation. Depreciation was the estimated loss in value and service capacity resulting from natural wear, obsolescence, accidental damage, weathering, etc. Technology has changed rapidly in the layer industry, which caused obsolescence to be an expense difficult to determine. Interviewees and people associated with the layer industry realized that houses and equipment must be depreciated over a short period of time as there was considerable write-off risk associated with the innovations which had been developed.

Based on these expectations, the more permanent items (buildings) were depreciated by the straight-line method over a 12-year period. No salvage values were allowed for the buildings. Equipment was depreciated over a 6-year period. A salvage value of ten percent of the new cost was allowed. These rates of depreciation were believed to be consistent with the technological advances in poultry science. The houses and equipment

[16] For specific information on the annual fixed costs see Appendix B.

TABLE VII

ANNUAL TOTAL FIXED COST BY PROCESS OF PRODUCTION FOR ALTERNATIVE FLOCK SIZES[1]

Size of Enterprise by Flock Number	Process of Production A	B	C	D	E
			- dollars -[2]		
1500 Flock					
Land & Building	406.21	406.27	544.70	509.58	3
Equipment	437.92	587.07	651.22	510.00	
Other	208.60	208.60	208.60	208.60	
Total[2]	1,052.73	1,201.94	1,404.52	1,228.18	
3000 Flock					
Land & Building	616.71	616.71	889.61	818.73	627.55
Equipment	667.50	816.53	1,084.99	802.54	1,084.87
Other 2	208.60	208.60	208.60	208.60	208.60
Total	1,492.81	1,641.84	2,183.20	1,829.87	1,921.02
6000 Flock					
Land & Building	1,149.43	1,149.43	1,694.01	1,553.47	1,171.10
Equipment	1,082.10	1,210.64	2,038.46	1,473.56	1,619.64
Other 2	417.20	417.20	417.20	417.20	417.20
Total	2,648.73	2,777.27	4,149.67	3,444.23	3,207.94
12000 Flock					
Land & Building	2,034.49	2,034.49	3,128.65	2,842.57	2,082.74
Equipment	2,021.60	2,310.11	3,938.27	2,808.47	3,082.01
Other 2	417.20	417.20	417.20	417.20	417.20
Total	4,473.29	4,761.80	7,484.12	6,068.24	5,581.95

[1]Source of Data: Appendix B.

[2]Includes depreciation, interest, taxes, insurance, and repairs.

[3]See footnote 1, Table III.

may still be usable after six or twelve years, but it may be obsolete and inefficient. After the 6 to 12 year depreciation period the poultryman who can cover variable costs will be able to compete with new methods of production and make the required changes to continue to be efficient.

Interest on Investment. The cost of resources to a firm are their values in their best alternative uses. Money used for the production of eggs could be used for other productive enterprises; therefore, interest on investment was considered as one of the costs of production.

It was convenient for this analysis to present an interest charge that was constant throughout the life of the houses and equipment. This was accomplished by making an annual interest charge on the average investment. The average investment was equal to one-half of the sum of the original cost plus salvage value if any. For example, the average investment costs for the 1500 size layer house of Process A was equal to $\frac{1,600}{2}$ = $800.00. In this study the interest was assumed to be five percent per year. Thus, the interest on investment for this layer house of Process A was equal to $40.00, (800 x .05). For the permanent fixtures such as the site, water well, and disposal pit, a straight five percent was charged against the initial investment. Thus, the annual charge for the site of Process A, size 1500, is $3.60, (72. x .05).

Taxes, Insurance, and Repairs. Costs for these items depend on several factors. The tax rate varies widely between localities due to the fact that school districts have independent tax levies. Insuring the investment was not a universal practice. The investment in buildings and equipment if highly mortgaged would probably be insured. Studies[17] of other enterprises indicated that a one percent charge for each of taxes, insurance and repairs would represent an equitable figure.

Total Fixed Cost. The annual fixed costs were combined in the "annual cost" column of Appendix B Tables. As an example, the annual fixed cost of owning the 1500 flock size layer house of Process A, valued at \$1,600.00 was \$221.33. The computation was depreciation, \$133.33 (1/12 of 1,600); interest on investment, \$40.00 ($\frac{1,600}{2}$ x .05); tax, insurance and repair, \$48.00 (1,600. x .01 x 3). These individual computations were summed to give a \$1052.72 annual fixed cost for Process A for the 1500 flock size (Appendix Table B-I).

Variable Costs Exclusive of Labor

A part of total costs are variable costs. Variable or operating costs are incurred as a result of actual production. Variable cost estimates were based on the price data of Appendix A and efficient inputs as outlined in Chapter III. Variable costs for this study included pullet replacement, feed, interest on pullet replacement, and other (electricity, litter material, veterinary, egg room supplies, gas and oil, miscellaneous) (Table VIII).

Pullet Replacement. It was stated that pullet replacement was taken as a given factor. In this situation one might think of pullet replacement

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[17] Fred Allen Mangum, Costs and Returns of Bulk Milk Tanks on Dairy Farms in the Oklahoma City Milkshed, (unpub. M. S. Thesis, Oklahoma State University, 1958), pp. 64-66.

TABLE VIII

ANNUAL VARIABLE COSTS, EXCLUSIVE OF LABOR AND MANAGEMENT COSTS, BY PROCESS OF PRODUCTION FOR ALTERNATIVE FLOCK SIZES[1]

Size of Enterprise by Flock Number	Process of Production A	B	C	D	E
	- dollars -				
1500 Flock					
Pullet	3,420.00	3,420.00	3,420.00	3.420.00	3
Feeds	5,858.33	5,858.33	5,993.33	5,993.33	
Other[2]	496.46	550.89	444.69	440.55	
Total	9,774.79	9,829.22	9,857.97	9,853.88	
3000 Flock					
Pullet	6,150.00	6,150.00	6,150.00	6,150.00	6,150.00
Feeds	10,555.66	10,555.66	10,825.66	10,825.66	10,825.66
Other[2]	843.35	897.75	737.65	731.52	696.29
Total	17,549.01	17,603.41	17,713.31	17,707.18	17,671.95
6000 Flock					
Pullet	10,260.00	10,260.00	10,260.00	10,260.00	10,260.00
Feeds	18,777.96	18,777.96	19,317.96	19,317.96	19,317.96
Other[2]	1,322.87	1,377.32	1,111.49	1,095.14	1,083.65
Total	30,360.83	30,415.28	30,689.45	30,673.10	30,661.61
12000 Flock					
Pullet	20,520.00	20,520.00	20,520.00	20,520.00	20,520.00
Feeds	37,553.92	37,553.92	38,635.92	38,635.92	38,635.92
Other[2]	2,475.65	2,584.51	2,050.84	2,020.18	1,993.42
Total	60,549.57	60,658.43	61,206.76	61,176.10	61,149.34

[1]Source of data: Appendix C.

[2]Includes supplies, medicines, and so forth.

[3]See footnote 1, Table III.

as a fixed cost, but it was variable in the sense that one does not have to put in pullets. Pullet replacement costs constituted between 30 and 35 percent of the total variable cost, thus it was one of the most important costs. The cost of a 22 week old pullet ranged from $2.28 for the 1500 flock size to $1.71 for the 12000 flock size.[18] This range in per pullet replacement cost was due to the bargaining power of the large operators.[19]

Feed. Feed costs constituted about one-half of total variable cost. All feed was purchased in the bulk. This constituted a saving, but it accrued largely to the larger flock owners. Ten to 15 tons of feed could be delivered several dollars cheaper than two or three tons of feed. Feed cost considerations were based on a blend, all-mash feed. No analysis was made of the possibilities of substituting one feed grain for another or various other alternatives. Feed intake per bird was based on 52 weeks of production, 20 dozen eggs per layer and 4.5 pounds of feed per dozen eggs produced. It was assumed that each layer consumed 90 pounds of feed during the 52 week period. The analysis did not assume any differences in feed intake due to the process.[20] Feed prices averaged $86.00 in Oklahoma during the 1957-59 period.[21] As quantity of feed purchased increased price per ton declined due to the savings in the bulk handling and bargaining

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[18]Mathia, pp. 54-65.

[19]Mathia reported that small producers paid $1.80 for 16 week-old pullets. Also reported that pullets could be raised to 22 weeks of age for about $1.70 cents.

[20]Random sample tests indicate cage layers may take more feed but it is probably not statistically significant.

[21]Appendix A.

power. Some large flock owners (6000 to 12000) mixed their own feed and realized reduced feed costs. The lowest assumed price was about $70.00 per ton.

Interest. It was assumed that the current sale of eggs would keep the feed account current. The interest charge was to reflect the real cost of purchasing pullets. A five percent interest charge was placed on one-half of the pullet replacement cost.

Other Variable Costs. Electricity costs were based on kilowatt hours used per year by the various motors and space to be lighted.[22] Total electric cost ranged from about $200.00 for the 1500 flock sizes to about $550.00 for the 12000 flock sizes. Litter material was used by Processes A, B, and E. The cost of litter ranged from $60.00 for the 1500 flock size to $480.00 for the 12000 flock size for Processes A and B. Costs for veterinary, egg room supplies, gas and oil, and miscellaneous were all based on an estimate per bird. For the 1500 and 3000 size flocks, this estimate was 11 cents per bird per annum and for the 6000 and 12000 size flocks, this estimate was eight cents per bird per annum.

Total Variable Cost Exclusive of Labor

Total variable costs were divided into pullet replacement cost, feed cost and other cost (Table VIII). The study indicated that there were practically no difference in total variable costs due to processes. However, total variable costs did not increase in a linear fashion as output or flock size increased. There was a slight decrease in per bird annual costs as flock size increased.

[22]Engineer estimate.

TABLE IX

TOTAL ANNUAL HOURS OF LABOR BY PROCESS OF PRODUCTION FOR ALTERNATIVE FLOCK SIZES[1]

Size of Enterprise by Flock Number	Process of Production A	B	C	D	E
			- hours -		
1500 Flock					
Operator	1,429	1,126	1,423	1,240	
Man (partial)	-	-	-	-	2
Man (regular)	-	-	-	-	
Total	1,429	1,126	1,423	1,240	
3000 Flock					
Operator	2,518	1,923	2,492	2,163	1,529
Man (partial)	-	-	-	-	-
Man (regular)	-	-	-	-	-
Total	2,518	1,923	2,492	2,163	1,529
6000 Flock					
Operator	2,500	2,500	2,500	2,500	2,620
Man (partial)	2,012	1,100	1,797	1,377	-
Man (regular)	-	-	-	-	-
Total	4,512	3,600	4,297	3,877	2,620
12000 Flock					
Operator	2,521	2,500	2,500	2,500	2,500
Man (partial)	-	696	2,029	1,755	2,154
Man (regular)	5,000	2,500	2,500	2,500	-
Total	7,521	5,696	7,029	6,755	4,654

[1] Source of data: Appendix D.

[2] See footnote 1, Table III.

TABLE X

ANNUAL TOTAL COSTS EXCLUSIVE OF LABOR AND MANAGEMENT COSTS BY PROCESS OF PRODUCTION FOR ALTERNATIVE FLOCK SIZES

Size of Enterprise by Flock Number	Process of Production				
	A	B	C	D	E
			- dollars -		
1500 Flock					
Annual Fixed Cost	1,052.73	1,201.94	1,404.52	1,228.18	[1]
Variable Cost	9,774.79	9,829.22	9,857.97	9,853.88	
Total	10,827.52	11,031.16	11,262.49	11,082.06	
3000 Flock					
Annual Fixed Cost	1,492.81	1,641.84	2,183.20	1,829.87	1,921.02
Variable Cost	17,549.01	17,603.41	17,713.31	17,707.18	17,671.95
Total	19,041.82	19,245.25	19,896.51	19,537.05	19,592.97
6000 Flock					
Annual Fixed Cost	2,648.73	2,777.27	4,149.57	3,444.23	3,207.94
Variable Cost	30,360.83	30,415.28	30,689.45	30,673.10	30,661.61
Total	33,009.56	33,192.55	34,839.12	34,117.33	33,869.55
12000 Flock					
Annual Fixed Cost	4,473.29	4,761.80	7,484.12	6,068.24	5,581.95
Variable Cost	60,549.57	60,658.43	61,206.76	61,176.10	61,149.34
Total	65,022.86	65,420.23	68,690.88	67,224.34	66,731.29

[1]See footnote 1, Table III.

Labor Cost

It was assumed that the operator would work up to 2,620 hours a year (Table IX). If a full-time man was required he would work only 2,500 hours a year. Part time labor was used as needed. Costs applicable to the labor input are analyzed in the following chapter.

Total Costs Exclusive of Labor

The total annual fixed cost and total annual variable cost were combined to give the total annual cost of operation exclusive of labor cost (Table X).

CHAPTER V

ESTIMATING OF LEAST-COST COMBINATIONS FOR ALTERNATIVE PROCESSES AND SIZES OF OPERATION

Farmers contemplating the addition of a layer enterprise to their farm business are interested in the behavior of costs associated with the process and size of layer enterprise. These per dozen cost estimates of output associated with process and size or volume provide prospective producers with information by which they can value resources if used in egg production.

Wages have been excluded thus far from cost computations. First, there was the problem of assuming representative wage levels. Second, the amount of hired labor varied between processes of different sizes. Third, there was the problem of determining the wage of the operator or, more correctly the wage at which the owner would consider discontinuing production. Finally, the assumptions regarding wage rates influenced the slope and shape of the economies of scale curve.

Estimation of Least-Cost Points

Least-cost output estimates involved computation of an average cost function. These average cost values could be continuous or discrete, but discrete values were used for this study. These cost values were prepared to analyze the per unit cost of a dozen eggs with assumed alternative level of returns to labor and operator-management (Tables XI thru XVIII).[23]

Low Labor Costs[24]

Production costs of eggs for low labor costs were analyzed (Table XI). A wage rate of $2,500.00 annually was assumed for regular hired help. The part-time labor was paid 75 cents per hour. These assumed hired-wage rates were typical of present labor prices in the area studied.

