REDUCING COSTS OF HANDLING AND HAULING LIVE CHICKENS FROM FARMS TO PROCESSING PLANTS

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PREFACE

This report presents some preliminary results of the cost phase of a study of handling and hauling live poultry from farm to processing plants in New England during 1957-59. These results will aid managers of assembly firms or assembly departments in integrated firms to increase operating efficiency and reduce costs. The methodology used in this study will permit firms to compare their operations with model firms of similar size, and also to estimate the cost reductions they might achieve by expanding capacity, increasing the volume hauled per mile of truck travel, or making other changes in firm type and practices.

Firms assembling live poultry have become increasingly interested in recent years in the possibilities for cost reduction. Intense competition has drastically reduced the number of firms and the operating margin for the assembly function. Newer methods of producing, assembling, processing, and distributing have facilitated volume handling. Integration of these functions under centralized management has become common. In this new environment, a thorough analysis of the costs in assembling live poultry was needed as one phase of an overall study.

The study is part of a broad program of research conducted cooperatively by the Economic Research Service and the New Hampshire and Massachusetts Agricultural Experiment Stations to improve the marketing of poultry in New England. Previous reports have dealt with (1) characteristics of the processing industry; (2) costs and economies of scale in chicken processing; and (3) the changing characteristics of the assembly system. A complete report, providing much more detailed information than is presented herein, will be issued as an agricultural experiment station bulletin by the University of New Hampshire, Durham.

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HIGHLIGHTS

In 1957 about 330 firms handled and hauled from New England farms to processing plants 470 million pounds of poultry at a cost of $4.6 million. Costs such as these can be reduced by increasing the efficiency of individual firms and by reducing and realigning resources within the industry. Despite substantial reductions in operating margins and in numbers of firms assembling live poultry in recent years, the present system is still characterized by excess capacity and duplication of travel and expense. The suggestions for reducing costs which were developed on the basis of studies in New England in 1958-59 are applicable to other areas.

As the total volume assembled annually per firm increases, handling and hauling costs per pound of poultry may decrease. This results from the use of trucks of larger capacity, increased specialization within the labor force and higher output per man-hour, lower costs per pound for overhead items such as management, buildings, and equipment, and the ability of larger firms to assemble and process larger flocks in a short time.

For a firm handling a given annual volume of poultry, assembly costs per pound will be progressively reduced as the miles it is necessary to travel to obtain this volume decline. Or, to state the relationship in more concise terms, assembly costs per pound decline as the density of the supply area increases. 1/

Individual firms can increase efficiency and reduce costs per pound for poultry assembly function by: (1) Capacity operation of a minimum number of trucks and careful organization of the pickup crew; (2) maintaining total volume at near-capacity levels; and (3) increasing the volume obtained per mile of truck travel. Achieving lower assembly costs requires the constant attention of management to details. Further progress in cost reduction in assembly, as well as in processing and distributing poultry, will increasingly depend upon the realization of small savings in unit costs which translate to large dollar savings on larger volumes.

Preliminary estimates can illustrate the magnitude of savings possible from increasing the size and changing the type and practices of the assembly firm, or increasing the density of its supply area. In an area where poultry is available at the rate of 100 pounds per mile of truck travel, unit costs in assembling decline from 0.90 cent per pound for a firm handling 1 million pounds per year to 0.47 cent per pound at 50 million pounds. Increasing the pounds per mile of truck travel to 1,000 would lower unit costs to 0.60 cent per pound for 1 million pounds and 0.35 cent per pound at 50 million pounds.

An important consideration in reducing costs of handling and hauling poultry is the location and size of farms supplying live birds. Assembly firms should take a more active role in the future in obtaining and retaining suppliers as

1/ In this report, density of production and pounds per mile of truck travel are used interchangeably.

close as possible to their place of business. They may also find it profitable to encourage such producers to expand their capacity. The potential savings in assembly costs would provide a basis for financially encouraging nearby growers. New resources can readily be located close to the assembler's place of business if investment capital is provided by the assembler.

To eliminate much duplication of travel, assemblers could work with one or more competitors toward the reassigning of supply flocks on the basis of location. However, extensive reassigning of flocks would raise some legal and sociological problems and necessitate changing grower payment procedures. Discussion of high density of supplies for individual firms was only an academic possibility until recent years. But the rise of new commercial poultry areas, extensive use of contract production of broilers, changing characteristics of marketing firms, and the spread of integration of the various production and marketing functions under common management, make substantial adjustments possible and give promise of further cost reductions in assembling live poultry.

