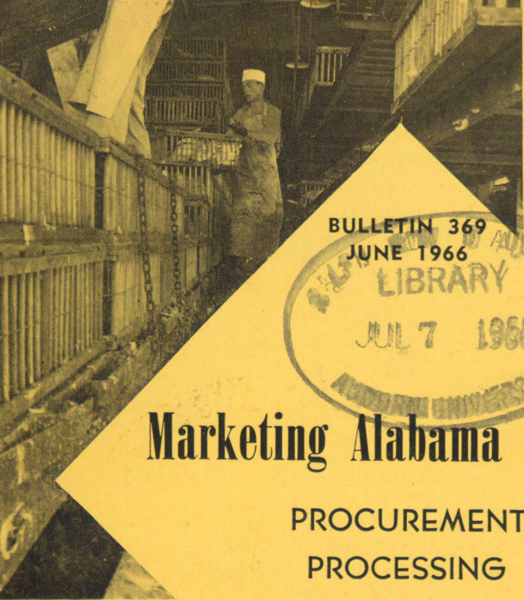
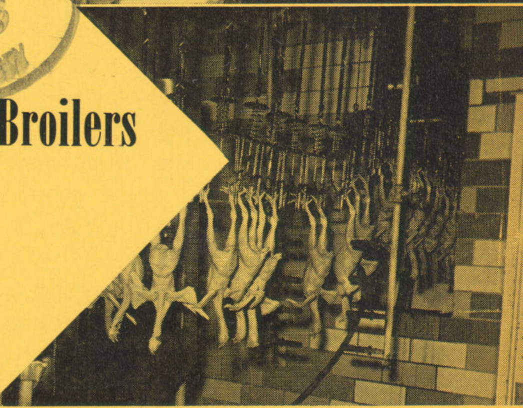
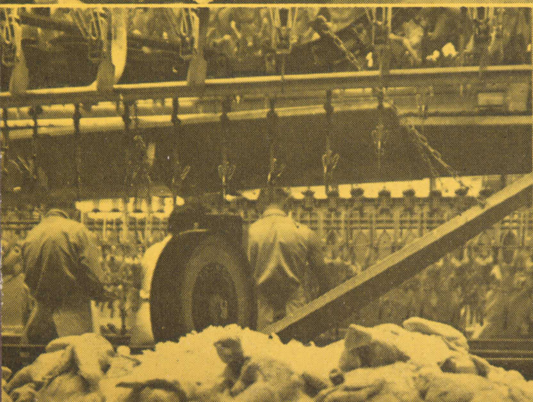
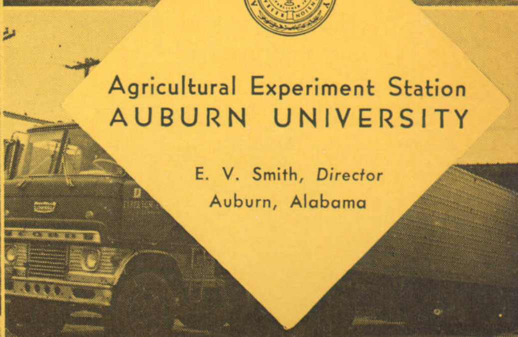



BULLETIN 369
JUNE 1966

Marketing Alabama Broilers

PROCUREMENT
PROCESSING
DISTRIBUTION



Agricultural Experiment Station
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CONCLUSIONS

The combined cost of assembly, processing, and distribution must be considered simultaneously when making long-range plans in the broiler industry. Any expansion in processing plant capacity should be accompanied by an increase in broiler production density. Economies of scale do exist in broiler processing, but expanding the supply area as a means of meeting requirements of a larger plant may in effect increase total cost because of increased hauling distance.

Probably the most profitable adjustment that Alabama processors could make would be to increase effective production density. Increasing effective production density of a given supply area would probably require incentive payments to nearby producers for expanding production, or payments to potential producers above current payment level to induce them to produce for the particular firm. However, in many instances savings in flock servicing and assembly costs would more than offset necessary incentive payments. Savings would be greatest for highly integrated firms.

Coordination of grow-out through contractual arrangements has enabled Alabama processors to remain competitive. Grow-out programs have provided an increased and more stable volume of uniform live poultry for processing plants. Thus, processors were able to lower cost.

Grow-out facilities are not likely to be drawn into integrated complexes through ownership acquisition in the foreseeable future. Limited owner integration in the grow-out segment assures a processor of some protection against temporary shortages. However, the amount of capital needed to completely integrate a grow-out segment through ownership would be large and could probably be invested more profitably in other segments of the industry. Only slightly less coordination is afforded by using contracts, and these probably will continue to be used quite extensively as a means of achieving coordination of the grow-out segment.

The structure of Alabama's broiler industry favors large plants that are associated with vertically integrated complexes because of economies of scale and coordination afforded by an integrated arrangement. Therefore, further steps are likely to be forthcoming in the foreseeable future to completely integrate vertically the broiler industry and to improve efficiency of existing vertically integrated arrangements. Also, many processing plants are likely to be expanded in capacity in future years as broiler production within the State continues to increase. Future growth of the industry will probably come about by expansion of existing firms rather than entrance of new firms. Entrance of new firms will be restricted because of sizeable capital requirements, and because of difficulties that would be present in establishing sources of supply and adequate market outlets for finished products.

Competition is not expected to become less keen in the future. Therefore, all segments of the industry in Alabama should continue their united efforts to make operational and organizational adjustments. Prompt action in making proper adjustments will be a major factor in determining whether Alabama's broiler industry will be able to maintain a favorable competitive position.

IMPLICATIONS

It appears that a majority of Alabama processing plants are cutting output excessively during the season of slack demand. An alternative worth considering would be to operate at a high per cent of designed capacity throughout the year, freeze output that could not be sold during the season of slack demand, and sell frozen inventories during the season of peak demand. If total costs of processing could be lowered enough by a stable operation to offset increases in costs resulting from freezing and storing birds, this would be a profitable adjustment. An adjustment of this nature would require a sizeable increase in freezing and storing facilities over and above those now available. Some problems related to consumer acceptance would have to be overcome in order to market an increased volume of frozen poultry. Nonetheless, this is an area that merits further research to determine the feasibility of such changes.

Development of new equipment, methods, and techniques has been rapid in the broiler industry. Though development may occur at a decreasing rate in the future, effects may be more pronounced in the area of marketing. Many in the industry are now of the opinion that the time has come when further processing of poultry products must be done. This opinion arises from (1) competitive position of poultry products with other meat products, (2) changing consumer desires, and (3) need for a more efficient system for marketing poultry and poultry products.

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First Printing 3M, June 1966

MARKETING ALABAMA BROILERS

Procurement
Processing
Distribution*

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INTRODUCTION

THE BROILER INDUSTRY of the United States has experienced rapid growth in recent years. Although a majority of the states involved in broiler production has shared in this growth, several have experienced a decline. Growth in the broiler industry has been very pronounced in Alabama, and production of poultry and poultry products is a leading industry in the State.

The last 10 years has been a period of rapid expansion in the State's broiler industry. In 1953 Alabama ranked tenth among broiler growing states, producing 28.4 million birds (3.0% of U.S. total). By 1963 the State had moved to third in the Nation, producing 228 million birds (10.8% of U.S. total)[1].

Expanded production in major supply areas of the United States has placed unusual pressure upon broiler prices. Concurrently, the continued downward pressure upon prices and

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* This project was supported by funds provided by the Research and Marketing Act of 1946 and State research funds. It is a contributing study to the Southern Regional Research Project **Market Structure for Broilers in the South, and an Analysis of the Impact of a National Marketing Order upon Its Economic Organization and Efficiency, SM-26.**

** The authors wish to express their appreciation to the managers and owners of poultry processing plants operating in Alabama who have cooperated in conducting this study.

*** Resigned.

[1] In 1965, Alabama's production was 285 million birds, representing 12.7 per cent of the U.S. total production.

the need for stable market outlets have spawned vertical integration activity within the industry. Producers have sought additional cost efficiencies through the development of larger operating units. These in turn have been consolidated into interlocking production-processing-marketing organization complexes.

It is desirable to evaluate the relative efficiency of various marketing systems that have evolved in order that (a) less efficient ones can be abandoned, and (b) new efficient models can be developed as a guide for the industry.

OBJECTIVES OF THE STUDY

There were three objectives in this study:

(1) To determine the types of broiler marketing systems operating.

(2) To determine the relative efficiency of various sizes of units and systems.

(3) To develop model systems designed to provide increased marketing efficiency.

METHOD OF STUDY

In 1962, a preliminary survey of poultry processing plants was conducted. Findings of this survey, together with information obtained from Cooperative Extension Service poultry specialists and from other sources, were used to ascertain the types of broiler marketing systems operating in the State.

A stratified random sample was used. All firms in the State whose primary business was processing broilers were classified into three categories according to size of operation. Size of operation was based on average weekly output in peak season. The classifications used were: Small—100,000 to 599,999 pounds per week, medium—600,000 to 1,199,999 pounds per week, and large—1,200,000 pounds or more per week. Four typical units were selected from each category and these plants constituted the sample.

A questionnaire was used in collecting data for this study, and answers were obtained through personal interviews with managers of processing plants.

INTEGRATION IN ALABAMA'S BROILER INDUSTRY

In recent years various forms of integration have developed in several sectors of agriculture. However, it has been most widely practiced in commercial broiler production, and the future of the industry may well depend on the success of this integration and related developments.

Controversy has developed in discussions concerning vertical integration because of divergent interpretations and definitions. Integrated economic endeavor occurs in such a wide variety of combinations that the definition applied makes a difference in the extent of integration, in analysis of effects, and in conclusions drawn about future developments.

Many economists are inclined toward a broad definition of vertical integration, one in which attention is given to decision making and resource allocation, regardless of ownership. Vertical integration may mean "any arrangement by which a decision maker in one stage of production acquires control of inputs, processes, or output levels in a vertically separated stage."[2] Vertical integration is usually referred to as "decision integration." This definition is acceptable because it embraces control by contracting facilities used in a separate stage, by an informal agreement kept effective by mutual benefits, as well as, by acquisition of these facilities. Therefore, the broad definition is used in this discussion of integration.

EXTENT OF INTEGRATION

Information obtained showed that 11 out of 12 processing plants visited were owned by or were part of a larger concern. Headquarters of nine of these were located out-of-state. This meant that top management staffs were not located in the vicinity of processing plants in Alabama. Eight of the nine concerns with out-of-state headquarters were vertically as well as horizontally integrated, and only one was not vertically integrated. Also, two of the three locally owned plants were part of vertically integrated firms. This was strong evidence to support a hypothesis that through growth, Alabama's broiler industry has been transformed from one composed of many independent firms to

[2] W. R. Henry and Robert Raunikar, "Integration in Practice—The Broiler Case." J. Farm Econ., XLII, p. 1265, Dec. 1960.

one of fewer but larger integrated firms. Integration probably contributed greatly to the tremendous growth of the industry that has taken place within the State.

The number of firms that indicated ownership of related facilities or control of these facilities through contract is summarized in Table 1. Several of these firms may also have owned breeder flocks and hatchery supply flocks to produce hatching eggs, but information was not obtained regarding these phases of production.