Five levels of operator-management returns, zero, 2,000, 4,000, 8,000 and 16,000 dollars, were assumed. The highest operator-management returns were not computed for small flock sizes because per unit costs greater than 50 cents per dozen were irrelevant.[25]

Size of Flock Comparison. The lowest possible costs per dozen were obtained at zero returns to the operator-manager. Zero returns to operator-management were used as a minimum concept to compare the other alternatives. The costs per dozen at zero returns to operator-management decreased from 37.5 cents for Process C for the 1500 flock size to a low of 28.1 per dozen for Process E for the 6000 flock size. This represented a decrease in per dozen costs of about 9 cents between these two size groups. Flock sizes of 1500 had an average cost of about 50 cents per dozen if the operator-manager were to receive an income of $4,000.00. An assumed

[23]Total annual costs exclusive of labor were presented in Table X. The per dozen cost was assumed at the maximum average productivity.

[24]Low labor cost was defined as $1.00 per hour or less for all hired labor.

[25]Price of eggs to the Oklahoma poultry farmer is seldom over 35 cents per dozen.

TABLE XI

TOTAL COST PER DOZEN OF EGGS PRODUCED BY PROCESS OF PRODUCTION, BY SIZE OF OPERATION AND WITH SPECIFIED LABOR COST ASSUMPTIONS

Process of Production by Flock Size	Total Cost Per Dozen With Regular Hired Labor at $2,500 Annually and Man Partially Hired at $.75 Per Hour With Management Return to Operator of:[1] 0	2,000	4,000	8,000	16,000
	- dollars -				
1500 Flock					
A	.361	.428	.494	[2]	[2]
B	.368	.435	.501		
C	.375	.442	.508		
D	.370	.436	.502		
E	[3]	[3]	[3]		
Average	.369	.435	.501		
3000 Flock					
A	.317	.351	.384	.450	[2]
B	.321	.355	.388	.453	
C	.332	.366	.399	.464	
D	.326	.360	.393	.458	
E	.327	.361	.394	.459	
Average	.325	.359	.392	.457	
6000 Flock					
A	.288	.304	.321	.354	.421
B	.284	.300	.317	.350	.416
C	.301	.318	.335	.368	.435
D	.292	.319	.326	.359	.427
E	.281	.298	.315	.348	.415
Average	.289	.308	.323	.356	.423
12000 Flock					
A	.292	.300	.307	.324	.359
B	.285	.294	.302	.318	.352
C	.303	.311	.319	.336	.369
D	.296	.304	.312	.339	.362
E	.285	.293	.291	.317	.351
Average	.292	.300	.306	.327	.359

[1]The total labor and the division of the labor between operator-management, regular hired labor, and partially hired labor are found in Table IX. It was assumed that the operator would work the first 2500 hours, the regular hired labor the second 2500 hours if needed, and the partially hired labor the remainder.

[2]Not relevant since egg prices to the producer will probably never reach this level.

[3]See footnote 1, Table III.

return to the operator-manager of $4,000.00 increased the minimum cost to about 31 cents per dozen for the 12000 flock sizes.

The 6000 size flocks returned $8,000.00 to the operator-manager, which increased the least-cost point to about 36 cents per dozen. This represented a wage rate of $2.75 per hour for the operator-manager. The 12000 size flocks produced eggs for about 36 cents per dozen and returned $16,000.00 to the operator-manager.

Process Comparison. Process A was the low cost process for the five levels of operator-management returns for flock sizes 1500 and 3000. Process C was the high cost process for these two flock sizes with per dozen costs ranging from 33.2 cents for zero management-operator returns to 46.4 cents for $8,000.00 management-operator returns. The spread in costs between Processes A and C for the 1500 and 3000 flock sizes was about 1.4 cents at all four levels of operator-management returns. At flock size 6000 Process E became the low cost process but Process B was approximately the same. Process C remained the high cost method at flock size 6000 with the spread between the high and low cost processes of about 2 cents at all five levels of operator-management returns. Processes B and E remained the low cost processes for flock size 12000 and Process C remained the high cost process with the spread in per dozen costs of about 1.8 cents.

High Labor Costs[26]

Per dozen production costs of eggs for high labor costs were analyzed (Table XII). A wage rate of $3,500.00 annually was assumed for full-time

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[26] High labor cost was defined as anything over $1.00 per hour for all hired labor.

TABLE XII

TOTAL COST PER DOZEN OF EGGS BY PROCESS OF PRODUCTION, BY SIZE OF OPERATION AND WITH SPECIFIED LABOR COST ASSUMPTIONS

Process of Production by Flock Size	Total Cost Per Dozen With Regular Hired Labor at $3,500 Annually and Man Partially Hired at $1.25 Per Hour With Management Return to Operator of:[1]				
	0	2,000	4,000	8,000	16,000
			- dollars -		
1500 Flock					
A	.361	.428	.494	2	2
B	.368	.435	.501		
C	.375	.442	.508		
D	.370	.436	.502		
E	3	3	3		
Average	.369	.435	.501		
3000 Flock					
A	.317	.351	.384	.450	2
B	.321	.355	.388	.453	
C	.332	.366	.399	.464	
D	.326	.360	.393	.458	
E	.327	.361	.394	.459	
Average	.325	.359	.392	.457	
6000 Flock					
A	.296	.313	.330	.364	.430
B	.288	.305	.322	.355	.422
C	.309	.325	.342	.375	.442
D	.299	.315	.332	.355	.432
E	.282	.298	.315	.348	.415
Average	.295	.311	.328	.359	.428
12000 Flock					
A	.300	.308	.317	.335	.368
B	.291	.299	.308	.324	.358
C	.311	.319	.327	.344	.377
D	.304	.312	.320	.337	.370
E	.289	.298	.306	.323	.356
Average	.299	.307	.316	.333	.366

[1]The total labor and the division of the labor between operator-management, regular hired labor, and partially hired labor are found in Table IX. It was assumed that the operator would work the first 2500 hours, the regular hired labor the second 2500 hours if needed, and the partially hired labor the remainder.

[2]Not relevant since egg prices to the producer will probably never reach this level.

[3]See footnote 1, Table III.

labor. The part-time labor was paid $1.25 an hour. These higher hired wage rates are likely to be in effect in the near future if the poultry enterprise competes with industry for labor.

Five levels of operator-management returns, zero, 2,000, 4,000, 8,000, and 16,000 dollars, were again assumed with these higher hired labor rates. Production costs were computed for each process with the higher wage rates for each of the assumed flock sizes to analyze effect on the five levels of operator-management returns.

Size of Flock Comparison. Assuming zero dollar return to the operator-manager, the per dozen costs ranged from a high of about 37 cents for flock sizes 1500 to a low of 29.5 cents for flock sizes of 6000. This represented a decrease of about 8 cents per dozen due entirely to size of operation.

Process Comparison. Process A was the low cost process at the two lower levels of output and Process C was the high cost process for these 1500 and 3000 flock sizes. The spread in per dozen costs between these two processes at these two levels of output was about 1.4 cents. At flock sizes of 6000, Processes E and B became the low cost processes but Process C remained the high cost process. The spread in per dozen costs between Processes B and E, the low cost processes, and C was about 2.7 cents at flock sizes of 6000 for all five levels of operator-management returns. At flock sizes of 12000 Processes B and E had production costs that were 2 cents lower than Process C at all five levels of operator-management returns.

Comparison and Analysis of Low Cost Vs. High Cost Labor

It was assumed that only the operator-manager's labor was required with flock sizes of 1500 and 3000 and thus costs were not affected by labor rates. With zero dollar returns to management, the four processes in the 1500 size flocks produced eggs for about an average of 36.9 cents per dozen. In a recent market survey,[27] it was determined that egg producers received an average price of approximately 34 cents per dozen for eggs that had received the same services as in this study. The 1500 size flocks were not covering all costs at a zero dollar return to the operator.

The 3000 size flocks produced eggs for about 32.5 cents per dozen at zero dollar operator-management returns. Per dozen costs decreased from 33.2 cents for Process C to 31.7 cents for Process A at this zero dollar operator-management return. With a $2,000.00 operator-management return, costs of producing eggs averaged about 36 cents for all five processes of the 3000 flock sizes. The 36 cent per dozen production cost was above the average annual price[28] by about 2 cents. If operator-management labor was subtracted out of the 36 cents, production costs were approximately 33 cents per dozen. Thus there was an operator-management return of about $1,000.00 annually.

The high labor cost assumption increased costs over the low labor cost assumption by about one cent for the labor intensive Processes (A, C, and D) at flock sizes of 6000. The higher labor rate assumption

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[27] James Bruce Hottle, Costs and Returns to Oklahoma Egg Producers From Marketing Services, (unpub. M. S. Thesis, Oklahoma State University, 1960), p. 50.

[28] Ibid.

increased costs per dozen by less than one-half cent for Processes B and E for all five levels of operator-management returns. At both hired labor rates and an operator-management return of $8,000.00, eggs were produced by all processes at a per dozen cost comparable to recent market prices of eggs.[29] The labor rate assumptions affected per dozen cost relationships of the 12000 size flocks in the same magnitude as for the 6000 size flocks.

Of the comparisons and conclusions that can be drawn from this analysis, several stood out. First, total costs per dozen decreased as flock sizes increased up to about 6000 birds and the decrease in total costs per dozen were more significant in some processes than in others. Secondly, the per dozen costs of producing eggs with the 1500 flock sizes at zero dollar operator-management return and the per dozen cost of producing eggs by the 12000 size flocks with a $16,000.00 operator-management return were about the same. This supported the contention that the poultrymen who operated without hired labor (1500 and 3000 flock sizes) withstand periods of adversity by accepting low or zero returns for his labor.

Total Cost Per Dozen Considerations With All Labor Priced At an Hourly Rate

Two major comparisons were made with all labor priced at hourly rates (Table XIII). First, a more precise cost analysis was drawn between per dozen costs of producing eggs by the various processes and sizes of operation. Second this was a meaningful comparison of farms which utilize only family labor and those that rely upon both hired labor and management.

[29] Ibid.

TABLE XIII

TOTAL COST PER DOZEN OF EGGS BY PROCESS OF PRODUCTION, BY SIZE OF OPERATION AND WITH SPECIFIED LABOR COST ASSUMPTIONS

Process of Production by Flock Size	Total Cost Per Dozen With All Labor (Hired or Managerial) at the Following Rates:[1] .50	1.00	1.50	2.00	2.50
			- dollars -		
1500 Flock					
A	.385	.409	.433	.456	.480
B	.387	.405	.423	.442	.461
C	.399	.419	.447	.470	.494
D	.390[2]	.411[2]	.432[2]	.452[2]	.471[2]
E					
Average	.390	.411	.434	.455	.477
3000 Flock					
A	.338	.359	.380	.401	.422
B	.337	.353	.369	.385	.401
C	.352	.373	.394	.415	.435
D	.344	.362	.380	.398	.416
E	.339	.352	.365	.378	.390
Average	.342	.360	.378	.395	.413
6000 Flock					
A	.294	.313	.331	.350	.369
B	.291	.307	.322	.337	.353
C	.308	.326	.344	.362	.379
D	.300	.317	.333	.349	.365
E	.293	.304	.315	.326	.337
Average	.297	.313	.329	.345	.361
12000 Flock					
A	.287	.302	.318	.334	.349
B	.284	.296	.308	.320	.332
C	.301	.315	.330	.345	.359
D	.295	.308	.322	.336	.350
E	.288	.297	.307	.317	.326
Average	.291	.304	.317	.330	.343

[1]The total labor and the division of the labor between management, regular hired labor, and partially hired labor are found in Table IX. It was assumed that the operator would work the first 2500 hours; the regular hired man the next 2500 hours, if needed; and the partially hired man the remainder.

[2]See footnote 3, Table III.

At low wage rates, 50 cents to one dollar, per dozen production costs differences between processes at all flock sizes was not very great, except for Process C. Per dozen costs for this process at these wage rates was about 1.5 cents per dozen higher than Processes A, B, or E and about .6 cents higher than Process D. Processes B and E, the most mechanized processes, had about the same per dozen costs as the less mechanized Process A. The conclusion was that at wage rates of less than one dollar, mechanization or automation is not economically practical even with very large flock sizes.

As the wage rate rose beyond one dollar and as flock sizes were increased, the difference in per dozen production costs between processes became much greater. For example if the 12000 flock size returned an average hourly wage of $2.50, Process B produced eggs 1.7 cents per dozen cheaper than Process A. A relatively small reduction in cost of 2 cents a dozen would increase operator-management returns for the 12000 flock sizes about $5,000.00 annually. Processes C and D of the cage system had production costs always much higher than any other process. At flock sizes of 12000 and labor rates of $2.50, Process C had production costs of about 36 cents compared with production costs of 33 cents for Processes B or E. Process D's production cost was about 1 cent per dozen lower than Process C at these higher wage rates and larger flock sizes.

A final conclusion which was evident from the data was that no process in the 1500 flock size category produced eggs for less than 38.5 cents (Table XIII). If an average price of 35 cents prevailed, these operator-managers received less than 50 cents per hour for their labor if annual fixed costs were met. Six thousand flock sizes which would be a typical family operation, produced eggs for about 34.5 cents and paid

$2.00 per hour for all labor.

Per Dozen Total Cost Curves

More knowledge of per dozen cost relationships for a given process and size of operation was gained from other than optimum conditions[30] (Table XIV and Figure 6). This was accomplished by determining the per dozen costs when practices which are variable in the short-run result in total egg production at 80 percent and 90 percent of the level at the least-cost combination. In other words, the less than optimum (80 and 90 percent) production rate assumed inefficient resource combination. More feed per dozen eggs, less layers per square foot, and more hours of labor per bird caused these inefficient combinations. No attempt was made to identify or describe the production practices which resulted in these levels of costs. The computation was effected by dividing 90 percent and 80 percent respectively into the least-cost estimate (Table XIV).

Production costs per dozen were increased significantly by the less than optimum conditions. At the 1500 and 3000 flock sizes, the increases in per dozen costs were much greater than at 6000 and 12000 flock sizes. At the 3000 flock sizes there was an increase in production costs of about 11 cents when 80 percent of optimum cost conditions was assumed. Previous analysis had demonstrated that the 1500 and 3000 flock sizes only break even at 100 percent efficiency at a market price of 34 cents. For the larger flock sizes (6000 and 12000), the per dozen cost increased about 5 cents when 80 percent of least-cost esti-

[30]The optimum condition was assumed to be the least-cost point of each process. Each point was assumed to represent potential maximum average productivity.

