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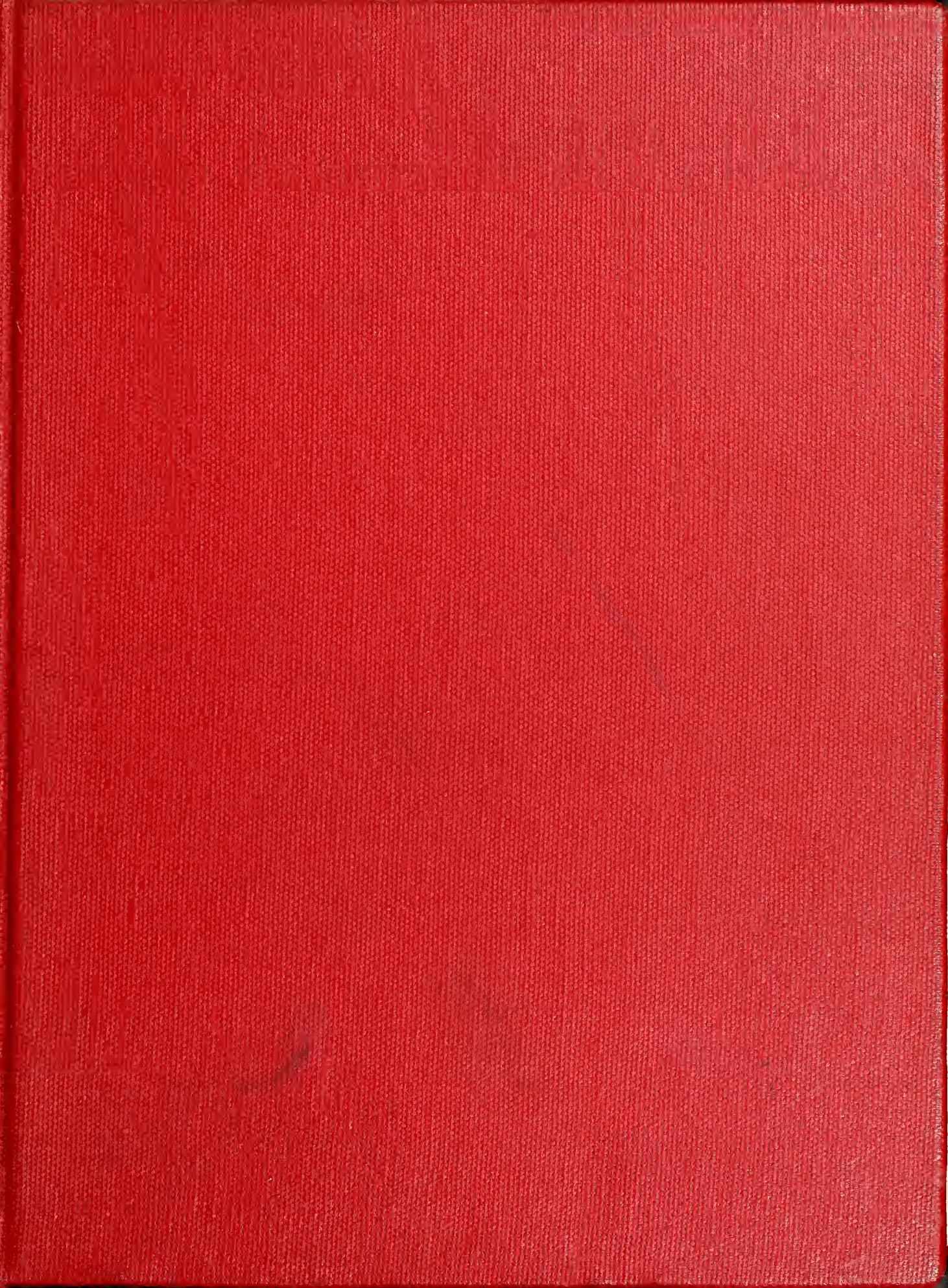
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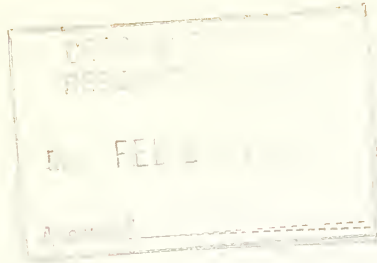


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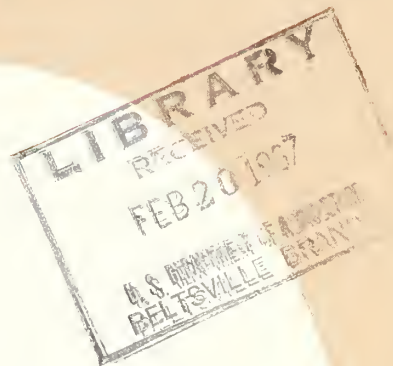
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# 782



# ***COSTS AND ECONOMIES OF SCALE IN EGG-TYPE CHICK HATCHERIES***



MARKETING RESEARCH REPORT NO. 782  
U.S. DEPARTMENT OF AGRICULTURE  
ECONOMIC RESEARCH SERVICE



## PREFACE

This report, based upon a survey of egg-type chick hatcheries located in 10 commercial egg-producing States, presents cost information and measures the economies of scale in egg-type chick hatcheries.

This is the fifth and final bulletin resulting from a study initiated in 1959 by the Department of Agriculture--the first comprehensive study of the hatchery industry in over 20 years. The first report, "The Hatchery Industry--Structure--Economic Changes--Problems" (U.S. Dept. Agr. Mktg. Res. Rpt. 483), based on a nationwide survey, described the industry and pointed out some of the problems confronting hatchery managers. The second report, "Economies to Size in Hatching Chicks" (N. C. State Col. Agr. Econ. Inf. Ser. 96), based on a survey of North Carolina broiler hatcheries, analyzed the costs, efficiencies, and economies of scale of various sized hatcheries. The third report, "Marketing New England Poultry. 6. Economies of Scale in Hatching and Cost of Distributing Broiler Chicks" (N. H. Agr. Expt. Sta. Bul. 483), based on a survey of New England firms, covered both the economies of scale in hatching and the costs of distributing broiler chicks. The fourth report, "Economies of Scale in Turkey Hatcheries" (U.S. Dept. Agr. Mktg. Res. Rpt. 719), was concerned with the costs of a sample of turkey hatcheries and the economies of scale in poult hatchery operations.

The author wishes to thank Earl H. Rinear, formerly agricultural economist, Economic Research Service, for his assistance in collecting the data and developing the initial stages of analysis. Without the cooperation and contribution of data by chick hatcheries, equipment manufacturers, and supply companies, the report could not have been written.

February 1967



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## SUMMARY

The major factors that affect the cost of hatching egg-type chicks are labor and managerial efficiency, utilization of capacity, hatchability of the eggs, distribution of fixed and utility costs over other agricultural enterprises, size of operations, age and condition of hatchery building and equipment, depreciation allowances, wage rates, and discounts on purchases of supplies and services.

During 1962, the in-plant costs for 24 egg-type chick hatcheries analyzed ranged from 9.11 to 25.86 cents per salable pullet. These costs include sexing, some debeaking, decombing, and dewinging.

Wages and salaries of in-plant labor in the hatcheries studied represent 64 percent of the cost of each salable pullet hatched. Labor, as a proportion of total cost of hatching a salable pullet, varied extensively between size groups of hatcheries (59 to 77 percent).

Over 80 percent of the hatcheries surveyed operated at less than 30 percent of their potential annual capacity. The range in use of annual capacity was from 4.1 to 64.1 percent. Only 9 of the 27 hatcheries surveyed operated 12 months a year. Of the 23 firms furnishing monthly volume information, at least 20 operated their incubators during the peak hatch season of February through May, with all 23 running their machines in March and April. Only nine hatcheries utilized their facilities during July and October. Only four hatcheries were not operated in conjunction with some other agricultural business.

Six model chick hatcheries were synthesized from this study. In the model hatcheries, the cost per salable pullet hatched ranged from 4.79 to 23.02 cents, depending on hatchery size, percentage of capacity utilized, and length of hatching season.

Each model hatchery was analyzed when operating at 100, 80, 60, 40, and 20 percent of capacity. The six models (A-F), when operating at 100 percent of annual capacity, set just under 1, 2, 3, 4, 7, and 10 million eggs a year, and salable pullets represented about 40 percent of all eggs set. As the size of hatchery increased, the cost per salable pullet hatched at 100 percent of capacity decreased from 5.90 cents in model A to 4.79 cents in model F. At 20 percent of annual capacity, the cost per salable pullet was 12.17 cents in model A and 9.90 cents in model F.

To more nearly conform to present operating practices, the output of the model hatcheries was reduced to the number of salable pullets that could be hatched in a 22-week season. Since fixed investment does not change with the reduction in output, the total cost per pullet available for sale increased. In model A, at 100 percent of 22-week capacity or about 36 percent of annual capacity, the cost per salable pullet was 8.64 cents and in model F, 6.72 cents. At 40 percent of 22-week hatching capacity, or about 15 percent of annual capacity, costs per salable pullet were 14.19 cents and 11.37 cents, respectively.

Most of the economies gained from increasing the capacity of an egg-type chick hatchery are achieved when about 3 million eggs are set a year. This is the annual capacity of the incubating units of the model C hatchery. Labor efficiency and productivity increased from model A to E, but beyond model C the rate of increase became smaller. While there were decreases in fixed and variable costs in model plants larger than model C, the total difference was only 0.38 cent per salable pullet between model C and F.

Since this study dealt only with in-hatchery costs, it should not be used by itself to determine optimum hatchery size. Egg-assembly and pullet-distribution costs, which can modify total operating costs, are also needed to determine optimum hatchery size.

# COSTS AND ECONOMIES OF SCALE IN EGG-TYPE CHICK HATCHERIES

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## INTRODUCTION

The objective of this study is to provide hatchery managers and owners with in-plant efficiency and cost information on egg-type chick hatcheries. Hatchery managers can use this report to compare their in-plant costs and operations with those in the study and those synthesized in the models. Three major areas for comparison are (1) utilization of incubator capacities, (2) scheduling of work crews, and (3) use of laborsaving and cost-reducing equipment. Hatcheries may be able to reduce in-plant costs and increase their efficiency of operation by utilizing some of the methods used in the six model hatcheries.

### Background

A nationwide survey of the hatchery industry in 1959 indicated that the industry was changing rapidly (26). 1/ Since that time, both the number of firms and the incubator capacities have decreased steadily. On January 1, 1961, there were 3,513 chick hatcheries (broiler and egg-type) in the United States. These firms had a total incubator capacity of 508,500,000 eggs. Four years later, on January 1, 1965, there were only 2,365 chick hatcheries with an incubator capacity of 471,318,000 eggs (31). All size groups of hatcheries have decreased in number except the largest--those with an incubator capacity of 500,000 eggs or more. The continuing movement to fewer and larger hatcheries suggests that economies of scale exist, that is, that costs per unit of output decrease as size of hatchery increases. Small or inefficient hatcheries are experiencing greater difficulty in remaining competitive. Decreases in the number of farms that raise chickens and eggs, shifts in regional output of broilers and eggs, and increases in the size of the remaining flocks are also contributing to the difficulties of many small hatcheries.

### Procedure

Part I of this report deals with the cost of hatching egg-type chicks, use of available incubator capacities by hatcheries, utilization of labor, and efficient scheduling of operations in the hatcheries surveyed. Part II deals with the potential economies of scale in hatchery operation. In part I, capacity refers to the total annual egg capacity of the combined hatcher and incubating units owned or operated by a hatchery. In part II, capacity refers to the total annual egg capacity of the incubating units owned or operated by a hatchery. Chicks refer to egg-type chicks and hatcheries refer to egg-type chick hatcheries in both parts of this report.

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1/ Underscored numbers in parentheses refer to items in the Selected Bibliography, p. 31



The egg-type chick hatcheries listed in "Hatcheries and Dealers Participating in the National Poultry Improvement Plan" (32), were stratified into six size categories based upon rated egg capacity. A random sample was drawn from each stratum. During 1962-63, data pertaining to in-plant operating costs in the sample plants were obtained by personal interviews with hatchery owners and managers.

The hatcheries surveyed varied in combined incubator and hatcher capacity from less than 260,000 to more than 9 million eggs a year. The hatcheries were located in Minnesota, Iowa, California, Pennsylvania, New Jersey, New York, Georgia, Illinois, Kansas, and Virginia. Some information was furnished by 32 firms on business operations performed, plant layout, types and cost of equipment and buildings, crew organization, chick services performed, seasonality of hatch, and the number of eggs set and chicks hatched. Of these 32 firms, 24 furnished specific data on in-plant operating costs for the most recent accounting year. These data were used for analyzing the current in-hatchery short-run costs as reported in part I of this study.

The synthetic method of determining economies of scale was used in part II. The physical input-output relationships were determined for each portion of the chick-hatching process. These input-output relationships, in conjunction with prices, provided the foundation upon which model plants were developed.

The model hatcheries represent the optimum combinations of resources possible from the information available. Short-run cost curves were developed for the six model hatcheries. An economies-of-scale curve was derived by drawing a curve tangent to the short-run cost curves of each model hatchery. This long-run cost curve, or economies-of-scale curve, shows the level of costs that can be expected from hatcheries of various sizes when they are operated as efficiently as possible within the limits of present knowledge and under given conditions.

## PART I. COSTS AND EFFICIENCY IN ACTUAL HATCHERIES

Most of the hatcheries surveyed were franchised by primary breeders, but were independently owned. Records kept by the hatcheries surveyed varied considerably, with the franchised hatcheries generally having the most complete sets. Many of the recordkeeping systems did not provide management with all of the information that could be used in decision making.

Only 4 of the 32 firms operated a hatchery as their sole business. The other 28, including 2 of the 3 largest, had other agricultural enterprises. The most typical combination of activities was with a supplies, feed, remedies, and equipment sales-and-service function. Other hatchery owners ran general farms, had breeding flocks, produced market eggs and starter pullets, operated commercial egg sit-in stations, and handled poultry and eggs.

Such combinations allow management to spread supervisory, office, utility, and fixed costs over a larger operation. Another reason for such combined operations is that egg-type chicks are hatched on a seasonal basis in most

hatcheries, which does not allow for maximum use of labor and fixed cost items. Either the labor force is idle a good part of the year, or the hatchery has to operate with seasonal labor, which generally is not as efficient.

### Costs by Size Group

In-hatchery costs varied widely among hatcheries. The cost per egg set ranged from 4.02 to 10.55 cents. The cost for each salable pullet hatched ranged from 9.11 to 25.86 cents.

Variations in average costs per unit of output are due to differences in (1) size of hatchery; (2) rate of utilization of capacity; (3) hatchability of eggs; (4) labor efficiency; (5) size of depreciation charges assessed against the buildings and equipment; and (6) levels of wages, salaries, utility rates, supply prices, and service charges.

In tables 1 and 2, costs obtained in the survey are grouped by annual egg capacity and by the number of units actually produced per year. Whether firms are grouped by egg capacity or by number of units produced, average cost per egg set, or per salable pullet chick hatched, tends to decline as size of hatchery or annual output increases, despite considerable variation within size groups.

Variations in types of expenses by size of hatchery (as measured by egg capacity) are shown in table 3. For 24 hatcheries providing such information, wages and salaries for all in-plant operations (including supervisory, managerial, and office, but excluding sales), represented 64 percent of the cost of each salable pullet hatched. Labor as a percentage of the total cost of hatching a salable pullet varied considerably, from 59 to 77 percent, between size groups. Actual costs for labor per salable pullet hatched varied from an average of 7.32 cents in the hatcheries with the largest egg capacity to an average of 14.63 cents in the hatcheries in the next to the smallest size group. These labor costs include some service work performed by the employees of each hatchery, or the work was completed by a service specialist. The services performed averaged as follows: 100 percent of all chicks hatched were sexed, 30 percent of the pullets were dewinged, and 35 percent of the pullets were debeaked and decomed. Fixed overhead costs were the next largest expense for most hatcheries. These costs, for all hatcheries combined, averaged about 18 percent of total operating costs.

### Costs of Least-Cost Hatchery in Each Group

In addition to showing average costs per salable pullet in hatcheries in each size group, table 3 also shows costs per unit in the least-cost hatchery in each size group.