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By George B. Rogers and
Edwin T. Bardwell 2/

INTRODUCTION

Development of new technology, a widening mass-market demand for chicken, and other changes in the industry have focused attention on increasing efficiency. Firms which handle and haul live poultry, like firms performing other functions, are continually seeking ways to reduce costs in order to improve their competitive position. They can accomplish these results by effecting internal economies in their present operations, by changing firm size, type, and practices, and by increasing the volume of poultry acquired per mile of truck travel.

To date little attention has been paid to the cost reduction possibilities in the assembly function because of the smaller share of marketing costs it involves, the decreases in costs which have resulted from the trend toward fewer and larger firms, and the increased concentration of production into highly commercialized areas. Over the last two decades, assembly costs have declined despite rising price and wage levels. Many firms formerly experienced costs in excess of 1 cent per pound live weight or more. Today, many firms are assembling chickens for less than 1 cent per pound, and some for as low as one-half cent per pound live weight. Nevertheless, substantial further decreases are possible and these aggregate to large dollar savings on large volumes.

Analysis of cost data from actual firms can suggest ways by which live-poultry assembly firms can increase the efficiency of their operations. However, the net effect of various factors is difficult to determine because of the variability in levels of operation, facilities, equipment, practices, market classes and weights, and prices of inputs inherent in cost records. Hence, this study is not confined to reporting actual average operating costs of a sample of firms of different sizes. The approach selected involves the synthesis of model firms of different capacities. A necessary condition was the standardization, insofar as available technology permits, of factors which cause variability in actual cost records.

Records were obtained in 1958-59 from a stratified random sample of 75 New England firms engaged in handling and hauling live chickens from farms to processing plants. These records were used to help determine organizational features, input-output relationships, and cost rates on variable items. Secondary data and methodology based upon previous studies were used to synthesize fixed costs and truck operating costs. Labor input-output relationships were based

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upon statistically derived curves using actual annual data from the 75 firms. Further study is underway to determine if higher labor standards are warranted. This is being accomplished by time studies of individual operations.

The shrinkage in live weight which occurs in hauling was not included as a cost item in this report. Shrinkage is less for short than for long hauls. Thus, reducing the length of haul would result in cost reductions in addition to those shown in this report.

Model assembly firms were developed ranging in capacity from about 1 million to 70 million pounds of live poultry handled and hauled annually. Such firms could assemble the poultry required by processing plants ranging in capacity from 150 to 10,000 broilers per hour of operation. The upper limit of this range represents a projection of a larger plant than any operating at the time the data were collected. As model firm size was increased, the proportion of broilers handled and the average flock size acquired were also increased. This is consistent with observed relationships as well as a necessary feature for deriving minimum costs in this analysis.

Cost curves for individual model firms were determined by selecting the least-cost combination of labor, equipment, management, and facilities from several alternatives at each of a number of densities of production. Development of a series of cost budgets which included alternative combinations of these resources preceded this selection.

The original data, taken at a particular point in time, provides a cross section of an industry in transition. By standardizing size and some other factors, the present industry is translated into a set of simplified models representing completed stages rather than a mixture of firms in all stages of transition. This is done to facilitate study of the effects of a continued movement toward fewer, larger, and more highly integrated firms. First, given a supply of specified quality, quantity, and geographical location, how could assembly costs be minimized if a number of firms of discrete sizes and types constituted the alternatives? Secondly, if a firm of particular size and type was able to overcome institutionalized restrictions and change to another size and type, what would the results be in terms of costs?

While the study on which this report is based involved New England assembly firms, their technology and operating practices are comparable to those in other areas. Thus, cost relationships determined among firms of different capacities should have general applicability. Inefficiencies in the present assembly system in New England result both from practices of individual firms and from structural features of the industry. Other areas have similar problems. Therefore, the potential savings available within New England, as shown in this study, may also be possible for the industry in other areas.

EFFECT OF SIZE OF FIRM ON ASSEMBLY COSTS

Costs per pound of live poultry handled and hauled decrease as the size of live poultry assembly firms increases, type and organization of firms changes, and if the capacity of each size of firm is used to the same extent. Increased

mileage per truck and per firm occurs as volume increases. This is because the supply area becomes larger. However, the cost-increasing tendencies of this factor have in practice been more than offset by the use of larger vehicles, increased labor efficiency, economies in management and facilities, larger flock sizes, and a higher proportion of young chickens handled.