Data in Table 1 also indicate the degree to which the broiler industry is horizontally integrated at the processing stage. Horizontal integration at the processing stage refers to the ownership of more than one processing plant by a firm, eight of the firms reporting ownership of other processing plants. Operators of two of these reported ownership of other processing plants within the State, and the other six had additional plants in other states.

Integration of segments of the broiler industry is summarized below. The separate segments of the industry included were

Number of segments of broiler industry integrated	*Number of firms*
1	1
2	1
3	1
4	5
5	4

hatching, feed manufacturing, growing, live hauling, and processing. Degree of integration by ownership or control was indicated by number of firms that controlled two or more segments through ownership or formal contracts. One of the firms controlled two segments, one controlled three segments, five

TABLE 1. NUMBER OF FIRMS OWNING OR CONTROLLING THROUGH CONTRACT-RELATED FACILITIES BY TYPE OF FACILITY, ALABAMA, JULY 1962-JUNE 1963

Type of facility	Number of firms
Hatchery	10[1]
Feed mill	9
Other processing plants	8
Assembly trucks	6
Grow-out[2]	10

[1] One firm was constructing a hatchery at the time the survey was conducted and is included.

[2] A firm was considered to be involved in the grow-out phase of broiler production if: (1) it provided feed and chicks to contract broiler growers, or (2) it engaged in production of broilers using hired labor.

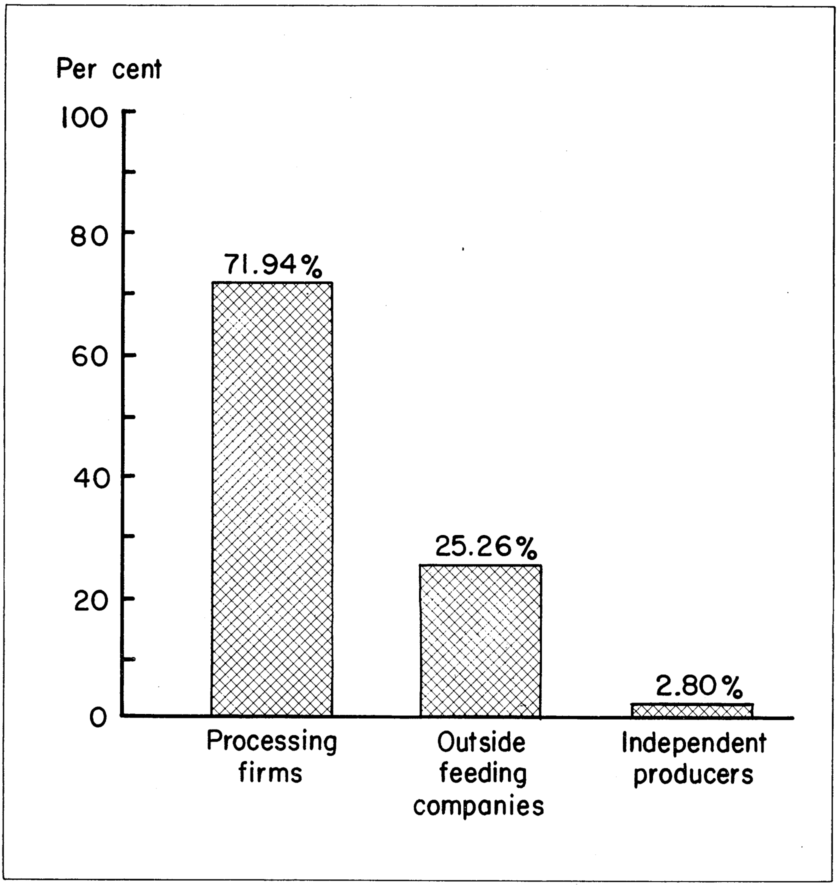

FIG. 1. Proportion of broilers grown, by location of decision control in grow-out stage, Alabama, July 1962-June 1963.

controlled four segments, and four firms controlled all five segments. All nine firms that controlled four or five segments had control of hatching, feed manufacturing, growing and processing segments.

Owner integration was widespread in coordinating all stages of the broiler production process except the grow-out stage. In Alabama, coordination of this stage was achieved almost entirely through contracts with very limited owner integrations. Figure 1 illustrates the extent to which contracts were used to coordinate growing and processing stages in the Alabama broiler industry. Seventy-one per cent of Alabama broilers was grown under direct contract between the grower and processor. Another 25 per cent was grown under contract between grower and outside feeding companies not involved in processing. Only 1 per cent of the birds was grown in grow-out facilities owned by the processing firms using hired labor, which indicated lack of owner integration in coordinating the grow-out segment. Processing firms that were procuring birds from outside feeding companies usually had informal agreements with such companies in respect to scheduling. Therefore, decision integration was almost complete at the grow-out stage even when only a very small percentage of broilers was grown in company-owned facilities.

PROCUREMENT AND ASSEMBLY OF ALABAMA BROILERS

An important phase in the operation of a poultry processing plant is the procedure of procuring and assembling live birds. The stability and adequacy of supply of live birds affects utilization of plant capacity and operation of a processing plant. Ownership arrangement under which birds are produced determines the degree of control a processor has over supply sources and extent of insurance against shortage of supply. Furthermore, concentration of production within a plant's supply area or the production density of a given firm will determine to a great extent assembly cost for the firm. Under a fully integrated arrangement, production density will affect other costs such as chick delivery, feed delivery, and field supervision.

Sources of Live Birds by Types of Arrangement

Alabama's broiler processors relied on four sources for live bird supplies. They were: (1) company-owned grow-out operations in which houses were owned by owners of a processing firm and grow-out operations were conducted by the processor using hired labor; (2) direct-contract in which producers retained ownership of houses, but grow-out operations were supervised by a processor; (3) outside feeding companies in which firms not associated with a processing plant through integration conducted grow-out operations either through contract with growers or in houses owned by the feeding company; and (4) independent producers who managed self-owned grow-out operations and did not rely on any form of a contractual arrangement with a processor or an outside feeding company. No broilers

TABLE 2. PROPORTION OF LIVE BIRDS PROCESSED THAT CAME FROM VARIOUS SOURCES, ALABAMA, JULY 1961-JUNE 1964

Source	Year		
	1961-62	1962-63	1963-64
	Pct.	*Pct.*	*Pct.*
Company owned houses	1.22	1.16	1.12
Direct contract growers	70.12	70.78	77.45
Outside feeding companies	25.81	25.26	19.22
Independent growers	2.85	2.80	2.21
Total	100.00	100.00	100.00

were procured from cooperative organizations or through auctions.

During the 3-year period in which information was obtained, direct-contractual production was the most important as a source of supply of live broilers, Table 2. Also, the proportion of birds grown under direct-contractual arrangements increased slightly during this period. Outside feeding companies were next in order of importance as a source of live broilers. Approximately 96 per cent of the birds processed in Alabama plants were produced under direct-contract or supplied by outside feeding companies. Company grow-out operations and independent producers were relatively insignificant as sources of live broilers for processing.

There were some notable differences in the small, medium, and large size plants as to the major source of supply of live broilers. Generally, plants classified as medium and large in terms of output were part of highly integrated firms; consequently, these processors relied very heavily on direct-contractual production as a source of supply, Table 3. In contrast, proces-

TABLE 3. PROPORTION OF BIRDS PROCESSED AT VARIOUS SIZE PLANTS BY SOURCE OF SUPPLY, ALABAMA, JULY 1962-JUNE 1963

Source	Plant size		
	Small[1]	Medium[2]	Large[3]
	Pct.	*Pct.*	*Pct.*
Company owned houses	6.14	----	----
Direct contract growers	6.14	80.66	88.93
Outside feeding companies	85.27	19.34	6.55
Independent growers	2.45	----	4.52
Total	100.00	100.00	100.00

[1] Average output in peak processing season was 100,000 to 599,999 pounds per week.
[2] Average output in peak processing season was 600,000 to 1,199,999 pounds per week.
[3] Average output in peak processing season was 1,200,000 pounds or more per week.

TABLE 4. NUMBER OF BROILER PROCESSORS PROCURING VARIOUS PROPORTIONS OF LIVE SUPPLIES FROM VARIOUS SUPPLY SOURCES, ALABAMA, JULY 1962-JUNE 1963

Proportion of live supplies	Company owned houses	Contract growers	Outside feeding companies	Independent producers	Total
	No.	*No.*	*No.*	*No.*	*No.*
90-100	----	6	2	----	8
75- 89	----	----	2	----	2
50- 74	----	1	1	----	2
25- 49	----	1	1	1	3
0- 24	1	1	2	2	6
Total	1	9	8	3	21

sors operating smaller plants relied heavily on outside feeding companies for a live bird supply. However, managers of two small plants indicated that the owners of the firms they represented planned to utilize direct-contracts to a greater degree in the future because of coordination of supply afforded by this arrangement.

In practice, 8 of 12 processors procured live broilers from 2 or more sources. Nevertheless, 8 processors procured 90 per cent or more of the supply of live birds from one source, Table 4. It appeared that these processors lacked diversification in their procurement programs since they relied heavily on a single supply source. However, diversification was adequate. Processors who were relying heavily on outside feeding companies for a source of supply procured birds from several suppliers rather than one. Also, processors procuring a large proportion of live supply from contract growers had adequate diversification in their procurement programs. It was not uncommon for a processor to have contracts with several hundred growers.

PRODUCTION DENSITY

Production density must be considered in evaluating the procurement program of any processing firm because of important associated economic aspects. Marketing margins have been reduced and competition intensified. Businessmen in the broiler industry must avail themselves of all possible economies when long-range plans are made. Broiler processing costs on a per unit basis decrease as plant output is increased, but unit costs of producing and assembling birds increase as larger numbers are required at a central location.

There are several criteria that may be used to make interplant and inter-area comparisons in the broiler industry. Two of these are related to production density. They are geographic production density and effective production density.

Geographic production density measures production density in number of broilers per square mile for a specific area. This measure is useful only in making inter-area comparisons. Inter-plant comparisons cannot be based on this measure of production density because any particular plant may have to share business in the surrounding trade area with competitors offering the same services. This is especially true in Alabama because production of broilers is concentrated in northern Alabama and a given production area may be supplying more than one processing plant with live broilers.

Thus, to make inter-plant comparisons, the effective production density of each plant must be used as an index for comparison. This can be derived for a particular plant if the average length of haul and volume of business are known[3]. The formula is as follows:

$$D' = \frac{4V}{9 \Pi A^2}$$

where D′ is effective density in number of birds per square mile per year, A is the average length of haul in air miles, and V is the annual volume of business in number of birds.

The average length of haul in road miles may be converted to air miles by the following equation: $A = -0.78 + 0.8794 R$

[3] W. R. Henry, J. S. Chappel, and James A. Seagraves, **Broiler Production Density, Plant Size, Alternative Operating Plans, and Total Unit Costs.** N.C. Agr. Expt. Sta. Tech. Bul. 144, 1960.

"Average length of haul" might be preferred to "effective production density" for making inter-plant comparisons. For example, if two plants purchase similar volumes, the one with the lowest average length of haul would have a competitive advantage in transportation costs.