The minimum-cost hatchery in the smallest size groups hatched less than 25,000 salable pullets in 1962. This firm operated only 3 months during the year and utilized only 10.3 percent of its combined capacity. This firm's fixed overhead cost per salable pullet was the highest of the five minimum-cost hatcheries.

Table 1.--Egg-type chick hatcheries: In-hatchery costs per egg set and salable pullet hatched, 24 firms grouped by annual egg capacity, 1962

Annual capacity <u>1/</u> (million eggs)	Cost per egg set			Cost per salable pullet chick		
	Range	Simple average	Weighted average <u>2/</u>	Range	Simple average	Weighted average <u>2/</u>
	----- Cents -----					
Under 0.5 ...	6.49 - 7.97	7.29	7.07	15.80 - 20.33	17.97	17.25
0.5 to 0.9 ...	4.58 - 10.55	7.24	7.50	11.00 - 25.86	18.25	18.82
1.0 to 1.9 ...	4.02 - 10.07	6.46	6.22	9.11 - 24.47	16.07	15.38
2.0 to 3.9 ...	5.37 - 8.98	7.11	6.32	12.63 - 21.63	17.16	15.55
4.0 to 10.0 ...	4.31 - 5.23	4.68	4.72	10.40 - 13.33	12.09	12.40

1/ Annual capacity equals total egg capacity of the hatching and incubating units set 15 times in a 12-month period.

2/ Weighted by volume of eggs set.

3/ Weighted by volume of salable pullet chicks hatched.

Table 2.--Egg-type chick hatcheries: In-hatchery costs per egg set and salable pullet hatched, 24 firms grouped by salable pullets hatched, 1962

Salable pullets hatched per year	Cost per egg set			Cost per salable pullet chick		
	Range	Simple average	Weighted average <u>1/</u>	Range	Simple average	Weighted average <u>2/</u>
	----- Cents -----					
Under 25,000 .....	6.22 - 10.55	7.73	7.68	15.80 - 25.86	19.13	18.90
25,001 to 75,000 ...	4.58 - 10.07	7.29	7.35	11.00 - 24.47	18.36	18.54
75,001 to 150,000 ..	5.08 - 9.11	7.28	7.33	12.97 - 22.16	18.03	18.22
150,001 to 225,000 :	4.02 - 7.04	5.36	5.45	9.11 - 16.26	12.79	12.94
225,001 to 500,000 :	5.37 - 7.26	6.28	6.26	12.63 - 19.08	15.37	15.16
Over 500,000 .....	4.31 - 6.22	5.07	5.04	10.40 - 15.78	13.01	13.23

1/ Weighted by volume of eggs set.

2/ Weighted by volume of salable pullet chicks hatched.

Table 3.--Egg-type chick hatcheries: Costs per salable pullet hatched, by cost components, 24 firms grouped by annual egg capacity, 1962

Cost components	Annual capacity (million eggs) <sup>1/</sup>					
	Under 0.5	0.5 to 0.9	1.0 to 1.9	2.0 to 3.9	4.0 to 10.0	All hatcheries
	<u>Weighted average cost per size group</u>					
	----- Cents -----					
Wages & salaries <sup>2/</sup> ..	12.19	14.63	9.55	11.00	7.32	9.05
Packaging, supplies, & miscellaneous <sup>3/</sup> ..	0.94	1.05	1.08	1.46	1.50	1.39
Utilities .....	1.79	1.62	1.95	0.91	0.94	1.15
Fixed overhead <sup>4/</sup> .....	2.33	1.52	2.80	2.18	2.64	2.50
Total cost .....	17.25	18.82	15.38	15.55	12.40	14.09
	<u>Average cost for minimum-cost hatchery</u>					
Wages & salaries <sup>2/</sup> ..	9.65	7.50	6.90	8.18	6.04	---
Packaging, supplies, & miscellaneous <sup>3/</sup> ..	0.79	1.49	0.29	1.39	0.62	---
Utilities .....	0.96	1.94	0.72	0.99	0.85	---
Fixed overhead <sup>4/</sup> .....	4.40	0.07	1.20	2.07	2.89	---
Total cost .....	15.80	11.00	9.11	12.63	10.40	---
	<u>Performance of minimum-cost hatchery</u>					
Months of operation ..	3	3	12	5	12	
Percent of annual capacity utilized ...	10.3	12.0	32.0	20.2	18.6	
Percent hatchability ..	84.0	85.0	89.3	86.8	88.3	

<sup>1/</sup> Annual capacity equals total egg capacity of the hatching and incubating units set 15 times in a 12-month period.

<sup>2/</sup> Includes hatchery labor for receiving eggs, candling, traying, and setting; assembling of chick boxes; transferring eggs from incubator to hatcher; taking off hatch; grading, counting, and boxing chicks; sexing chicks; debeaking, decombing, and dewinging an average of 30 percent of salable pullets; loading out pullets; cleanup; maintenance; supervisory, office, and managerial personnel; and fringe benefits.

<sup>3/</sup> Includes all hatchery and office supplies, management travel, dues, contributions, and advertising.

<sup>4/</sup> Includes repairs and maintenance, rent, depreciation, interest, taxes, and insurance.



The minimum-cost hatchery in the second smallest size group had very low fixed overhead costs per salable pullet. This firm was operating in an old building and with old incubating and hatching equipment, and did not have insurance and interest payments on its capital investment.

The two hatcheries with the lowest cost per salable pullet hatched operated 12 months a year. The firm with the lowest cost per salable pullet, 9.11 cents, operated at 32 percent of its capacity in a compact well-organized building with an average hatchability of 89.3 percent, the highest of the hatcheries surveyed (appendix A, table 22).

### Utilization of Capacity

In 1962, over 80 percent of the hatcheries surveyed operated at less than 30 percent of capacity and nearly 60 percent of the hatcheries operated at less than 20 percent of capacity (table 4). Costs can be reduced by greater utilization of capacity, specifically, reductions can be made in fixed overhead unit costs such as depreciation, taxes, rent, interest, and insurance.

The larger of the 27 hatcheries operated more months of the year than the smaller ones. The average annual capacity of the nine hatcheries operating 12 months a year was 5.11 million eggs, whereas the seven hatcheries operating 4 and 5 months a year had an average capacity of 1.47 million eggs (table 5). The firms that operated 8 months or more a year generally utilized their capacity to a greater extent than the others. Greater use of available capacity gives a firm a better chance to operate at a lower cost per unit.

All of the 23 hatcheries that furnished monthly set and hatch data were operating during March and April. Between February and May, a 4-month period, 20 or more of the hatcheries were hatching chicks (table 6). During these peak months of demand for baby pullets, none of the hatcheries were operating at 100 percent of potential monthly capacity; however, a few were utilizing over 90 percent. Most of the hatcheries do not operate during the last 5 months of the year--the period of lowest demand for chicks.

### Utilization of Labor

Labor is the largest cost item in a chick hatchery, representing 64 percent of the total in-plant costs in the firms surveyed.

Labor efficiency can be measured by comparing the number of eggs set and the corresponding salable pullets hatched per man-hour of all in-hatchery labor. The number of eggs set per man-hour in all the hatcheries ranged from 37 to 265; the number of salable pullets hatched per man-hour varied from 16 to 115 (table 7). The smaller hatcheries--those setting less than 5,000 eggs a week--had the lowest average number of eggs set per man-hour. The average number of salable pullets hatched per man-hour increased as the number of eggs set each week increased, except in the largest group. The average number of eggs set per man-hour increased as the total number of eggs set each week increased. However, by both measurements, the efficiency of labor varied

Table 4.--Egg-type chick hatcheries: Percentage of annual capacity utilized, 27 firms, 1962 1/

Percent of annual capacity utilized	Percent of firms
0 - 9.9 . . . . .	18
10 - 19.9 . . . . .	41
20 - 29.9 . . . . .	26
30 - 39.9 . . . . .	11
40.0 or more . . . . .	4
Total . . . . .	100

1/ Annual capacity equals total egg capacity of the hatching and incubating units set 15 times in a 12-month period.

Table 5.--Egg-type chick hatcheries: Months of operation and use of available annual capacity, 27 firms, 1962

Months of operation	Hatcheries	Use of available capacity		Average annual capacity <u>1/</u>
		Range	Average	
	Number	Percent	Percent	Million eggs
12 . . . . .	9	15.6 - 64.1	30.4	5.11
8 - 10 . . . . .	3	11.9 - 35.8	24.9	1.50
6 - 7 . . . . .	3	4.1 - 16.7	11.6	2.68
4 - 5 . . . . .	7	4.1 - 28.8	14.3	1.47
2 - 3 . . . . .	5	4.6 - 12.0	8.5	0.72
Total . . . . .	27	4.1 - 64.1	19.5	2.68

1/ Annual capacity equals total egg capacity of the hatching and incubating units set 15 times in a 12-month period.

Table 6.--Egg-type chick hatcheries: Months of operation and use of available monthly capacity, 23 firms, 1962

Month	Hatcheries in operation	Use of available monthly capacity		Eggs set as percentage of yearly total	
		Range	Average	Range	Average
	Number	Percent	Percent	Percent	Percent
January	14	0.8 - 59.5	17.0	0.4 - 15.0	5.6
February	20	3.2 - 56.2	27.9	2.6 - 30.6	9.4
March	23	11.2 - 93.7	47.5	5.8 - 53.4	14.7
April	23	14.2 - 94.9	53.2	9.0 - 53.8	16.8
May	21	5.0 - 92.6	42.1	4.3 - 47.5	13.4
June	13	1.7 - 86.6	24.4	1.1 - 12.3	7.2
July	9	3.8 - 57.6	19.6	1.9 - 10.6	5.6
August	10	1.3 - 51.5	19.4	0.8 - 11.2	5.6
September	10	2.2 - 52.9	17.8	1.2 - 9.5	5.3
October	9	1.7 - 67.4	25.8	0.5 - 10.9	6.0
November	10	1.2 - 72.1	22.1	0.6 - 13.3	4.7
December	12	2.0 - 57.0	17.4	0.6 - 10.4	5.7

Table 7.--Egg-type chick hatcheries: Output per man-hour, by number of eggs set and salable pullets hatched per week, 23 firms, 1962 1/

Number of eggs set per week	Eggs per man-hour		Salable pullets per man-hour	
	Average	Range	Average	Range
	- - - - - <u>Number</u> - - - - -			
Less than 5,000	99	54 - 158	40	21 - 64
5,001 to 10,000	118	37 - 265	49	16 - 115
10,001 to 15,000	133	99 - 196	53	38 - 75
15,001 to 30,000	184	170 - 199	76	67 - 85
30,001 to 70,000	192	109 - 240	72	46 - 95
All hatcheries	130	--- ---	52	--- ---

1/ Generally includes supervised hatchery operations, but not sales, delivery, or overhead management activities.

considerably within each size group. Differences stemmed from varying uses of surveillance labor, the use of modern equipment and better work flow versus antiquated methods and equipment, and variations in scheduling hatchery activities for utilization of employees.

The average number of salable pullets hatched per man-hour increased from 40 to 76 as the number of eggs set per week increased from less than 5,000 to 30,000. The range in salable pullets hatched per man-hour within the groups became narrower as the size groups increased from 10,001 to 30,000 eggs set. The narrowest range was in the group of hatcheries setting between 15,001 and 30,000 eggs per week. This group of firms used vacuum egg-traying equipment, dollies to move egg cases, and other laborsaving equipment in conjunction with systemized work schedules.

### Wage and Salary Rates

Wages paid to in-hatchery employees varied between \$1.00 and \$2.43 per hour. The smaller hatcheries generally paid the lowest wages, with the average wage per hour increasing as the firms increased in size (table 8). The lower wage was primarily paid to part-time employees. Variations in hourly wages were partially due to regional differences in pay scales.

The average wage rates for the different size groups ranged from \$1.18 paid by hatcheries in the smallest size group to \$1.70 per hour paid by hatcheries in the largest size group. (Wages include Social Security and other basic fringe benefits.) In a number of the hatcheries, during the peak operating season employees worked more than 40 hours a week and were paid time-and-a-half for such labor. In many instances during the peak hatching season, the managers put in extra hours without compensation.

Managerial and supervisory employees were generally paid on a weekly basis; some managers were paid a monthly salary. In most cases, the managers were the owners or part-owners of the hatcheries. The estimated return to the manager ranged from \$100 to \$414 per week. As hatcheries increased in size, average salaries of managers increased. In some hatcheries, the manager was the chief salesman, service agent, and office and plant manager. He received a combined paycheck for all these services. In other instances, the bookkeeper kept the costs of these various functions separate and the manager's weekly income was allocated to each function. Therefore, table 8 reflects composite rather than exact returns for the duties of a plant manager.

Hatcheries that approached a combined annual capacity of 1 million eggs hired plant supervisors in addition to plant managers. These plant supervisors received from \$52 to \$160 for a 40-hour week (table 8). Most of the supervisors were full-time employees who were shifted to some other enterprise if the hatchery closed down after the main hatching season. When a hatchery had a plant supervisor, the manager was able to spend more time in the office on recordkeeping, sales promotion, and public relations work.

The tendency of wage and salary rates to increase with hatchery size tended to offset some of the cost advantages of larger hatcheries.



Table 8.--Egg-type chick hatcheries: Weekly salaries paid to managers and supervisors, and hourly wages paid hatchery employees, 17 firms grouped by annual egg capacity, 1962

Annual capacity $\frac{1}{2}$ (million eggs)	Managers		Supervisors		Hatchery employees	
	Range	Average	Range	Average	Range	Average
	Dollars					
0.5 to 0.9 ...	100 - 160	130	110	110	1.00 - 1.30	1.18
1.0 to 1.9 ...	125 -	125	90 - 112	104	1.00 - 1.60	1.21
2.0 to 3.9 ...	150 - 252	201	52 - 160	102	1.00 - 1.65	1.28
4.0 to 10.0 ..	100 - 414	206	100 - 148	124	1.00 - 2.43	1.70

$\frac{1}{2}$  Annual capacity equals total egg capacity of the hatching and incubating units set 15 times in a 12-month period.

#### Schedule of Hatchery Operations

The labor requirements in a hatchery vary from day to day, depending on the operations performed. Hatcheries generally try to maintain a smooth work flow during the week. However, this is not always possible. Hatchery operation is a recurrent process. The cycle starts when the eggs are received and stored in the cooler, and ends when the pullets are loaded on the truck for delivery. In smaller hatcheries, the work flow varies irregularly from day to day because of the jobs that must be performed on certain days. This can be seen when a weekly work schedule is analyzed.

Table 9 shows a work schedule for a one-hatch-a-week hatchery based on practices used in the hatcheries surveyed. The work inputs vary considerably. For example, following the schedule in table 9, when 9,000 eggs are set per setting, 1 man-hour is required on Thursday and Friday to check the machines. On Monday, the incubator is set, the chicks are pulled from the hatcher, counted, boxed, debeaked, dewinged, decumbed, graded, counted, and reboxed. This entire operation requires a minimum of 7.7 man-hours. The sexing operation is usually performed by a specialist hired by the hatchery at a rate of about 1 cent per chick.

As the size of a hatchery increases, the number of egg settings per week also increases. With more settings a week, the utilization of labor becomes more uniform. Tables 23 to 26 in appendix A show typical work schedules for two, three, four, and five settings a week, not including maintenance and repairs. These five work schedules shown in table 9 and tables 23 to 26 show only one method of dividing the hatchery jobs among the weekly labor force. Other methods can be used and many of the jobs can be performed on one day as well as the next.

Table 9.--Egg-type chick hatcheries: Typical work schedule, including services, for a hatchery producing one hatch a week, on Monday

Day	Work performed
Sunday .....	Check machines
Monday .....	Clean incubator and set eggs Pull hatch, count, and box chicks Sex chicks Debeak 35 percent of pullets Dewing 30 percent of pullets Decomb 30 percent of pullets Grade, count, and box pullets
Tuesday .....	Load out pullets Clean and disinfect hatcher Clean and disinfect hatch trays Clean hatchery building
Wednesday .....	Make chick boxes Check machines
Thursday .....	Check machines
Friday .....	Check machines
Saturday .....	Transfer eggs from incubator to hatcher Receive and store eggs Grade and tray eggs Clean hatchery

Chick boxes can be assembled any time before the chicks are hatched. In the schedule in appendix A, table 23, the chick boxes are assembled on Wednesday, a relatively light workday, for the chicks that are hatched on Friday and Monday. These boxes could have been assembled on another day as long as the extra time required did not involve overtime payments.