TABLE XIV

TOTAL UNIT COST PER DOZEN OF EGGS BY PROCESS OF PRODUCTION, BY SIZE OF OPERATION, WHEN TOTAL PRODUCTION WAS 80 AND 90 PERCENT OF THE LEVEL OF THE LEAST-COST COMBINATION

Process of Production by Flock Size	Cost Per Dozen at Specified Percent of the Level at Least-Cost:[1] 80 Percent	90 Percent	100 Percent
		- dollars -	
1500 Flock			
A	.790	.704	.634
B	.794	.705	.635
C	.804	.714	.643
D	.794	.705	.635
E	[2]	[2]	[2]
3000 Flock			
A	.563	.500	.450
B	.566	.503	.453
C	.580	.516	.464
D	.573	.509	.458
E	.574	.510	.459
6000 Flock			
A	.455	.404	.364
B	.444	.394	.355
C	.456	.406	.365
D	.444	.394	.355
E	.423	.376	.338
12000 Flock			
A	.419	.372	.335
B	.405	.360	.324
C	.430	.382	.344
D	.421	.374	.337
E	.404	.359	.323

[1]Assumed situation: Regular hired labor at $3,500.00 annually, man partially hired at $1.25 and management return of $8,000.00 annually.

[2]See footnote 1, Table III.

mate was assumed. However, 5 cents per dozen on a 12000 flock size amounted to about $10,000.00 annually. The conclusion was that per dozen costs rise rapidly and are very significant when optimum conditions are not met.

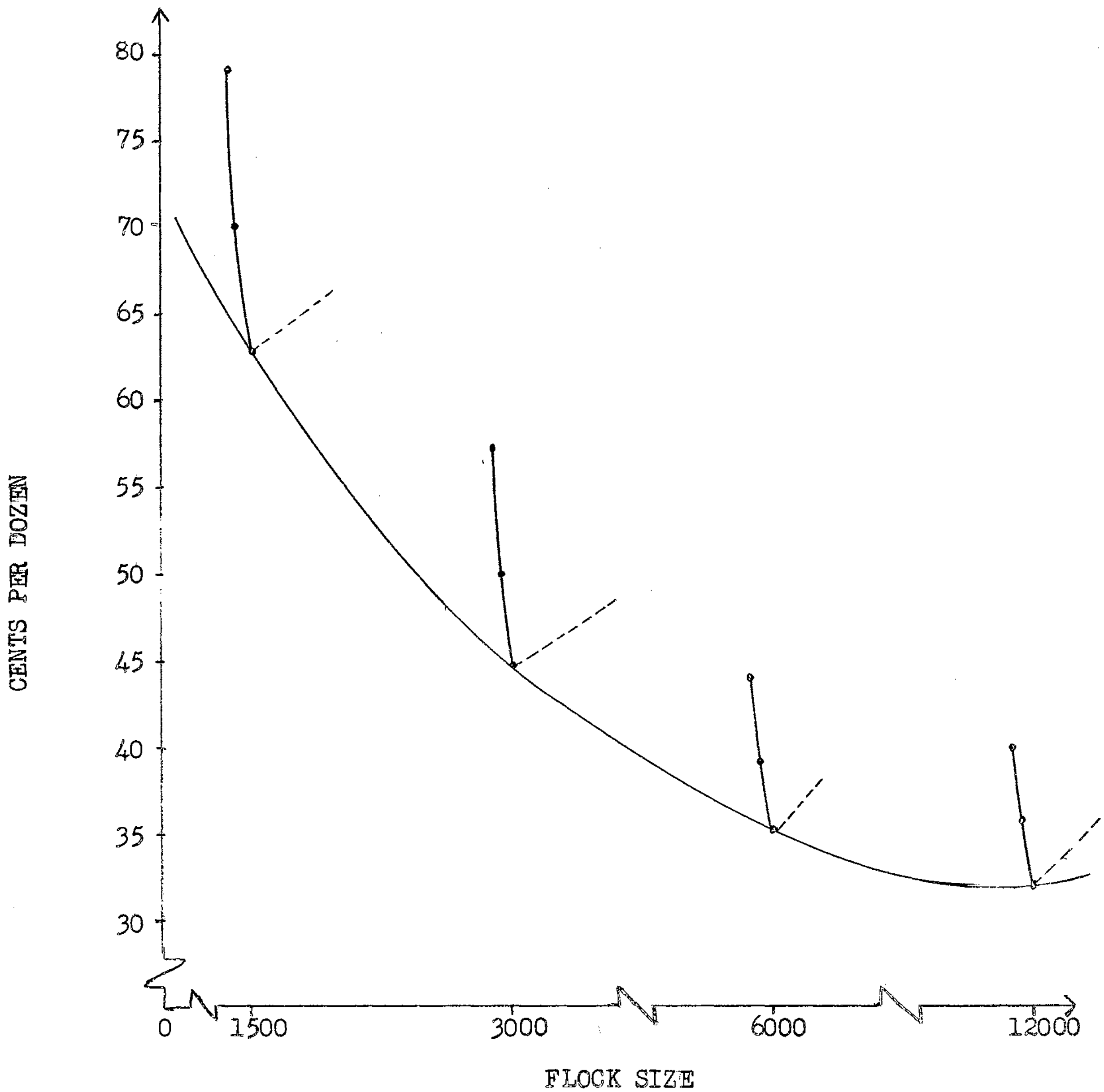

FIGURE 6

COST PER DOZEN OF EGGS PRODUCED ON FOUR FARM MODELS UNDER PROCESS B WHEN TOTAL EGG PRODUCTION IS 80 AND 90 PERCENT OF THE LEVEL AT THE LEAST-COST COMBINATION

Process B was plotted to give an indication of the left or upper position of the cost curve. The right portion of the curve was assumed to rise to the right although the slope was not known.

Per Dozen Variable Cost Comparisons

Per dozen variable cost considerations were important from several standpoints. The specialized equipment used in egg production had very few other uses; thus, when the initial investment was made variable costs were all the costs that had to be covered. Prospective egg contractors were primarily interested in variable cost information. By and large these contracts usually called for the contractor to supply feed and pullets and the producer to furnish house, equipment and labor.

To analyze per dozen variable costs, a high labor cost (Table XV) and an all hourly wage rate (Table XVI) assumption were used. To furnish a logical basis for comparison the wage rates were identical to those in the total per dozen cost tables. For an accurate comparison the total costs per dozen were compared with the total variable costs per dozen.

High Labor Costs

The least-cost estimates were tabulated when regular hired labor was $3,500.00 annually, partial hired labor $1.25 per hour and the assumed operator-management returns of zero, 2,000, 4,000, 8,000, and 16,000 dollars (Table XV). At flock sizes of 1,500 the per dozen variable costs were about 33 cents for zero dollar operator-management returns. This was about one cent below per dozen receipts as found in a recent market study.[31] The lowest per dozen variable cost was 25.6 cents for Process

[31]Hottel, p. 50.

TABLE XV

VARIABLE COST PER DOZEN OF EGGS PRODUCED BY PROCESS OF PRODUCTION, BY SIZE OF OPERATION AND WITH SPECIFIED LABOR COST ASSUMPTIONS

Process of Production by Flock Size	Variable Cost Per Dozen With Regular Hired Labor at $3,500 Annually and Man Partially Hired at $1.25 Per Hour with Management Return to Operator of: 0	2,000	4,000	8,000	16,000
			- dollars -		
1500 Flock					
A	.326	.393	.459	.593	-
B	.328	.395	.461	.595	-
C	.329	.395	.462	.596	-
D	.329[3]	.395[3]	.462[3]	.596[3]	-
E					-
Average	.328	.394	.461	.595	
3000 Flock					
A	.292	.326	.359	.426	.559
B	.293	.327	.360	.427	.560
C	.295	.327	.362	.429	.562
D	.295	.329	.362	.429	.562
E	.294	.328	.361	.428	.561
Average	.294	.327	.361	.428	.561
6000 Flock					
A	.274	.291	.308	.341	.408
B	.265	.282	.299	.332	.399
C	.274	.291	.307	.341	.407
D	.270	.287	.304	.337	.404
E	.256	.273	.289	.323	.389
Average	.268	.285	.301	.335	.401
12000 Flock					
A	.281	.290	.298	.315	.348
B	.271	.279	.287	.304	.337
C	.280	.288	.296	.314	.346
D	.279	.288	.296	.312	.346
E	.266	.274	.283	.300	.332
Average	.275	.284	.292	.309	.342

[1]The total labor and the division of labor between management, regular hired labor and partially hired are found in Table IX. It was assumed that the operator would work the first 2500 hours, the regular hired man the second 2500 hours if needed, and the partial hired man the remainder.

[2]Not relevant since egg prices to the producer will probably never reach this level.

[3]See footnote 1, Table III.

E at 6000 birds and zero operator-management returns. The low least-cost estimate appeared here due to the nature of labor requirements.[32] There was a decrease in variable costs per dozen of about 7 cents between flock sizes of 1500 and 6000 at zero operator-management returns. At higher operator-management returns the decrease in costs due to increases in flock sizes was even more significant, reaching a spread of about 20 cents at $8,000.00 operator-management returns. Per dozen variable costs amounted to about 34 cents for either the 6000 size flocks at $8,000.00 operator-management returns or the 12000 size flocks at $16,000.00 operator-management returns.

The decline in variable costs per dozen as flock size increased was attributed to economies in feed purchasing and pullet replacement and also labor efficiency. Differences in variable costs per dozen with respect to processes at any given size of operation was explained largely by the specific labor requirements. At flock sizes of 12000 and zero operator-management returns this difference amounted to about 1.5 cents (Process A, 28.1 cents, Process E, 26.6 cents).

When total costs per dozen were compared with variable costs per dozen, the fixed cost made up a larger percentage of the smaller flock size costs. At flock sizes of 1500 and zero dollar operator-management returns, the total costs per dozen were about 37 cents as compared to variable costs per dozen of about 33 cents. At flock sizes of 12000 and zero dollar management returns the total costs per dozen were about 30 cents and the per dozen variable costs were about 28 cents. Therefore, fixed costs irrespective of the process were reduced from about 4 cents

[32] No hired labor was needed for Process E at flock size 6000.

per dozen for flock sizes of 1500 to about 2 cents per dozen for flock sizes of 12000.

All Labor Priced Hourly

Variable cost per dozen was analyzed under the assumption that all labor was priced at an hourly rate (Table XVI). With all labor priced at 50 cents per hour, it cost the 1500 size flocks about 35 cents per dozen to produce eggs. Therefore, if egg receipts do not average over 34 cents per dozen, egg producers with 1500 birds are not even covering variable costs at 50 cent per hour labor.

The data indicated the significance of labor cost (Table XVI). At very low wage rates, 50 cents to one dollar, there was no significant variation in per dozen variable production costs due to process of production. However, as the wage rate per hour increased a significant variation appeared. The largest differential was at the 12000 size flock and the $2.50 wage rate. The per dozen variable cost of Process E was about 30 cents, while the per dozen variable cost of Process A was about 33 cents for flock sizes of 12000. These high wage rates made mechanization profitable.

Minus Cost Considerations

Two items which were quite variable as to returns were poultry manure and the depleted layer. Value for manure depended on whether it could be used on the farm to increase yields or sold for commercial fertilizer. Prices for depleted layers were irregular or uncertain.

Manure Returns

The value assigned to manure would not necessarily reflect the cost

TABLE XVI

VARIABLE COST PER DOZEN OF EGGS PRODUCED BY PROCESS OF PRODUCTION, BY SIZE OF OPERATION AND WITH SPECIFIED LABOR COST ASSUMPTIONS

Process of Production by Flock Size	Variable Cost Per Dozen With All Labor (Hired or Managerial) at the Following Wage Rates Per Hour: .50	1.00	1.50	2.00	2.50
			- dollars -		
1500 Flock					
A	.350	.373	.397	.421	.445
B	.346	.365	.384	.403	.421
C	.352	.376	.400	.423	.447
D	.350[2]	.370[2]	.391[2]	.412[2]	.432[2]
E					
Average	.349	.371	.393	.415	.436
3000 Flock					
A	.313	.334	.355	.376	.397
B	.309	.325	.341	.357	.373
C	.316	.337	.358	.378	.399
D	.313	.331	.349	.367	.385
E	.307	.320	.333	.346	.358
Average	.312	.329	.347	.365	.382
6000 Flock					
A	.272	.291	.310	.328	.347
B	.268	.283	.298	.313	.328
C	.274	.292	.309	.325	.345
D	.272	.288	.304	.320	.336
E	.266	.277	.288	.299	.310
Average	.270	.286	.302	.317	.333
12000 Flock					
A	.268	.284	.299	.215	.331
B	.265	.276	.288	.300	.312
C	.270	.284	.299	.314	.329
D	.269	.283	.297	.311	.325
E	.264	.274	.284	.294	.303
Average	.267	.280	.293	.287	.320

[1]The total labor and the division of the labor between management, regular hired labor and man partially hired are found in Table IX.

[2]See footnote 1, Table III.

of labor and equipment to remove it but reflect its value as a product. Since most of the layer enterprises in Oklahoma are still a part of a land-farming operation, manure has value as a factor of production. It was estimated that poultry manure had about 22.2 pounds nitrogen, 7.6 pounds phosphorous, and 7.6 pounds potassium to the ton.[33] It was further estimated that 1,000 pounds liveweight of poultry produced about four and one-half tons of manure annually.[34] This represented the droppings from 250 birds weighing four pounds each. Manure was valued at four dollars a ton, the respective total value by flock sizes was $120.00, $204.00, $408.00, and $816.00 (Table XVII). Some researchers have given a higher value to manure (Table XVIII).

Depleted Layer Returns

A more important secondary return consideration was the value of the depleted layers for meat after the laying period. Prices for old hens fluctuate widely and to some extent the market was limited as reported by some of the interviewees. Prices ranged from five to 12 cents a pound depending on season and the supply and demand conditions. Ordinarily a bird weighed about four pounds at the end of the laying period and had a value of 30 to 40 cents per bird. Figuring a mortality rate of 10 percent, a 1500 size flock was estimated to have 1350 saleable birds after 52 weeks of production.

The extreme limits on returns from pountry manure and the depleted flock were summarized (Table XVII and XVIII). With the two assumptions of

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[33] Frank B. Morrison, Feeds and Feeding, (21 ed., Ithaca, 1954), p. 644.

[34] Ibid.

TABLE XVII

RETURNS FOR MANURE AND DEPLETED FLOCK AT SELECTED VALUES

Flock Size	1500	3000	6000	12000
		- dollars -		
Manure[a]	102.00	204.00	408.00	816.00
Flock[b]	405.00	810.00	1,620.00	3,240.00
Total	507.00	1,014.00	2,028.00	4,056.00
Per Bird	.338	.338	.338	.338
Per Dozen[c]	.017	.017	.017	.017

[a]$4.00 per ton.