On the other hand, if two plants have the same length of haul, but one has a larger volume of business, the one with the largest volume of business would be expected to have a competitive advantage. Furthermore, average length of haul and volume of business may be related to distribution of production in a given supply area. If this supply area is thought of as circular, and having production distributed evenly throughout, the following index number may be calculated:

$$\frac{1}{D'} = \frac{9 \Pi A}{4V} \cdot A.$$

Then $\frac{1}{D'}$ may be thought of as average length of haul corrected by taking account of the volume of raw material purchased in a circular supply area. The corrected average length of haul is the reciprocal of effective production density as defined by Henry, Chappel, and Seagraves.

where A is average length of haul in air miles and R is average length of haul in road miles. The above equation is a regression estimate based upon a sample of common road and air distances to three points selected at random in the vicinity of each processing plant in the State.

Annual volume and average length of haul data were ascertained for each plant. From these data effective production density in each firm's supply area was estimated, and summarized in Table 5.

There were differences in effective production densities among the three size groups, as well as within each size group. Average effective densities ranged from 1,100 to 10,400 birds per square mile per year. The size group composed of the four large plants appeared to have a significant competitive advantage in effective density. There were wide variations in effective densities within each group. All plants, especially the small and medium-size plants, could have had substantial reductions in flock servicing or assembly cost or both if effective densities had been increased.

Under an integrated arrangement where processors contract directly with growers, increases in costs of servicing broiler flocks are similar to increases in hauling costs when live birds are grown greater distances from a processing plant. Costs that increase as average length of haul increases are those for (1) chick delivery, (2) feed delivery, (3) field supervision, (4) transportation for loading crew, (5) live haul for trucks and truck drivers, and (6) weight lost during live haul. The cost of loading birds does not vary with average length of haul.

To eliminate the necessity of collecting costs data relative to broiler flock servicing and live hauling in Alabama, costs data for these operations were adapted from an extensive study con-

TABLE 5. ESTIMATES OF EFFECTIVE BROILER PRODUCTION DENSITIES IN SUPPLY AREAS OF TWELVE PROCESSING PLANTS, ALABAMA, JULY 1962-JUNE 1963

Plant size	Plants	Average length of haul, mean for size group	Effective density (birds per sq. mile per year)	
	No.	*Miles*	*Range*	*Mean*
Small	4	48.45	88- 2,102	1,111
Medium	4	41.97	437- 2,592	1,450
Large	4	26.42	2,274-23,896	10,398

ducted in North Carolina.[4] Costs figures used for North Carolina could be used in this study without major adjustment because they were budgeted for typical Southeastern conditions. In the North Carolina study, total unit costs for servicing broiler flocks and hauling live birds to processing plants were found to be 52.9 cents per hundred pounds of live weight, plus an additional cost of 1.40 cents for each mile added to average length of haul between broiler farms and processing plant. These costs figures were based on an operating plan of single-shift, early morning processing with live birds being loaded on assembly trucks as needed. If all birds were loaded on trucks prior to daybreak, average costs of hauling were greater because a larger truck fleet was required since each truck could make fewer trips between broiler farms and a processing plant per day.

The relationship of plant capacity to costs of servicing broiler flocks and hauling live birds to a processing plant for different effective production densities is illustrated in Figure 2. Costs of servicing flocks and hauling live birds to a processing plant rise rapidly if processing plant size is increased without an accompanying increase in effective production density. A processor may reduce these costs an appreciable amount by increasing effective production density in the surrounding supply area. For example, a processing plant having a capacity of 9,600 birds per hour with an effective production density of 1,000 birds per square mile per year could have saved 42 cents per hundred live pounds of poultry processed or $262,000 per year if effective density was increased to the 4,000 bird level. These savings were estimated using the assumption of a fully integrated arrangement. Under nonintegrated or partially integrated conditions, the above savings would accrue to several firms, and it would be difficult for a processor to offer incentives to nearby growers to increase production.

The composition of additional cost per hundred pounds of live broilers for flock servicing and live hauling when one mile was added to average length of haul is given.[5]

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[4] *Ibid.*, pp. 36-37.

[5] These are costs when headquarters for all services are located at the processing plant.

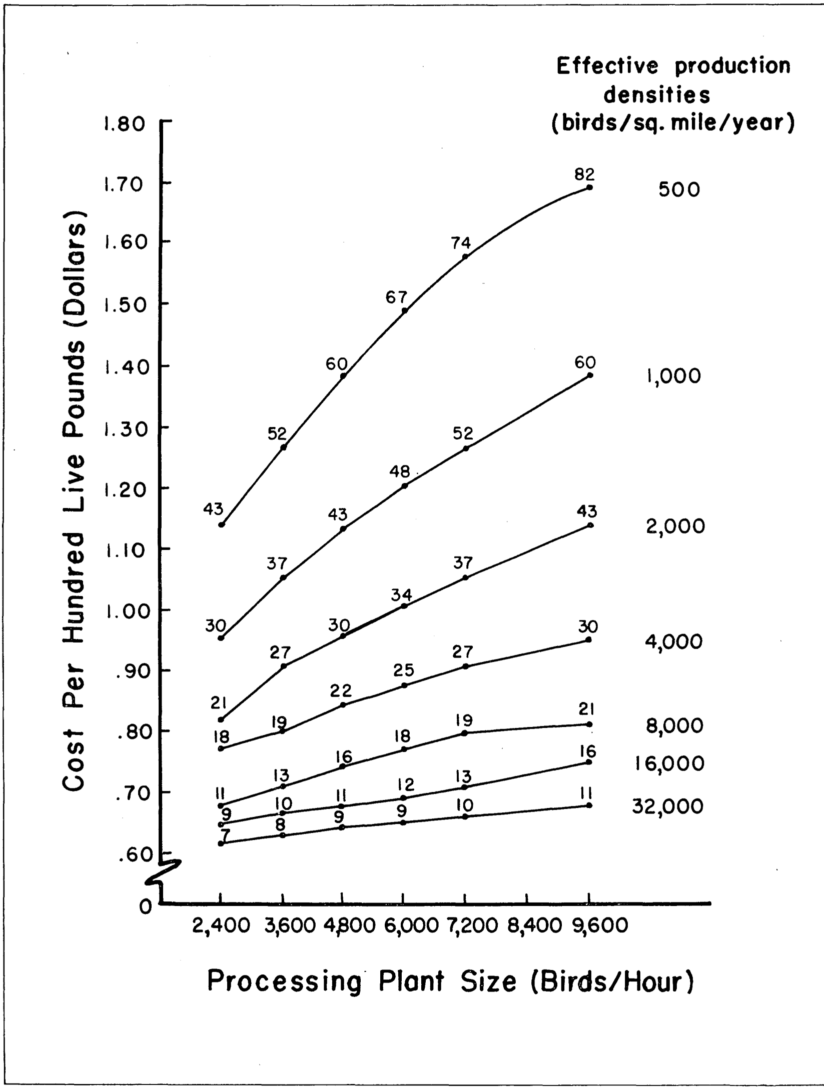

FIG. 2. Relationship of processing plant size to combined costs of servicing broiler flocks and assembly for different effective production densities, Southeast, 1960. Distances posted along curves are average lengths of haul between farm and central facilities, in miles. (Source: Appendix Table).

Activity	*Cost per additional mile*
Flock servicing:	
Chick delivery	$0.0004
Feed delivery	.0051
Field supervision	.0020
Live hauling:	
Trucking and truck driver	.0031
Transportation of loading crew	.0017
Weight loss during live haul	.0017
Total	$0.0140

The amount of savings that accrued to the processing plant from a shorter average length of haul depended upon the number of activities that were performed by the broiler processor.

A majority of Alabama processors could have made profitable adjustments in production density. In most cases the savings in flock servicing and hauling costs that resulted from an increase in production density would have greatly outweighed any incentives necessary to bring about an increased production density.

Assembly of Live Birds

Transportation equipment used for hauling birds from the point of production to the processing plant varied with plant size. Fifty per cent of the processors owned trucks for assembling live birds. Other processors contracted with outside trucking firms to transport live birds to processing plants. Leased trucks were considered to be the same as trucks owned by a processor since the processor had complete control over the operation of trucks in both instances.

The number of firms in each size group that owned assembly equipment and the proportion of plants' total annual supply of broilers hauled on this equipment are given in Table 6. There

TABLE 6. NUMBER OF FIRMS THAT OWNED ASSEMBLY EQUIPMENT AND PROPORTION OF PLANTS' TOTAL ANNUAL SUPPLY OF BROILERS HAULED BY OWNED EQUIPMENT, BY PLANT SIZE, ALABAMA, JULY 1962-JUNE 1963

Plant size group	Firms owning trucks	Per cent of annual supply hauled	
	No.	*Range*	*Av.*[1]
Small	2	90-100	95
Medium	1	25	25
Large	3	80-100	90

[1] Average does not include plants that did not own assembly equipment.

TABLE 7. NUMBER OF TRUCKS OWNED BY OWNERS OF PROCESSING PLANTS IN EACH SIZE GROUP, BY TRUCK SIZE, ALABAMA, JULY 1962-JUNE 1963

Plant size group	Truck capacity (birds per load)[1]		
	2,000-4,000	4,000-6,000	6,000-8,000
	No.	*No.*	*No.*
Small	3	7	1
Medium	1	--	3
Large	38	6	----

[1] No trucks with capacities of less than 2,000 birds or greater than 8,000 birds were in use.

were differences among the three size groups with respect to ownership of assembly equipment. Truck ownership was common with firms that owned large processing plants. Only one firm in this group did not own equipment for assembly of live birds. This processor hired independent haulers to pick up and deliver birds to the plant according to a schedule set by the management. In contrast to the large size group, processors owning medium sized plants relied heavily on independent haulers to deliver live birds to processing plants.

Table 7 gives the size of trucks owned by processing firms. Straight-bed or platform-type trucks having capacities between 2,000 and 4,000 birds per load were much more common than were tractor-trailer combinations in the large plant group. This suggested limitations in the use of trailers for assembly of live birds. Limitations may have been because of country roads, bridges, maneuvering space at the farm, and length of haul. Trucks of greater capacity were probably used more extensively in the small size group because average lengths of haul were much longer, and the larger trucks were more economical under this condition.

DETERMINATION OF PRICE PAID FOR LIVE BIRDS PROCURED FROM OUTSIDE FEEDING COMPANIES

All eight plants that procured birds from outside feeding companies determined the price that they paid for the birds in a similar manner. With one exception the price paid to outside feeding companies was the same as the USDA's quoted market price for live broilers.

However, some differences were found in the particular market price used. Four plants paid North Georgia farm price quotation the day birds were dressed; three plants paid Alabama farm price quotation the day birds were dressed; and one plant paid a price equivalent to an average of the above two prices. One plant also had a share-profit and share-loss agreement with its principal suppliers. Under the agreement profits and losses were computed periodically and redistributed between participants with a 50 per cent participation with this plant. The agreement stipulated that all transactions were to be based on a price that was the average of Mississippi, Alabama, and Georgia farm prices as quoted on Wednesday of the week of dressing. To this base price, half a cent per pound was added, and profits and losses were computed from this price.