The function of receiving and storing eggs in the cooler can be altered 1 to 3 days from the time they are needed for grading and traying. This also allows the grading and traying function to be altered, as the eggs can be removed from the cooler, placed in trays, then put back into the cooler until the day of setting. The cleaning of hatcheries, hatchers, and hatch trays can also be completed on different days than those designated in the tables. The hatchers and trays must be cleaned and ready for the eggs when they are transferred from the incubators to the hatchers on the 19th day of the hatching cycle. There is some leeway on when they can be cleaned; however, they are easiest to clean immediately after the hatch is pulled.

## Maintenance

Some hatcheries have a night crew to perform the cleaning and necessary maintenance functions. The night crew is also responsible for reporting or correcting any malfunctions of the machines. Hatcheries that have no night crew use an alarm system connected to two or three employees' homes. Thus, at least one of the employees of the hatchery is within hearing distance of the alarm at all times, and can be at the hatchery within minutes if trouble develops. An alarm system is less costly than maintaining a night crew.

Many hatcheries do not operate 12 months of the year. During the inactive months a skeleton crew is retained. These employees service, repair and paint the equipment and building. New equipment is usually installed during the slack season. Upon completion of hatchery-connected duties, these employees are used in other activities.

### PART II. ECONOMIES OF SCALE IN MODEL EGG-TYPE CHICK HATCHERIES

Six model hatcheries with annual capacities of just under 1, 2, 3, 4, 7, and 10 million eggs were synthesized, incorporating the most efficient methods used by the hatcheries surveyed. A floor plan was prepared for each model showing the major equipment needed for performing the various operations. Each workflow system was designed to reduce operating cost and to use labor efficiently. The egg cooler was placed near the egg-traying area to facilitate traying before setting the eggs. The hatcher and the chick room were located near the tray-washing area to provide for a circular pattern of continuous operations (appendix B, figures 3-8).

Work schedules were based on two settings a week in models A and B, three in model C, four in model D, and five in models E and F. Appendix A, tables 23 to 26 show the basic work schedules utilized in these models.

To achieve standardized costs in the six models, the following assumptions were made:

1. All six model hatcheries used the same type of incubators and hatchers. All used commercially available laborsaving equipment.
2. Quantity discounts on the purchase of supplies and utilities were obtained as the hatcheries increased in size.
3. The hatcheries received 5 percent more eggs than were set to allow for breakage in handling.
4. The hatcheries were operating at 100 percent of capacity when they utilized 17.3 incubator turnovers during a 12-month period.
5. The eggs were in the incubator for 19 days and transferred to the hatchers for the final 2 days. Eggs were set on the same day each week.
6. The cost per chick hatched was based on an estimated 83-percent hatchability of all eggs set.
7. Fifty percent of all chicks hatched were cockerels and were destroyed.
8. One percent of the pullets hatched were destroyed as culls.

9. Services performed in these model hatcheries were as follows:  
Sexing--100 percent of all chicks hatched. A specialist performed this function for 1 cent per chick.  
Debeaking--35 percent of all salable pullets.  
Dewinging--30 percent of all salable pullets.  
Decombing--30 percent of all salable pullets.
10. No vaccinations were performed at the hatchery.
11. The wage rate for employees was \$1.35 an hour with a 40-hour week and time-and-a-half for overtime. This hourly wage included Social Security and other fringe benefits.
12. As size of hatchery increased, managerial and supervisory responsibilities were greater and salaries were higher.
13. All model hatcheries were equipped with electronic alarm systems which eliminated the need for surveillance workers at night and on weekends.
14. All hatcheries contained adequate cooler facilities to hold a one-half week's supply of eggs for operation at 100 percent of capacity.
15. In all hatcheries, storage areas were standardized to hold sufficient supplies for 4 weeks of operation at 100 percent of capacity, and a 2-day supply of assembled chick boxes.

#### Costs in Model Hatcheries

Using the above assumptions, operating costs were synthesized for the six model hatcheries operating at various percentages of capacity for a full 12 months and for an approximately 5-month season. (A detailed discussion of methods used to make cost estimates appears below.) Whether the model hatcheries were operated for the full 12 months or for a 5-month period only, the total cost per salable pullet hatched decreased as size of model increased.

#### 12-Month Operation

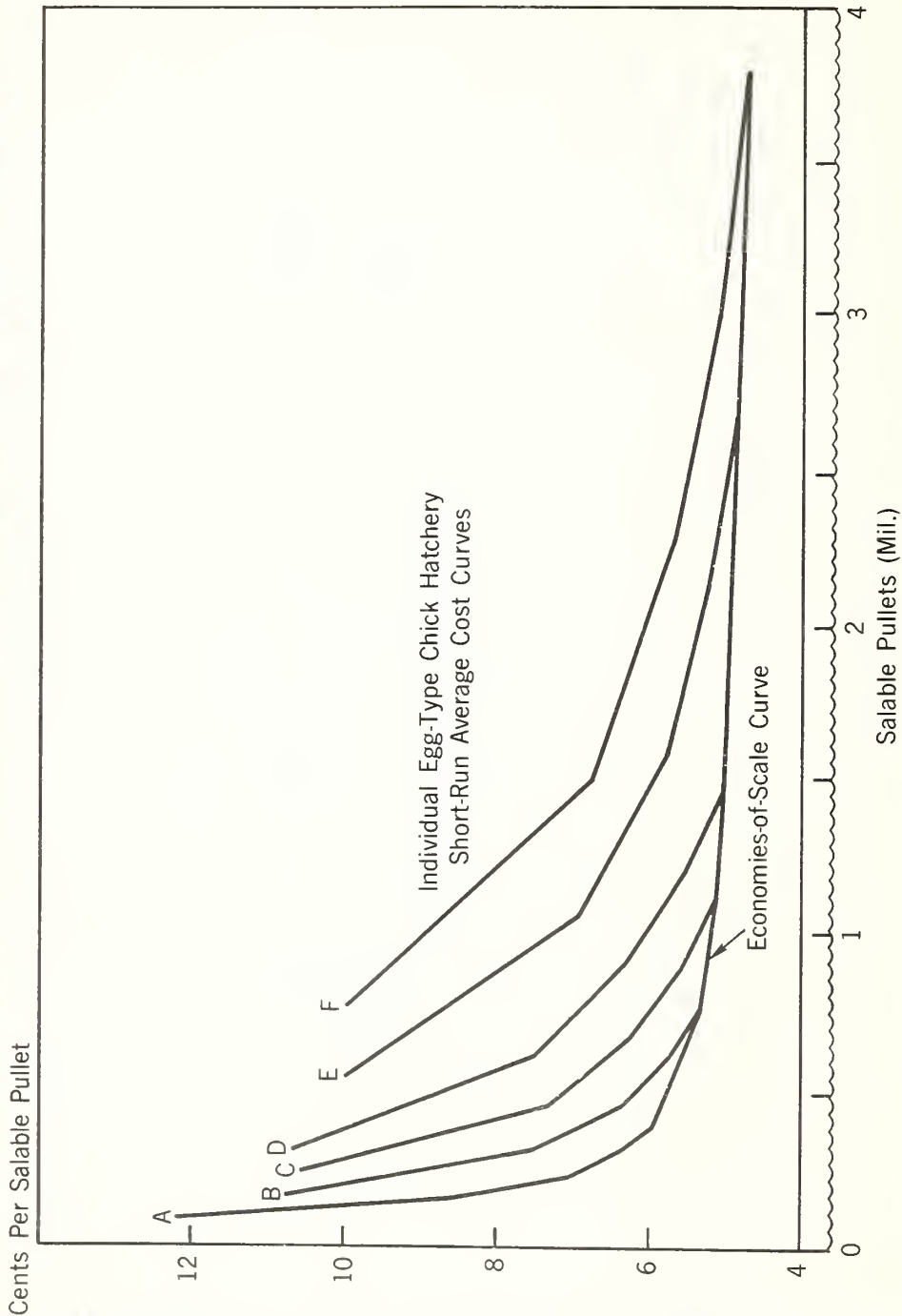
Figure 1 shows the economies-of-scale curve and the short-run average-cost curves for the six models when operated from 20 to 100 percent of capacity on a 12-month basis. Average operating costs at 100 percent of capacity ranged from 5.90 cents in model A, the smallest hatchery, to 4.79 cents in model F, the largest (table 10). The two largest cost items in model A were labor and utilities. In the other five models, labor and supplies were the largest cost components.

Economies of scale were evident in most unit cost components within each model hatchery. There were greater economies in some cost components than in others, as utilization of capacity increased--for example, the variable cost components decreased at a slower rate than the fixed cost components (appendix A, table 27). Cost of supplies per salable pullet appeared to have the lowest rate of decrease as utilization of capacity increased.

A comparison among models revealed diseconomies of scale with respect to particular cost items. That is, miscellaneous costs per salable pullet, which represented not over 5 percent of the average total costs of any model,



# ECONOMICS-OF-SCALE AND AVERAGE-COST CURVES FOR SIX MODEL EGG-TYPE CHICK HATCHERIES, 52-WEEK SEASON



U.S. DEPARTMENT OF AGRICULTURE  
 NEG.-ERS 4873-67 (1) ECONOMIC RESEARCH SERVICE

Figure 1

Table 10.--Summary of estimated hatching cost per salable pullet, for six model egg-type chick hatcheries at 100 percent of capacity, 52-week season, services included

Cost components	Model					
	A	B	C	D	E	F
	Cents per salable pullet					
Fixed costs:						
Equipment depreciation	.37	.32	.31	.31	.31	.30
Building depreciation	.15	.12	.11	.11	.10	.10
Building repair and maintenance	.10	.07	.07	.07	.06	.06
Equipment repair and maintenance	.12	.10	.10	.10	.10	.10
Taxes	.07	.06	.05	.05	.05	.05
Insurance	.07	.06	.05	.05	.05	.05
Interest	.22	.17	.17	.16	.16	.15
Miscellaneous	.09	.08	.11	.11	.11	.13
Average total fixed costs	1.19	.98	.97	.96	.94	.94
Variable costs:						
Utilities	.66	.59	.49	.36	.33	.28
Supplies	.64	.63	.62	.61	.60	.59
Labor	1.37	1.10	1.05	1.14	1.00	.94
Sexing cost	2.04	2.04	2.04	2.04	2.04	2.04
Average total variable costs	4.71	4.36	4.20	4.15	3.97	3.85
Average total costs	5.90	5.34	5.17	5.11	4.91	4.79
	Number					
Salable pullets hatched	379,012	758,024	1,137,036	1,516,047	2,653,083	3,790,120

increased with the increase in size of hatchery in all models larger than model B (table 10). Diseconomies of scale in fixed cost items of equipment were not evident until the automatic tray washer was installed in model E. Equipment depreciation and repair and maintenance costs increased in model E, but the labor cost per salable pullet hatched decreased from that in model D where the tray washer was not used. Also, in model D a supervisor was hired to oversee the in-hatchery operation. This additional cost increased the average labor cost per salable pullet, but was necessary because the manager had to spend more time with office management problems.

When an estimated cost per egg of 5.1 cents, or 13.06 cents per salable pullet, was added to the model hatchery operating costs, combined costs when the hatcheries were operated at 100 percent of annual capacity ranged from 18.96 cents per salable pullet in model A to 17.85 cents in model F. At 40 percent of annual capacity, these costs increased to 21.59 cents per salable pullet in model A and 19.79 cents in model F.

### 22-Week Operation

Most hatcheries do not hatch chicks continuously for 12 months a year. Figure 2 shows average-cost and economies-of-scale curves for the model hatcheries operated at different levels during a 5-month, or 22-week, season. The average total cost of hatching chicks increases as the length of hatching season is shortened. With a hatching season of 22 weeks, where hatches are pulled for 19 weeks of the season, the average total cost in model A was 8.64 cents per salable pullet and in model F, 6.72 cents (table 11). These costs were greater than when these two model hatcheries were operated on a 12-month basis (table 10). The major increase in cost was due to the larger fixed costs per unit. As shown in appendix A, tables 27 and 28, the total fixed cost in actual dollars did not change with the reduction in quantity of salable pullets hatched. For all practical purposes, the owners of hatcheries must pay the fixed costs regardless of how many salable pullets they hatch or how long a hatching season they run.

At 40 percent of capacity and for the 22-week season, or at about 15 percent of annual capacity, a level at which many hatcheries actually operate, the average total cost per salable pullet in model A was 14.19 cents, and in model F, 11.37 cents (fig. 2).

The same equipment was used in the 22-week operations as in the 12-month operation of each model. This created some drawbacks when the quantity of total chicks hatched was decreased below the annual output. For example, the tray washer in model E justified its capital and operating cost for the 12-month operation when 5 million or more eggs were set. However, in the 22-week hatching season, only 2.4 million eggs are set; therefore, in model E, total costs for a 22-week season would be reduced if the tray washer was not installed.

The average total variable costs differ with the length of hatching season, the change in discounts for quantity purchases of utilities and supplies, and the availability of competent labor for less than full-time operation. Model hatcheries that operated only 22 weeks a year had higher average total variable costs per salable pullet than those that operated 52 weeks (tables 10 and 11). Labor costs increased slightly due to the higher weekly costs of management and supervisory labor. It was assumed that labor for the 22-week season of operation was as competent as that in the full 52-week operation.

# ECONOMICS-OF-SCALE AND AVERAGE-COST CURVES FOR SIX MODEL EGG-TYPE CHICK HATCHERIES, 22-WEEK SEASON

Cents Per  
Salable Pullet

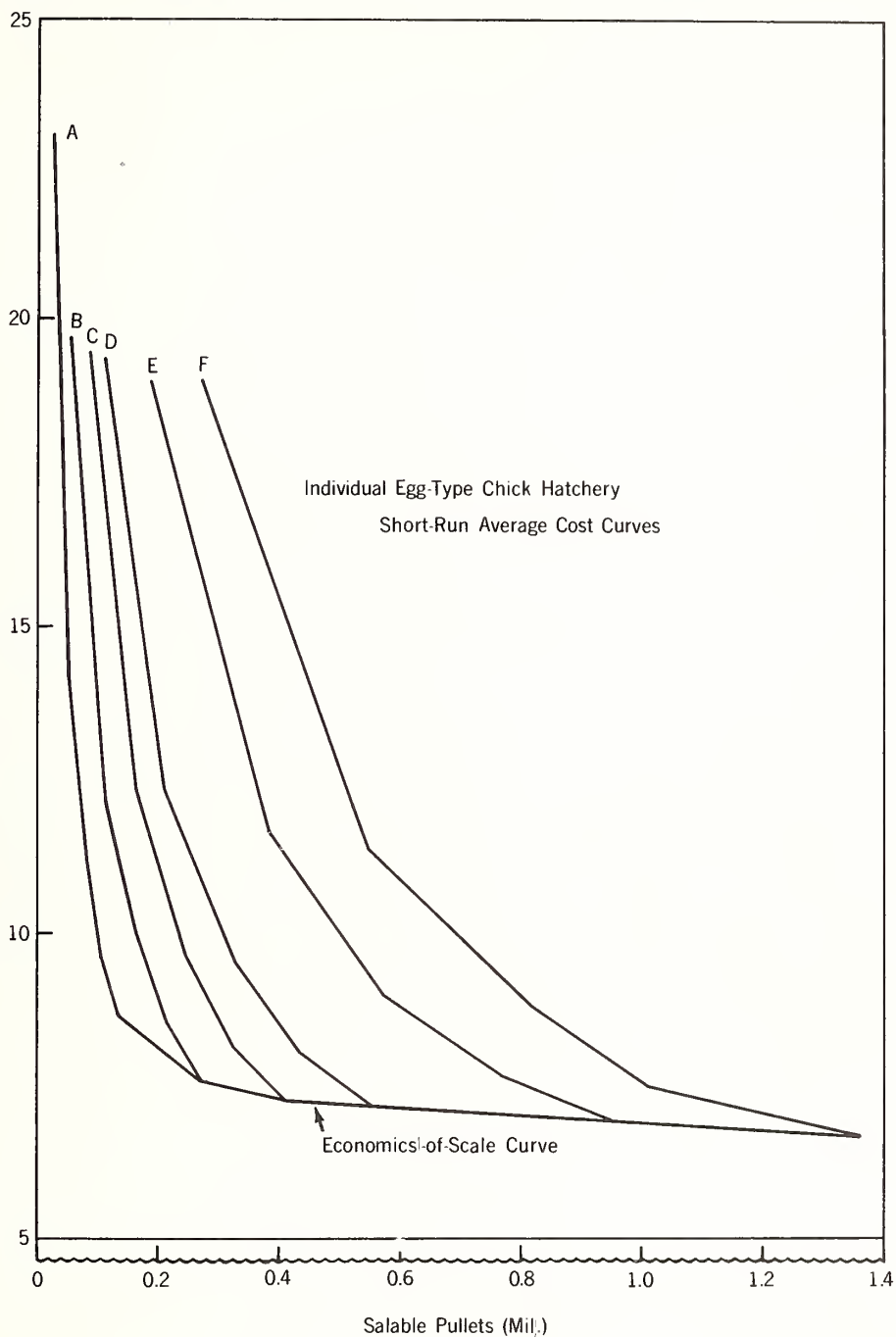


Figure 2



Table 11.--Summary of estimated hatching cost per salable pullet hatched, six model egg-type chick hatcheries at 100 percent of capacity, 22-week season, services included