[b]Thirty cents per bird.

[c]Twenty dozen per bird.

TABLE XVIII

RETURNS FOR MANURE AND DEPLETED FLOCK AT SELECTED VALUES

Flock Size	1500	3000	6000	12000
		- dollars -		
Manure[a]	153.00	306.00	612.00	1,224.00
Flock[b]	540.00	1,080.00	2,160.00	4,320.00
Total	693.00	1,386.00	2,772.00	5,544.00
Per Bird	.462	.462	.462	.462
Per Dozen[c]	.023	.023	.023	.023

[a]$6.00 per ton.

[b]Forty cents per bird.

[c]Twenty dozen per bird.

four dollars a ton for manure and 30 cents salvage value per bird, there was a reduction of 1.7 cents for each least-cost estimate in all the preceding analyses.[35] With poultry manure at six dollars per ton and depleted birds at 40 cents each, the reduction for all least-cost estimates was about two cents per dozen. A deduction in per dozen costs of 1.5 to 2.5 cents can probably be expected from manure and depleted birds.

The Fitted Cost Curve

Generally, the long-run average cost curve is "U" shaped due to factors that are both internal and external to the firm. It decreases as volume increases due to division and specialization of labor and technological factors. Due to diseconomies brought about by inefficient management or diminishing returns to some fixed factor, the long-run average cost curve will begin to rise. This long-run average cost curve is often considered the planning curve for the firms in an industry.

To approach the problem of estimating the economies of scale curve, the optimum process[36] for each size might be chosen. Since this gave

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[35]These are not subtracted out of the data due to the high variability of these two factors.

[36]Even under ideal budgeting conditions, it was not expected that the theoretical scale would be estimated (c. f. Chapter II). In addition, the budgeted results of the study gave some indication that the optimum process at any size was being operated at an output where short-run average total costs were declining. This indication is centered in the fact that average total costs were declining over the entire range of output even for Process A. If this indication be valid, the assumption of "superior" organization can be questioned. Thus estimating a LAC curve for such points would lead to an even greater over-estimation of costs.

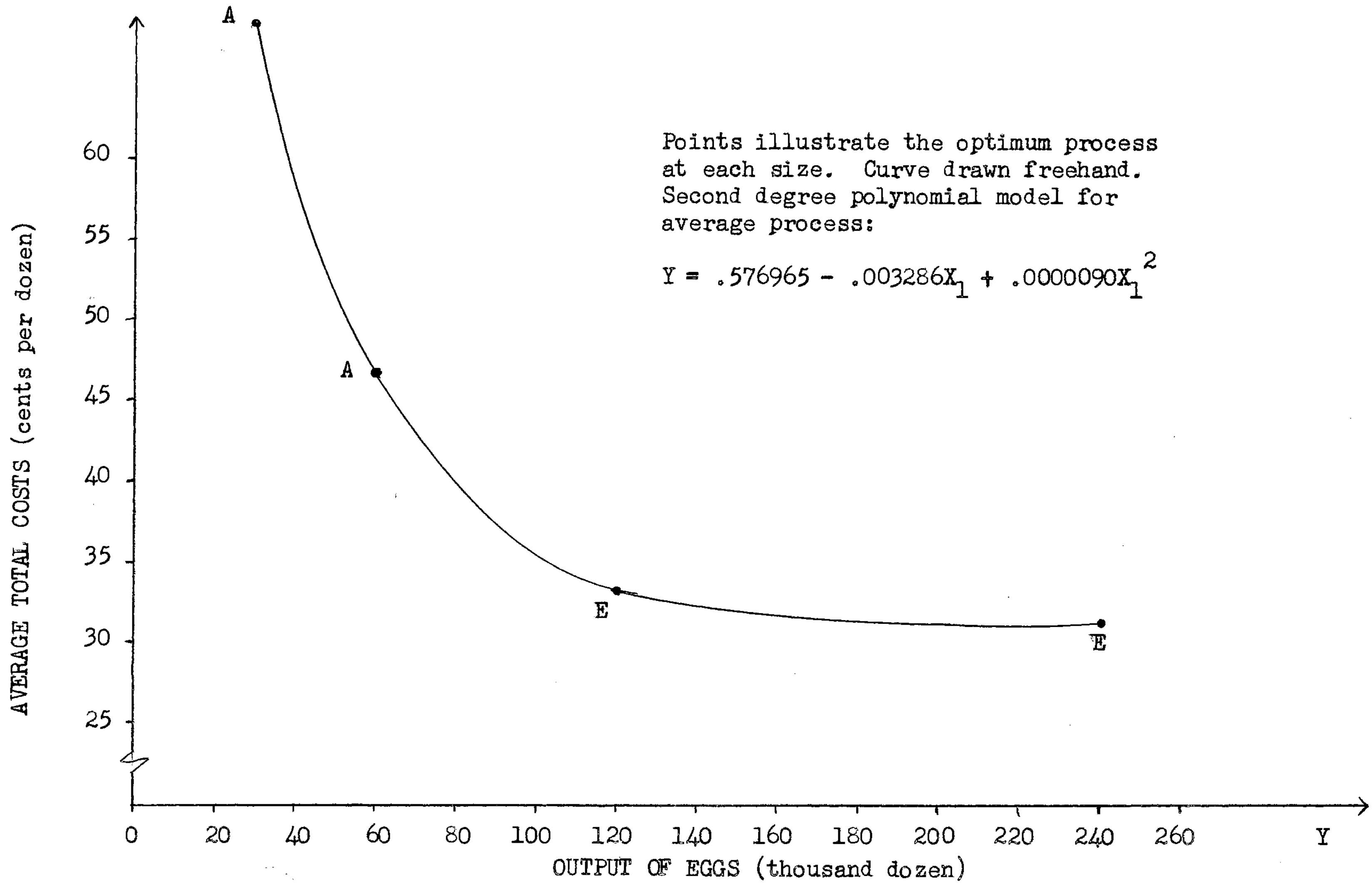

Figure 7

ESTIMATED LONG-RUN AVERAGE COSTS OF PRODUCING EGGS FOR AN OPERATOR-MANAGEMENT RETURN OF $4,000.00

only four observations statistical fitting was inappropriate. A free-hand curve was drawn through the points as illustrated in Figure 7. Since there was only a small range in average costs for the processes, the curve is a close approximation to the fit for all twenty observations.[37]

If an average cost trend is desired which would be independent of process of production, a statistical technique might be used. This was done under the assumption of an operator-management return of $4,000.00 annually (Table XII). Cost per dozen was the dependent variable and output was the independent variable.

The second degree polynomial of the form $Y = a - bX_1 + cX_1^2$ was selected as the type equation likely to represent this data. In computing this equation, the method of least squares was employed. The fitted equation was $Y = .576965 - .003286X_1 + .0000090X_1^2$. This curve was not plotted but would roughly follow the freehand curve (see footnote 37).

[37]The optimum average costs for $X_1 = 30{,}000$; 60,000; 120,000; and 240,000 were \$0.494; \$0.384; \$0.315; and \$0.306 respectively. The estimated average costs using all twenty observations for the same output levels in order were \$0.486; \$0.305; \$0.312; and \$0.307. The statistical fit is not too useful for interpolation since a minimum of \$0.277 occurred at 183,000 dozen eggs.

CHAPTER VI

FINANCING THE LAYER ENTERPRISE

Two types of capital were important in the laying enterprise; namely, pullet replacement capital and investment capital. The amount of pullet replacement cost was $20,000.00 and the level of fixed investment was about $30,000.00 for the 12000 flock sizes. These costs and investments tend to emphasize the importance of finance in the layer industry. Thus, it is evident that credit policies will be a very important factor in the further development of the layer phase of the egg industry in Oklahoma. Poultrymen with limited resources will likely have difficulty securing credit of this magnitude. However, if the size of the units are increased additional fixed and operating capital will be needed.

Implications of Credit in Pullet Replacement

About $1.80 per bird was invested in the 22 week old pullet. During a 52 week laying period this layer must return enough above current operating costs (feed, supplies, and hired labor) to repay this $1.80. Two factors determined the period of time required to pay back the pullet replacement cost, (1) the average egg price and (2) the average current operating costs.[38] These were important considerations regardless of

[38]Another factor, the quality of the layer, influences the length of the period. However, quality or performance is related to cost of the replacement and the cost of $1.80 per layer assured quality capable of laying 240 eggs in 365 days.

TABLE XIX

PRODUCTION REQUIRED TO RECOVER COST OF PULLET AFTER BEGINNING OF LAYING PERIOD BY DIFFERENT PRODUCTION COSTS, BY FLOCK SIZE AND FOR DIFFERENT PRICES OF EGGS[a]

Production Cost Per Dozen[b] by Flock Size		Price of Eggs Per Dozen					
		$.25	$.30	$.35	$.40	$.45	$.50
		(Number of dozen eggs required[c])					
1500	.227	d/	d/	14.63	10.40	8.07	6.59
3000	.204	d/	18.75	12.33	9.18	7.32	6.08
6000	.180	d/	15.00	10.59	8.18	6.67	5.62
12000	.179	d/	14.88	10.53	8.14	6.64	5.61

[a]Assume pullet cost of $1.80.

[b]Production cost based on an average feeds and other cost taken at each size. Management return, pullet, and fixed cost not included.

[c]Based on 240 eggs in 365 days or 66 percent egg house production.

[d]Dozen of eggs was in excess of 20, which was the limit of this study.

TABLE XX

LENGTH OF TIME REQUIRED TO RECOVER PULLET COST, BY DIFFERENT PRODUCTION COSTS, BY FLOCK SIZE AND FOR DIFFERENT PRICES OF EGGS[a]

Production Cost Per Dozen[b] by Flock Size		Price of Eggs Per Dozen					
		$.25	$.30	$.35	$.40	$.45	$.50
		(Number of days required[c])					
1500	.227	d/	d/	266	189	147	120
3000	.204	d/	341	224	167	133	111
6000	.180	d/	273	193	149	121	102
12000	.179	d/	271	191	148	121	102

[a]Assume pullet cost of $1.80.

[b]Production cost based on an average feeds and other cost taken at each size. Management return, pullet, and fixed costs not included.

[c]Based on 240 eggs in 365 days or 66 percent egg production.

[d]Number of days was in excess of 365, which was the limit of this study.

whether credit was involved, because the faster the bird paid for itself, the sooner the producer realized a return and less risk was involved.

The current production costs at each size represented only feed, hired labor and the miscellaneous items (Table XIX and XX). An average of all processes for any given flock size was taken to secure the current production cost. For example, for flock sizes of 6000, it took 18 cents to produce eggs exclusive of any returns to operator-management, repayment of pullet cost, and a charge of fixed investment (Tables XIX and XX).

At egg prices of 25 cents, it was impossible to recover pullet cost for any size operation. Pullet cost was recovered by the 3000 thru 12000 flock sizes only when egg prices reached 30 cents per dozen, but no payments were made to management and no fixed costs were covered. If egg prices averaged 35 cents, all flock sizes recovered pullet cost. It took almost 15 dozen eggs laid in 266 days to recover pullet replacement cost for the 1500 flock sizes. Only 10 dozen laid in 191 days was required by the 12000 flock sizes for 35 cent eggs. At higher egg prices the number of dozens and length of time was reduced still further.

Economies of flock size were pointed out in these comparisons. By increasing flock sizes from 1500 to 12000 and assuming an expected egg price of 35 cents, credit extension time was reduced about 2.5 months. This probably made credit for pullet replacement more readily available for the larger flocks since the credit period was shorter, although more capital was involved. From another standpoint, these data suggested a reason why the layer business has not gone to an integrated-contract basis. When a lender's money is tied up 300 to 400 days in a variable production cost, lending policies have had to be comparable with the broiler industry. Management becomes more acute compared with broiler operations since investments are tied up for a much longer time period.

Implications of Credit in Egg Production Expansion

From the analysis in Chapter IV and V it was determined that there were certain economies associated with flock size in the layer business. It was shown that a manager with a 3000 size flock may have the same per dozen costs as a flock owner with 12000 birds, but the 3000 size flock will not be making an operator-management return and the 12000 size flock will be making a $8,000.00 to $16,000.00 operator-management return. How does a manager go from 3000 layers to 12000 layers to take advantage of these economies? The total net return from a 12000 size flock must meet family needs, and principal and interest payments on the borrowed capital.

Budget for a 12000 Size Operation

A complete budget of total cash income and expenses that a manager might expect from a 12000 size flock operation was budgeted (Table XXI). An average egg price of 33 cents per dozen and a salvage value of 35 cents per hen were assumed. To be conservative, 19 dozen eggs were assumed per bird. The expenses were taken from the operating statements of the study. The gross return to the operator for labor, management, risk and capital was about $14,000.00.[39] From this gross return $6,000.00 was subtracted from living expenses and $1,520.00 was subtracted for manure credits. This left an income of about $6,700.00 to meet interest and principal payments on fixed investment.

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[39] Depreciation was not included in expense due to the fact that the analysis was interested only in determining pay-back ability.

TABLE XXI

BUDGET OF ESTIMATED INCOME, EXPENSE AND EARNINGS FOR AN EGG FARM OF 12000 HENS[1]

Item		Quantity Total	Quantity Per Hen	Estimated Price	Total Value	Per Hen
					- dollars	
Egg Sales	doz.	240000	19	.33	75,240.00	6.27
Cull Hens	bird	10800		.35	3,780.00	.32
Manure	ton	760		2.00	1,520.00	.13
Total Income					80,540.00	7.05
Feed	ton	540	9/200	68.80	37,152.00	3.10
Other Feed					504.00	.03
Pullet Cost	bird	1200	1	1.71	20,520.00	1.71
Interest on Pullet Cost					504.00	.04
Miscellaneous Expense[2]					2,071.56	.17
Taxes, Repairs, Insurance[3]					824.28	.07
Hired Labor	hour	3200		1.50	4,800.00	.40
Total Cash Expense					66,257.76	5.52
Income to Operator for Labor, Management, Risk, Capital					14,282.24	
Need for Living					6,000.00	
Nonsaleable Fertilizer					1,520.00	
Income to meet Interest & Principal on Investment					6,762.24	

[1]Process B was assumed for this analysis.