The achievement of least-cost operations for each size of firm, and for any given density of production in the supply area, involves a distinct combination of numbers and sizes of trucks, crew size and organization, and flock size composition and location. As firm size increases, more and larger trucks are required. Similarly, as firm size increases, additional workers are needed. Larger flocks can then be handled more efficiently.

Very small firms own one small truck and send only one man out on the truck. Firms which require one or more larger trucks send two, and eventually three men with each truck. Still larger firms utilize bigger trucks and may send only the driver with each vehicle. They employ larger crews of men who meet one or more trucks at the farms and move from farm to farm in passenger vehicles. As the size of the field crew increases, output per worker in catching, crating, and loading chickens increases due largely to specialization of the working force.

Data from 75 firms assembling live poultry in New England indicated that the average size of flock handled increased with firm size. Such a relationship represents a desirable adjustment for assembly firms seeking to minimize costs. In synthetic analysis, a more optimum and standardized flock size can be selected than is found in practice. As firm size increases, the larger numbers of trucks and workers can handle larger flocks in a short time. For example, a firm with 1 truck with a capacity of 100 crates would need to make 10 trips to clean up a lot of 20,000 broilers. If these birds were delivered to a plant capable of processing 300 broilers per hour, it would require in excess of 8 days operations to process 20,000 broilers. On the other hand, a firm with 5 trucks with a capacity of 200 crates each could clean up a lot of 20,000 broilers in 1 visit. Moreover, the entire lot could be processed in less than 6 hours by a plant with a capacity of 3,600 broilers per hour.

Figure 1 shows the derived individual average cost curves for 10 selected model assembly firms when poultry is available at the rate of 500 pounds per mile of truck travel. Since costs per pound decline as use of capacity increases toward 100 percent, each plant should strive to operate as near capacity as possible to minimize its costs per unit of output. It is also evident that, at any uniform percentage of capacity, the cost advantage in assembling poultry rests with larger firms. Hence, if supplies can be obtained, it will pay to increase firm size.

The points for 100 percent of capacity in figure 1 fall approximately on the curve for the density level of 500 pounds per mile of truck travel in figure 2. Similar sets of individual cost curves could be drawn for density levels other than 500 pounds per mile of truck travel in figure 2.