Cost components	Models					
	A	B	C	D	E	F
	----- <u>Cents per salable pullet</u> -----					
Fixed costs:						
Equipment depreciation	1.03	.90	.86	.85	.86	.84
Building depreciation	.42	.33	.31	.31	.27	.27
Building repair and maintenance	.27	.21	.19	.19	.17	.16
Equipment repair and maintenance	.34	.29	.27	.27	.28	.27
Taxes	.20	.17	.15	.15	.15	.14
Insurance	.20	.17	.15	.15	.15	.14
Interest	.61	.49	.46	.45	.44	.43
Miscellaneous	.26	.22	.32	.31	.31	.37
Average total fixed costs	3.33	2.78	2.71	2.68	2.63	2.62
Variable costs:						
Utilities	1.18	.94	.76	.64	.56	.43
Supplies	.66	.65	.64	.62	.62	.61
Labor	1.43	1.19	1.14	1.24	1.07	1.02
Sexing cost	2.04	2.04	2.04	2.04	2.04	2.04
Average total variable costs	5.31	4.82	4.58	4.54	4.29	4.10
Average total costs	8.64	7.60	7.29	7.22	6.92	6.72
	----- <u>Number</u> -----					
Salable pullets hatched	134,832	269,701	408,212	544,258	948,910	1,355,568

At 100 percent of capacity and during the 22-week hatching season, the combined hatching-egg and operating costs of the model hatcheries ranged from 21.70 cents per salable pullet in model A to 19.78 cents in model F. At 40 percent of the 22-week hatching capacity, combined egg and in-plant costs per salable pullet ranged from 27.25 cents in model A to 24.43 cents in model F.

## Summary of Costs

In figures 1 and 2, the short-run cost curves for each size of hatchery reach their lowest point at 100 percent of capacity. To go beyond 100 percent of capacity, the technology used in the hatching operation would have to be changed. For example, infertile eggs would have to be pulled earlier in the incubating stage. In this study, the present industry practice of not pulling infertiles early was assumed.

The short-run cost curves for each model hatchery slope down gradually as the use of capacity increases. However, a long-run cost curve drawn at each level of utilization of capacity (20, 40, 60, or 80 percent) would not slope downward consistently. In figure 1, a long-run cost curve drawn through the short-run cost curves at the 40 percent of capacity level would slope upward from model C to model D, then decline through model F. This indicates that model hatchery D, when operating at 40 percent of capacity, might not be an optimum-sized unit for that volume level. However, as model D increases utilization of capacity, this discrepancy disappears. The basic reason for this uneven long-run cost curve is that model D is the smallest model utilizing a full-time supervisor.

### Cost Estimates

Costs were divided into fixed and variable components. Variable costs consist of supplies, utilities, labor, and management. Management was included under variable costs since, except for the largest model (F), half or more of the managers' time was assumed to be spent in the hatchery rather than in the office. Fixed costs include equipment and building depreciation, certain types of maintenance and repairs, taxes, insurance, interest, and miscellaneous costs.

In many studies, costs are grouped into fixed operating, fixed overhead, variable operating, and constant-unit operating costs. However, in the operation of hatcheries this more detailed breakdown would not add significantly to the analysis.

### Fixed Costs

Fixed costs per unit of production vary directly with the quantity of output produced. The rates used to determine fixed costs of the model hatcheries are shown in table 12. These rates were developed from data supplied by the responding sample hatcheries, or were adapted from previous economies-of-scale studies.

### Equipment Costs

The equipment selected for the six model hatcheries was the most efficient type used by the hatcheries surveyed, and included the most efficient mechanized units commercially available. The most expensive pieces of equipment were the incubators and hatches. The number of incubators needed by each model hatchery

Table 12.--Annual rates (as percentage of costs of new building and equipment) used to determine fixed costs of investment in model egg-type hatcheries

Item	Building	Equipment
	<u>Percent</u>	<u>Percent</u>
Depreciation .....	5	1/ 10
Repairs .....	3	3
Taxes .....	1	1
Insurance .....	1	1
Interest on new value .....	3	3

1/ Except standby generator, tray washer, and egg-room cooler which are depreciated at 5 percent.

was based on (1) the capacity of the incubator per setting, (2) 17.3 turnovers of incubator capacity per year, and (3) the volume of output of each hatchery. The size and number of hatcheries needed was dependent upon the size and number of incubators used.

All model hatcheries were equipped with egg coolers. The use of an egg-cooling room facilitates the scheduling of egg traying. A hatchery with an egg cooler can more fully utilize its labor force and regulate its weekly work flow since the eggs can be graded and trayed during a light work period, and replaced in the cooler for future setting.

A standby generator is a form of insurance against power failure which could result in total loss of all the eggs and chicks in the incubators and hatcheries. All hatcheries had standby generators of sufficient capacity to meet minimum demands, and were equipped with automatic line transfer equipment. Estimates of the type and size required for each model hatchery were developed from data on electricity used by the hatcheries surveyed.

All model hatcheries were equipped with vacuum lift egg-traying machines. Models A, B, and C were each equipped with one vacuum head, and models D, E, and F were equipped with two.

The other large piece of equipment, a tray-washing machine, was used in models E and F only. Miscellaneous equipment included tray carts, chick box carts, dollies, egg case conveyors, worktables, debeakers, dewingers, flash candling worktables, and other minor items necessary for efficient hatchery operation.

The quantity of equipment for each model hatchery and the itemized cost per unit of equipment are shown in appendix A, tables 29 and 30. The cost of the equipment was calculated at 1962 price levels and generally includes shipping and installation charges. The total cost and annual depreciation of the major equipment are shown in table 13.

Table 13.--Total investment and annual depreciation costs of the major equipment utilized in the 12-month operation of six model egg-type chick hatcheries at 100 percent of incubator capacity

Type of equipment	Model					
	A	B	C	D	E	F
	<u>Dollars</u>					
Vacuum-lift egg trayer .....	494.62	494.62	494.62	<u>1/799.44</u>	<u>1/799.44</u>	<u>1/799.44</u>
Tray carts <u>2/</u> .....	570.00	760.00	760.00	950.00	1,330.00	1,900.00
Chicken box dollies .....	50.00	100.00	150.00	200.00	350.00	500.00
Dirty hatch tray dollies .....	25.00	37.50	75.00	75.00	125.00	175.00
Egg case dollies ..	50.00	50.00	50.00	75.00	75.00	75.00
Conveyor for egg cases <u>2/</u> .....	52.15	52.15	52.15	104.30	156.45	156.45
Worktable for candling, transfer, & takeoff .....	250.00	250.00	250.00	375.00	500.00	750.00
Central vacuum system .....	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00
Incubators .....	7,552.50	15,105.00	22,657.50	30,210.00	52,867.50	75,525.00
Hatchers .....	1,928.50	3,857.00	5,785.50	7,714.00	13,499.50	19,285.00
Debeakers .....	87.00	87.00	130.50	174.00	304.50	435.00
<b>Total .....</b>	<b>12,059.77</b>	<b>21,793.27</b>	<b>31,405.27</b>	<b>41,676.74</b>	<b>71,007.39</b>	<b>100,600.89</b>
10-yr. depreciation rate equals annual depreciation of ..	1,205.98	2,179.33	3,140.53	4,167.67	7,100.74	10,060.09
Other equipment:						
Standby generator <u>3/</u> .....	2,340.00	2,610.00	3,309.00	4,125.00	6,846.00	9,115.00
Egg room coolers <u>3/</u> .....	385.00	540.00	615.00	775.00	1,230.00	1,550.00
Tray washer <u>3/</u> ...	----	----	----	----	4,950.00	4,950.00
<b>Total .....</b>	<b>2,725.00</b>	<b>3,150.00</b>	<b>3,924.00</b>	<b>4,900.00</b>	<b>13,026.00</b>	<b>15,615.00</b>
20-yr. depreciation rate equals annual depreciation of ..	136.25	157.50	196.20	245.00	651.30	780.75

1/ Price for second unit is \$304.82

2/ Does not include shipping cost.

3/ Does not include shipping and installation cost.



## Building Costs

The size of building required to hatch the quantity of chicks specified was determined from an analysis of (1) the shape, size, and layout of the hatcheries surveyed, (2) suggested floor plans of various incubator companies, and (3) floor plans in studies of broiler chick and turkey poult hatcheries (11, 21).

Building costs, estimated for each model hatchery, ranged from \$7.25 to \$7.50 per square foot, including costs of electricity, heating, plumbing, and air conditioning based on the southern California climate (table 14). This estimate was for a one-story building constructed of cinder block walls with steel reinforcement, concrete floors, a pitched roof, insulated ceiling, and clear span construction where possible. For a comparable building in Minnesota, it would be necessary to add 15 percent for extra insulation and heavier construction, including an extra row of columns to withstand the weight of snow on the roof. Cost of the site for each model hatchery was estimated at \$500 per acre. The size of the site did not allow space for expansion.

All of the model hatcheries contained central air conditioning. Only a few of the sample hatcheries were air conditioned; however, the managers of air-conditioned hatcheries specifically mentioned two immediate results--in-plant employees increased their work output considerably, and the morale of the employees improved.

The floor plans of the six model hatcheries are shown in figures 3 to 8, appendix B. As the size of the model hatcheries increased from 1,520 square feet in model A to 10,000 square feet in model F, the annual egg capacity per square foot of floor space increased from 613 to 932. However, the floor space per building did not increase proportionately with the increase in incubator capacity. Such areas as office space, boiler room, tray-washing areas, and restrooms are not directly related to capacity and increase at a slower rate than other areas.

## Miscellaneous Costs

Miscellaneous costs included such items as office supplies, lawn supplies, dues, contributions, and subscription fees. These costs were estimated from the actual costs reported by firms surveyed. The cost of office supplies represented the largest item of this group, followed by contributions to local school and other community activities. These costs were a minor part of the total average annual cost in each model hatchery, and did not exceed 0.66 cent per salable pullet (appendix A, table 27).

## Variable Costs

The variable in-hatchery costs were labor, management, supplies, and utilities. Total variable costs vary with changes in output, as needs for labor, utilities, and supplies decrease with a decrease in output. In the six model hatcheries, a larger portion of total costs was represented by variable costs than by fixed costs.

Table 14.--Estimated cost of six model egg-type chick hatchery buildings with utilities and land sites 1/

Model hatchery:	Building structure			Building site <u>2/</u>			Total cost
	Size	Cost per square foot	Cost <u>3/</u>	Size	Cost per acre	Cost	
	Square ft.	Dollars	Dollars	Acres	Dollars	Dollars	Dollars
A .....	1,520	7.50	11,400	1	500	500	11,900
B .....	2,394	7.50	18,000	1	500	500	18,500
C .....	3,406	7.50	25,500	1	500	500	26,000
D .....	4,480	7.50	33,600	1	500	500	34,100
E .....	<u>4/</u> 6,971	7.50	52,300	1	500	500	52,800
F .....	<u>4/</u> 10,000	7.25	72,500	2	500	1,000	73,500

1/ Includes electricity, heating, air conditioning, and plumbing, based on southern California climate.

2/ Does not allow space for expansion. 3/ Rounded to nearest \$100.

4/ Clear span construction in all models except E and F, where 1 row of columns is required.

Source: Building costs were estimated by John A. Hamann, agricultural economist, and Heber D. Bouland, civil engineer, Transportation and Facilities Research Division, Agricultural Research Service, U.S. Department of Agriculture.

### Labor Costs

Labor requirements for the six model hatcheries were based on the labor used by hatcheries in the survey, specifications on output per man-hour suggested by equipment manufacturers, and information from other studies (4, 11, 21). These labor requirements were based on equipment and methods in use at the time of this study (table 15). A small hatchery setting around a million eggs a year can utilize all the mechanized equipment used by the larger hatcheries except the automatic tray washer. A hatchery must set over 5 million eggs a year before the tray washer becomes less costly than hand labor at \$1.35 per hour. There are some additional economies in the setting, transferring, grading, and traying of eggs as size increases. The economies in labor inputs are relatively small and by themselves would not warrant a hatchery operation of over 3 million eggs set a year.

The number of in-hatchery employees needed varied from two in model A to six in model F (table 16). In all the model hatcheries, some part-time help was employed, due to the irregularity of the hatching cycle. In model A, man-hour needs from day to day were irregular, but the total weekly requirement

Table 15.--Labor productivity and crew size for in-hatchery operations, six model egg-type chick hatcheries

Operation	Model					
	A	B	C	D	E	F
	<u>Eggs per man-hour</u>					
Receive and store eggs	(2) <u>1</u> / 55,000	(2) 55,000	(2) 55,000	(2) 55,000	(2) 55,000	(2) 55,000
Grade and tray eggs ...	(1) 1,800	(1) 1,800	(1) 3,600	(1) 3,600	(2) 4,700	(2) 4,700
Set eggs in incubator	(1) 30,000	(1) 30,000	(1) 30,000	(1) 35,000	(1) 35,000	(1) 35,000
Transfer eggs	10,000	14,800	14,800	14,800	14,800	14,800
Clean and disinfect hatchers	(1) 10,000	(1) 10,000	(1) 10,000	(1) 10,000	(1) 10,000	(1) 10,000
Clean hatcher trays by:					(1)	(1)
Machine	----	----	----	----	37,000	37,000
Hand	(1) 8,850	(1) 8,850	(1) 8,850	(1) 8,850	----	----
	<u>Chicks per man-hour</u>					
Pull, hatch, count, grade and box pullets	(2) 3,000	(2) 3,000	(3) 3,000	(3) 3,000	(3) 3,000	(3) 3,000
Assemble chick boxes	(1) 5,000	(1) 5,000	(1) 5,000	(1) 5,000	(1) 5,000	(1) 5,000
Load out pullets	(2) 30,000	(2) 30,000	(2) 30,000	(2) 30,000	(2) 30,000	(2) 30,000
Maintenance & custodial	(1) 6,000	(1) 6,000	(1) 6,000	(1) 6,000	(1) 6,000	(1) 6,000
Sexing	1,000	1,000	1,000	1,000	1,000	1,000
Dewinging	600	600	600	600	600	600
Debeaking	1,000	1,000	1,000	1,000	1,000	1,000
Decombing	600	600	600	600	600	600

1/ Crew size for each operation in parentheses.

was only 23.9 man-hours. Thus, model A could easily be operated by one man with some extra help when the chicks were pulled, counted, graded and boxed. In models E and F, some overtime work is required and time-and-a-half is paid to the employees who transfer the eggs and assemble chick boxes on Sunday.

Labor costs in the model hatcheries were restricted to costs inside the hatchery; that is, costs started when the hatching eggs were placed on the conveyor for entrance into the cooler and ended when the pullets were loaded into the delivery vehicles. The three largest and costliest labor operations were (1) grading and trayng eggs; (2) pulling the baby chicks from the hatchers and grading and counting them; and (3) cleaning the hatchery (table 17).