PROCESSING OF ALABAMA BROILERS

Probably the most important segment in Alabama's broiler marketing system is processing. Economics indicates that the State should be in a very favorable competitive position relative to other broiler producing areas. Climatic conditions are favorable and there is easy access to adequate supplies of feed grain shipped in on barges via the Tennessee River system and by rail especially since rail rates have been reduced. Therefore, in the future a primary determinant of how effectively the broiler industry of the State can compete with that of other states will be the efficiency of the processing operation. It was found that approximately 87 per cent of the broilers processed in Alabama was sold in out-of-state markets where the competition among supply sources was keen. The effectiveness to which these markets can be maintained or expanded will depend upon the efficiency obtained in processing Alabama broilers.

Various aspects of the operation of a processing plant that influence processing cost were considered. Labor productivity standards were adapted from time and motion studies and these standards were useful in pinpointing inefficiencies in the labor force of a plant. Comparisons were made among plants of similar capacities as well as among plants of different capacities. Major emphasis was given to labor productivity and utilization of labor because labor was the largest item in total costs of processing. Also, processing techniques, plant organization, and prices of nonhuman production inputs are quite similar in broiler processing plants of a given size, wherever they may be located. Therefore, costs related to processing other than labor cost were adapted from secondary sources.

LABOR REQUIREMENTS, PRODUCTIVITY, AND COST

Much variation existed in size of the labor force for a given size plant within the State. Also, large variations existed in labor productivity among plants of like capacities and among plants of different capacities. Consequently, there were many adjustments that could have been made in the labor force to improve labor efficiency and increase productivity.

Minimizing the number of workers necessary to operate a processing plant of a given size and maximizing labor productivity and efficiency should be goals of all processors. Plant wages represented approximately 40 per cent of the total cost of processing; therefore, any adjustments that would have reduced the size of the labor force and improved labor efficiency would have had pronounced effects on total unit cost of processing broilers. For example, a reduction in size of the labor force of two workers would have resulted in an estimated yearly savings of $5,000 in wages alone. This estimate did not include fringe benefits and other costs associated with processing labor.

Labor requirements and productivity in hypothetical plants

For purposes of studying labor requirements, model plants with capacities corresponding to rated capacities of plants operating within the State were developed, Table 8. To serve as a basis for determining the number of workers required for various operations, job standards or established work rates were used. Standards for jobs performed on eviscerating lines were adapted from a time and motion study conducted by the United States Department of Agriculture in cooperation with the University of Georgia.[6] Standards other than those for eviscerating operations were developed by B. D. Raskopf.[7]

[6] Rex E. Childs and Roger E. Walters, **Methods and Equipment for Eviscerating Chickens.** Transpor. and Facilities Res. Div., Agr. Mktg. Ser., U.S. Dept. Agr. Mktg. Res. Rept. 549, pp. 42-43. 1962.

[7] Associate Professor, University of Tennessee, who conducted the labor efficiency phase of the regional study. These standards were obtained through correspondence.

Assuming the established work rates were not in error, these requirements represented the optimum number of employees for each operation in which output was determined by line speed. The maximum line speed for receiving and dressing was assumed to be 6,000 birds per hour or 100 birds per minute. All plant sizes considered except the 9,600-birds-per-hour size required only one receiving and dressing line whereas the latter required two lines.

With respect to eviscerating, the maximum line speed was assumed to be 3,000 birds per hour or 50 birds per minute. Consequently, plants of larger receiving capacities could not operate with one eviscerating line. Plants having capacities of 4,800 and 6,000 birds per hour used a dual conveyor line. This consisted of two lines running parallel that eviscerated 40 and 50 birds per minute per line, respectively. Plants having capacities of 9,600 birds per hour employed two dual conveyor lines and were similar to plants having capacities of 4,800 birds per hour except that the conveyor lines were duplicated. Dual eviscerating lines were seldom operated at speeds in excess of 100 birds per minute, or 50 birds per minute for each individual conveyor line, because the speed would have been too fast for effective workmanship.

The relationship between these established work rates and line speed was such that all workers were not fully utilized. Theoretically, the most efficient line would run at the lowest common multiple of all established work rates for all operations performed on overhead conveyor lines. However, the lowest common multiple was higher than the assumed maximum line speed. Therefore, it was impossible to have one conveyor line operating at this desired speed.

One would expect labor productivity to increase as line speed increased, but this did not hold true in all parts of a plant. In eviscerating, a line speed of 40 birds per minute resulted in an output per man hour equivalent to that attained at a line speed of 50 birds per minute in hypothetical plants. Therefore, a plant having a capacity of 6,000 birds per hour should have had approximately the same labor efficiency in eviscerating as plants having capacities of 2,400, 4,800 or 9,600 birds per hour, Table 9. On the other hand, a plant having a capacity of 6,000 birds per hour should have been more efficient in receiving, dressing, and packing than plants of other capacities.

TABLE 8. MANPOWER REQUIREMENTS AND UTILIZATION OF LABOR IN HYPOTHETICAL BROILER PROCESSING PLANTS WITH CAPACITIES CORRESPONDING TO RATED CAPACITIES OF PLANTS OPERATING WITHIN THE STATE, ALABAMA, 1962-63

Departments and operations	Established work rate	Plant capacity (birds per hour)							
		2,400	4,800	6,000	9,600	2,400	4,800	6,000	9,600
	Birds per hour	*No. of workers*				*Per cent of labor utilized*			
Receiving and dressing:									
Hang birds	1,086	3	5	6	10	78.0	93.6	97.4	93.6
Handle coops	1,950	2	3	3	6	61.5	82.0	100.0[1]	82.0
Kill birds	1,950	2	3	3	6	61.5	82.0	100.0	82.0
Reverse birds	1,302	2	4	5	8	92.2	92.2	100.0	92.0
Remove pin feathers	1,266	2	4	5	8	94.8	94.8	97.8	94.8
Remove shanks	2,478	1	2	3	4	96.8	96.8	80.7	96.8
Remove oil glands	2,208	1	2	3	4	100.0	100.0	90.6	100.0
Total	----	13	23	28	46	----	----	----	----
Eviscerating:									
Transfer birds to line	1,536	2	3	4	6	78.1	100.0	97.6	100.0
Open birds and remove vent	882	3	6	8[2]	12	90.7	90.7	100.0	90.7
Abdomen incision	2,388	1	2		4	100.0	100.0		100.0
Draw viscera	822	3	6	8	12	97.3	97.3	91.2	97.3
Aid USDA inspectors	1,396	2	4	4	8	92.6	92.6	100.0	92.6
Remove heart and liver	852	3	6	8	12	93.9	93.9	88.0	93.8
Trim, split, and wash gizzards	702	4	8	10	16	85.5	85.5	85.4	100.0
Peel gizzards (manual ejector)	2,292	1	2	3	4	100.0	100.0	87.3	100.0
Remove lungs	1,500	2	4	4	8	80.3	80.0	100.0	80.3
Snip neck vertebrae	2,220	1	2	4	4	100.0	100.0	67.6	100.0
Remove crop and windpipe	1,266	2	4	6	8	94.8	94.8	79.0	94.8
Remove neck w/knife	4,728	1	1	2	2	50.8	100.0	63.4	100.0
Inspect birds	1,500	2	4	4	8	83.3	83.3	100.0	83.3
Wrap and stuff giblets	828	3	6	8	12	96.6	96.6	90.0	96.6
Transfer to chiller	2,750	1	2	2	4	87.3	87.3	100.0	87.3
Total	----	31	60	75	120	----	----	----	----

(Continued)

TABLE 8 (*Continued*). MANPOWER REQUIREMENTS AND UTILIZATION OF LABOR IN HYPOTHETICAL BROILER PROCESSING PLANTS WITH CAPACITIES CORRESPONDING TO RATED CAPACITIES OF PLANTS OPERATING WITHIN THE STATE, ALABAMA, 1962-63

Departments and operations	Established work rate	Plant capacity (birds per hour)							
		2,400	4,800	6,000	9,600	2,400	4,800	6,000	9,600
	Birds per hour	*No. of workers*				*Per cent of labor utilized*			
Cooling and packing:									
Transfer birds to sizer	1,998	2	3	3	6	60.0	80.0	100.0	80.0
Assemble boxes	3,900	1	2	2	3	61.5	61.5	77.0	82.0
Grade birds	3,900	1	2	2	4	61.5	61.5	77.0	61.5
Pack birds	1,920	2	3	3	6	61.5	82.0	100.0	82.0
Weigh and mark boxes	6,000		1	1	2		80.0	100.0	80.0
Add ice to boxes	6,000	1	1	1	2	100.0	80.0	100.0	80.0
Close boxes	7,800		1	1	2		61.5	76.9	61.5
Load boxes for shipment	2,500	1	2	3	4	96.0	96.0	80.0	96.0
Total	----	8	15	16	29	----	----	----	----

[1] If line speeds did not exceed established rate for manpower used by 10 per cent, an additional worker was not added.

[2] Requirement represents two workers performing opening cut separately and six workers removing vent and making abdomen incision as a combination cut. Using another combination cut would increase labor requirements to 12 workers.

TABLE 9. LABOR PRODUCTIVITY, BY DEPARTMENTS AND ENTIRE PLANT, FOR FOUR HYPOTHETICAL PLANTS UNDER ALABAMA CONDITIONS

Plant capacity (birds per hour)	Receiving and dressing	Eviscerating	Cooling and packing	Entire plant[1]
2,400:				
Number of workers[2]	13	31	8	54
Birds per man hour	184.6	77.4	300.0	44.45
4,800:				
Number of workers	23	60	15	102
Birds per man hour	208.7	80.0	320.0	47.06
6,000:				
Number of workers	28	75	16	124
Birds per man hour	214.3	80.0	375.0	48.39
9,600:				
Number of workers	46	120	29	203
Birds per man hour	208.7	80.0	331.0	47.29

[1] Total number of workers for each size plant differ from a total of three departments, due to inclusion of cleaning personnel and floaters at the rate of one per 1,200 birds output. A floater is a roving "floor walker" who is always available to relieve a worker in case he must leave his work station for personal needs.
[2] Taken from Table 8.

Work rates were not established for jobs classified under general services, i.e., jobs in which output was not dependent upon or limited by speed of conveyor lines. Therefore, the manpower requirements were not determined for these jobs. Jobs classified as general services are (1) plant maintenance and repair, (2) general plant cleanup, (3) offal and chilling equipment operators, (4) shipping clerk, (5) supply clerk, and (6) time and payroll clerk. It will be shown later that the number of employees included under general services is sizeable in most plants and that they significantly affect the output per man hour for the entire plant.