[2]Includes electricity, litter, veterinary supplies, egg room supplies, gas and oil, miscellaneous.

[3]Total investment (27,557) times three percent.

TABLE XXII

SCHEDULE OF FIXED CAPITAL NEEDED TO INCREASE FLOCK SIZE FROM 3000 TO 12000[1]

Item	Total Amount Needed
	- dollars -
Land	--
Land Grading and Preparation for Construction	381.00
Well and pump	596.00
Lay house Extension of No. 1	3,100.00
Additional Equipment No. 1	1,754.47
Lay house No. 2	6,200.00
Equipment No. 2	4,225.74
New Egg Room and Equipment	3,082.00
Total	19,339.21

[1]Itemized from Tables B-II and B-IV of Appendix B.

Investment Requirements to Increase From 3000 to 12000 Hens

Approximately $20,000.00 worth of fixed capital was needed to increase flock size to 12000 birds (Table XXII). The additional capital requirements depended on the process chosen. For instance, Process C would have required about $30,000.00 of additional capital to expand to 12000 birds.

Work Sheet of Production and Total Income

A work sheet was prepared to show how a 12000 size flock might be managed (Table XXIII). Two houses with 6000 birds in each were assumed. A one percent death loss was assumed per month. The numbers in parenthe-

TABLE XXIII

OPERATING PLAN, PRODUCTION AND INCOME FOR EGGS AT AN AVERAGE PRICE OF 33 CENTS, AND HENS AT AN AVERAGE PRICE OF 35 CENTS

Mo.	Layer House[1] A	Layer House[1] B	Total Hens	Dozen Eggs[2]	Egg Price[3]	Egg Income	Hens at 35¢	Total Income
				at 1.67				- dollars -
1	5648	(6000)	11648	19452	35	6,808.20	--	6,808.20
2	5592	(5940)	11532	19258	35	6,740.30	--	6,740.30
3	5536	(5880)	11416	19065	35	6,672.75	--	6,672.75
4	5481	(5821)	11302	18874	35	6,605.90	--	6,605.90
5	5426	(5763)	11189	18686	35	6,540.10	--	6,540.10
6	5372	(5705)	11077	18498	35	6,474.30	1,879.15	8,353.45
7	(6000)	5648	11648	19452	31	6,030.12	--	6,030.12
8	(5940)	5592	11532	19258	31	5,969.98	--	5,969.98
9	(5880)	5536	11416	19065	31	5,910.15	--	5,910.15
10	(5821)	5481	11302	18874	31	5,850.94	--	5,850.94
11	(5763)	5426	11189	18686	31	5,792.66	--	5,792.66
12	(5705)	5372	11077	18498	31	5,734.38	1,879.15	7,613.53

[1] One percent loss per house per month.

[2] This will figure out at about a 19 dozen per hen housed per year rate.

[3] An average price of 33 cents assumed, 35 cents for six months and 31 cents for six months.

sis show the pullet flock. In month one there were 11648 birds. Six thousand of these were pullets housed in house "B". In the sixth month, the birds in house "A" were sold and birds in house "B" became old hens. Pullets were started in house "A" in the seventh month. It was assumed that the rate of lay was 19 dozen per hen housed or 1.67 dozen eggs per hen per month. The peak production was 19452 dozen eggs per month for two months and the low was 18498 dozen eggs per month for two months. This 1000 dozen spread between the peak and low months could only be reduced by starting pullets more often than two times a year.

To allow the flow of egg income to be realistic,[40] it was assumed that eggs were 35 cents per dozen for six months and 31 cents for six months. Old hens were sold twice a year at 35 cents per head. Total cash income exclusive of hen sales ranged from a high of about $6,800.00 per month to a low of about $5,700.00 per month.

Work Sheet of Total Cash Expenses and Net Income

The current operating expenses of a typical 12000 size flock were prorated over 12 month period (Table XXIV). The four dollar spread in feed price per ton allowed matching of current revenue and current expenses. The low price for feed and high price for eggs occurred in the first six months. The high price for feed and low price for eggs occurred in the second six months. All other current costs including the operator labor were prorated out over a 12 month period. Depreciation cost was excluded since it did not influence the pay back ability of the assumed situation. Total cash expenses averaged about $6,000.00 per month.

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[40]Realistic in that monthly revenue must be matched with monthly operating expenses.

TABLE XXIV

EXPENSES[1] AND NET CASH INCOME ASSUMING 33 CENT PER DOZEN EGGS AND 35 CENT HENS

Month	Total Feed Ton	Feed Cost Ton	Total Feed Cost	Other Feed Cost	Pullet Cost	Interest Pullet Cost	Hired Labor	Miscel. Expense	Taxes, Repair, Insurance	Operator Labor	Total Cash Expense	Total Cash[2] Income	Net Cash Income	Accumulated Net Cash Income
								- dollars -						
1	45	66.80	3,006.00	33.66	1,710.00	42.00	400.00	172.63	68.69	500.00	5,932.98	6,808.20	875.22	875.22
2	45	66.80	3,006.00	33.66	1,710.00	42.00	400.00	172.63	68.69	500.00	5,932.98	6,740.30	807.32	1,682.54
3	45	66.80	3,006.00	33.66	1,710.00	42.00	400.00	172.63	68.69	500.00	5,932.98	6,672.75	739.77	2,422.31
4	45	66.80	3,006.00	33.66	1,710.00	42.00	400.00	172.63	68.69	500.00	5,932.98	6,605.90	672.92	3,095.23
5	45	66.80	3,006.00	33.66	1,710.00	42.00	400.00	172.63	68.69	500.00	5,932.98	6,540.10	607.12	3,702.35
6	45	66.80	3,006.00	33.66	1,710.00	42.00	400.00	172.63	68.69	500.00	5,932.98	8,353.45	2,420.47	6,122.82
7	45	70.80	3,186.00	33.66	1,710.00	42.00	400.00	172.63	68.69	500.00	6,112.98	6,030.12	-82.86	6,039.96
8	45	70.80	3,186.00	33.66	1,710.00	42.00	400.00	172.63	68.69	500.00	6,112.98	5,969.98	-143.00	5,896.96
9	45	70.80	3,186.00	33.66	1,710.00	42.00	400.00	172.63	68.69	500.00	6,112.98	5,910.15	-202.83	5,694.13
10	45	70.80	3,186.00	33.66	1,710.00	42.00	400.00	172.63	68.69	500.00	6,112.98	5,850.94	-262.04	5,432.09
11	45	70.80	3,186.00	33.66	1,710.00	42.00	400.00	172.63	68.69	500.00	6,112.98	5,792.66	-320.32	5,111.77
12	45	70.80	3,186.00	33.66	1,710.00	42.00	400.00	172.63	68.69	500.00	6,112.98	7,613.53	1,500.55	6,612.32

[1]Based on expenses as computed in Appendix, Table C-IV.

[2]Total cash income from Table XXIII.

Debt Retirement Ability Assuming 33 Cents Per Dozen Eggs

The total per month cash income minus total per month cash expenses left a per month net cash income available for debt retirement (Table XXIV). The accumulated net cash income was the 12 month aggregate amount available for retiring debt (Table XXIV). With egg prices at the higher price (35 cents), the operator repaid about $800.00 per month for six months. For five months when prices were low (31 cents) current operating costs were about $200.00 dollars per month above current revenue. At the average price of 33 cents per dozen, there was available about $6,600.00 a year for interest and debt repayment. Depending on the interest expense, the operator should retire the $20,000.00 debt for additional capital in four to six years.

Debt Retirement Ability Assuming 32 Cents Per Dozen Eggs

Per month total cash income assuming 32 cents per dozen eggs and 25 cents per head salvage value for old hens was computed (Table XXV). The total cash income was compared to total cash expense to compute the debt retirement ability (Table XXVI).

Assuming an egg price of 32 cents, only about $600.00 per month was available for debt retirement for a five month period. In another five month period expenses were in excess of revenue by about $350.00 per month. The pay back ability was much more difficult than in the previous assumption since the amount of interest on the unpaid balance was much greater. Depending on the interest charge, it would take approximately eight to ten years to repay the additional $20,000.00 needed to increase flock size from 3000 to 12000 birds.

TABLE XXV

PRODUCTION AND INCOME FOR EGGS AT AN AVERAGE CASH PRICE OF 32 CENTS AND HENS AT AN AVERAGE PRICE OF 25 CENTS PER HEN

Month	Total Hens[1]	Dozen Eggs at 1.67 Per Month	Egg Price	Egg Income	Hen Income @25	Total Cash Income
					- dollars -	
1	11648	19452	34	6,613.68	--	6,613.68
2	11532	19258	34	6,547.72	--	6,547.72
3	11416	19065	34	6,482.10	--	1,482.10
4	11302	18814	34	6,417.16	--	6,417.16
5	11189	18686	34	6,353.24	--	6,353.24
6	11077	18498	34	6,289.32	1,343.00	7,632.32
7	11648	19452	30	5,835.60	--	5,835.60
8	11532	19258	30	5,777.40	--	5,777.40
9	11416	19065	30	5,719.50	--	5,719.50
10	11302	18874	30	5,662.20	--	5,662.20
11	11189	18686	30	5,605.80	--	5,605.80
12	11077	18498	30	5,549.40	1,343.00	6,892.40

[1] Operating plan same as in Table XXIII.

TABLE XXVI

EXPENSES AND NET CASH INCOME ASSUMING 32 CENT PER DOZEN EGGS AND 25 CENT HENS

Month	Total Cash Expense[1]	Total Cash Income[2]	Net Cash Income	Accumulated Net Cash Income
		- dollars -		
1	5,932.98	6,613.68	680.70	680.70
2	5,932.98	6,547.72	614.74	1,295.44
3	5,932.98	6,482.10	549.12	1,844.56
4	5,932.98	6,417.16	484.18	2,328.74
5	5,932.98	6,353.24	420.26	2,749.00
6	5,932.98	7,632.32	1,699.34	4,448.34
7	6,112.98	5,835.60	-277.38	4,170.96
8	6,112.98	5,777.40	-335.58	3,835.38
9	6,112.98	5,719.50	-393.48	3,441.90
10	6,112.98	5,662.20	-450.78	2,991.12
11	6,112.98	5,605.80	-507.18	2,483.94
12	6,112.98	6,892.40	779.42	3,263.36

[1]From Table XXIV, Column 12.

[2]From Table XXV.

Comparison of Debt Retirement Ability of High Vs. Low Priced Eggs

A one cent per dozen difference in expected returns made a substantial difference in the ability to retire the $20,000.00 loan to expand the flock size (Tables XXIV and XXVI). A one cent decline in price lengthened the pay back period by at least four or five years. This additional four or five years could be very important since technology is changing rapidly in the layer business. It is likely that flock sizes will increase to take advantage of cost reducing technological changes. Increased flock sizes could lower egg prices, thus making it harder to retire a debt acquired investment in the layer business.

Several conclusions could be drawn from this analysis. Producers who borrow capital to make expansions should plan to repay as rapidly as possible. Another possibility is to integrate the first year of expansion with a rising egg price and make two repayments the first year of operation as insurance.

CHAPTER VII

SUMMARY AND CONCLUSION

The major purpose of this study was to analyze production process alternatives for commercial poultry (layer) enterprises, and the costs relationships of these processes to increases in flock size. These relationships were evaluated in terms of associated costs.

Input information was obtained from published research, personnel connected with the layer industry, and from interviews with managers of "superior" layer organizations. Resource requirements along with factor prices and the resulting outputs were the major types of information needed. The budget method was used to determine least-cost estimates for the various processes and flock sizes.

The inputs and resource combinations were analyzed and described for five processes for four assumed flock sizes. Processes A and B were alternative floor methods of production and Processes C, D, and E were alternative cage methods of production. Each process was analyzed for flock sizes of 1500, 3000, 6000, and 12000 birds. Input factors of housing, equipment, feed, pullet replacement, labor, and miscellaneous were synthesized in these five egg producing processes.

The feed and pullet replacement input units were not affected by process of production or the size of the enterprise. A feed consumption ratio of 4.5 pounds of feed per dozen eggs was used. Pullet replacement inputs were assumed to be hybrids of strain crosses, 22 weeks of age, and in excellent health.

Housing, equipment, labor inputs, and resource combinations varied due to process of production. Processes A and B (floor system), used two square feet of floor space per bird. Process A used hand feeders and Process B automatic feeders; thus labor requirements were greater for Process A. Other equipment and labor requirements were identical for these two processes. Process C used 2.45 square feet of floor space and Process D required 2.2 square feet of floor space. The cage equipment used in these two processes served as a roost, nest, feeder, and waterer. Process C used a single bird per 8 inch by 18 inch cage and Process D used a 24 inch by 18 inch cage for five birds. Labor requirements were somewhat less for Process D than for Process C since more birds were concentrated in one area. Process E required only one square foot of floor space per bird. Specialized roost, manuring cleaning, and fan equipment were used. Labor requirements for this process at all flock sizes were lower than for any of the other four processes.

Initial investment in land, buildings, and equipment was a function of the specific process and flock size. Processes A and B required the least total initial investment for all flock sizes. Process C necessitated the largest initial investment of all processes and all flock sizes. Process C required about $8,000.00 initial investment for flock size 1500 compared with $7,000.00 for Process B. For flock sizes of 12000, initial investment increased to approximately $28,000.00 for Process B and to $43,000.00 for Process C. In all processes initial investment declined by at least 90 cents per bird as flock size increased from 1500 to 12000 and in Process B the decline was about $2.00.

Fixed and variable costs of operation were put on an annual basis. Buildings and equipment were depreciated at a rate in accord with the uncertainty that exists in regards to technological advancements in the layer business. Annual total fixed costs amounted to at least $1,000.00 for any process for the 1500 flock size and increased to above $7,000.00 for Process C at the 12000 flock size level. Variable costs, exclusive of labor costs, did not materially vary due to process of production. Total annual variable cost (feed, pullet replacement, and supplies), exclusive of labor costs, amounted to nearly $10,000.00 for the 1500 flock sizes and increased to approximately $60,000.00 for the 12000 flock sizes. Annual variable cost per bird decreased as flock size increased due to economies in feed and supply purchases and due to economies in the pullet replacement programs of larger flock owners.

Least-cost estimates of producing a dozen eggs were made for various hired labor cost assumptions and operator-management returns assumptions. The short-run and long-run cost curves derived from these estimates supported the following interpretation of the size and process economies in the layer enterprise.