Table 16.--Weekly labor requirements by day of week, number of employees, and hours worked per week in six model egg-type chick hatcheries at 100 percent of incubator capacity, excluding all services 1/

Day of week	Model					
	A	B	C	D	E	F
	<u>Man-hours</u>					
Monday ..	2.8	5.6	12.1	15.3	23.4	33.4
Tuesday ..	5.0	7.1	11.8	15.2	22.8	35.6
Wednesday:	1.0	4.2	6.9	12.5	22.5	32.1
Thursday :	4.2	5.8	12.8	12.3	21.5	30.8
Friday ..:	2.8	9.5	9.5	12.3	18.8	26.7
Saturday :	7.1	10.3	10.2	15.5	11.9	17.1
Sunday ..:	1.0	1.0	1.0	1.4	7.8	8.2
Total ..	23.9	43.5	64.3	84.5	128.7	183.9

Use of man-hours:	<u>Number of employees and hours worked per week</u>											
	<u>Men</u>	<u>Hrs.</u>	<u>Men</u>	<u>Hrs.</u>	<u>Men</u>	<u>Hrs.</u>	<u>Men</u>	<u>Hrs.</u>	<u>Men</u>	<u>Hrs.</u>	<u>Men</u>	<u>Hrs.</u>
Regular time ..	1	2.5	-	----	1	2.0	1	4.5	1	20.9	1	5.5
	1	21.4	1	8.6	1	40.0	1	40.0	1	40.0	3	40.0
	-	----	1	34.9	1	22.3	<u>2/1</u>	40.0	<u>2/1</u>	40.0	<u>2/1</u>	40.0
									1	20.0	1	10.0
Over-time ..	-	----	-	----	-	----	-	----	<u>3/2</u>	3.9	<u>3/2</u>	4.2
Total ..	2	23.9	2	43.5	3	64.3	3	84.5	4	128.7	6	183.9

1/ Services excluded are sexing, debeaking, dewinging, and decombing.

2/ Supervisor's man-hours per week.

3/ Two men every Sunday are paid overtime for transferring and making chick boxes. Men rotate so all will draw equal overtime pay.



Table 17.--In-hatchery labor requirements per week to perform specified jobs, six model egg-type chick hatcheries operating at 100 percent of incubator capacity

Jobs performed	Model and average number of eggs set per week					
	A	B	C	D	E	F
	17,920	35,840	53,760	71,680	125,440	179,200
	----- Man-hours -----					
Receive and store eggs	0.4	0.7	1.0	1.4	2.4	3.5
Grade and tray eggs ...	5.0	10.0	15.0	20.0	26.8	38.3
Set eggs .....	0.6	1.2	1.8	2.1	3.6	5.1
Transfer eggs .....	1.8	2.5	3.6	4.9	8.6	12.2
Make chick boxes .....	1.5	2.9	4.4	5.9	10.3	14.7
Pull hatch, grade, & count chicks .....	5.0	10.0	14.9	19.9	34.8	49.8
Load out pullet chicks	0.3	0.5	0.7	1.0	1.7	2.4
Clean hatchers .....	1.8	3.6	5.4	7.2	12.6	18.0
Clean hatcher trays:						
By hand .....	2.0	4.1	6.1	8.1	---	---
Tray washer .....	---	---	---	---	3.4	4.9
Clean hatchery .....	3.0	6.0	8.9	12.0	21.0	30.0
Clean and vacuum incubators .....	0.5	1.0	1.5	2.0	3.5	5.0
Check machines .....	2.0	1.0	1.0	---	---	---
Subtotal .....	23.9	43.5	64.3	84.5	128.7	183.9
Dewinging $\frac{1}{2}$ .....	3.6	7.1	10.8	14.4	25.5	36.2
Debeaking $\frac{1}{2}$ .....	2.6	5.2	7.8	10.5	17.4	25.3
Decombing $\frac{1}{2}$ .....	3.6	7.1	10.8	14.4	25.5	36.2
Total .....	33.7	62.9	93.7	123.8	197.1	281.6

$\frac{1}{2}$  Man-hours required when 30 percent of the salable pullets were dewinged and decomed, and 35 percent were debeaked.

Currently there is a trend toward having the eggs graded and, in some instances, trayed at the farm, which eliminates the costs of grading and traying from the in-hatchery costs. Essentially, the cost of the eggs delivered to the hatchery would be increased to compensate for the extra labor required at the farm. However, one handling of the hatching eggs would be eliminated and, in the long-run, it might become the most efficient system.

The hatcheries surveyed performed a number of chick services. Sexing the chicks to separate straight-run chicks into pullets and cockerels was generally done by a specialist on the day the chicks were removed from the hatchers. These specialists were paid on a per-chick basis. Therefore, these labor costs were not included in the model hatchery labor cost data. The other three services--dewinging, decombing, and debeaking--were performed when requested

on the order for the pullet chicks. On an average, the hatcheries surveyed debeaked 35 percent, and dewinged and decumbed 30 percent of the salable pullets. When the man-hours required to perform these special services were added to the regular labor requirements, the day-to-day fluctuations were greatest in models A and B (table 18). In the other four models, the day-to-day work load remained fairly stable. In models D, E, and F, additional persons were hired to help with these extra duties. The costs of operating the model hatcheries do not include expenses for sales, public relations, or management of hatching-egg flocks.

### Managerial, Supervisory, and Secretarial Costs

In all the model hatcheries, plant managers and supervisors were working employees in the hatchery. The managers performed two functions--decision making and production work. As the hatcheries increased in size, their roles in production work decreased, and their salaries increased with the increase in responsibilities (table 19).

In each of the three smaller hatchery models, the manager was responsible for the entire in-plant hatchery operation, including office duties. The managers in models B and C could rely on other employees to handle the essential items if they had to be away from the hatchery. In model A, the manager was the only full-time employee of the hatchery, needing only part-time help for removal of chicks from the hatcher. Therefore, he could not leave the hatchery except on days when his workload was light, as on Wednesday. In models D, E, and F, a good portion of the plant operation was the responsibility of the supervisor, and the manager split his time between management of the office and plant. In the largest model, model F, two full-time secretaries were needed to take care of the bookkeeping, payroll accounts, inventory accounts, producer accounts, and ordering of hatchery supplies.

Management efficiency was most difficult to calculate because most hatcheries surveyed were operated in connection with other enterprises, and the management staff had a multitude of jobs to perform. In the six models, management was responsible for scheduling in-plant operations, office procedures, and employee performance, and also did some work in the hatchery. The division of weekly man-hour inputs for the manager of each model hatchery is shown in table 20. In these models management responsibility did not include breeding operations, egg procurement, assembling, sale of pullets, advertising, distribution of pullets, and service to the producers of the hatching eggs or the growers of the chicks. These excluded functions would require additional service personnel. However, in some sample hatcheries, the hatchery was a segment of an integrated market egg operation, which eliminated the functions of sales, advertising, and procurement of eggs from independent producers.

### Cost of Supplies

The quantity, price per unit, and total cost of hatchery supplies needed for 100-percent capacity operation of each model hatchery are shown in table 21. The cost per unit of egg cases, pads, boxes, and lids decreased slightly with increased volume purchases. Supplies were purchased every 4 weeks.

Table 18.--Number of employees and hours worked per week in six model egg-type chick hatcheries operating at 100 percent of incubator capacity, including services

Use of man-hours	Model											
	A		B		C		D		E		F	
	Men	Hrs.	Men	Hrs.	Men	Hrs.	Men	Hrs.	Men	Hrs.	Men	Hrs.
Regular time	1	2.5	1	28.0	1	31.4	1	33.8	1	9.3	1	23.4
	1	31.2	1	34.9	1	40.0	1	40.0	3	40.0	5	40.0
	1		1		1	22.3	$\frac{1}{1}$	40.0	$\frac{1}{1}$	40.0	$\frac{1}{1}$	40.0
							1	10.0	1	20.0	1	10.0
Over-time	-	----	-	----	-	----	-	----	$\frac{2}{2}$	3.9	$\frac{2}{2}$	4.1
Total	2	33.7	2	62.9	3	93.7	4	123.8	6	197.1	8	281.6

$\frac{1}{1}$  Supervisor.

$\frac{2}{2}$  Two men every Sunday are paid overtime for transferring and making chick boxes. Men rotate so all will draw equal overtime pay.

Table 19.--Managerial, supervisory, and secretarial labor requirements and costs for 12 months of in-hatchery operation of six model hatcheries

Model hatchery	Managerial		Supervisory		Secretarial		Total salaries per year
	Employees	Salary per year	Employees	Salary per year	Employees	Salary per year	
		Dollars		Dollars		Dollars	
A	1	4,680	-	----	-	----	4,680
B	1	5,200	-	----	$\frac{1}{4}$	702	5,902
C	1	5,720	-	----	$\frac{1}{4}$	702	6,422
D	1	6,240	1	4,680	$\frac{1}{4}$	702	11,622
E	1	6,760	1	5,200	$1\frac{1}{2}$	4,212	16,172
F	1	7,280	1	5,720	2	5,616	18,616

Table 20.--Division of manager's weekly man-hour inputs between hatchery and office in six model hatcheries, chick services included

Model hatchery	Weekly man-hours in--	
	Hatchery	Office
A .....	31.2	8.8
B .....	34.9	5.1
C .....	22.3	17.7
D .....	10.0	30.0
E .....	20.0	20.0
F .....	10.0	30.0

The cost of supplies per salable pullet varied very little between models. In model A at 100 percent of annual capacity, the cost of supplies per salable pullet hatched was 0.64 cent; at 20 percent of capacity it was 0.70 cent (appendix A, table 27). In the largest hatchery, model F, cost of supplies varied from 0.59 cent per salable pullet at 100 percent of capacity to 0.63 cent at 20 percent of capacity (appendix A, table 27).

#### Cost of Utilities

Cost of utilities was estimated using the rates obtained by the more efficient hatcheries in each strata. These rates were determined for salable pullets and adjusted to a 12-month average for the hatcheries that set eggs for 5 or more months a year. The expense of a telephone was omitted from the model hatchery costs.

A few firms in the survey obtained lower rates by combining utilities for the hatchery, supplies and sales room, and occasionally their brooding and starter pullet operations. The cost of these utilities will vary depending on weather conditions, the condition and insulation of the building, quality and type of equipment, and the location of the hatchery in the United States. Also, the greater the use of electricity, water, and fuel, the lower the rate.



Table 21.--Quantity, price, and total cost of supplies utilized in the 12-month operation of six model egg-type chick hatcheries operating at 100 percent of capacity

Item	Model					
	A	B	C	D	E	F
	-----Number-----					
Supply units:						
Egg cases <u>1/</u> . . . . .	281	562	842	1,123	1,966	2,808
Tray paper (250 sheet roll) . . . . .	22	43	65	87	152	216
Boxes and lids . . . . .	3,740	7,590	11,390	15,130	26,520	38,700
Pads . . . . .	14,980	30,370	45,550	60,530	106,080	154,800
Fumigants (gals.) . . . . .	12	20	32	40	68	100
Detergents (lbs.) . . . . .	120	200	300	400	680	1,000
Potassium perman- ganate (lbs.) . . . . .	8	12	16	20	28	48
	-----Dollars-----					
Price:						
Egg cases--per case . . . . .	.60	.60	.55	.55	.50	.50
Tray paper--per roll . . . . .	19.45	19.45	19.45	19.45	19.45	19.45
Boxes & lids--per set . . . . .	.39	.3825	.375	.37	.365	.36
Pads--per 1,000 . . . . .	18.75	18.25	18.00	17.50	17.00	16.00
Fumigants--per gal. . . . .	5.00	5.00	5.00	5.00	5.00	5.00
Detergents--per lb. . . . .	.20	.20	.20	.20	.20	.20
Potassium perman- ganate--per lb. . . . .	.50	.50	.50	.50	.50	.50
Total cost:						
Egg cases . . . . .	168.60	337.20	463.10	617.65	983.00	1,404.00
Tray paper . . . . .	427.90	836.35	1,264.25	1,692.15	2,956.40	4,201.20
Boxes and lids . . . . .	1,458.60	2,903.18	4,271.25	5,598.10	9,679.80	13,932.00
Pads . . . . .	280.88	554.25	819.90	1,059.28	1,803.36	2,476.80
Fumigants . . . . .	60.00	100.00	160.00	200.00	340.00	500.00
Detergents . . . . .	24.00	40.00	60.00	80.00	136.00	200.00
Potassium perman- ganate . . . . .	4.00	6.00	8.00	10.00	14.00	24.00
Total . . . . .	2,423.98	4,776.98	7,046.50	9,257.18	15,912.56	22,738.00

1/ Each egg case was used an average of 10 times before discarding.

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APPENDIX A. TABLES

Table 22.--Percentage hatchability of egg-type chicken eggs for specific months, 1962

Months	Average hatchability	Range
	<u>Percent</u>	<u>Percent</u>
January	84.4	71.9 - 95.0
February	83.8	69.9 - 91.3
March	84.2	73.0 - 91.0
April	82.9	67.2 - 94.3
May	83.1	74.0 - 89.0
June	81.7	70.1 - 87.7
July	82.6	77.0 - 88.9
August	80.6	73.0 - 87.7
September	83.0	72.0 - 89.5
October	83.1	75.0 - 93.3
November	85.2	76.2 - 91.5
December	86.5	76.3 - 93.0
Annual	83.1	71.4 - 89.3

Table 23.--Typical work schedule for an egg-type chick hatchery producing two hatches a week, Monday and Friday, including services

Day	:	Work performed
Sunday .....	:	Check machines
Monday .....	:	Set eggs
	:	Pull hatch, count, and box chicks
	:	Sex chicks
	:	Debeak 35 percent of pullets
	:	Dewing 30 percent of pullets
	:	Decomb 30 percent of pullets
	:	Grade, count, and box pullets
Tuesday .....	:	Load out salable pullets
	:	Clean hatchers
	:	Clean hatch trays by hand or machine
	:	Clean hatchery building
	:	Make chick boxes
Wednesday .....	:	Transfer eggs to hatchers
	:	Check machines
Thursday .....	:	Receive and store eggs
	:	Grade and tray eggs
	:	Clean hatchery building
Friday .....	:	Set eggs
	:	Pull hatch, count, and box chicks
	:	Sex chicks
	:	Debeak 35 percent of pullets
	:	Dewing 30 percent of pullets
	:	Decomb 30 percent of pullets
	:	Grade, count, and box pullets
Saturday .....	:	Load out pullets
	:	Transfer eggs to hatcher
	:	Clean hatcher
	:	Clean hatch trays by hand or machine
	:	Clean hatchery building
	:	Receive and store eggs
	:	Grade and tray eggs

Table 24.--Typical work schedule for an egg-type chick hatchery producing three hatches a week, Monday, Wednesday and Friday, including services

Day	Work performed
Sunday .....	Check machines
Monday .....	Clean incubator and set eggs
	: Pull hatch, count, and box chicks
	: Sex chicks
	: Debeak 35 percent of pullets
	: Dewing 30 percent of pullets
	: Decomb 30 percent of pullets
	: Grade, count, and box pullets
	: Transfer eggs from incubator to hatcher
Tuesday .....	Load out pullets
	: Clean and disinfect hatchers
	: Clean and disinfect hatch trays
	: Clean hatchery building
	: Receive and store eggs
	: Grade and tray eggs
	: Make chick boxes
Wednesday .....	Transfer eggs from incubator to hatcher
	: Clean incubator and set eggs
	: Pull hatch, count, and box chicks
	: Sex chicks
	: Debeak 35 percent of pullets
	: Dewing 30 percent of pullets
	: Decomb 30 percent of pullets
	: Grade, count, and box pullets
Thursday .....	Load out pullets
	: Receive and store eggs
	: Grade and tray eggs
	: Clean and disinfect hatchers
	: Clean and disinfect hatch trays
	: Clean hatchery building
Friday .....	Clean incubator and set eggs
	: Pull hatch, count, and box chicks
	: Sex chicks
	: Debeak 35 percent of pullets
	: Dewing 30 percent of pullets
	: Decomb 30 percent of pullets
	: Grade, count, and box pullets
Saturday .....	Load out pullets
	: Transfer eggs from incubator to hatcher
	: Receive and store eggs
	: Grade and tray eggs
	: Clean and disinfect hatchers
	: Clean and disinfect hatch trays
	: Clean hatchery building

Table 25.--Typical work schedule for an egg-type chick hatchery producing four hatches a week, Monday, Wednesday, Thursday and Friday, including services