Labor productivities and cost in Alabama poultry processing plants

The number of workers employed to perform each in-plant operation was ascertained during interviews with managers of poultry processing plants operating within the State. From this information, productivity of labor for each operation was determined by the following formula:

$$\text{Labor productivity (birds per man minute)} = \frac{\text{Plant capacity (birds per hour)}}{\text{Number of workers}} \div 60.$$

The average labor productivity obtained in plants of different

TABLE 10. LABOR PRODUCTIVITY FOR VARIOUS OPERATIONS BY PLANT SIZE IN POULTRY PROCESSING PLANTS, ALABAMA, JULY 1962-JUNE 1963[1]

Operation	Plant capacity (birds per hour)[1]					
	4,800		6,000		9,600	
	Range	Av.	Range	Av.	Range	Av.
	Birds per man minute					
Hang birds	13.2-19.2	18.0	16.7- 16.8	16.7	13.2- 17.9	14.7
Handle coops	19.8-38.5	27.8	25.0- 50.0	36.1	28.7- 39.6	35.9
Kill birds	38.5-39.6	39.3	25.0- 33.3	30.5	23.9- 26.4	29.9
Reverse birds	19.2-39.6	26.2	20.0- 25.0	23.3	23.9- 52.8	34.3
Remove pin feathers	19.2-26.4	21.3	12.5- 33.3	20.8	15.8- 23.9	18.5
Remove shanks	26.4-39.6	32.7	25.0- 33.3	30.5	35.8- 39.6	38.3
Remove oil gland	38.5-39.6	39.3	25.0- 50.0	36.1	35.8- 39.6	38.3
Transfer to eviscerating line	19.8-39.6	27.9	16.7- 25.0	22.2	19.8- 26.3	23.3
Open birds, remove vent, and abdomen incision	9.9-10.0	10.0	8.3- 12.5	9.7	9.9- 13.2	11.7
Draw viscera	12.8-13.2	13.1	12.5- 16.7	11.9	11.9- 13.2	12.7
Aid USDA inspectors	19.8-39.6	24.6	24.8- 25.0	25.0	17.9- 39.6	32.3
Remove heart and liver	12.8-13.2	13.1	12.5- 16.7	15.3	13.2- 17.9	14.7
Trim, split, and wash gizzards	9.9-12.8	11.5	10.0- 12.5	11.7	11.9- 13.2	12.7
Peel gizzards	25.7-39.6	32.8	25.0- 33.3	27.8	23.9- 39.6	34.3
Remove lungs	19.2-19.8	19.7	12.5- 25.0	20.8	17.9- 19.8	19.1
Remove crop, windpipe, and neck	10.0-12.5	11.0	8.3- 12.5	11.1	6.3- 11.9	8.7
House inspection	13.2-39.6	23.0	25.0- 50.0	33.3	35.8- 39.6	38.3
Wrap and stuff giblets	7.9-12.8	9.6	9.1- 12.5	10.9	6.0- 13.1	9.0
Transfer birds to chiller	38.5-79.2	49.2	49.8- 50.0	50.0	35.8- 39.6	38.3
Transfer to sizer	26.4-39.6	36.0	33.3- 50.0	38.9	26.3- 39.6	33.9
Assemble boxes	39.6-79.2	58.9	49.8- 50.0	50.0	35.8- 79.2	58.1
Grade birds	38.5-39.6	39.3	49.8- 50.0	50.0	23.9- 39.6	34.3
Pack birds	19.2-39.6	27.9	25.0- 50.0	36.1	17.9- 26.4	21.3
Weigh and mark boxes	77.0-79.2	68.8	50.0-100.0	83.3	47.8-118.3	81.8
Add ice to boxes	39.6-79.2	68.8	----	100.0	71.7-158.3	116.1
Close boxes	77.0-79.2	77.6	----	----	----	----
Move and/or load boxes	38.5-39.6	38.8	25.0- 33.3	27.8	79.8- 21.5	20.6

[1] Labor productivities were not presented on plants having capacities of 2,400 birds per hour because only one plant of this capacity was visited and presentation would reveal confidential information.

sizes for various plant operations is summarized in Table 10. Existing variations in labor productivity in these operations among plants of similar capacities are indicated by the ranges given for each size of plant.

No plant in the State consistently had a high labor productivity with respect to every job when compared to other plants of similar capacities. Plants that were very efficient in certain operations fell below average in other operations.

For any given operation, productivities obtained in plants having capacities of 6,000 birds per hour differed from those found in plants having capacities of 4,800 and 9,600 birds per hour primarily because conveyor lines in the former were operated at higher speeds. Since established work rates were different, depending upon the job under consideration, one line speed would have logically resulted in higher labor productivity on a particular job. However, a given line speed did not result in the highest output on every job because one line speed was more nearly a multiple of the established work rate for a given job than was some other line speed. For example, consider the operation of neck removal, which had an established work rate of 78.8 birds per minute per worker. In plants having capacities of 4,800 birds per hour or 80 birds per minute, one worker could remove all necks and his time would have been fully utilized. On the other hand, in plants having capacities of 6,000 birds per hour or 100 birds per minute, two workers would have been required but only 63.4 per cent of their capabilities would have been utilized. In performing this operation, workers in both plants were as efficient as possible in their own situations, yet the plant processing 4,800 birds per hour had a much higher output per worker.

Hence, the variation in labor productivity deserving major attention was the variation that existed among plants of similar capacities. A large portion of existing variations in labor productivity among plants of similar capacities on some jobs resulted entirely from too many workers being employed. A relatively inefficient method of performing a job was employed in some plants which resulted in lower labor productivity on the particular job. In poultry processing plants, "best" methods have been developed for performing various operations. These "best" methods yielded a higher productivity than did alternate methods of performing the same operation. Likewise, in some instances combining two operations resulted in a higher output per man hour than if the two operations were performed separately. Operations that performed differently in different plants were examined to determine if plants could eliminate one or more workers by adapting a different technique. Also, the possibility of combining operatings as a means of improving labor productivity was considered. Operations in which different methods were used are discussed.

Shank Removal. The first of the operations that were performed differently in different plants was removal of shanks. Three types of tools were used for removal: a knife, a hand-operated shears, and mechanical shears. There was a general preference for a knife and workers at two-thirds of the plants used a knife. The other two tools were used in one-third of the plants. The labor productivity for each method is given below.

Method	*Labor productivity (birds/man minute)*
Knife	36.8
Manual shears	25.0
Mechanical shears	31.2

In all but one plant where shears were used, shanks were cut while birds were suspended by the feet and birds dropped to a conveyor belt or table from which they were transferred to eviscerating lines. When shanks were removed while birds were suspended by the neck, transfer was direct from dressing line to eviscerating line. Less time was required when birds were transferred from a belt or table. Therefore, labor efficiency lost in shank removal was recovered in transfer of birds to eviscerating lines, and overall productivity was approximately the same under each alternative when both jobs were considered. The technique used to remove shanks and transfer birds to eviscerating lines depended on such factors as plant layout, available space, and preferences of management.

Body Incision and Vent Removal Cuts. There was some variation in method of making body incision and removing vents. The opening made in the abdomen to remove viscera involved three basic cuts: (1) an initial incision (opening cut); (2) cutting out the vent (vent removal cut); and (3) a cut splitting the abdomen skin from the vent to the tip of the breast bone (abdomen incision). In two plants the three cuts were performed separately; in two plants abdomen incision and vent removal cuts were combined into one operation while the opening cut was performed separately; and, in 8 of the 12 plants, opening and vent removal cuts were combined into one operation and the abdomen incision was made afterwards as a separate operation.

The average productivity when all three cuts were performed separately was 10.0 birds per man minute as compared with an average of 10.6 when opening and vent removal cuts were combined and abdomen incision was performed separately, and with an average of 10.4 when the opening cut was a separate operation and vent removal and abdomen incision cuts were combined.

In plants having capacities of 4,800 and 9,600 birds per hour, labor productivity was approximately the same regardless of the method used. Combining two of these cuts did not change the number of workers required. However, in plants having capacities of 6,000 birds per hour if the opening cut was performed separately and the vent removal and abdomen incision cuts were combined, productivity was 12.5 birds per man minute. Eight workers were required under this arrangement—two performing former cut and six performing combination cut. On the other hand, if cuts were performed separately or if the other combination was employed, 12 workers were required resulting in a labor productivity of 8.3 birds per man minute. Plants having a capacity of 6,000 birds per hour in which a less productive method was used might make a profitable adjustment and eliminate four workers by changing to the more efficient technique. This one adjustment would amount to an annual saving of $10,000 in wages.

Gizzard Processing. Labor cost for processing gizzards was greater than for any other giblet item. In addition to removal from the viscera and trimming, gizzards had to be opened, cleaned and the inside lining removed.

There were differences among plants in the technique employed to process gizzards, and, since labor requirements were high, an analysis was justified to determine the most efficient technique. In all plants, gizzards were split manually with scissors. Automatic gizzard splitting machines were available at the time the study was made; however, no plant used one. The reasons most often given for hand splitting were that gizzards were not uniform in size and machine splitting resulted in cuts that were inconsistent and off center. As a result, more labor was necessary to peel gizzards.

After gizzards were split and cleaned, the linings were removed. Two types of gizzard peelers were in use: semi-automatic and automatic. The semi-automatic type was known as the manual ejector peeler because operators placed gizzards on the peeler and then removed them after the lining had been peeled. The automatic ejector type required labor only to place gizzards on the peeler, and gizzards were ejected automatically. In Alabama plants, the two machines were equal in use.

Average productivity when a manual ejector peeler was used was 26.6 birds per man minute as compared with 36.9 when the automatic ejector peeler was used. Established work rates for operators of the two types of machines were 38.2 and 50.0 birds per man minute, respectively. At processing rates of 80 and 160 birds per man minute, labor requirements would be the same regardless of the type of peeler used. At a processing rate of 80 birds per minute two workers would have been needed, and four would have been required at a processing rate of 160 birds per minute. However, this was not the case in situations where plants were processing 6,000 birds per hour or 100 birds per minute. In plants of this capacity, two workers could have handled the gizzard-peeling operation using an automatic ejector type, whereas three would have been needed had manual ejector peelers been used. In all plants of this capacity manual ejectors were used. If automatic ejectors had been used, two plants could have eliminated two workers and the other plant could have eliminated one worker. Based on established work rates, 50 per cent of the plants could have reduced the number of workers engaged in peeling gizzards without making any changes in the type of peeling machine used.

Removal of Crop, Windpipe, and Neck. The crop, windpipe, and neck were usually removed from chickens after the viscera and head had been removed from the carcass. This left both ends of the crop and windpipe detached and permitted easy removal. These parts were removed through an incision at a point where the neck joins the body. The incision was made in one of two ways. The most common was to sever the vertebrae at the back of the neck close to the bird's body with snips, leaving a portion of skin on the underside of the neck to keep the neck attached and providing an opening for removal of the windpipe and crop. The second method of preparing the neck for crop and windpipe removal was to make a 2- or 3-inch slit along back of the neck.

With either type of neck opening, the crop and windpipe were removed by grasping both at once and pulling downward to dislodge them from inside the body cavity, and then pulling through the neck incision.

Two methods were used for manually removing necks from broilers. One method was to remove them with a knife by severing the remaining neck skin after the neck vertebrae had been severed in the operation just described. The other method required use of snips to sever both vertabrae and neck skin in one operation. A mechanical in-line neck cutter used in two plants eliminated manual labor for this operation.

To determine the most efficient methods of removing the crop and windpipe, the neck incision and neck removal operations were considered simultaneously. When only the neck skin was slit, more time was required to remove the crop and windpipe, and either manual snips or a mechanical cutter was used for severing the neck bone. Labor productivity in birds per man minute for four combinations of methods found in Alabama plants for crop, windpipe, and neck removal, are summarized below. Each method was employed in three plants. Method A

Method	*Average output (birds per man minute)*
A	8.0
B	12.5
C	9.9
D	11.6

consisted of slitting the neck skin with a knife and severing the neck with shears. Method B followed the same procedure as method A except the necks were removed by a mechanical cutter. In method C, the neck vertebrae were severed for crop and windpipe removal and the neck was removed with shears. Method D was the same as method C except the necks were removed with a knife.