(1) For flock sizes of 1500 and 3000 hired labor rates did not affect per dozen costs since all labor was performed by the operator-manager.

(2) Total cost per dozen eggs declined rapidly for the flock sizes between 1500 and 6000. An increase in flock size from 6000 to 12000 did not materially affect production costs per dozen.

(3) Total costs per dozen eggs declined more rapidly at high hired wage rates and operator-management returns. At low wage rates and operator-management returns costs declined approximately 8 cents for flock size increases from 1500 to 6000. For high wage rates and operator-management returns costs declined approximately 15 cents for flock size increases from 1500 to 6000.

(4) When all labor was priced at an hourly rate, production cost differences between processes became significant. When all labor, hired or operator-management labor, was priced at less than one dollar per hour there was no sifnificant difference in production costs between the five processes of production at any given flock size. As wage rates approached $2.50 per hour and as flock sizes increased to 6000 or 12000, significant differences in per dozen costs due to process appeared. For flock size of 12000 and wage rate of $2.50 there was a spread in costs between the high and low cost process of approximately 3.5 cents per dozen.

(5) Fixed cost per dozen was reduced about two cents per dozen depending on specific process as flock size increased from 1500 to 12000.

(6) Operator-managers of layer enterprises of less than 3000 birds cannot achieve a per dozen cost level similar or comparable to the level for larger flocks unless the operator-management return to the operator and/or returns to other owned resources are substantially below such returns to operators of larger units.

Two factors affected the ability to repay the pullet cost (1) the average egg price and (2) the average current operating costs. If egg prices average less than 25 cents per dozen no flock size repaid pullet replacement costs. As flock size increased and egg prices increased total number of days, or dozen eggs required to repay pullet cost was reduced. An excess of six months, after the start of the laying period, was required to repay pullet replacement cost for the 12000 size flock if egg prices averaged 35 cents.

To expand from 3000 birds to 12000 birds, approximately $20,000.00 was needed, depending on the particular process of production. If egg prices averaged 33 cents per dozen, repayment of the $20,000.00 took about 4 years but if egg prices dropped to 32 cents per dozen it took approximately ten years to repay the $20,000.00

It is evident from the complete study that costs are reduced as flock size increases to approximately 6000. This adjustment would probably be output increasing. Expansions of output by all producers would create surpluses and/or reduce prices under the present market structure. The optimum condition would probably be for some producers to drop out or for the Oklahoma egg industry to find adequate out of state markets.

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APPENDIX A

APPENDIX TABLE A-I

SCHEDULE OF PRICES PAID BY FARMERS FOR STARTED PULLETS, FEED AND SUPPLIES, OKLAHOMA, 1960[a]

Item	Unit	Price (Dollars)
22 Week Old Pullets[b]		
≤1500	Bird	2.28
>1500 ≤ 3000	Bird	2.05
>3000	Bird	1.71
Feed		
15% Protein - ≤2 ton[c]	Ton	86.00
>2 ton ≤6 ton[d]	Ton	77.40
>6 ton[e]	Ton	68.80
17% Protein[f] - ≤2 ton	Ton	88.00
>2 ton ≤6 ton	Ton	79.40
>6 ton	Ton	70.80
Oyster Shells		
≤10 Cwt.	Cwt.	1.35
>10 Cwt.	Cwt.	1.27
Grit[g]		
≤10 Cwt.	Cwt.	1.25
>10 Cwt.	Cwt.	1.20
Other		
Electricity	K. W.	.028
Item		
Litter Material	Bale	1.50
Veterinary - ≤3000	Bird	.03
>3000	Bird	.02
Egg Room Supplies - ≤3000	Bird	.03
>3000	Bird	.02
Miscellaneous - ≤3000	Bird	.03
≥3000	Bird	.02
Gas and Oil -	Bird	.02

[a]Based on best available estimates (schedules, price catalogs, poultry literature, U.S.D.A. Agricultural prices and previous research) except as stated otherwise.

[b]Gene Arthur Mathia, Management Practices and Problems of Commercial Egg Production on Oklahoma Farms, (unpub. M. S. Thesis, Oklahoma State University, 1960), Chapter IV, p. 54-70. Also interview data was used.

[c]Three year (57-59) average price.

[d]Ten percent discount from average price.

[e]Twenty percent discount from average price.

[f]Two dollars per ton added to the 15 percent protein feed price.

APPENDIX TABLE A-II

SCHEDULE OF PRICES PAID BY FLOOR SYSTEM PRODUCERS FOR FIXED ASSETS, OKLAHOMA, 1960[a]

Item	Unit	Price (Dollars)
Site[b]	Sq. Ft.	.02
Disposal Pit	-	50.00
House[c]	Sq. Ft.	.50
Water Well	Ft.	2.50
Feed Equipment		
Self-Feeder	25 Bird Capacity	2.92
Shell, Grit Feeder	250 Bird Capacity	2.92
Automatic Feeder		
Hopper & Motor (3/4 Hp.)	600 Lb. Capacity	316.00
Trough	Ft.	.60
Chain	Ft.	.56
Corner	Each	21.60
Leg (every ten feet)	Each	2.40
Time Clock	Each	30.40
Chain Tightener	Each	6.40
Feed Cleaner	Each	78.40
Bulk Tank and Auger		
6 Ton	Each	224.80
10 Ton	Each	256.00
Water Equipment		
Pump (1 Hp.)	Each	96.50
Pipe	Ft.	.16
Automatic Trough Waterer	Ft.	.48
Electrical Control Box	Each	24.00
Medicine Tank	50 Gallon Barrel	16.49
Heat Tape	Ft.	.20
Thermostat	Each	6.00
Egg Equipment		
Nest (metal)	Each	1.29
Collapsible Egg Basket	15 Dozen Capacity	4.03
Plastic Flat	Each	.54
Egg Gathering Track	Ft.	.38
Egg Carrier	Each	47.20
Track Wheels and Assembly	Each	19.60
Hanger Bolt (one per ten feet)	Each	.46
Other Equipment		
Truck, 1/2 Ton	Each	1,600.00
Manure Spreader, 100 Bu.	Each	515.00
2-Plow Tractor	Each	2,183.28
Misc. (shovels, forks, scoops, etc.)	-	100.00

[a]Based on best available estimates (schedules, price catalogs, poultry literature and previous research).

[b]Cost of land, clearing and leveling.

[c]House cost includes labor, electrical wiring, roosts, and dirt floor.

APPENDIX TABLE A-III

SCHEDULE OF PRICES PAID BY CAGE SYSTEM PRODUCERS FOR FIXED ASSETS, OKLAHOMA, 1960[a]

Item	Unit	Price (Dollars)
Housing (Processes C or D)[b]	Sq. Ft.	.67
Housing (Process E)[c]	Sq. Ft.	1.00
Site[d]	Sq. Ft.	.02
Water Well	Ft.	2.50
Equipment		
Cage[e]	8" x 18"	1.05
Cage[e]	24" x 18"	3.15
Automatic Feeder		
Hopper & Motor	600 Lb. Capacity	316.00
Trough	Ft.	.60
Chain	Ft.	.56
Legs	Each	2.40
Corner	Each	21.60
Chain Tightener	Each	6.40
Time Clock	Each	30.40
Egg Equipment		
Nest (metal)	Each	1.29
Collapsible Egg Basket	15 Doz. Capacity	4.03
Plastic Flat	Each	.54
Egg Cart	Each	44.00
Egg Gathering Track	Ft.	.38
Egg Carrier	Each	47.20
Track Wheels & Assembly	Each	19.60
Hanger & Bolt (one per ten feet)	Each	.46
Bulk Tank & Auger		
6 Ton	Each	224.80
10 Ton	Each	256.00
Water Equipment		
Pump	Each	96.50
Exterior Pipe	Ft.	.16
Automatic Trough Water	Ft.	.48
Electrical Box	Each	24.00
Medicine Tank	50 Gallon Barrel	16.49
Heat Tape	Ft.	.20
Thermostat	Each	6.00

APPENDIX TABLE A-III (Cont.)

Iten	Unit	Price (Dollars)
Roosting Equipment		
Slatted Roosts	Sq. Ft.	.42
Cleaner Blade	Each	86.40
Protable Motor	1 Hp.	316.00
Cable	Ft.	.32
Cable Drive Unit	Each	86.40
Other Equipment		
Feed Cart	Each	79.75
Self-Feeder	25 Bird Capacity	2.92
Truck, 1/2 Ton	Each	1,600.00
2-Plow Tractor	Each	2,183.28
Manure Spreader, 100 Bu.	Each	515.00
Misc. (shovel, scoop, forks, etc.)	-	100.00

[a]Based on best available estimates (schedules, price catalogs, poultry literature and previous research).

[b]House cost includes labor, electrical wiring, dirt floor, and cages installed.

[c]House cost includes labor, electrical wiring, fans, and dirt floor.

[d]Cost of land, clearing and leveling.

[e]A cage includes nest, waterer, and feeder.

APPENDIX TABLE A-IV

SCHEDULE OF PRICES PAID BY EGG PRODUCERS FOR EGG ROOM AND COOLER ROOM EQUIPMENT, OKLAHOMA, 1960[a]

Item	Unit	Price (Dollars)
Egg Room[b]	Sq. Ft.	2.10
Cooler Room	Sq. Ft.	2.00
Cooler Door	Each	112.00
Cooler Motor		
Size A (3/4 Ton)	Each	420.00
Size B (1 Ton)	Each	516.00
Water Heater	40 Gal.	102.50
Fan	Each	50.00
Egg Room Accessories	-	50.00
Egg Washer		
Size A (1/4 Hp.)	Each	200.00
Size B (1/3 Hp.)	Each	480.00

[a]Based on best available estimates (schedules, price catalogs, poultry literature, previous research).

[b]Egg room cost includes labor, electrical wiring, drainage, and concrete floor.

APPENDIX B

APPENDIX TABLE B-I

ESTIMATED CAPITAL INVESTMENT AND ANNUAL FIXED CHARGES FOR THE 1500 SIZE FLOCK WITH DIFFERENT PROCESSES OF PRODUCTION

Process[1]	Floor System				Cage System					
	A		B		C		D		E	
	Investment	Annual Cost[2]	Investment	Annual Cost[2]	Investment	Annual Cost[2]	Investment	Annual Cost[2]	Investment	Annual Cost[2]
Land and Buildings										
Site[a]	$ 72.00	$ 3.60	$ 72.00	$ 3.60	$ 85.50	$ 4.28	$ 78.00	$ 3.90	$	$
Water well[b]	250.00	12.50	250.00	12.50	250.00	12.50	250.00	12.50		3
Disposal pit	50.00	2.50	50.00	2.50	50.00	2.50	50.00	2.50		
Layer house[c]	1,600.00	221.33	1,600.00	221.33	2,596.25	359.14	2,345.00	324.40		
Egg room[d]	840.00	116.20	840.00	116.20	840.00	116.20	840.00	116.20		
Cooler room & door[e]	362.00	50.08	362.00	50.08	362.00	50.08	362.00	50.08		
Equipment										
Feed Equipment										
Cage(s)[f]	-	-	-	-	1,575.00	353.06	945.00	211.84		
Self-feeder(s)[g]	175.20	39.27	-	-	-	-	-	-		
Shell feeder(s)[h]	17.52	3.91	17.52	3.91	-	-	-	-		
Mechanical feeder[i]	-	-	840.80	188.48	-	-	-	-		
Bulk tank & auger (6 ton)	224.80	50.40	224.80	50.40	224.80	50.40	224.80	50.40		
Feed cart	-	-	-	-	79.75	17.89	79.75	17.89		
Water Equipment										
Pump	96.50	21.64	96.50	21.64	96.50	21.64	96.50	21.64		
Piping[j]	16.00	3.59	16.00	3.59	16.00	3.59	16.00	3.59		
Automatic trough waterer[k]	54.24	12.15	54.24	12.15	-	-	-	-		
Medicine tank	16.49	3.68	16.49	3.68	16.49	3.68	16.49	3.68		
Heat tape & thermostat	21.00	4.39	21.00	4.39	-	-	-	-		
Egg Gathering Equipment										
Nests (metal)[l]	387.00	86.75	387.00	86.75	-	-	-	-		
Collapsible egg basket[m]	44.33	9.93	44.33	9.93	44.33	9.93	44.33	9.93		
Plastic flats[m]	35.64	8.00	35.64	8.00	35.64	8.00	35.64	8.00		
Gatherer[n]	93.86	21.04	93.86	21.04	44.00	9.86	44.00	9.86		
Egg Room Equipment										
Cooler motor (3/4 ton)	420.00	94.15	420.00	94.15	420.00	94.15	420.00	94.15		
Water heater	102.50	22.98	102.50	22.98	102.50	22.98	102.50	22.98		
Egg washer	200.00	44.83	200.00	44.83	200.00	44.83	200.00	44.83		
Other (fan, roller cart)	50.00	11.21	50.00	11.21	50.00	11.21	50.00	11.21		
Roosting Equipment										
Slatted roosts	-	-	-	-	-	-	-	-		
Cleaning equipment	-	-	-	-	-	-	-	-		
Other										
Truck, 1/2 ton (1/4 poultry)	400.00	89.67	400.00	89.67	400.00	89.67	400.00	89.67		
Manure spreader, 100 bu. (1/2 poultry)	257.50	57.74	257.50	57.64	257.50	57.74	257.50	57.74		
2-plow tractor (1/8 poultry)	272.91	61.19	272.91	61.19	272.91	61.19	272.91	61.19		
TOTAL	6,059.49	1,052.73	6,725.09	1,201.94	7,969.17	1,404.52	7,130.42	1,228.18		
Per bird	4.04	.70	4.48	.80	5.31	.94	4.75	.82		

[1] Process A, Floor Hand Feeding; Process B, Floor Mechanical Feeding; Process C, Single Cage; Process D, Multiple Cage (5); Process E, Slatted Floor.

[2] Annual costs include depreciation, interest on average investment, taxes, insurance, repairs.

[3] Process E was not considered at this flock size, see footnote 1, Table III.