Day	Work performed
Sunday .....	Make chick boxes
Monday .....	Clean incubators and set eggs Pull hatch, count and box chicks Sex chicks Debeak 35 percent of pullets Dewing 30 percent of pullets Decomb 30 percent of pullets Grade, count, and box pullets Transfer eggs from incubators to hatchers
Tuesday .....	Load out pullets Receive and store eggs for Wednesday and Thursday's setting Grade and tray eggs for Wednesday and Thursday's setting Transfer eggs from incubators to hatchers Clean and disinfect hatchers Clean and disinfect hatch trays Clean hatchery building Make chick boxes
Wednesday .....	Transfer eggs from incubators to hatchers Clean incubators and set eggs Pull hatch, count, and box chicks Sex chicks Debeak 35 percent of pullets Dewing 30 percent of pullets Decomb 30 percent of pullets Grade, count, and box pullets
Thursday .....	Load out pullets Clean incubators and set eggs Pull hatch, count, and box chicks Sex chicks Debeak 35 percent of pullets Dewing 30 percent of pullets Decomb 30 percent of pullets Grade, count, and box pullets Receive and store eggs Grade and tray eggs Clean and disinfect hatchers Clean and disinfect hatch trays Clean hatchery building Make chick boxes



Table 25.--Typical work schedule for an egg-type chick hatchery producing four hatches a week, Monday, Wednesday, Thursday and Friday, including services--  
Continued

Day	:	Work performed
Friday .....	:	Load out pullets
	:	Clean incubators and set eggs
	:	Pull hatch, count, and box chicks
	:	Sex chicks
	:	Debeak 35 percent of pullets
	:	Dewing 30 percent of pullets
	:	Decomb 30 percent of pullets
	:	Grade, count, and box pullets
	:	Clean and disinfect hatch trays
Saturday .....	:	Load out pullets
	:	Transfer eggs from incubators to hatchers
	:	Receive and store eggs
	:	Grade and tray eggs
	:	Clean and disinfect hatchers
	:	Clean and disinfect hatch trays
	:	Clean hatchery building

Table 26.--Typical work schedule for an egg-type chick hatchery producing five hatches a week, Monday, Tuesday, Wednesday, Thursday and Friday, including services

Day	Work performed
Sunday .....	: Transfer eggs from incubators to hatchers : Make chick boxes for pullets from two : hatches
Monday .....	: Transfer eggs from incubators to hatchers : Clean incubators and set eggs : Receive and store eggs : Grade and tray eggs : Pull hatch, count, and box chicks : Sex chicks : Debeak 35 percent of pullets : Dewing 30 percent of pullets : Decomb 30 percent of pullets : Grade, count, and box pullets : Clean and disinfect hatchers : Clean and disinfect hatch trays
Tuesday .....	: Transfer eggs from incubators to hatchers : Clean incubators and set eggs : Load out pullets : Receive and store eggs for Wednesday and : Thursday's settings : Grade and tray eggs for Wednesday and : Thursday's settings : Pull hatch, count, and box chicks : Sex chicks : Debeak 35 percent of pullets : Dewing 30 percent of pullets : Decomb 30 percent of pullets : Grade, count, and box pullets : Clean and disinfect hatch trays
Wednesday .....	: Transfer eggs from incubators to hatchers : Clean incubators and set eggs : Load out pullets : Make chick boxes : Pull hatch, count, and box chicks : Sex chicks : Debeak 35 percent of pullets : Dewing 30 percent of pullets : Decomb 30 percent of pullets : Grade, count, and box pullets

Table 26.--Typical work schedule for an egg-type chick hatchery producing five hatches a week, Monday, Tuesday, Wednesday, Thursday and Friday, including services--Continued

Day	Work performed
Wednesday (cont.)	Clean and disinfect hatchers (Tuesday's and Wednesday's) Clean and disinfect hatch trays Clean hatchery building
Thursday	Load out pullets Clean incubators and set eggs Receive and store eggs Grade and tray eggs Pull hatch, count, and box chicks Sex chicks Debeak 35 percent of pullets Dewing 30 percent of pullets Decomb 30 percent of pullets Grade, count, and box pullets Clean and disinfect hatch trays Make chick boxes
Friday	Load out pullets Clean incubators and set eggs Pull hatch, count, and box chicks Sex chicks Debeak 35 percent of pullets Dewing 30 percent of pullets Decomb 30 percent of pullets Grade, count, and box pullets Clean and disinfect hatchers (Thursday's and Friday's) Clean and disinfect hatch trays Clean hatchery building
Saturday	Load out pullets Transfer eggs from incubators to hatchers Receive and store eggs Grade and tray eggs Clean hatchery building

Table 27.--Estimated hatching cost per salable pullet for model egg-type chick hatchery at various capacities, 52-week season, services included

Cost components	Annual cost	Percentage of annual capacity utilized				
		100	80	60	40	20
MODEL A	<u>Dollars</u>	<u>- Cents per salable pullet -</u>				
Fixed costs:						
Equipment depreciation .....	1,392.23	.37	.46	.61	.91	1.83
Building depreciation .....	570.00	.15	.19	.25	.37	.75
Building repair & maintenance .....	357.00	.10	.12	.16	.24	.47
Equipment repair & maintenance .....	458.55	.12	.15	.20	.30	.60
Taxes .....	271.85	.07	.09	.12	.18	.36
Insurance .....	271.85	.07	.09	.12	.18	.36
Interest .....	815.55	.22	.27	.36	.54	1.07
Miscellaneous .....	350.00	.09	.11	.15	.23	.46
Average total fixed costs .....	4,487.03	1.19	1.48	1.97	2.95	5.90
Variable costs:						
Utilities .....		.66	.79	.96	1.15	1.35
Supplies .....		.64	.64	.65	.65	.70
Labor .....		1.37	1.37	1.44	1.74	2.18
Sexing cost .....		2.04	2.04	2.04	2.04	2.04
Average total variable costs .....		4.71	4.84	5.09	5.58	6.27
Average total costs ..		5.90	6.32	7.06	8.53	12.17
		- - - - - <u>Number</u> - - - - -				
Salable pullets .....		379,012	304,537	228,403	152,268	76,134



Table 27.--Estimated hatching cost per salable pullet for model egg-type chick hatchery at various capacities, 52-week season, services included-- Continued

Cost components	Annual cost	Percentage of annual capacity utilized				
		100	80	60	40	20
	<u>Dollars</u>	<u>Cents per salable pullet</u>				
MODEL B						
Fixed costs:						
Equipment depreciation .....	2,436.83	.32	.40	.53	.80	1.60
Building depreciation .....	900.00	.12	.15	.20	.29	.59
Building repair & maintenance .....	555.00	.07	.09	.12	.18	.37
Equipment repair & maintenance .....	778.29	.10	.13	.17	.25	.51
Taxes .....	444.43	.06	.07	.10	.15	.29
Insurance .....	444.43	.06	.07	.10	.15	.29
Interest .....	1,333.29	.17	.22	.29	.44	.88
Miscellaneous .....	600.00	.08	.10	.13	.20	.39
Average total fixed costs .....	7,492.27	.98	1.23	1.64	2.46	4.92
Variable costs:						
Utilities .....		.59	.62	.65	.81	1.18
Supplies .....		.63	.63	.64	.64	.65
Labor .....		1.10	1.23	1.38	1.59	1.90
Sexing cost .....		2.04	2.04	2.04	2.04	2.04
Average total variable costs .....		4.36	4.52	4.71	5.08	5.77
Average total costs .....		5.34	5.75	6.35	7.54	10.69
		- - - - - <u>Number</u> - - - - -				
Salable pullets .....		758,024	609,074	456,805	304,537	152,268

Table 27.--Estimated hatching cost per salable pullet for model egg-type chick hatchery at various capacities, 52-week season, services included--Continued

Cost components	Annual cost	Percentage of annual capacity utilized				
		100	80	60	40	20
		-----Cents per salable pullet-----				
MODEL C						
Fixed costs:						
Equipment depreciation .....	3,486.73	.31	.38	.51	.76	1.53
Building depreciation .....	1,275.00	.11	.14	.19	.28	.56
Building repair & maintenance .....	780.00	.07	.08	.11	.17	.34
Equipment repair & maintenance .....	1,104.87	.10	.12	.16	.24	.48
Taxes .....	628.29	.05	.07	.09	.14	.27
Insurance .....	628.29	.05	.07	.09	.14	.27
Interest .....	1,884.87	.17	.21	.28	.41	.83
Miscellaneous .....	1,300.00	.11	.14	.19	.28	.57
Average total fixed costs .....	11,088.05	.97	1.21	1.62	2.42	4.85
Variable costs:						
Utilities .....		.49	.56	.61	.68	.98
Supplies .....		.62	.62	.63	.64	.65
Labor .....		1.05	1.16	1.33	1.54	1.96
Sexing cost .....		2.04	2.04	2.04	2.04	2.04
Average total variable costs .....		4.20	4.38	4.61	4.90	5.63
Average total costs ..		5.17	5.59	6.23	7.32	10.48
		-----Number-----				
Salable pullets .....		1,137,036	913,611	685,208	456,805	228,403

Table 27.--Estimated hatching cost per salable pullet for model egg-type chick hatchery at various capacities, 52-week season, services included--Continued

Cost components	Annual cost	Percentage of annual capacity utilized				
		100	80	60	40	20
MODEL D	<u>Dollars</u>	<u>- Cents per salable pullet -</u>				
Fixed costs:						
Equipment depreciation .....	4,607.46	.31	.38	.51	.76	1.51
Building depreciation .....	1,680.00	.11	.14	.18	.27	.55
Building repair & maintenance .....	1,023.00	.07	.08	.11	.18	.34
Equipment repair & maintenance .....	1,455.75	.10	.12	.16	.24	.48
Taxes .....	825.25	.05	.07	.09	.13	.27
Insurance .....	825.25	.05	.07	.09	.13	.27
Interest .....	2,475.75	.16	.20	.27	.41	.81
Miscellaneous .....	1,700.00	.11	.14	.19	.28	.56
Average total fixed costs .....	14,592.46	.96	1.20	1.60	2.40	4.79
Variable costs:						
Utilities .....		.36	.45	.58	.66	.84
Supplies .....		.61	.61	.62	.63	.64
Labor .....		1.14	1.26	1.45	1.74	2.31
Sexing cost .....		2.04	2.04	2.04	2.04	2.04
Average total variable costs .....		4.15	4.36	4.69	5.07	5.83
Average total costs..		5.11	5.56	6.29	7.47	10.62
		<u>- Number -</u>				
Salable pullets .....		1,516,047	1,218,148	913,611	609,074	304,537

Table 27.--Estimated hatching cost per salable pullet for model egg-type chick hatchery at various capacities, 52-week season, services included--Continued

Cost components	Annual cost	Percentage of annual capacity utilized				
		100	80	60	40	20
		-----Cents per salable pullet-----				
MODEL E	Dollars					
Fixed costs:						
Equipment depreciation	8,091.61	.31	.38	.51	.76	1.52
Building depreciation	2,615.00	.10	.12	.16	.25	.49
Building repair & maintenance	1,584.00	.06	.07	.10	.15	.30
Equipment repair & maintenance	2,622.87	.10	.12	.16	.25	.49
Taxes	1,402.29	.05	.07	.09	.13	.26
Insurance	1,402.29	.05	.07	.09	.13	.26
Interest	4,206.87	.16	.20	.26	.39	.79
Miscellaneous	3,000.00	.11	.14	.19	.28	.56
Average total fixed costs	24,924.93	.94	1.17	1.56	2.34	4.67
Variable costs:						
Utilities		.33	.35	.36	.47	.66
Supplies		.60	.60	.61	.61	.62
Labor		1.00	1.08	1.22	1.46	2.00
Sexing cost		2.04	2.04	2.04	2.04	2.04
Average total variable costs		3.97	4.07	4.23	4.58	5.32
Average total costs		4.91	5.24	5.79	6.92	9.99
		-----Number-----				
Salable pullets		2,653,083	2,131,759	1,598,819	1,065,879	532,940



Table 27.--Estimated hatching cost per salable pullet for model egg-type chick hatchery at various capacities, 52-week season, services included--Continued

Cost components	Annual cost	Percentage of annual capacity utilized				
		100	80	60	40	20
	<u>Dollars</u>	<u>Cents per salable pullet</u>				
MODEL F						
Fixed costs:						
Equipment depreciation .....	11,335.62	.30	.37	.50	.74	1.49
Building depreciation .....	3,625.00	.10	.12	.16	.24	.48
Building repair & maintenance .....	2,205.00	.06	.07	.10	.14	.29
Equipment repair & maintenance .....	3,634.92	.10	.12	.16	.24	.48
Taxes .....	1,946.64	.05	.06	.08	.13	.25
Insurance .....	1,946.64	.05	.06	.08	.13	.25
Interest .....	5,839.92	.15	.19	.25	.38	.77
Miscellaneous .....	5,000.00	.13	.17	.22	.33	.66
Average total fixed costs .....	35,533.74	.94	1.16	1.55	2.33	4.67
Variable costs:						
Utilities .....		.28	.32	.34	.39	.61
Supplies .....		.59	.60	.60	.61	.63
Labor .....		.94	1.02	1.15	1.36	1.95
Sexing cost .....		2.04	2.04	2.04	2.04	2.04
Average total variable costs .....		3.85	3.98	4.13	4.40	5.23
Average total costs .....		4.79	5.14	5.68	6.73	9.90
		----- <u>Number</u> -----				
Salable pullets .....	3,790,120	3,045,370	2,284,030	1,522,680	761,340	

Table 28.--Estimated hatching cost per salable pullet for model egg-type chick hatchery at various capacities, 22-week season, services included

Cost components	Annual cost	Percentage of capacity utilized				
		100	80	60	40	20
		- - - - -Cents per salable pullet- - - - -				
MODEL A	<u>Dollars</u>					
Fixed costs:						
Equipment depreciation .....	1,392.23	1.03	1.29	1.71	2.50	5.00
Building depreciation .....	570.00	.42	.53	.70	1.03	2.05
Building repair & maintenance .....	357.00	.27	.33	.44	.64	1.28
Equipment repair & maintenance .....	458.55	.34	.42	.56	.82	1.65
Taxes .....	271.85	.20	.25	.34	.49	.98
Insurance .....	271.85	.20	.25	.34	.49	.98
Interest .....	815.55	.61	.75	1.00	1.47	2.93
Miscellaneous .....	350.00	.26	.32	.43	.63	1.26
Average total fixed costs .....	4,487.03	3.33	4.14	5.52	8.07	16.13
Variable costs:						
Utilities .....		1.18	1.26	1.35	1.51	1.70
Supplies .....		.66	.68	.70	.71	.73
Labor .....		1.43	1.44	1.52	1.86	2.42
Sexing cost .....		2.04	2.04	2.04	2.04	2.04
Average total variable costs .....		5.31	5.42	5.61	6.12	6.89
Average total costs		8.64	9.56	11.13	14.19	23.02
		- - - - -Number- - - - -				
Salable pullets .....		134,832	108,336	81,252	55,632	27,816

Table 28.--Estimated hatching cost per salable pullet for model egg-type chick hatchery at various capacities, 22-week season, services included--Continued

Cost components	Annual cost	Percentage of capacity utilized				
		100	80	60	40	20
	<u>Dollars</u>	<u>-Cents per salable pullet-</u>				
MODEL B						
Fixed costs:						
Equipment depreciation .....	2,436.83	.90	1.12	1.50	2.19	4.38
Building depreciation .....	900.00	.33	.42	.56	.81	1.62
Building repair & maintenance .....	555.00	.21	.26	.34	.50	1.00
Equipment repair & maintenance .....	778.29	.29	.36	.48	.70	1.40
Taxes .....	444.43	.17	.20	.27	.40	.80
Insurance .....	444.43	.17	.20	.27	.40	.80
Interest .....	1,333.29	.49	.62	.82	1.19	2.39
Miscellaneous .....	600.00	.22	.28	.37	.54	1.08
Average total fixed costs .....	7,492.27	2.78	3.46	4.61	6.73	13.47
Variable costs:						
Utilities .....		.94	1.03	1.13	1.26	1.51
Supplies .....		.65	.65	.65	.68	.70
Labor .....		1.19	1.33	1.51	1.66	2.00
Sexing cost .....		2.04	2.04	2.04	2.04	2.04
Average total variable costs .....		4.82	5.05	5.33	5.64	6.25
Average total costs		7.60	8.51	9.94	12.37	19.72
				<u>-Number-</u>		
Salable pullets .....		296,701	216,672	162,504	111,264	55,632