Method B resulted in the highest labor productivity. Where mechanical neck cutters were not employed, method D was most desirable. If plants in which method C was used had changed to method D, only half the workers used in removing necks would have been needed. Very little effort was required to remove necks with a knife, and one operator could usually remove the necks from birds on two eviscerating lines where the lines were close enough together. If lines were not close enough, this operation might have been transferred to the drip line rather than performing it on each eviscerating line.

Variations in labor productivity on jobs other than these resulted primarily from a greater number of workers being employed in some plants to perform identical operations rather than from different methods being used.

Cut-up. A phase of broiler processing that greatly influenced total plant output per man hour was cutting up eviscerated broilers. In plants where a regular cut-up crew was employed, the labor productivity for cutting up was extremely low. Forty per cent of the plants visited had regular cut-up crews employed, and an average of 33.7 birds per man hour was cut up and packaged. At this rate of output, direct labor cost alone for cutting up broilers would amount to approximately 3.4 cents per bird, or 1.4 cents per pound for a 2.4 pound broiler. Packaging materials cost and additional shrink cost were not ascertained from plant managers. A study in Maine indicated that materials cost averaged 2.18 cents per pound and shrinkage cost averaged 1.94 cents per pound in a cut-up operation.[8] Adding these to labor cost of cutting up broilers in Alabama plants, gave a total direct cost of 5.52 cents per pound or 13.25 cents per bird for a 2.4 pound fryer. Plant managers indicated that high labor cost was the major disadvantage to cutting up broilers. Nonetheless, a tray pack operation could be instituted because it could be a means of establishing brand identification and increasing bargaining strength.

If the cut-up operation had been eliminated from these plants, output would have averaged 3.7 birds per man hour higher, and one plant could have increased overall labor productivity by 6.3 birds per man hour. The only adjustment that would have been needed in the labor forces as a result of this change would have been the employment of an additional worker to pack fresh birds. The additional worker would not have been necessary in most instances. An increase in output per man hour of 3.7 birds would have, in effect, decreased direct labor cost approximately 29 cents per bird. This reduction in labor cost would have been a sizeable savings in the size plants operating in Alabama.

However, in most instances, cutting up birds that were downgraded because of a bruised part and bulk packing wholesome parts was desirable. Cutting up these birds was justified if the wholesome parts demanded a sufficient premium above the selling price of down-graded whole birds to cover costs of additional shrink and cut-up labor.

It was extremely difficult to get a precise measure of labor efficiency in plants by considering individual operations. As indicated earlier, no plant was consistently high in labor productivity on all operations. Also, nothing has been reported con-

[8] R. G. Saunders and M. O. Jordan, **Tray Packing Fresh Fryers at the Store and Plant Levels.** Maine Agr. Expt. Sta. Bul. 588, p. 18. 1960.

TABLE 11. OUTPUT PER MAN HOUR IN POULTRY PROCESSING PLANTS BY DEPARTMENTS AND PLANT CAPACITY, ALABAMA, JULY 1962-JUNE 1963

Plant department	Plant capacity (birds per hour)					
	4,800		6,000		9,600	
	Range	Av.	Range	Av.	Range	Av.
			Birds per man hour			
Receiving and dressing	197.9-271.8	236.2	181.8-230.8	206.5	183.0-215.9	202.6
Eviscerating	73.1- 78.3	75.6	65.9- 89.6	80.8	68.8- 86.1	78.0
Cooling and packing	226.2-283.5	247.2	285.7-428.6	371.4	220.5-339.3	264.1
General services	271.8-339.3	311.1	240.0-500.0	357.8	226.3-507.1	411.1
Cut-up	----	28.8	----	30.0	----	47.3
All plant	35.7- 41.3	38.3	32.8- 46.9	42.1	34.5- 45.0	40.7

cerning productivity attained by workers performing general services. For these reasons, plants were classified by departments, and output per man hour was computed by department for each plant, as well as, for the entire plant, Table 11.

On the average, plants having capacities of 4,800 birds per hour had a higher output per man hour in receiving and dressing, which was not indicated by analysis of hypothetical plants. Generally, however, large plants had a higher output per man hour in general service jobs. A relationship such as this in general services would be expected, however, because labor requirements for these jobs would not increase in proportion to plant capacity. Here, as in other in-plant departments, the variation was great. Several plants were significantly more efficient than plants of similar capacities as well as those of different capacities.

From the standpoint of plant output, those plants having capacities of 6,000 birds per hour had the highest average output per man hour. This group showed the largest amount of variation in output per man hour among plants. Based on an average wage rate of $1.15 per hour, the existing rate at the time the survey was made, variation in productivity between the most efficient and the least efficient plants represented a difference in labor cost of $1.06 per hundred birds, or approximately 1 cent per bird. At a capacity of 6,000 birds per hour, this would amount to a cost difference of approximately $2,544 for a 40-hour operating week.

COSTS OF PROCESSING

Labor Cost

Labor cost in Alabama plants varied directly with output per man hour, and the greatest amount of variation in direct labor cost existed in the 6,000 birds-per-hour size group, Table 12. Average per unit labor cost for plants having capacities of 4,800 birds per hour was higher than the average for other plant sizes. Also, average per unit labor cost was lowest for the 6,000 birds-per-hour plants. However, each size group contained very efficient plants, as well as, some relatively less efficient plants. The average for each size group varied less than a tenth of a cent per pound.

TABLE 12. LABOR COST IN POULTRY PROCESSING PLANTS, BY PLANT CAPACITY, ALABAMA, JULY 1962-JUNE 1963

Plant capacity	Cost per pound (liveweight)	
	Range	Average
	Cents	*Cents*
4,800	0.893-1.081	0.984
6,000	.828-1.081	.929
9,600	.857-1.034	.942

Total costs of processing

Prices of mechanical production inputs were almost identical among broiler processing plants of a given size, wherever they were located. Therefore, these costs data were adapted from a study conducted in New Hampshire.[9] They were adjusted to reflect conditions in Alabama and are shown in Table 13 along with average labor cost that existed in Alabama.

Only very small economies of scale were found to exist. Total processing costs were lowered by only about 0.1 cent per pound when plant capacity was expanded from 4,800 birds per hour to 9,600 birds per hour. The primary reason why costs did not fall more when plant capacity was expanded from 4,800 to 9,600 birds per hour was that expansion entailed a duplication of facilities. Most of Alabama's poultry processing plants were of sufficient size that only small benefits in the form of lower costs could have been obtained from further plant expansion.

[9] G. B. Rogers and E. T. Bardwell, **Economics of Scale in Chicken Processing.** N.H. Agr. Expt. Sta. Bul. 459, p. 16. April 1959.

TABLE 13. COSTS OF PROCESSING BROILERS, BY ITEM AND PLANT CAPACITY, ALABAMA, JULY 1962-JUNE 1963[1]

Item	Plant capacity		
	4,800	6,000	9,600
	Costs per pound, live weight basis		
	Cents	*Cents*	*Cents*
Plant wages[2]	0.984	0.929	0.942
Electricity, water	.091	.089	.084
Variable, repairs	.019	.019	.017
Wear depreciation	.104	.104	.100
Supplies and materials	.824	.824	.824
Management[3]	.227	.217	.199
Miscellaneous	.042	.040	.036
Heat, telephone	.054	.054	.049
Depreciation	.066	.065	.061
Repairs, maintenance	.028	.028	.025
Taxes, interest, ins.	.056	.054	.050
Total	2.495	2.423	2.387

[1] All costs data except plant wages adapted from Rogers and Bardwell. All costs revised to reflect average live weight of 3.4 pounds per bird instead of the 3.5 pound average assumed for the New England study.
[2] Average wage cost for each size plant operating in Alabama, computed for a wage rate of $1.15 per hour.
[3] The New England managerial costs were reduced by 20 per cent.

Future increases in size of plants in Alabama will depend upon factors other than economies to scale. An alternative to increasing output by expansion of plant capacity would be double-shift operations. The North Carolina study[10] indicated that, although average total processing costs were decreased by double-shift operations in a plant of given size, these costs did not fall to the level that could be achieved by single-shift operation of a plant twice as large with the same daily output.

VARIATIONS IN THE USE OF PROCESSING CAPACITY

Broiler production varies seasonally. Additionally, there are definite swings in production because of price influences that during certain periods greatly increase demands on processing facilities. Therefore, processing capacity must be sufficient to handle output at the top of these cycles with hours of operation reasonable for an operating shift.

A reasonable overtime qualification was inserted because many of the operations in processing plants required a great amount of skill. Consequently, workers could not be expected to work an extended overtime period without loss of efficiency. Further-

[10] Henry, Chappel, and Seagraves, *op. cit.*, p. 41.

TABLE 14. PERCENTAGE UTILIZATION OF PROCESSING CAPACITY AND SEASONAL VARIATION IN USE OF CAPACITY IN BROILER PROCESSING PLANTS, ALABAMA, JULY 1962-JUNE 1963

Plant	Utilization of available capacity		
	Entire year[1]	Period of peak output[2]	Period of lowest output[2]
	Per cent	*Per cent*	*Per cent*
A	102	115	74
B	104	108	94
C	101	121	81
D	90	99	81
E	89	130	96
F	85	118	75
G	79	98	68
H	99	100	96
I	101	130	57
J	101	125	63
K	70	95	51
L	94	101	83
Range	70-104	95-130	51-96
Mean	93	113	77

[1] These coefficients are yearly outputs for each plant expressed as a percentage of capacity in 2,000 hours of operation.

[2] Utilization coefficients in peak and low output periods are weekly output data expressed as per cent of capacity for 40 hours of operation.

more, it was not practical for a plant to operate an additional shift during the peak season because of labor problems that would be encountered.

When annual processing capacity was compared with annual output, it appeared that some plants were not being utilized efficiently and that surplus capacity actually existed, Table 14. Utilization coefficients for the entire year were standardized by assuming a 2,000 hour work year. Although an average utilization of 93 per cent may seem good, variations among plants ranged from 70 per cent to 104 per cent of capacity. However, a comparison of annual volume with annual capacity did not give a true indication of utilization of capacity; nor did it answer the question concerning surplus capacity. To determine if surplus capacity existed, seasonal variations in output was considered.

To determine the cylical or seasonal utilization of processing capacity during the 1962-63 year, data were obtained from plant managers concerning plant output in peak- and low-output periods. Specific times of the year in which these periods occurred were ascertained. Actual weekly outputs were converted to utilization of plant capacity coefficients by the following formula:

$$\frac{\text{Actual weekly output}}{\text{Processing capacity (birds per hour)} \times 40} \times 100 = \begin{array}{l}\text{Percentage}\\ \text{utilization.}\end{array}$$

Variation among plants with respect to utilization of capacity was relatively great in both peak- and slack-output periods, Table 14. During the peak processing season, output expressed as a percentage of processing capacity in a 40-hour week varied from a low of 94 per cent to a high of 130 per cent. During the slack season, utilization of capacity varied from a low of 51 per cent to a high of 96 per cent. Processors were asked what time during the year periods of peak and low output occurred. Eight processors reported that the period of peak output of broilers occurred in July, two reported June, and two reported August. Five processors reported that the period of low output of broilers occurred in November and seven reported December.