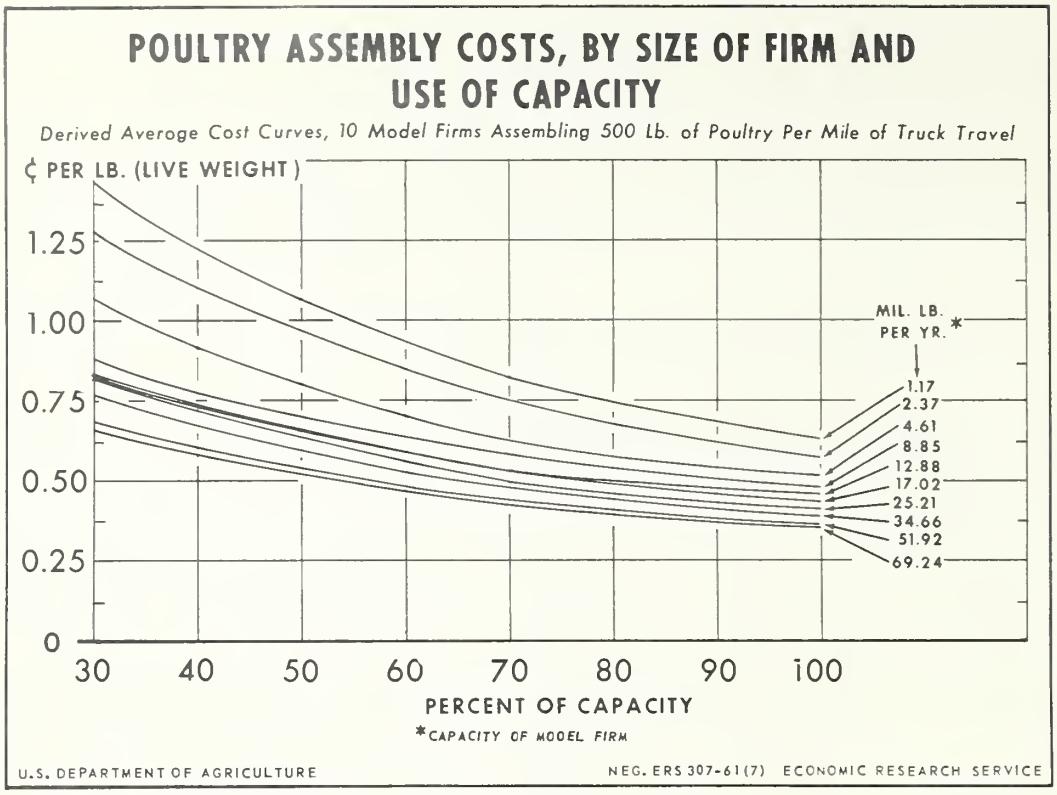

Figure 1

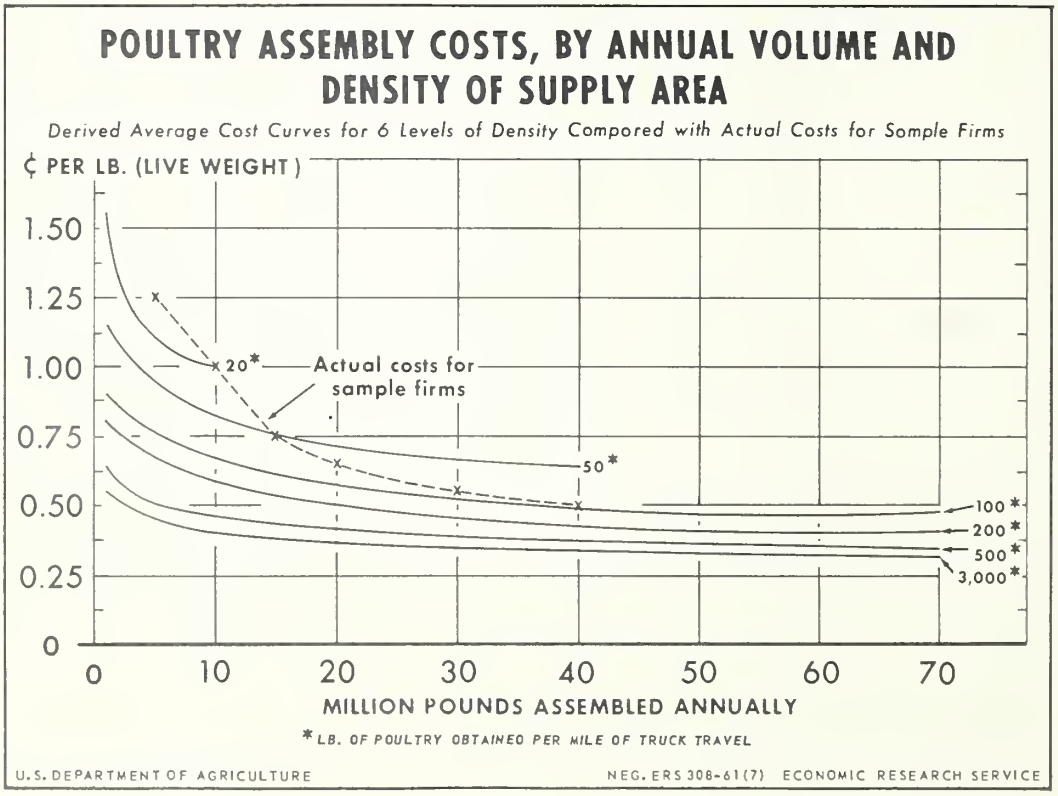

Figure 2

CHARACTERISTICS OF ASSEMBLY COSTS AND INVESTMENT

Capital investment required for poultry assembly firms ranges from $6,700 for a firm with a capacity of 1.17 million pounds annually to $96,500 for 69.2 million pounds annually. In contrast, the investment in processing facilities for these volumes ranges from $20,000 to $700,000. The major items of investment required in assembling poultry are trucks, crates, and buildings. As firm capacity increases, investment per unit of capacity declines.

Wages are the single largest cost in assembling live poultry, accounting for two-thirds to three-fifths of total costs per pound. If density of production remains constant, the share of total unit costs represented by wages declines as volume increases. Savings from increased labor productivity continue well beyond the volume levels where per pound costs for truck ownership and operation level off. Labor savings result from use of larger crews, increased specialization, minimization of in-field travel by crews through the use of supplementary vehicles, and the ability of larger firms to handle flocks of larger average size.

At any one volume level, and as density of production decreases, the proportion of total per pound costs represented by wages increases. Under these conditions mileage per truck or per pound increases. The increased importance of labor costs results from the increase in the ratio of travel time to work time and the greater proportion of overtime wages.