Table 28.--Estimated hatching cost per salable pullet for model egg-type chick hatchery at various capacities, 22-week season, services included--Continued

Cost components	Annual cost	Percentage of capacity utilized				
		100	80	60	40	20
MODEL C						
	<u>Dollars</u>	<u>Cents per salable pullet</u>				
Fixed costs:						
Equipment depreciation .....	3,486.73	.86	1.06	1.43	2.14	4.18
Building depreciation .....	1,275.00	.31	.39	.52	.78	1.53
Building repair & maintenance .....	780.00	.19	.24	.32	.48	.93
Equipment repair & maintenance .....	1,104.87	.27	.34	.45	.68	1.32
Taxes .....	628.29	.15	.19	.26	.39	.75
Insurance .....	628.29	.15	.19	.26	.39	.75
Interest .....	1,884.87	.46	.57	.77	1.16	2.26
Miscellaneous .....	1,300.00	.32	.40	.53	.80	1.56
Average total fixed costs .....	11,088.05	2.71	3.38	4.54	6.82	13.28
Variable costs:						
Utilities .....		.76	.85	.96	1.14	1.35
Supplies .....		.64	.64	.65	.65	.70
Labor .....		1.14	1.25	1.45	1.65	2.07
Sexing cost .....		2.04	2.04	2.04	2.04	2.04
Average total variable costs .....		4.58	4.78	5.10	5.48	6.16
Average total costs		7.29	8.16	9.64	12.30	19.44
		- - - - - <u>Number</u> - - - - -				
Salable pullets .....		408,212	327,936	243,793	162,504	83,448



Table 28.--Estimated hatching cost per salable pullet for model egg-type chick hatchery at various capacities, 22-week season, services included--Continued

Cost components	Annual cost	Percentage of capacity utilized				
		100	80	60	40	20
		----- <u>Number</u> -----				
MODEL D	<u>Dollars</u>	<u>Cents per salable pullet</u>				
Fixed costs:						
Equipment depreciation .....	4,607.46	.85	1.05	1.41	2.13	4.14
Building depreciation .....	1,680.00	.31	.39	.51	.78	1.51
Building repair & maintenance .....	1,023.00	.19	.23	.31	.47	.92
Equipment repair & maintenance .....	1,455.75	.27	.33	.44	.67	1.31
Taxes .....	825.25	.15	.19	.25	.38	.74
Insurance .....	825.25	.15	.19	.25	.38	.74
Interest .....	2,475.75	.45	.57	.76	1.14	2.22
Miscellaneous .....	1,700.00	.31	.39	.52	.78	1.53
Average total fixed costs .....	14,592.46	2.68	3.34	4.45	6.73	13.11
Variable costs:						
Utilities .....		.64	.72	.79	.99	1.24
Supplies .....		.62	.63	.64	.65	.68
Labor .....		1.24	1.36	1.57	1.90	2.44
Sexing cost .....		2.04	2.04	2.04	2.04	2.04
Average total variable costs .....		4.54	4.75	5.04	5.58	6.40
Average total costs		7.22	8.09	9.49	12.31	19.51
Salable pullets .....		544,258	437,304	327,936	216,672	111,264

Table 28.--Estimated hatching cost per salable pullet for model egg-type chick hatchery at various capacities, 22-week season, services included--Continued

Cost components	Annual cost	Percentage of capacity utilized				
		100	80	60	40	20
		- - - - - <u>Number</u> - - - - -				
MODEL E	<u>Dollars</u>	<u>Cents per salable pullet</u> - - - - -				
Fixed costs:						
Equipment depreciation .....	8,091.61	.86	1.06	1.41	2.11	4.27
Building depreciation .....	2,615.00	.27	.34	.46	.68	1.38
Building repair & maintenance .....	1,584.00	.17	.21	.28	.41	.84
Equipment repair & maintenance .....	2,622.87	.28	.34	.46	.69	1.38
Taxes .....	1,402.29	.15	.18	.24	.37	.74
Insurance .....	1,402.29	.15	.18	.24	.37	.74
Interest .....	4,206.87	.44	.55	.73	1.10	2.22
Miscellaneous .....	3,000.00	.31	.39	.52	.78	1.58
Average total fixed costs .....	24,924.93	2.63	3.25	4.34	6.51	13.15
Variable costs:						
Utilities .....		.56	.60	.64	.86	1.10
Supplies .....		.62	.63	.64	.64	.66
Labor .....		1.07	1.16	1.31	1.57	2.15
Sexing cost .....		2.04	2.04	2.04	2.04	2.04
Average total variable costs .....		4.29	4.43	4.63	5.11	5.95
Average total costs .....		6.92	7.68	8.97	11.62	19.10
Salable pullets .....		948,910	765,240	573,944	382,648	189,588

Table 28.--Estimated hatching cost per salable pullet for model egg-type chick hatchery at various capacities, 22-week season, services included--Continued

Cost components	Annual cost	Percentage of capacity utilized				
		100	80	60	40	20
		-----				
	<u>Dollars</u>	<u>Cents per salable pullet</u>				
MODEL F						
Fixed costs:						
Equipment depreciation .....	11,335.62	.84	1.04	1.39	2.07	4.18
Building depreciation .....	3,625.00	.27	.33	.44	.66	1.34
Building repair & maintenance .....	2,205.00	.16	.20	.27	.40	.81
Equipment repair & maintenance .....	3,634.92	.27	.33	.45	.67	1.34
Taxes .....	1,946.64	.14	.18	.24	.36	.72
Insurance .....	1,946.64	.14	.18	.24	.36	.72
Interest .....	5,839.92	.43	.54	.71	1.07	2.16
Miscellaneous .....	5,000.00	.37	.46	.61	.91	1.85
Average total fixed costs .....	35,533.74	2.62	3.26	4.35	6.50	13.12
Variable costs:						
Utilities .....		.43	.46	.56	.72	.94
Supplies .....		.61	.61	.62	.62	.65
Labor .....		1.02	1.11	1.25	1.49	2.25
Sexing cost .....		2.04	2.04	2.04	2.04	2.04
Average total variable costs .....		4.10	4.22	4.47	4.87	5.88
Average total costs ..		6.72	7.48	8.82	11.37	19.00
-----						
		----- <u>Number</u> -----				
Salable pullets .....	1,355,568	1,089,309	817,005	546,616	270,877	

Table 29.--Quantity of equipment required for annual operation of six model egg-type chick hatcheries at 100 percent of annual incubator capacity

Type of equipment	Models					
	A	B	C	D	E	F
	-----Units-----					
Vacuum lift egg tray	1	1	1	2	2	2
Tray carts	6	8	8	10	14	20
Chicken box dollies	2	4	6	8	14	20
Dirty-hatch-tray dollies	2	3	6	6	10	14
Egg case dollies	4	4	4	6	6	6
Conveyor for egg cases	1-10'	1-10'	1-10'	2-10'	3-10'	3-10'
Work tables for candling, transfer and take off	2	2	2	3	4	6
Central vacuum system	1	1	1	1	1	1
Incubators	2	4	6	8	14	20
Hatchers	1	2	3	4	7	10
Egg-room coolers	1- $\frac{1}{2}$ ton	1- $\frac{3}{4}$ ton	1-1 ton	1-1 $\frac{1}{2}$ ton	1-2 ton	2-1 $\frac{1}{2}$ ton
Standby generators	1-10 kw	1-15 kw	1-30 kw	1-45 kw	1-85 kw	1-115 kw
Debeakers	2	2	3	4	7	10
Tray-washing equipment:						
Tub	1	1	2	2	1	1
High-pressure hose	1	2	2	2	2	2
Scrub brushes	3	3	5	5	3	3
Tray washer	---	---	---	---	1	1



Table 30.--Price per unit of equipment utilized in the annual operation of six egg-type chick hatcheries at 100 percent of capacity

Type of equipment	Model					
	A	B	C	D	E	F
	-----Dollars-----					
Vacuum lift egg tray	494.62	494.62	494.62	<u>1</u> /799.44	<u>1</u> /799.44	<u>1</u> /799.44
Tray carts <u>2</u> /	95.00	95.00	95.00	95.00	95.00	95.00
Chicken box dollies	25.00	25.00	25.00	25.00	25.00	25.00
Dirty-hatch-tray dollies	12.50	12.50	12.50	12.50	12.50	12.50
Egg case dollies	12.50	12.50	12.50	12.50	12.50	12.50
Conveyor for egg cases per 10 ft. section <u>2</u> /	52.15	52.15	52.15	52.15	52.15	52.15
Worktables for candling, transfer, & take-off	125.00	125.00	125.00	125.00	125.00	125.00
Central vacuum system	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00
Incubators	3,776.25	3,776.25	3,776.25	3,776.25	3,776.25	3,776.25
Hatchers	1,928.50	1,928.50	1,928.50	1,928.50	1,928.50	1,928.50
Egg room coolers <u>3</u> /	385.00	540.00	615.00	775.00	1,230.00	775.00
Standby generators	2,340.00	2,610.00	3,309.00	4,125.00	6,846.00	9,115.00
Debeakers	43.50	43.50	43.50	43.50	43.50	43.50
Tray washer <u>3</u> /	---	---	---	---	4,950.00	4,950.00

1/ Price of second unit equals \$304.82.

2/ Price does not include shipping expense.

3/ Price does not include shipping and installation.