Seven of 12 plants processed fowl or turkeys or both during the season of low broiler output when supplies were available. Concentrating on processing broilers appeared to be a feasible choice for processing plants the size of those operating in Alabama. A supply of fowl was dependent to a considerable extent on locations, and upon the number of egg producers who did not process their own birds.

Labor efficiency was an hourly-basis problem and did not vary with fluctuations in output. Labor efficiency on a 20-hour week was approximately equivalent to that for a 40-hour week. Utilizing plant and equipment and spreading fixed costs were important factors connected with wide swings in output because of seasonal variations in demand.

DISTRIBUTION OF ALABAMA BROILERS

Alabama has been a surplus broiler producing area for a number of years. Expansion of broiler production within the State has been much more rapid than expansion for the Nation as a whole. As the broiler industry of the State continues to expand in the future, the distribution aspect of the marketing process will become more important because of increased volume of dressed poultry that will have to be sold in out-of-state markets.

Intermarket price relationships and factors that influence supply and demand for broilers are continuously changing. There is strong competition among sources of supply in these out-of-state markets; therefore, producers, handlers, and processors of Alabama broilers must be prepared to adjust to changes if they are to continue to sell in the competitive markets.

FORM IN WHICH THE FINISHED PRODUCTS LEAVE PLANTS

The form in which Alabama broilers were shipped was predominantly fresh ice-packed. Ninety-one per cent was shipped as whole, ice-packed birds where crushed ice was packed inside crates with birds. In addition to keeping birds chilled, ice served to reduce shrinkage by keeping the product moist. Another 2 per cent of the broilers was cut-up and sold fresh. These were shipped fresh and carried no brand name. Seven per cent was frozen before shipment. Six and a half of this seven per cent had the brand name of an Alabama processor on the wrapping material. Only three processors were freezing a significant proportion of output.

METHOD OF DISTRIBUTING THE PROCESSED PRODUCT

Processors had two alternative means of distributing the finished products. They either purchased trucks for distribution purposes or contracted with outside trucking firms to deliver the finished product to various receiving points.

Five of 12 processors owned one or more trucks for distribution of dressed broilers, Table 15. Three of the five processors owned only one truck for distribution purposes and distributed less than 10 per cent of output with this equipment. Only two processors hauled 50 per cent or more of output on self-owned trucks. In addition, only three of the trucks owned by processors were refrigerated, which indicated that those trucks to a large extent were used to deliver to markets located relatively near the point of processing. Almost all birds shipped to

TABLE 15. NUMBER OF FIRMS THAT OWNED DISTRIBUTION TRUCKS, NUMBER OF TRUCKS OWNED, AND PROPORTION OF ANNUAL OUTPUT TRANSPORTED IN TRUCKS OWNED, BY PLANT SIZE, ALABAMA, JULY 1962-JUNE 1963

Plant size group	Firms owning trucks	Trucks owned	Per cent of total finished product hauled
	Number		Mean
Small	3	6	14.6
Medium	2	13	28.4
Total or average	5	21	21.9

distant markets were shipped on trucks owned by a trucking firm, and approximately 96 per cent of all broilers processed in Alabama were distributed on trucks owned by a trucking firm. No processor in the large size group owned trucks for distribution purposes.

Taking into account distances to most out-of-state markets and numbers of broilers processed in each plant, ownership of an adequate number of trucks to distribute output of a typical plant would have required a large investment in trucks.

Product Pricing and Quantity Negotiation

Examination of negotiations on processed product pricing and on quantity was limited to that carried on between processors and national or regional food chains. The relevance of price negotiation between processors and food chains become increasingly apparent as processors sell larger proportions of their output to such outlets. Large food chains were the dominant retail outlets for broilers. Given the relatively high concentration of food chains in comparison with broiler processing operations, buyers for chain stores had a theoretical advantage in the bargaining process.

Information was ascertained relative to techniques used by processors in price and quantity negotiations with food chains. All processors reported that negotiation concerning volume was conducted every week. No arrangement was found where volume was determined by a written contract—a commitment 30 or more days prior to delivery.

Price determination was a routinized type of transaction between processors and food chain buyers. Nevertheless, a great amount of bargaining was involved. With one exception, selling price was based on the quoted Alabama or North Georgia live-market price on the day birds were shipped. One plant was selling frozen birds on a bid basis. Insignificant differences existed in the two market quotations used. Therefore, the results were the same for all practical purposes regardless of which market price was used. A typical method for calculating the f.o.b. or net plant price was by the following formula:

$$\text{Net plant price} = \frac{\text{Live market price}}{.73} + \text{Plant margin}$$

Dividing live market price by the constant .73 (average yield in dressed weight was 73 per cent of live weight) gave acquisition cost per pound of dressed weight. The most often reported plant margin was 6 cents per pound. This margin covered costs of assembly of live birds and processing, and any remainder after all costs were covered was profits. Shipping charges were added to this net plant price if birds were delivered. Five processors reported that discounts were necessary occasionally to sell birds under "sticky" market conditions. Discounts ranged from a fourth to a cent per pound and processors indicated that discounts were "the exception rather than the rule."

Marketing margins received by processors were inflexible. The major reason why these margins did not move up and down in proportion with changes in broiler prices was because a majority of the costs associated with processing were related to the physical volume rather than the value of that volume. As a result these margins are likely to remain relatively inflexible in the future.

Even though discounts were sometimes allowed, the pricing techniques suggested that processors were not in an unfavorable bargaining position relative to chain stores. However, several processors were in a favorable bargaining position relative to other processors because the former were freezing sizeable quantities of dressed poultry that was sold under the brand name of the processors. This was a method of achieving product differentiation, and should theoretically increase market power since these companies' products could be identified in retail outlets. In addition to increasing bargaining power, a large freezing operation afforded a more stable processing operation by increasing the plant's supply flexibility through time.

Alabama Broilers in the National Market

As the existing gap between production and consumption of broilers in Alabama continues to widen, a larger proportion of broilers produced and processed here must be sold in out-of-state markets. These markets are located in regions of the United States where deficits of commercial broilers exist. Results of this study indicated that approximately 87 per cent of Alabama broilers were sold out-of-state.

All markets were not equally profitable for Alabama processors. Other surplus producing states were more advantageously situated with respect to certain markets and location gave those states an advantage over Alabama. The most profitable markets for Alabama processors should have been markets in which they had the greatest advantage or least disadvantage relative to other supply sources in shipping costs. Nevertheless, as demand in nearby markets was satisfied, processors had to seek more distant markets.

A study in North Carolina in 1957[11] indicated that the most profitable out-of-state markets for Alabama processors were located in the Great Lakes Region and the New Orleans Area. However, since intermarket price relationships affecting the relative profitability of different markets have changed, the pattern of broiler shipments from Alabama has undergone change. Since the North Carolina study was completed, broiler production increased in Mississippi and Louisiana to a level sufficient to supply the New Orleans Area, and no Alabama processor reported any broiler shipments to that market. On the other hand, the Great Lakes Region continued to be a relatively profitable market area; approximately 59 per cent of Alabama's broilers was being shipped to the East North Central Region, Figure 3. An ad-

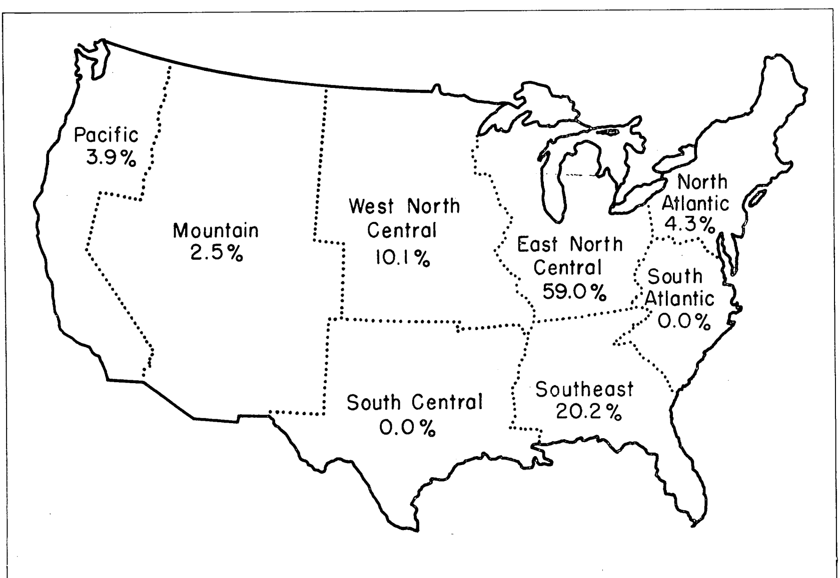

FIG. 3. Proportion of Alabama broilers marketed in each geographic area, 1962-63.

[11] William R. Henry and Charles E. Bishop, **North Carolina Broilers in Interregional Competition.** Dept. of Agr. Econ., N.C. State College. A. E. Infor. Ser. No. 56, pp. 17 and 24. 1957.

ditional 10 per cent was shipped into the West North Central Region. This indicated the importance and relative profitability of out-of-state markets located in those regions.

Significantly smaller quantities of broilers were shipped to relatively less profitable markets. It is not likely that western markets will be very important to Alabama processors in the foreseeable future because processors in Arkansas, a leading state in broiler production, are more favorably situated with respect to those markets. The supply pressure from Arkansas should continue to be great in western markets. Likewise, Georgia, North Carolina, Maine, and the Delmarva producing areas supplied markets located in the North and South Atlantic Regions, and will probably continue to do so in the near future.

The standard metropolitan areas receiving 2 per cent or more of poultry processed in Alabama are given in Table 16 along with the number of plants serving each area. Approximately 64 per cent of the broilers processed in the State were sold in these 11 metropolitan areas. Chicago was the most important metropolitan area by far, receiving 25.2 per cent. The second major area in terms of the proportion of broilers received was Detroit with 12.8 per cent.

If locational advantages of various supply sources are considered, receiving points located in East and West North Central Regions, especially the Chicago Area, should remain relatively attractive among out-of-state markets for Alabama broilers during the next several years. Conceivably, the proportion of Ala-

TABLE 16. STANDARD METROPOLITAN AREAS RECEIVING AT LEAST 2 PER CENT OF BROILERS PROCESSED IN 12 POULTRY PROCESSING PLANTS, AND NUMBER OF PLANTS SHIPPING TO EACH, ALABAMA, JULY 1962-JUNE 1963

Standard metropolitan area	Plants serving each area	Proportion received
	Number	*Pct.*
Chicago	9	25.19
Detroit	7	12.80
Grand Rapids	4	2.27
Cleveland	4	3.99
Milwaukee	3	2.45
St. Paul	4	3.42
Los Angeles	5	2.71
Miami	1	2.36
Louisville	3	2.46
St. Louis	3	4.73
New York	3	2.05
Total	----	64.43

bama's broilers marketed in the Great Lakes Region will increase as population continues to increase in that area and as the number of broilers produced within the State continues to increase.