APPENDIX TABLE B-II

ESTIMATED CAPITAL INVESTMENT AND ANNUAL FIXED CHARGES FOR THE 3000 SIZE FLOCK WITH DIFFERENT PROCESSES OF PRODUCTION

Process[1]	Floor System				Cage System					
	A		B		C		D		E	
Land and Buildings	Investment	Annual Cost[2]	Investment	Annual Cost[2]	Investment	Annual Cost[2]	Investment	Annual Cost[2]	Investment	Annual Cost[2]
Site[a]	$ 132.00	$ 6.60	$ 132.00	$ 6.60	$ 159.00	$ 8.56	$ 144.00	$ 7.20	$ 72.00	$ 3.60
Water well[b]	250.00	12.50	250.00	12.50	250.00	12.50	250.00	12.50	250.00	12.50
Disposal pit	50.00	2.50	50.00	2.50	50.00	2.50	50.00	2.50	50.00	2.50
Layer house[c]	3,100.00	428.83	3,100.00	428.83	5,058.50	699.77	4,556.00	630.25	3,200.00	442.67
Egg room[d]	840.00	116.20	840.00	116.20	840.00	116.20	840.00	116.20	840.00	116.20
Cooler room & door[e]	362.00	50.08	362.00	50.08	362.00	50.08	362.00	50.08	362.00	50.08
Equipment										
Feed Equipment										
Cage(s)[f]	-	-	-	-	3,150.00	706.13	1,890.00	423.68	-	-
Self-feeder(s)[g]	350.40	78.54	-	-	-	-	-	-	-	-
Shell feeder(s)[h]	35.04	7.85	35.04	7.85	-	-	-	-	35.04	7.85
Mechanical feeder[i]	-	-	1,015.20	227.57	-	-	-	-	957.28	214.59
Bulk tank & auger (6 ton)	224.80	50.40	224.80	50.40	224.80	50.40	224.80	50.40	224.80	50.40
Feed cart	-	-	-	-	79.75	17.89	79.75	17.89	-	-
Water Equipment										
Pump	96.50	21.64	96.50	21.64	96.50	21.64	96.50	21.64	96.50	21.64
Piping[j]	16.00	3.59	16.00	3.59	16.00	3.59	16.00	3.59	16.00	3.59
~~Automatic trough waterer~~[k]	91.20	20.44	91.20	20.44	-	-	-	-	115.20	25.82
Medicine tank	16.49	3.68	16.49	3.68	16.49	3.68	16.49	3.68	16.49	3.68
Heat tape & thermostat	34.00	7.63	34.00	7.63	-	-	-	-	20.00	4.48
Egg Gathering Equipment										
Nests (metal)[l]	774.00	173.50	774.00	173.50	-	-	-	-	774.00	173.50
Collapsible egg basket[m]	88.66	19.86	88.66	19.86	88.66	19.86	88.66	19.86	88.66	19.86
Plastic flats[m]	71.28	16.00	71.28	16.00	71.28	16.00	71.28	16.00	71.28	16.00
Gatherer[n]	126.80	28.43	126.80	28.43	44.00	9.86	44.00	9.86	154.74	34.70
Egg Room Equipment										
Cooler motor (3/4 ton)	420.00	94.15	420.00	94.15	420.00	94.15	420.00	94.15	420.00	94.15
Water heater	102.50	22.98	102.50	22.98	102.50	22.98	102.50	22.98	102.50	22.98
Egg washer	480.00	107.60	480.00	107.60	480.00	107.60	480.00	107.60	480.00	107.60
Other (fan, roller cart	50.00	11.21	50.00	11.21	50.00	11.21	50.00	11.21	50.00	11.21
Roosting Equipment										
Slatted roosts	-	-	-	-	-	-	-	-	596.40	133.68
Cleaning equipment	-	-	-	-	-	-	-	-	620.64	139.14
Other										
Truck, 1/2 ton (1/4 poultry)	400.00	89.67	400.00	89.67	400.00	89.67	400.00	89.67	400.00	89.67
Manure spreader, 100 bu. (1/2 poultry)	257.50	57.74	257.50	57.74	257.50	57.74	257.50	57.74	257.50	57.74
2-plow tractor (1/8 poultry)	272.91	61.19	272.91	61.19	272.91	61.19	272.91	61.19	272.91	61.19
TOTAL	8,642.08	1,492.81	9,306.88	1,641.84	12,489.89	2,183.20	10,712.39	1,829.87	10,543.94	1,921.02
Per bird	2.88	.50	3.10	.55	4.16	.73	3.57	.61	3.51	.64

[1]Process A, Floor Hand Feeding; Process B, Floor Mechanical Feeding; Process C, Single Cage; Process D, Multiple Cage (5); Process E, Slatted Floor.

[2]Annual costs include depreciation, interest on average investment, taxes, insurance, repairs.

APPENDIX TABLE B-III

ESTIMATED CAPITAL INVESTMENT AND ANNUAL FIXED CHARGES FOR THE 6000 SIZE FLOCK WITH DIFFERENT PROCESSES OF PRODUCTION

	Floor System				Cage System					
	A		B		C		D		E	
Land and Buildings	Investment	Annual Cost[2]	Investment	Annual Cost[2]	Investment	Annual Cost[2]	Investment	Annual Cost[2]	Investment	Annual Cost[2]
Site[a]	$ 260.00	$ 13.00	$ 260.00	$ 13.00	$ 314.00	$ 15.70	$ 284.00	$ 14.20	$ 140.00	$ 7.00
Water well[b]	250.00	12.50	250.00	12.50	250.00	12.50	250.00	12.50	250.00	12.50
Disposal pit	50.00	2.50	50.00	2.50	50.00	2.50	50.00	2.50	50.00	2.50
Layer house[c]	6,200.00	857.66	6,200.00	857.66	10,117.00	1,399.54	9,112.00	1,260.50	6,400.00	885.33
Egg room[d]	1,260.00	177.45	1,260.00	177.45	1,260.00	177.45	1,260.00	177.45	1,260.00	177.45
Cooler room & door[e]	624.00	86.32	624.00	86.32	624.00	86.32	624.00	86.32	624.00	86.32
Equipment										
Feed Equipment										
Cage(s)[f]	-	-	-	-	6,300.00	1,412.26	3,780.00	847.36	-	-
Self-feeder(s)[g]	700.80	157.08	-	-	-	-	-	-	-	-
Shell feeder(s)[h]	70.08	15.70	70.08	-	-	-	-	-	70.08	15.70
Mechanical feeder[i]	-	-	1,537.80	344.73	-	-	-	-	1,379.60	309.27
Bulk tank & auger	449.60	100.80	256.00	57.39	899.20	201.57	899.20	201.57	-	-
Feed cart	-	-	-	-	158.50	35.78	158.50	35.78	224.80	50.40
Water Equipment										
Pump	96.50	21.64	96.50	21.64	96.50	21.64	96.50	21.64	96.50	21.64
Piping[j]	16.00	3.59	16.00	3.59	16.00	3.59	16.00	3.59	16.00	3.59
Automatic trough waterer[k]	182.40	40.88	182.40	40.88	-	-	-	-	182.40	13.88
Medicine tank	32.98	7.36	32.98	7.36	65.96	14.72	65.96	14.72	32.98	7.36
Heat tape & thermostat	68.00	15.24	68.00	15.24	-	-	-	-	68.00	15.24
Egg Gathering Equipment										
Nests (metal)[l]	1,548.00	347.00	1,548.00	347.00	-	-	-	-	1,548.00	347.00
Collapsible egg basket[m]	177.32	39.72	177.32	39.72	177.32	39.72	177.32	39.72	177.32	39.72
Plastic flats[m]	142.56	32.00	142.56	32.00	142.56	32.00	142.56	32.00	142.56	32.00
Gatherer[n]	194.60	43.63	194.60	43.63	88.00	19.72	88.00	19.72	200.16	44.86
Egg Room Equipment										
Cooler motor (1 ton)	516.00	115.67	516.00	115.67	516.00	115.67	516.00	115.67	516.00	115.67
Water heater	102.50	22.98	102.50	22.98	102.50	22.98	102.50	22.98	102.50	22.98
Egg washer	480.00	107.60	480.00	107.60	480.00	107.60	480.00	107.60	480.00	107.60
Other (fan, roller cart)	50.00	11.21	50.00	11.21	50.00	11.21	50.00	11.21	50.00	11.21
Roosting Equipment										
Slatted roosts	-	-	-	-	-	-	-	-	1,218.00	273.04
Cleaning equipment	-	-	-	-	-	-	-	-	840.80	188.48
Other										
Truck, 1/2 ton (1/2 poultry)	800.00	179.34	800.00	179.34	800.00	179.34	800.00	179.34	800.00	179.34
Manure spreader, 100 bu.	515.00	115.48	515.00	115.48	515.00	115.48	515.00	115.48	515.00	115.48
2-plow tractor (1/4 poultry)	545.82	122.38	545.82	122.38	545.82	122.38	545.82	122.38	545.82	122.38
TOTAL	15,332.16	2,648.73	15,975.66	2,777.27	23,568.36	4,149.67	20,013.36	3,444.23	17,930.52	3,207.94
Per bird	2.56	.44	2.66	.46	3.93	.69	3.34	.57	2.99	.53

[1]Process A, Floor Hand Feeding; Process B, Floor Mechanical Feeding; Process C, Single Cage; Process D, Multiple Cage (5); Process E, Slatted Floor.

[2]Annual costs include depreciation, interest on average investment, taxes, insurance, repairs.

APPENDIX TABLE B-IV

ESTIMATED CAPITAL INVESTMENT AND ANNUAL FIXED CHARGES FOR THE 12000 SIZE FLOCK WITH DIFFERENT PROCESSES OF PRODUCTION

	Floor System				Cage System					
	A		B		C		D		E	
Land and Buildings	Investment	Annual Cost[2]	Investment	Annual Cost[2]	Investment	Annual Cost[2]	Investment	Annual Cost[2]	Investment	Annual Cost[2]
Site[a]	$ 508.00	$ 25.40	$ 508.00	$ 25.40	$ 716.00	$ 35.80	$ 556.00	$ 27.80	$ 268.00	$ 13.30
Water well[b]	500.00	25.00	500.00	25.00	500.00	25.00	500.00	25.00	500.00	25.00
Disposal pit	100.00	5.00	100.00	5.00	100.00	5.00	100.00	5.00	100.00	10.00
Layer house[c]	12,400.00	1,715.32	12,400.00	1,715.32	20,234.00	2,799.08	18,224.00	2,521.00	12,800.00	1,770.00
Egg room[d]	1,260.00	177.45	1,260.00	177.45	1,260.00	177.45	1,260.00	177.45	1,260.00	177.45
Cooler room & door[e]	624.00	86.32	624.00	86.32	624.00	86.32	624.00	86.32	624.00	86.32
Equipment										
Feed Equipment										
Cage(s)[f]	-	-	-	-	12,600.00	2,824.52	7,560.00	1,694.72	-	-
Self-feeder(s)[g]	1,401.60	314.16	-	-	-	-	-	-	-	-
Shell feeder(s)[h]	140.16	31.40	140.16	31.40	-	-	-	-	140.16	31.40
Mechanical feeder[i]	-	-	3,075.60	689.46	-	-	-	-	2,759.20	618.54
Bulk tank & auger	899.20	201.57	512.00	114.78	1,798.40	403.14	1,798.40	403.14	449.60	100.80
Feed cart	-	-	-	-	317.00	71.56	317.00	71.56	-	-
Water Equipment										
Pump	193.00	43.28	193.00	43.28	193.00	43.28	193.00	43.28	193.00	43.28
Piping[j]	32.00	7.18	32.00	7.18	32.00	7.18	32.00	7.18	32.00	7.18
Automatic trough waterer[k]	344.80	77.30	344.80	77.30	-	-	-	-	364.80	27.76
Medicine tank	65.96	14.72	65.96	14.72	131.92	29.44	131.92	29.44	32.98	7.36
Heat tape & thermostat	138.00	30.94	138.00	30.94	-	-	-	-	138.00	30.94
Egg Gathering Equipment										
Nests (metal)[l]	3,096.00	694.00	3,096.00	694.00	-	-	-	-	3,096.00	694.00
Collapsible egg basket[m]	354.64	79.44	354.64	79.44	354.64	79.44	354.65	79.44	354.64	79.44
Plastic flats[m]	285.12	64.00	285.12	64.00	285.12	64.00	285.12	64.00	285.12	64.00
Gatherer[n]	389.20	87.34	389.20	87.34	176.00	39.44	176.00	39.44	347.96	78.00
Egg Room Equipment										
Cooler motor (1 ton)	516.00	115.67	516.00	115.67	516.00	115.67	516.00	115.67	516.00	115.67
Water heater	102.50	22.98	102.50	22.98	102.50	22.98	102.50	22.98	102.50	22.98
Egg washer	960.00	215.20	960.00	215.20	960.00	215.20	960.00	215.20	960.00	215.20
Other (fan, roller cart)	100.00	22.42	100.00	22.42	100.00	22.42	100.00	22.42	100.00	22.42
Roosting Equipment										
Slatted roosts	-	-	-	-	-	-	-	-	2,436.00	546.08
Cleaning equipment	-	-	-	-	-	-	-	-	1,365.60	376.96
Other										
Truck, 1/2 ton (1/2 poultry)	800.00	179.34	800.00	179.34	800.00	179.34	800.00	179.34	800.00	179.34
Manure spreader, 100 bu.	515.00	115.48	515.00	115.48	515.00	115.48	515.00	115.48	515.00	115.48
2-plow tractor (1/4 poultry)	545.82	122.38	545.82	122.38	545.82	122.38	545.82	122.38	545.82	122.38
TOTAL	26,271.00	4,473.29	27,557.80	4,761.80	42,861.40	7,484.12	35,651.40	6,068.24	31,086.38	5,581.95
Per bird	2.19	.37	2.30	.40	3.57	.62	2.97	.51	2.59	.47

[1]Process A, Floor Hand Feeding; Process B, Floor Mechanical Feeding; Process C, Single Cage; Process D, Multiple Cage (5); Process E, Slatted Floor.

[2]Annual costs include depreciation, interest on average investment, taxes, insurance, repairs.

Footnotes

[a]Site - Land, Cleaning and leveling of land for layer house(s), storage room(s) in the layer house(s) and the egg room are included in this cost figure. For the layer house(s), two square feet per bird for Processes A and B, 2.45 square feet for Process C, 2.2 square feet for Process D, and one square foot for Process E. For flock sizes of 1500 and 3000, 200 square feet of storage room space was assumed. For flock size 6000, 400 square feet of storage room was assumed, and for 12000 flock size, 800 square feet of storage room space was assumed. For flock size of 1500 and 3000 a 20 by 20 square foot egg room was assumed, and for flock sizes of 6000 and 12000 a 30 by 20 square foot egg room was assumed.