# LAYOUT OF EGG-TYPE CHICK HATCHERY A

## Annual Capacity About 1 Million Eggs

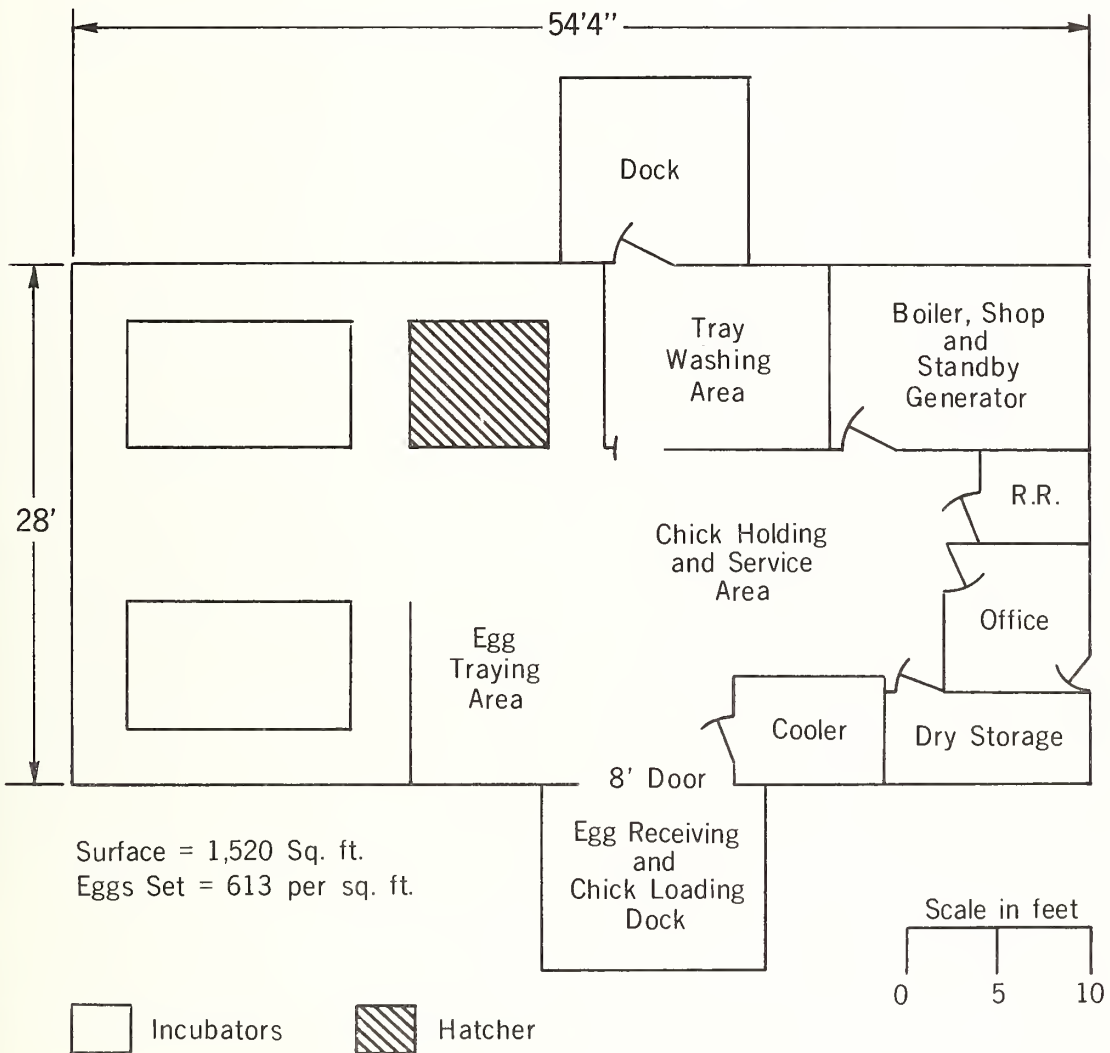


Figure 3

# LAYOUT OF EGG-TYPE CHICK HATCHERY B

## Annual Capacity About 2 Million Eggs

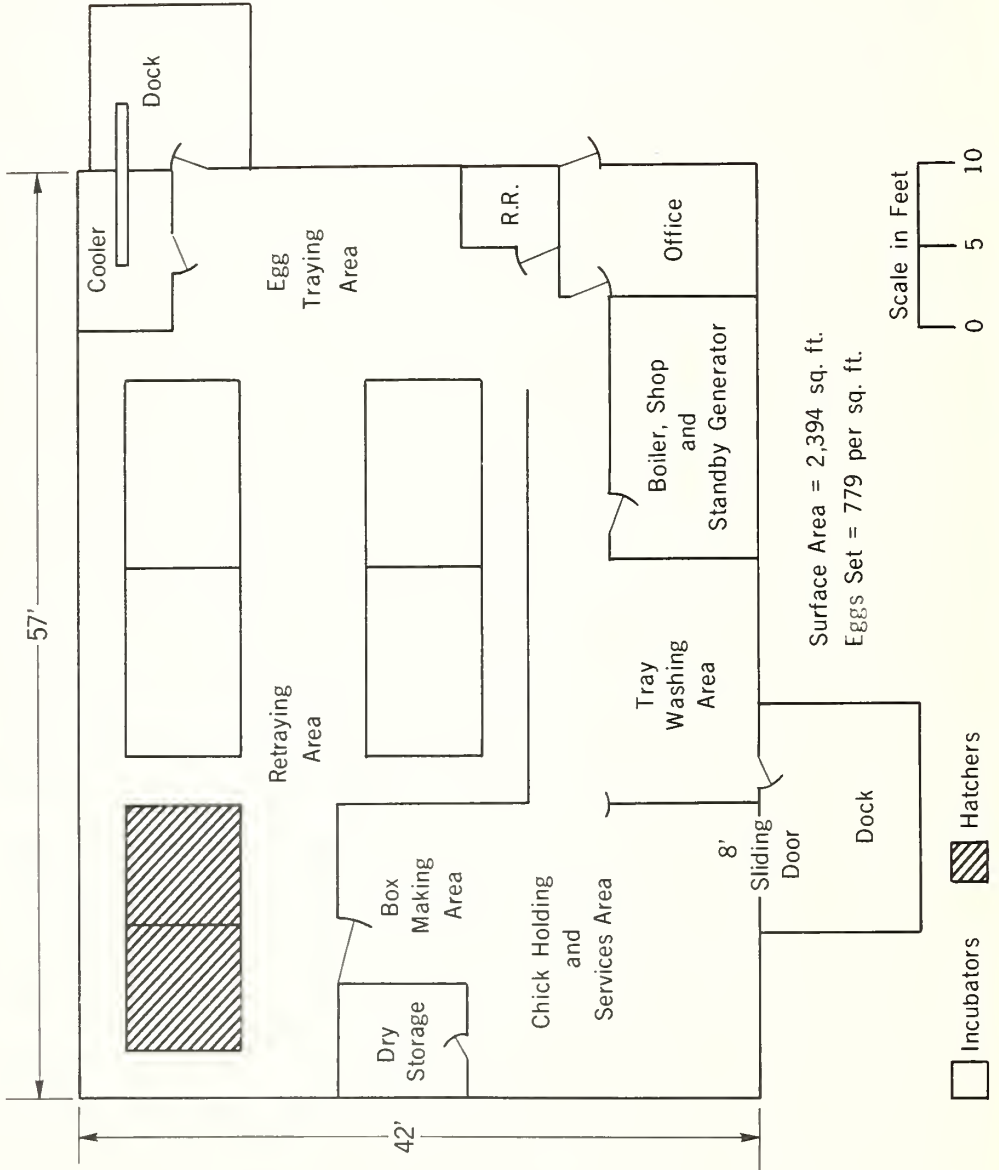


Figure 4

# LAYOUT OF EGG -TYPE CHICK HATCHERY C

## Annual Capacity About 3 Million Eggs

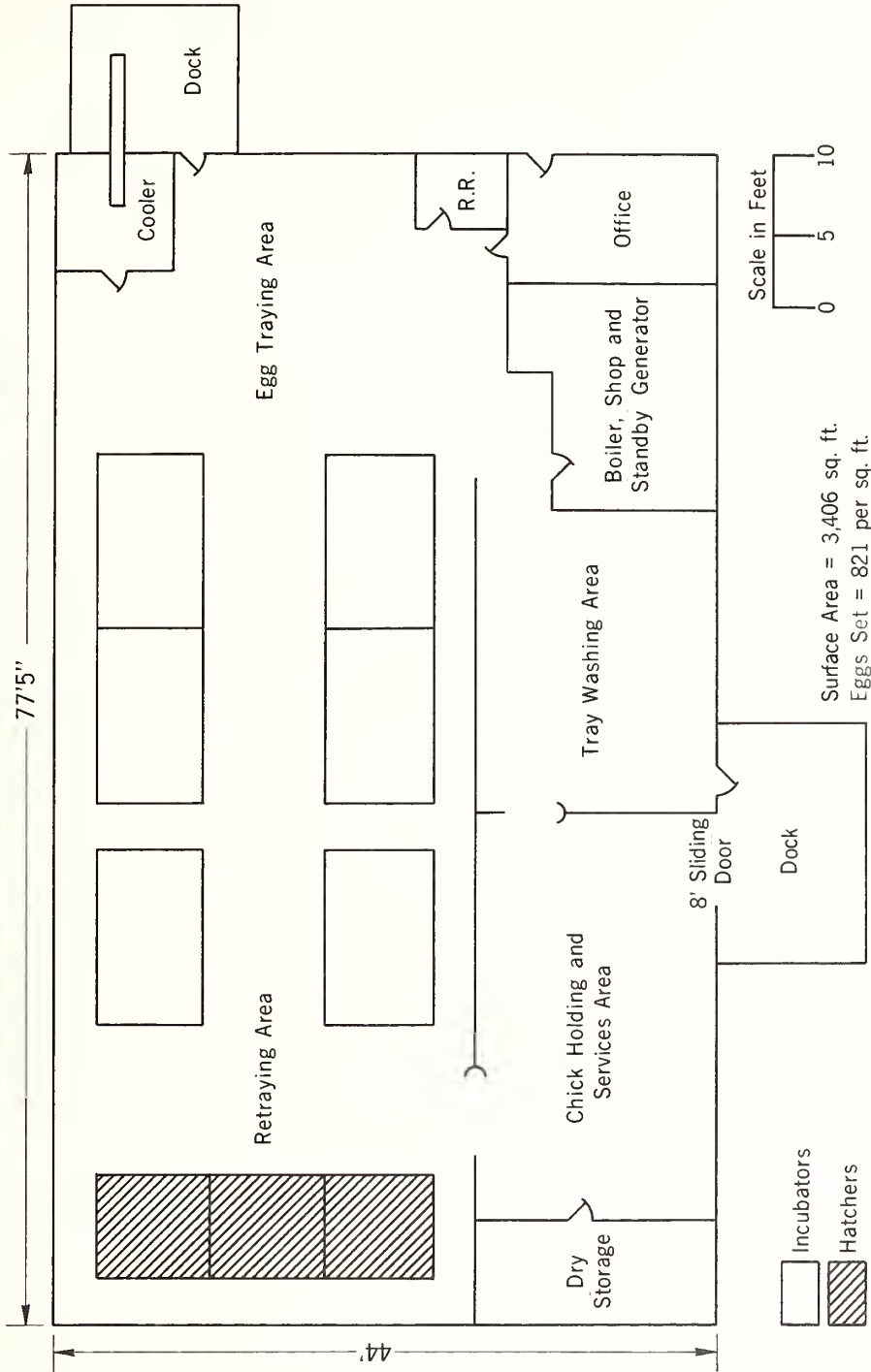


Figure 5

# LAYOUT OF EGG-TYPE CHICK HATCHERY D

## Annual Capacity About 4 Million Eggs

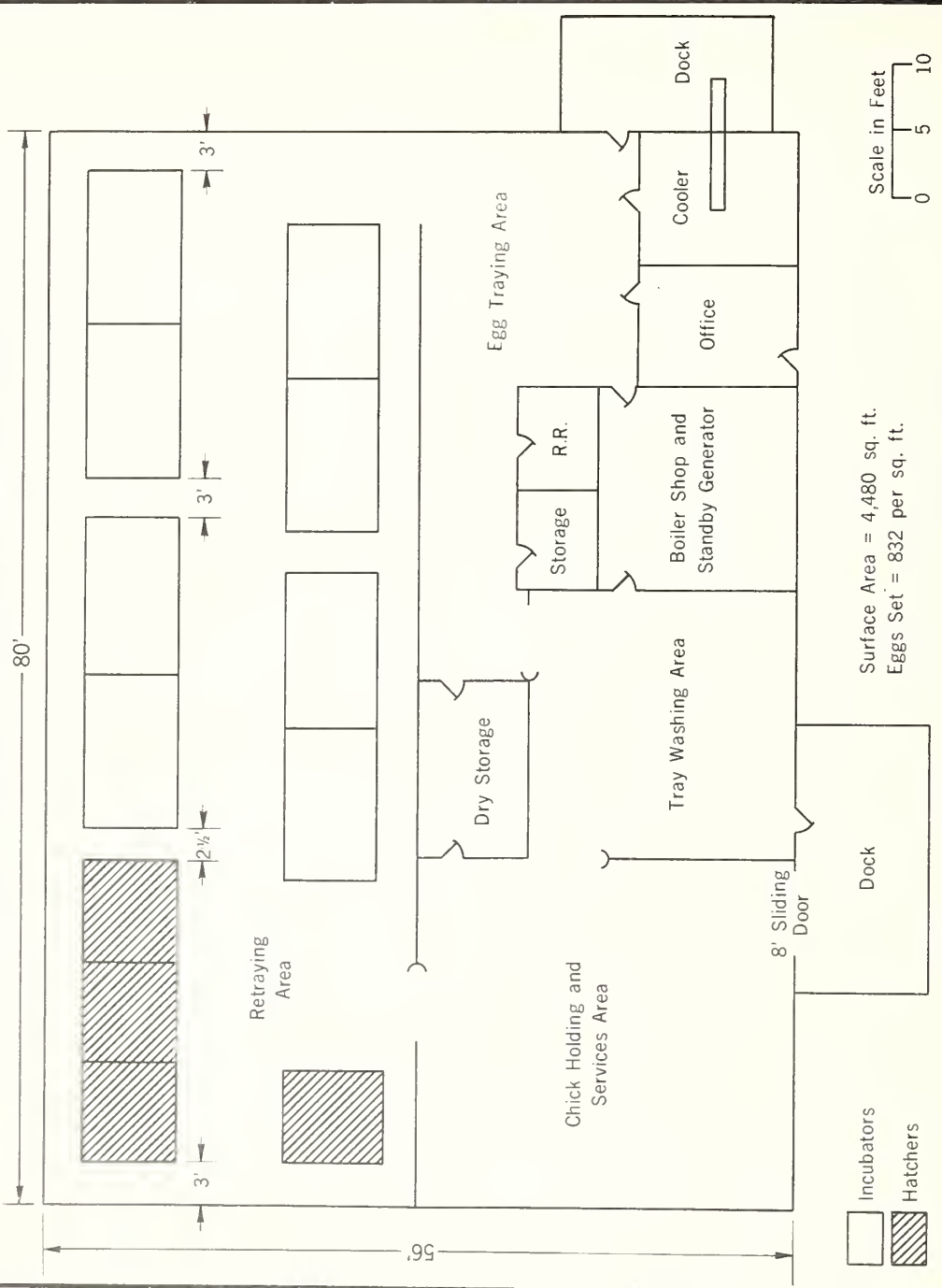
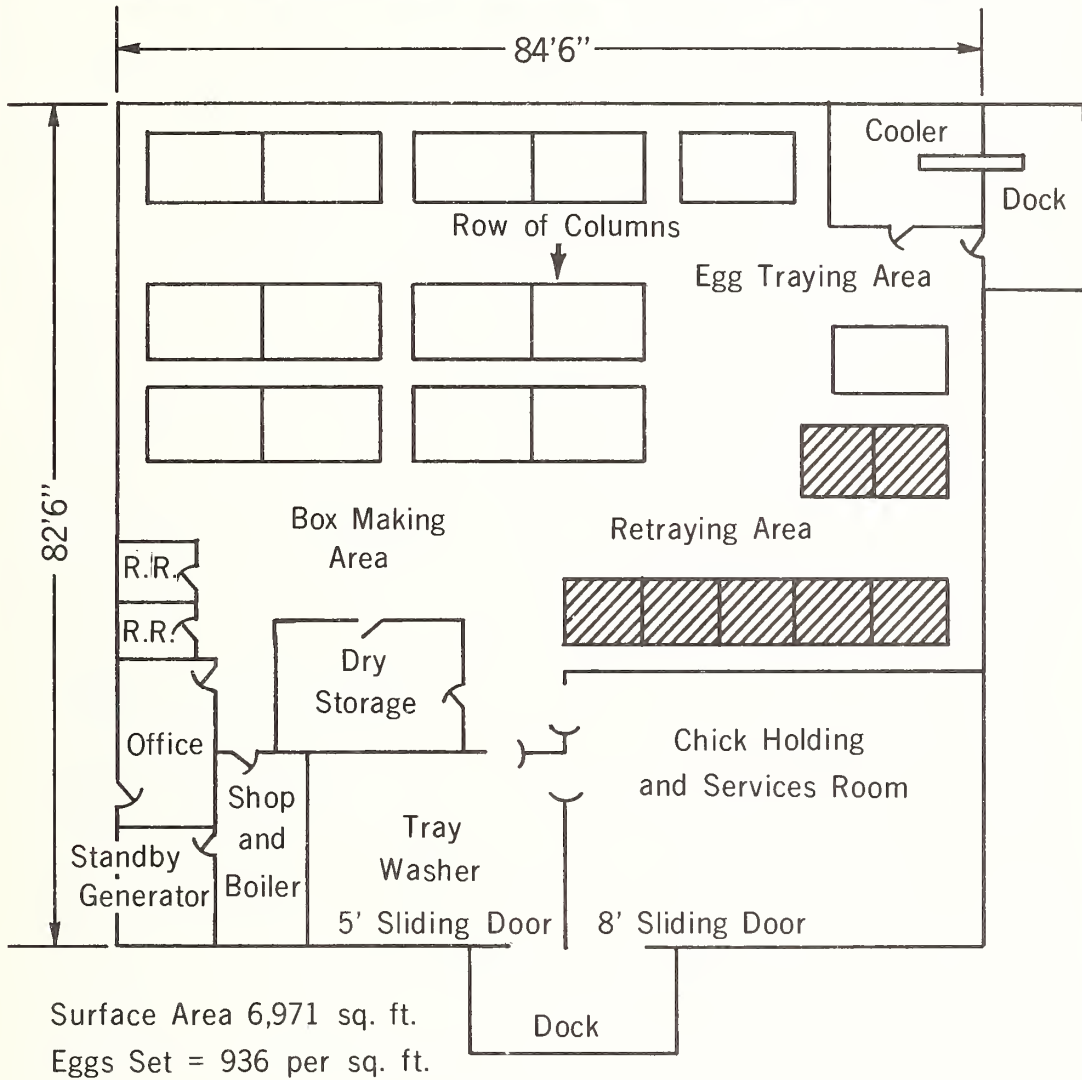


Figure 6



# LAYOUT OF EGG-TYPE CHICK HATCHERY E

## Annual Capacity About 7 Million Eggs



□ Incubators

▨ Hatchers

Scale in Feet  
0 10 20

Figure 7

# LAYOUT OF EGG-TYPE CHICK HATCHERY F

## Annual Capacity About 10 Million Eggs

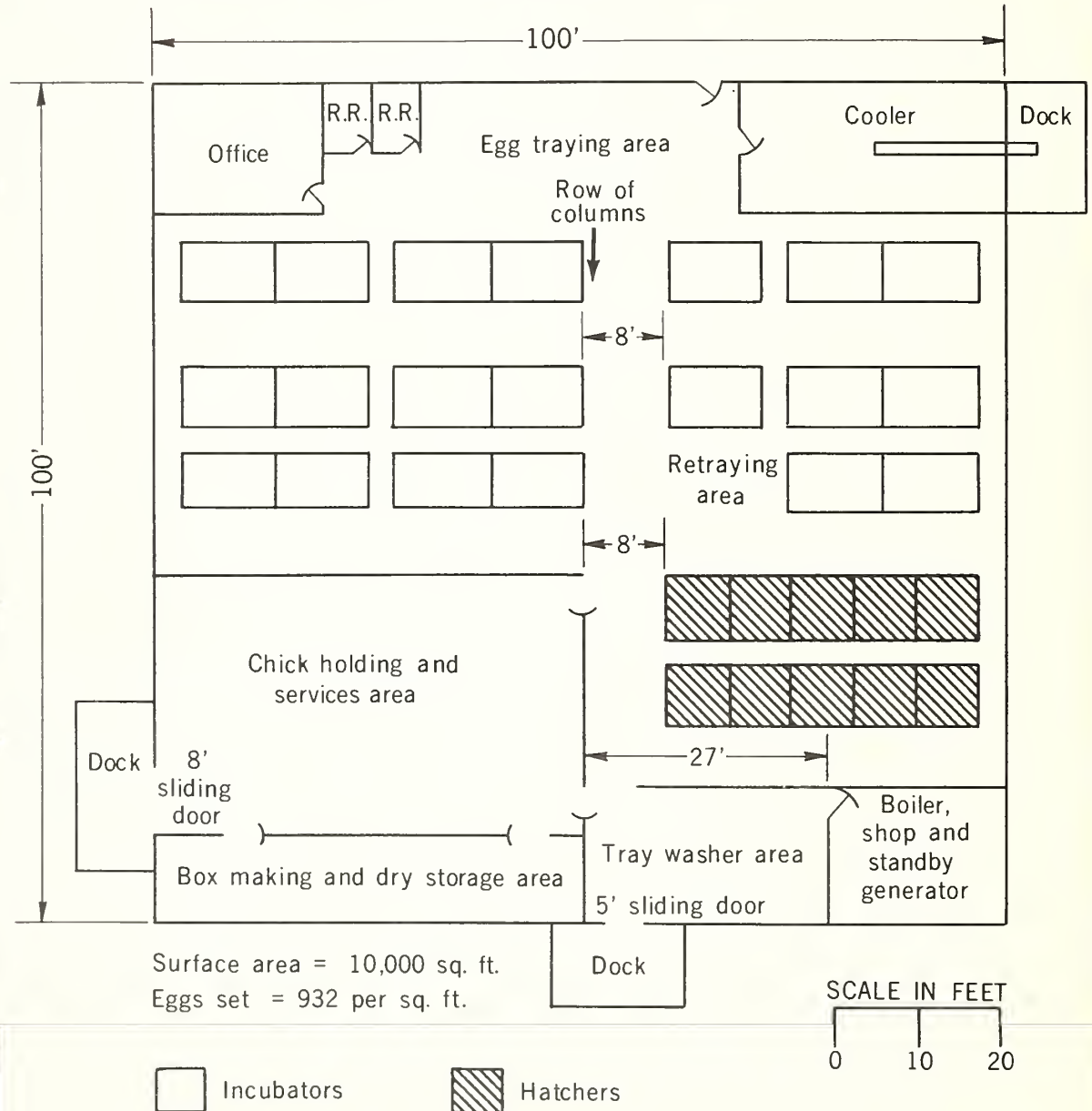


Figure 8



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