MARKETING AREA AND OUTLET MIX

Planning a plant's distribution program through which processed birds are sold is very important for the owners of a poultry processing plant. Two factors that should be given prime consideration in any distribution program are the market area served and the outlet mix.[12] The primary reason why these are of great importance is that a plant's market area or region and its outlet mix, are indications, theoretically, of its relative market power or "staying ability."[13]

The number of markets or metropolitan areas served and the proportion of output sold in in-state and out-of-state markets varied among plants, Table 17. The number of markets served by plants ranged from 6 to 19, and Alabama processors shipped to an average of 13 markets. The average number of markets

TABLE 17. NUMBER OF METROPOLITAN AREAS LOCATED IN VARIOUS REGIONS SERVED BY 12 POULTRY PROCESSING PLANTS, ALABAMA, JULY 1962-JUNE 1963

Region	Plant code number											
	A	B	C	D	E	F	G	H	I	J	K	L
	Number of metropolitan areas											
Southeast[1]	----	4	6	4	2	5	5	----	3	4	6	6
S. Central[2]	.	----	----	----	----	----	----	----	----	----	----	----
E. N. Central[3]	12	7	----	3	4	1	6	12	8	9	2	5
W. N. Central[4]	2	1	----	3	----	2	2	----	----	1	1	1
N. Atlantic[5]	2	----	----	3	2	----	----	3	----	3	1	----
S. Atlantic[6]	----	----	----	----	----	----	----	----	----	----	----	----
Mountain[7]	----	----	----	----	----	----	4	----	----	1	----	1
Pacific[8]	2	----	----	2	----	----	2	----	----	----	1	3
Total	18	12	6	15	8	8	19	15	11	18	11	16

[1] Alabama, Kentucky, Tennessee, Mississippi, Georgia, Florida.
[2] Arkansas, Louisiana, Oklahoma, Texas.
[3] Ohio, Indiana, Illinois, Michigan, Wisconsin.
[4] Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas.
[5] Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania.
[6] Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina.
[7] Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada.
[8] Washington, Oregon, California.

[12] Outlet mix as used here refers to the number of different types of market outlets served by a processing plant.
[13] "Staying ability" as used here refers to the ability of a processor to continue to operate when one or more markets are lost.

served by various size plants was not significantly different.[14] These findings indicated that the "staying ability" of a majority of Alabama processors was adequate if number of metropolitan areas served was used as a criterion. A number of out-of-state markets were a relatively great distance from the plants, and this placed processors in a weaker bargaining position relative to other supply areas because of higher shipping cost. However, only a small proportion of output was shipped to the more distant markets. Major markets were located in the Southeast and North Central regions.

Market profiles or outlet mixes of Alabama plants were similar, Table 18. Managers of nine processing plants indicated that 50 per cent or more of plant output was sold to wholesalers or through food brokers. During the year 1962-63, 71.5 per cent of output was sold through these outlets. Two other processors sold some birds to wholesalers or through food brokers, but relied more heavily on distributing houses that were owned by the parent company. Ten plant managers indicated sale of dressed poultry to chain food stores. However, only three processors sold 50 per cent or more of output through this outlet. Nonetheless, it was found that almost 20 per cent of Alabama's broilers moved directly to food chain store warehouses. The proportion moving directly to chain food stores increased slightly during the 3-year period in which information was obtained. Also, it is highly likely that this increasing trend will continue since a large proportion of broilers move through chain stores before reaching consumers. A decline in the bargaining power held by processors might result because the plant management would be expected to have greater bargaining power when dealing with local indeoendent retailers than when dealing with national food chain buyers.

The type of transfer in most situations was via sales. The exception was intracompany transfers when birds moved in company branch or distributing houses.

It is true that a plant's market area or region and its outlet mix were indications, theoretically, of its market power or "staying ability." However, other things being equal, the most economical operation may have been only one market in terms of

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[14] No significant difference at the .10 level by analysis of variance.

TABLE 18. PROPORTION OF EACH PLANT'S OUTPUT MARKETED THROUGH VARIOUS TYPES OF OUTLETS, ALABAMA, 1962-63

Type of outlet served	Plant code number												Average
	A	B	C	D	E	F	G	H	I	J	K	L	
	%	%	%	%	%	%	%	%	%	%	%	%	%
Chain food stores													
National	----	10	----	----	50	65	10	50	27	3	20	13	17.4
Regional	----	----	38	----	----	10	----	----	6	5	5	----	2.5
Local retailers and route	----	----	----	*	----	----	----	----	*	----	----	2	*
Wholesalers and/or food brokers	100	90	60	99	50		89	50	9	92	25	85	71.5
Company branch houses	----	----	----	----	----	24	----	----	55	----	50	----	8.0
Military	----	----	----	----	----	*	----	----	----	----	----	----	*
School lunch	----	----	2	----	----	----	----	----	3	----	----	----	*
Purchases at plant	----	----	----	----	----	*	----	----	----	----	----	----	*
Further processor	----	----	----	----	----	----	----	----	----	----	----	----	----
Export	----	----	----	----	----	----	1	----	----	----	----	----	*
Total	100	100	100	100	100	100	100	100	100	100	100	100	100.0

* Less than 1 per cent.

both physical location and type of outlet: e.g., all birds delivered frozen to a national food chain's distribution center. Several Alabama processors moved a large proportion of their output through one type of outlet, Table 17; however, the outlets in terms of location were widely dispersed, Table 18.

SUMMARY

Growth in the broiler industry has been pronounced in Alabama, and today the industry occupies a position of dominance in the State. In 1963 Alabama ranked third among broiler producing states in terms of numbers produced whereas the State ranked tenth in 1953. Organization within the industry has undergone marked changes during its rapid expansion. Probably, the most significant of these changes was the merging of firms that were performing different operations. Coordination of production, processing, and marketing functions was achieved as a result.

Information obtained showed that above 91 per cent of the processing plants were owned by or were part of a larger concern. The headquarters of nine of the firms were located out-of-state. Eight of the nine concerns with out-of-state headquarters were vertically as well as horizontally integrated, and only one was not vertically integrated. The three locally owned plants were not horizontally integrated at the processing stage, but two of these were part of a vertically integrated firm.

With respect to ownership or control through contract with operators of related facilities, 10 of 12 firms owned hatcheries, 9 owned feed mills, 8 owned other broiler processing plants and 6 owned assembly trucks. Ten firms were involved in the broiler grow-out operation, usually by contracting with growers.

The degree of integration by ownership or contract was indicated by the number of firms that controlled two or more segments of the industry. The separate segments of the industry included were hatching, feed manufacturing, growing, live hauling, and processing. One of the processing firms controlled two segments, one controlled three segments, five controlled four segments, and four firms controlled all five segments. Control of all segments except the grow-out phase was through ownership.

Coordination of the grow-out segment was achieved almost entirely through contracts. Seventy-two per cent of Alabama broilers was grown under direct contract between a grower and processor. Another 25 per cent was grown under contract between a grower and an outside feeding company that was not involved in processing. In the latter situation, coordination was achieved by agreements between processors and feeding companies relative to scheduling.

Generally, plants classified as medium and large in terms of output were owned by highly integrated firms; consequently, contractual production was the major source of live bird supplies. Operators of medium and large plants obtained 81 and 89 per cent, respectively, of live supplies through this type of arrangement. In contrast the major source of live supplies for small plants was outside feeding companies. An average of 85 per cent of live supplies for small plants was procured from these feeding companies.

Variation among plants' effective production density was great and ranged from a low of 88 to a high of 23,896 birds per square mile per year. The average effective production densities for the small, medium, and large plant size groups were 1,111, 1,450, and 10,398 birds per square mile per year, respectively. A majority of Alabama processors could have lowered flock servicing and assembly cost by a considerable amount had steps been taken to increase production density.

Fifty-eight per cent of Alabama processors owned trucks for assembly of live birds. Truck ownership was more common when plant size was large, and 75 per cent of firms owning large plants also owned assembly trucks. Straight-bed trucks were more common than the trailer type. Large trucks were used by processors with a low production density where birds were transported relatively great distances.

Prices paid for birds procured from outside feeding companies were the same as the market price for live broilers quoted by the United States Department of Agriculture the day birds were processed.

Variations in labor productivity were sizeable both among plants of similar capacities and among different size plants. The variation resulted in part from too many workers being employed to perform a particular job and in part from a relatively inefficient method of performing a job in some plants. Plants employing a regular crew to cut-up dressed broilers had a lower output per man hour than did plants of a similar capacity where no cutting up was done. Direct labor cost of cutting up broilers was found to be approximately 1.4 cents per pound.

A great amount of variation was found among plants with respect to labor cost. Average per unit labor cost was lowest for the 6,000 bird-per-hour plants. Only small economies of scale were found in the range of plant capacities included in the study; total processing costs were only about 0.1 cent lower per live pound in 9,600 bird-per-hour plants than in 4,800 bird-per-hour plants.

Seasonal variation in utilization of plant capacity was great. Average utilization of capacity during periods of peak output was 113 per cent and for periods of lowest output 77 per cent. This variation resulted in high average per unit processing costs.

The predominant form in which Alabama broilers were sold was fresh ice-packed. Ninety-one per cent was sold as whole birds packed in ice. Two per cent was cut-up and sold fresh and seven per cent was frozen at a processing plant before shipment.

Five of 12 processors owned one or more trucks for distribution of dressed broilers, and an average of 21.9 per cent of the output from these plants was shipped on these trucks. Three processors owned only one truck each and distributed less than 10 per cent of output with this equipment. Two processors hauled 50 per cent or more of plant output on self-owned trucks. Approximately 96 per cent of all broilers processed in Alabama was distributed on trucks owned by a trucking firm.

Pricing of both live and dressed birds was based on the quoted market price for live broilers on the day of processing. The market price used was either the quoted North Georgia or North Alabama farm price. The difference in the two quotations was small.

Approximately 87 per cent of Alabama broilers was sold in out-of-state markets. The most important markets were located in the North Central Region and approximately 69 per cent of Alabama broilers was shipped to those markets. The two most important markets in terms of proportion received were Chicago and Detroit. Those markets received 25.2 per cent and 12.8 per cent respectively of the broilers processed in Alabama.

The number of markets into which Alabama processors sold broilers ranged between 6 and 19 per processor. The average was 13 markets for each processor. The most important types of outlet were wholesalers and food brokers, and 71.5 per cent of the birds processed in Alabama was sold through these outlets. Twenty per cent moved directly to chain food stores' warehouses and eight per cent was shipped to company branch houses to be distributed.

APPENDIX

APPENDIX TABLE 1. RELATIONSHIP OF PROCESSING PLANT SIZE TO COMBINED COSTS OF SERVICING BROILER FLOCKS AND ASSEMBLY FOR DIFFERENT EFFECTIVE PRODUCTION DENSITIES, SOUTHEAST, 1960[1]

Effective production density	Plant size (birds/hour)					
	2,400	3,600	4,800	6,000	7,200	9,600
	Costs per hundred live pound					
	Dol.	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*
500	1.133	1.260	1.373	1.471	1.569	1.682
1,000	.951	1.049	1.134	1.204	1.260	1.376
2,000	.824	.909	.951	1.007	1.049	1.134
4,000	.782	.796	.838	.880	.909	.951
8,000	.684	.712	.754	.782	.796	.824
16,000	.656	.670	.684	.698	.712	.754
32,000	0.627	0.642	0.656	0.656	0.670	0.684

[1] Adapted from Henry, Chappel, and Seagraves, **Broiler Production Density, Plant Size, Alternative Operating Plans, and Total Unit Costs,** North Carolina Agricultural Experiment Station Bulletin 144, (Raleigh: North Carolina State College, 1960).