[b]Water well - A 100-foot water well for flock sizes of 1500, 3000, and 6000 was assumed. Two 100-foot wells were assumed for flock size of 12000.

[c]Layer house(s) square footage per bird explained in footnote a. Storage room construction is included in layer house(s) cost at the same cost rate per square foot.

[d]Dimensions of egg room are explained in footnote a above.

[e]As explained in the text, the cooler room is a partitioned part of the egg room. For flock sizes of 1500 and 3000, 125 square feet of cooler room was assumed. For flock sizes of 6000 and 12000, 200 square feet of cooler room was assumed.

[f]A complete cage includes waterer, feeder, and nest.

[g]Twenty-five birds per self-feeder was assumed, thus providing at least 2.4 linear inches of feeder space per bird.

[h]Two-hundred and fifty birds per shell and grit hopper was assumed.

[i]A minimum of 2.0 and a maximum of three linear inches of trough space was assumed per bird. For flock sizes of 1500 and 3000, one feed hopper and motor was used, and for flock sizes of 6000 and 12000, two feed hoppers and motors were used.

[j]Bulk tank size depended on method of production. By referring to Appendix A, it can easily be seen what size was used.

[k]Assumed 100 feet of piping from layer house to water well(s).

[l]A minimum of one linear inch of water trough space was assumed per bird.

[m]The ratio of one nest per five birds was assumed.

[n]The number of collapsible egg baskets and plastic flats needed was based on 65 percent of the number of hens started with a two-day supply assumed.

[o]Track length for the egg gatherer was equivalent to the length of the layer house(s) minus ten feet.

APPENDIX C

APPENDIX TABLE C-I

ESTIMATED OPERATING COSTS FOR SIZE 1500 WITH DIFFERENT PROCESSES OF PRODUCTION

	System				
	Floor		Cage		
Process	A	B	C	D	E
Pullet	$3,420.00	$3,420.00	$3,420.00	$3,420.00	1
Feed[a]	5,805.00	5,805.00	5,940.00	5,940.00	
Oyster shell[b]	36.45	36.45	36.45	36.45	
Grit[c]	16.88	16.88	16.88	16.88	
Other					
Electricity[d]	185.96	240.39	194.14	190.05	
Litter material[e]	60.00	60.00	-	-	
Veterinary	45.00	45.00	45.00	45.00	
Egg room supplies	45.00	45.00	45.00	45.00	
Gas and oil	30.00	30.00	30.00	30.00	
Miscellaneous	45.00	45.00	45.00	45.00	
Sub-Total	9,689.29	9,743.72	9,772.47	9,768.38	
Interest[f]	85.50	85.50	85.50	85.50	
Total	9,774.79	9,829.22	9,857.97	9,853.88	

[1]See footnote 1, Table III.

APPENDIX TABLE C-II

ANNUAL OPERATING COSTS FOR SIZE 3000 WITH DIFFERENT PROCESSES OF PRODUCTION

	System				
	Floor		Cage		
Process	A	B	C	D	E
Pullet Replacement	$ 6,150.00	$ 6,150.00	$ 6,150.00	$ 6,150.00	$ 6,150.00
Feed[a]	10,449.00	10,449.00	10,719.00	10,719.00	10,719.00
Oyster shell[b]	72.90	72.90	72.90	72.90	72.90
Grit[c]	33.76	33.76	33.76	33.76	33.76
Other					
Electricity[d]	239.60	294.00	253.90	247.77	212.54
Litter material[e]	120.00	120.00	-	-	-
Veterinary	90.00	90.00	90.00	90.00	90.00
Egg room supplies	90.00	90.00	90.00	90.00	90.00
Gas and oil	60.00	60.00	60.00	60.00	60.00
Miscellaneous	90.00	90.00	90.00	90.00	90.00
Sub-Total	17,395.26	17,449.66	17,559.56	17,553.43	17,518.20
Interest[f]	153.75	153.75	153.75	153.75	153.75
Total	17,549.01	17,603.41	17,713.31	17,707.18	17,671.95

APPENDIX TABLE C-III

ANNUAL OPERATING COSTS FOR SIZE 6000 WITH DIFFERENT PROCESSES OF PRODUCTION

	System				
	Floor		Cage		
Process	A	B	C	D	E
Pullet Replacement	$10,260.00	$10,260.00	$10,260.00	$10,260.00	$10,260.00
Feed[a]	18,576.00	18,576.00	19,116.00	19,116.00	19,116.00
Oyster shell[b]	137.16	137.16	137.16	137.16	137.16
Grit[c]	64.80	64.80	64.80	64.80	64.80
Other					
Electricity[d]	346.37	400.82	374.99	358.64	347.15
Litter material[e]	240.00	240.00	-	-	-
Veterinary	120.00	120.00	120.00	120.00	120.00
Egg room supplies	120.00	120.00	120.00	120.00	120.00
Gas and oil	120.00	120.00	120.00	120.00	120.00
Miscellaneous	120.00	120.00	120.00	120.00	120.00
Sub-Total	30,104.33	30,158.78	30,432.95	30,416.60	30,405.11
Interest[f]	256.50	256.50	256.50	256.50	256.50
Total	30,360.83	30,415.28	30,689.45	30,673.10	30,661.61

APPENDIX TABLE C-IV

ANNUAL OPERATING COSTS FOR SIZE 12000 WITH DIFFERENT PROCESSES OF PRODUCTION

	System				
	Floor		Cage		
Process	A	B	C	D	E
Pullet Replacement	$20,520.00	$20,520.00	$20,520.00	$20,520.00	$20,520.00
Feed[a]	37,150.00	37,150.00	38,232.00	38,232.00	38,232.00
Oyster shell[b]	274.32	274.32	274.32	274.32	274.32
Grit[c]	129.60	129.60	129.60	129.60	129.60
Other					
Electricity[d]	522.65	631.51	577.84	547.18	520.42
Litter material[e]	480.00	480.00	-	-	-
Veterinary	240.00	240.00	240.00	240.00	240.00
Egg room supplies	240.00	240.00	240.00	240.00	240.00
Gas and oil	240.00	240.00	240.00	240.00	240.00
Miscellaneous	240.00	240.00	240.00	240.00	240.00
Sub-Total	60,036.57	60,145.43	60,693.76	60,663.10	60,636.34
Interest[f]	513.00	513.00	513.00	513.00	513.00
Total	60,549.57	60,658.43	61,206.76	61,176.10	61,149.34

Footnotes

[a]Feed consumption was based on the following assumptions - 52 weeks of production, 20 dozen eggs per layer, 4.5 pounds of feed per dozen eggs produced.

[b]Oyster shell consumption was assumed to be 150 pounds per thousand layers per month.

[c]Grit consumption was assumed to be 75 pounds per thousand per month.

[d]Consumption of electricity for the various electrical devices was based on the following formulas:

$$(\text{Motor Rating in Watts})\left(\frac{1}{1000}\right)(\text{Hours in Use}) = \text{Kilowatt Hours.}$$

Motor ratings are as follows:

Motor Size	Watts Used Per Hour
1/4	700
1/3	850
1/2	1000
3/4	1350
1	1500
1 1/2	2500
100 watt bulb	100

Electricity consumption by items were as follows:

Item	Use Per Day in Hours	Killowatt Hours per Yr.
Mechanical feeder (3/4 hp.)	4	1944.00
100 watt bulb per 200 sq. ft.	2	73.00
Cooler (3/4 hp.)	6	2956.50
Cooler (1 hp.)	6	3285.00
Washer (1/4 hp.)	1	255.50
Washer (1/3 hp.)	2	620.50
Pump (1 hp.)	4	2190.00
Pump (1 hp.)	6	3285.00
Pump (1 hp.)	8	4380.00
Manure cleaner (1 hp.)	1/4	138.70
Manure cleaner (1 hp.)	1/2	273.75
Other (heating tape, water trough, etc.)		
Size - 1500	-	400.00
3000	-	600.00

6000	-	800
12000	-	1000

[e]One bale for 75 square feet of floor space was assumed as sufficient.

[f]A five percent charge on 1/2 of the pullet cost was assumed to be sufficient to cover this cost.

APPENDIX D

APPENDIX TABLE D-I

LABOR REQUIREMENTS FOR PROCESS "A" FOR THE VARIOUS FLOCK SIZES

Item	Size of Flock			
	1500	3000	6000	12000
	- Hours -			
Watering[a]	.25	.42	.58	.75
Feeding[b]	1.00	1.80	3.00	5.00
Collecting eggs[c]	1.25	2.25	4.25	7.50
Washing eggs[d]	1.00	1.60	2.93	4.76
Other[e]	.25	.50	1.00	1.50
Total per day	3.75	6.57	11.76	19.51
Man hours for above Items, per year	1,369	2,398	4,292	7,121
Manure clean out, per year	60	120	220	400
Total man hours, per year	1,429	2,518	4,512	7,521

[a]Checking and cleaning waterers; add ten minutes each size increase.

[b]One hour base time for 1500; each size is multiple of this base minus 10, 25, and 37.5 percent respectively.

[c]One and one-fourth hour base time for 1500, each size is multiple of this base minus 10, 15, 30 percent respectively.

[d]Size 1500, 12 minutes per case washing time; 10 minutes per case packing time; other flock sizes' time, 6 minutes per case washing time; 10 minutes packing time. Two washers for flock size 12000.

[e]General overseeing, record keeping, dead bird disposal, management, etc.

APPENDIX TABLE D-II

LABOR REQUIREMENTS FOR PROCESS "B" FOR THE VARIOUS FLOCK SIZES

Item	Size of Flock			
	1500	3000	6000	12000
	- Hours -			
Watering[a]	.25	.42	.58	.75
Feeding[b]	.17	.17	.50	.50
Collecting eggs[c]	1.25	2.25	4.25	7.00
Washing eggs[d]	1.00	1.60	2.93	4.76
Other[e]	.25	.50	1.00	1.50
Total, per day	2.92	4.94	9.26	14.51
Man hours for above items, per year	1,066	1,803	3,380	5,296
Manure clean out, per year	60	120	220	400
Total man hours, per year	1,126	1,923	3,600	5,696

[a]Checking and cleaning waterers; add ten minutes each size increase.

[b]Estimated.

[c]One and one-fourth hour base time for 1500; each size is miltiple of this base minus 10, 15, 30 percent respectively.

[d]Size 1500, 12 minutes per case washing time, 10 minutes per case packing time; other flock sizes' time, 6 minutes per case washing time, 10 minutes packing time. Two washers for flock size 12000.

[e]General overseeing, record keeping, dead bird disposal, management, etc.

APPENDIX TABLE D-III

LABOR REQUIREMENTS FOR PROCESS "C" FOR THE VARIOUS FLOCK SIZES

Item	Size of Flock			
	1500	3000	6000	12000
	- Hours -			
Watering[a]	.25	.42	.58	.75
Feeding[b]	1.00	1.80	3.00	5.00
Collecting eggs[c]	1.25	2.25	3.75	6.25
Washing eggs[d]	1.00	1.60	2.93	4.76
Other[e]	.25	.50	1.00	1.50
Total, per day	3.75	6.57	11.26	18.26
Man hours for above items, per year	1,369	2,398	4,110	6,665
Manure clean out, per year	54	94	187	364
Total man hours, per year	1,422	2,492	4,297	7,029

[a] Checking and turning waterer on and off, each size increase adds 10 minutes.

[b] One hour is base time for 1500; each size is a multiple of this base minus 10 percent for size 3000 and 25 percent cut for 6000 and 37.5 percent for 12000.

[c] One and one-fourth hour is base time for 1500; each size is a multiple of this, minus 10 percent for size 3000; 25 percent for 6000 and 37.5 percent for 12000.

[d] For size 1500, 12 minuted washing time per case and 10 minutes packing time. For other sizes, six minutes washing time per case and 10 minutes packing time per case. Two washers for flock size 12000.

[e] General overseeing, record keeping, dead bird disposal, management, etc.

APPENDIX TABLE D-IV

LABOR REQUIREMENTS FOR PROCESS "D" FOR THE VARIOUS FLOCK SIZES

Item	Size of Flock			
	1500	3000	6000	12000
	- Hours -			
Watering[a]	.25	.42	.58	.75
Feeding[b]	.75	1.35	2.40	4.50
Collecting eggs[c]	1.00	1.80	3.20	6.00
Washing eggs[d]	1.00	1.60	2.93	4.76
Other[e]	.25	.50	1.00	1.50
Total, per day	3.25	5.67	10.11	17.51
Man hours for above items, per year	1,186	2,069	3,690	6,391
Manure clean out, per year	54	94	187	364
Total man hours, per year	1,240	2,163	3,877	6,755

[a] Checking and cleaning waterers; add ten minutes each size increase.

[b] Three-fourths hour base time for 1500 size flock; each size increase is the multiple, minus 10, 20, 25 percent respectively.

[c] One hour base time for 1500 size flock; each size increase is the multiple minus 10, 20, 25 percent respectively.

[d] Size 1500, 12 minutes per case washing time; 10 minutes per case packing time; other flock sizes' time, 6 minutes per case washing time; 10 minutes packing time. Two washers for flock size 12000.

[e] General overseeing, record keeping, dead bird disposal, management etc.

APPENDIX TABLE D-V

LABOR REQUIREMENTS FOR PROCESS "E" FOR THE VARIOUS FLOCK SIZES

Item	Size of Flock			
	1500	3000	6000	12000
		- Hours -		
Watering[a]	1	.42	.58	.75
Feeding[b]		.17	.17	.50
Collecting eggs[c]		1.50	2.50	5.00
Washing eggs[d]		1.60	2.93	4.76
Other[e]		.25	.50	1.00
Total per day		3.94	6.68	12.01
Man hours for above items, per year		1,438.10	2,438.20	4,380.00
Manure clean out, per year		91.25	182.50	274.00
Total man hours, per year		1,529.35	2,620.00	4,654.00

[a]Checking and cleaning waterers; add ten minutes each size increase.

[b]Estimated.

[c]Estimated.

[d]Size 1500, 12 minutes per case washing time, 10 minutes per case packing time; other flock sizes' time, 6 minutes per case washing time, 10 minutes packing time. Two washers for flock size 12000.

[e]General overseeing record keeping, dead bird disposal, management, etc.

[1]See footnote 1, Table III.

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