Costs for truck ownership and operation decline with increasing truck size. At a level of 5,000 miles per truck per year, least costs per pound are realized at the $1\frac{1}{2}$-ton size (130 crates capacity per load). For greater annual mileages, larger trucks give costs per pound as low or lower than the $1\frac{1}{2}$-ton size. Within the area of declining costs per pound, increasing cost per mile of operation is more than offset by the larger volume carried.

Truck costs per pound of poultry hauled rise rapidly for any particular truck size as average length of haul increases. The absolute, and in many cases, the relative advantage of larger trucks increases as length of haul increases.

Costs per pound for other items, such as management and facilities, continue to decline as volume increases. While more people are required in managerial, supervisory, and office jobs, costs per unit of product decline. Moreover, the cost of space per square foot for trucks, storage, and unloading birds is cheaper as size of firm increases.

RELATIONSHIP OF DENSITY OF PRODUCTION TO ASSEMBLY COSTS

The smaller the geographic area in which the assembly firm obtains poultry, the lower will be the resulting assembly costs. Figure 2 illustrates this relationship for selected levels of density of poultry production. Table 1 summarizes the estimated costs per pound for selected size of firms at the several density levels.

Table 1.--Average cost per pound for assembling live poultry, by annual volume assembled and quantity assembled per mile of truck travel

Annual volume (million pounds)	Pounds of poultry per mile of travel (density)										
	5 lb.	10 lb.	20 lb.	50 lb.	100 lb.	200 lb.	500 lb.	1,000 lb.	2,000 lb.	3,000 lb.	4,500 lb.
Mil. lb.	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
1	3.100	2.000	1.550	1.150	0.900	0.800	0.637	0.595	0.575	0.555	0.532
2	2.820	1.750	1.325	1.075	.850	.750	.576	.535	.520	.505	.483
3	2.690	1.660	1.200	1.020	.820	.720	.543	.510	.495	.480	.458
4	2.560	1.600	1.140	.975	.790	.695	.522	.490	.475	.460	.440
5	2.500	1.560	1.100	.940	.770	.670	.506	.475	.461	.445	.425
6	1/2.450	1.540	1.070	.915	.745	.650	.493	.462	.448	.433	.414
9	--	1/1.460	--	--	--	--	--	--	--	--	--
10	2/	2/	1.000	.820	.670	.584	.458	.427	.413	.399	.381
14	--	--	1/.975	--	--	--	--	--	--	--	--
20	--	--	2/	.710	.574	.505	.415	.388	.376	.364	.350
30	--	--	--	.660	.530	.460	.391	.365	.356	.344	.333
40	--	--	--	1/.640	.490	.425	.375	.352	.344	.333	.323
50	--	--	--	2/	.470	.410	.364	.343	.335	.327	.316
56	--	--	--	--	1/.464	--	--	--	--	--	--
60	--	--	--	--	.470	.402	.354	.338	.330	.322	.312
62	--	--	--	--	--	1/.400	--	--	--	--	--
70	--	--	--	--	.480	.404	.347	.334	.327	.320	.310

1/ Point of lowest cost at density shown. (At densities of 500 lb. or more, lowest-cost points were at volumes over 70 million lb. and beyond range of projection.)

2/ Before these volumes are reached assembly costs per unit will increase or level off due to excessive travel time, mileage, and overtime wage rates, or to restriction of operations to a single load per operating day, or to use of a larger number of vehicles than at higher densities. Hence, no firms of these sizes operated with these densities.

Discussion of high density of supplies for the individual firm was only an academic possibility until recent years. While areas of concentrated poultry production existed, they supplied a large number of firms which were only slightly larger than those operating in areas of less dense production. Each firm obtained its share of the aggregate supply by exploiting its particular location and by nonprice competitive devices.

The rise of new commercial poultry areas in the last decade has been accompanied by extensive use of contract production. In these areas as well as in the older areas to which contract production has also spread, assembly and processing firms have been able to assure themselves of larger total volume by (1) direct financing of production; (2) risk-sharing contracts with feed dealers and hatcheries; or (3) their ability to handle large volumes under more informal marketing arrangements. Since the expansion in poultry meat production has been predicated on commercial broilers, realization of high density of supplies and lowest costs is most likely when broilers are stressed.

Figure 2 compares the curves computed for selected levels of volume per mile of truck travel with actual average costs incurred by firms of various sizes under 1958-59 conditions. Because of variations in use of capacity, input prices, performance levels, volume composition, and volume obtained per mile of travel, the curve connecting the actual average costs cuts across several of the curves representing costs with volume per mile of travel standardized. This situation shows the greater degree of success already achieved by assembly firms of larger size and new type in reducing costs. Figure 2 also illustrates the opportunities which may be open to assembly firms of a given size to reduce costs through contracting the size of the supply area and reducing the average length of haul.

Although the savings in average cost per pound from increasing the density of the firm's supply area may be small, total dollar savings may be substantial. This condition is also true of the efficiencies realized by small increases in the percentage of capacity at which the firm operates, and of savings by increasing the capacity of firms which are already larger than average. Further progress toward enhanced efficiency and lower costs will increasingly depend on the ability of management to realize such fractional unit cost savings.

SOME IMPLICATIONS FOR INDIVIDUAL FIRMS

The existence of potential cost savings in assembling live poultry is likely to force a continued reduction in number of firms and more attention by all firms to costs. In the short run, many firms can survive by using depreciated and low-cost resources. Over a longer period small firms, whose costs seem excessive can best survive by stressing fowl or specialty items, acquiring live poultry in non-commercial areas, and selling to small-volume buyers. These steps will be less likely to bring small firms into direct competition with large firms buying live birds in the commercial broiler areas or selling processed birds in volume trade.

It is relatively easy to increase the capacity of a firm to assemble poultry, but difficult to obtain large, regular, and concentrated volume on the open market. The acquisition of more and larger trucks and the hiring of a larger crew can increase capacity promptly. However, with an increasing share of the

commercial broiler production under contract, a firm may be forced to create or control a supply if it wishes to expand without adverse effects on its cost position. Contract growing and other arrangements in which the assembly firm assumes production risks will affect the overall profit position of the firm. The effect of market prices on the firm's decisions is not considered in this report.

As firm numbers have decreased, the volume of poultry per firm and per mile of truck travel has increased, thereby reducing assembly costs. Further reduction in costs may occur as firm numbers are reduced still more. Despite the reduction in costs which has occurred, duplication of travel and expense is still considerable when several firms operate in one area. Furthermore, the random location of farms and variability in their size and layout maintains costs above minimum levels.

An individual firm can reduce assembly costs by (1) increasing the density of its supply area through selection, retention, and expansion of producing units of suitable size and layout as close as possible to the plant serviced; and (2) creating an exclusive supply area for the firm. Whether independent producers or contract growers are involved, inclusion of location and size as short-run criteria for payment would aid the development of a supply area of smaller radius. The potential savings in assembly costs would provide a basis for financially encouraging nearby growers. New sources can be located close to the plant as a policy matter if investment capital is provided contract growers or assemblers own producing units outright.

Although a start toward developing an exclusive supply area might be made by exchanging some supply flocks with competitors, extensive development of this practice would raise some legal and sociological problems and necessitate changing procedures for paying growers. Apprehension exists in the industry relative to the extent to which firms can work jointly without facing antitrust investigation. At present, the associations of buyer and seller or of fieldman and grower frequently may be based on personal considerations rather than economic decisions. Furthermore, many growers experience difficulty in evaluating the alternative contracts offered. One solution would be the periodic negotiation between growers and firms of uniform terms, practices, and supervision, with growers assigned to assemblers largely on the basis of proximity to the plant.

Additional savings can be realized by integration of the assembly and processing functions under one management. By 1957, 70 percent of the live poultry moving from New England farms to slaughtering plants was handled and hauled by combined-function firms. By combining the two functions under one management, a duplicate set of personnel engaged in managerial, buying, and office duties can be eliminated. Some economies are also obtainable by including garage and holding space in the greater square footage of a processing plant rather than in distinct facilities for an assembling firm.

EFFECTS ON INDUSTRY STRUCTURE AND COSTS

Realization of the full potential savings which individual assemblers can achieve through improved efficiency, larger volume, increased density of supplies, and combination of the assembly and processing functions under one management, would be accompanied by major structural changes in the industry. The New England region may be used as an example.

In 1957 the 332 firms assembling live poultry in New England hauled 470 million pounds of poultry at an estimated cost of $4,640,000. If these firms had been able to halve truck mileage by increasing the density of their supply areas, costs could have been reduced to $3,930,000.

The present system of assembling live poultry in New England is characterized by a substantial amount of excess capacity. If all the trucks owned by assembly firms operating in the region in 1957 had been used at 100 percent of capacity, volume handled through the system could have been more than tripled. With a reduction in firm numbers of 60 percent, capacity operations of the smaller number of trucks, and exclusive supply areas, costs could be reduced to $2,932,000.

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