COMPARATIVE COSTS OF SLAUGHTERING CATTLE IN MICHIGAN PACKING PLANTS

A Research Paper for the Degree of M. S.

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Donald J. Wissman

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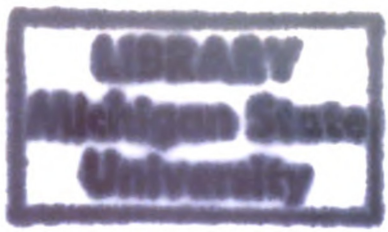

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COMPARATIVE COSTS OF SLAUGHTERING CATTLE IN MICHIGAN PACKING PLANTS

by

Donald J. Wissman

A RESEARCH PAPER

Submitted to the College of Agriculture
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TABLE OF CONTENTS

TABLE OF CONTENTS continued --

LIST OF TABLES

CHAPTER I

INTRODUCTION

General Considerations

Many changes have occurred in the meat packing industry in Michigan over the past decade. Changing economic conditions have reduced profit opportunities of earlier years and plants that were built many years ago may no longer provide the most economical size of plant for slaughtering operations. The introduction of new technology such as the more automated on-the-rail dressing operation has raised questions as to the cost advantages of these new plants over the conventional ones.[1/]

Profits as reported by the meat packers have generally been the lowest of all nondurable goods manufacturing industries. Figures for 1963 show that packers reported earnings, as a percent of sales, was by far the lowest of all nondurable goods industrial groups while the packers sales to assets ratio was the highest (see Table 1). Perhaps a more meaningful ratio is the return on net worth. Here again the packers' earnings, as a percent of net worth, are the lowest of all nondurable goods industries except the textile mill product-

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1/ There are two basic types of plants in general operation: 1) the conventional bed-type system and 2) the "on-the-rail" dressing system. In the conventional bed-type system, most commonly used in Michigan today, cattle are moved manually on the rails and removed from the rails to beds on the floor for certain work. In the more automated on-the-rail system either power or gravity is used to move the cattle through the dressing process.

The unsatisfactory profit situation has existed for some time. Data from the American Meat Institute indicates that earnings in the meat packing industry have been the lowest of all manufacturing groups for the past ten-year period.[2/]

Table 1. Financial Ratios for All Nondurable Goods Manufacturing Corporations, by Industry, 1963

Industries	Earnings As % of			Sales to Assets Rate	Net Worth As % of Total Assets
	Sales	Assets	Net Worth		
Dairy products	1.91	5.16	8.34	$2.70	61.9
Bakery products	2.22	5.96	9.14	2.69	65.2
Alcoholic beverages	3.48	5.22	7.83	1.50	66.7
Other food & kindred prod.	2.30	5.43	9.27	2.36	58.6
Tobacco manufacturers	5.92	8.64	13.01	1.46	66.5
Textile mill products	2.35	3.80	6.05	1.61	62.7
Apparel & other products	1.38	3.70	7.47	2.68	49.6
Paper & allied products	4.52	5.35	8.04	1.18	66.5
Printing & publishing	3.15	4.88	9.16	1.55	53.2
Chemicals & allied pro.	7.44	8.46	12.92	1.14	65.5
Petrol. refining & related	10.28	8.04	11.03	.79	73.4
Rubber & misc. plastic prod.	3.59	5.44	9.07	1.52	60.0
Leather & leather products	1.78	3.85	6.79	2.16	56.7
Total nondurable goods	4.88	6.73	10.25	1.38	65.6
Total manufacturing	4.71	6.44	10.13	1.37	63.6
Meat packing industry	.84	4.21	6.67	5.00	63.2

Source: Meat packing industry figures estimated by American Meat Institute. All other figures calculated from figures shown in joint report of the Security and Exchange Commission and the Federal Trade Commission. Data taken from American Meat Institute, Financial Facts About the Meat Packing Industry, Chicago, 1963, p. 20.

[2/] American Meat Institute, Financial Facts About the Meat Packing Industry, Chicago, 1954-1956.

The goal of profit improvement not only benefits the packing industry but also has long-run social implications. If the meat packing industry is to continue its traditional role as processor and distributor of the nation's meat supply in a manner that is satisfactory to both producers and consumers, its earnings must be sufficient to provide for basic research, the modernization of present day plants and the development of new products which are demanded by our modern day shoppers.

Approximately three-fourths of all dollars paid out by a meat packing company go for the purchase of livestock or processing meats.[3/] It is understandable then that a relatively large portion of management efforts has been directed toward the procurement and selling aspects of the operation. As a result many of the small and medium sized plants have neglected internal costs analysis for the purpose of cost reductions in the processing operation. There is, however, recent widespread interest in operational costs in livestock slaughter plants.

Other Research

Little information is available concerning the actual costs of slaughtering livestock. One such study is currently in progress by the U.S.D.A.[4/] This study is being accomplished by means of mail-in

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[3/] Cost of livestock and other raw materials as a percent of total sales was: 1959, 73.4 percent; 1960, 72.7 percent; 1961, 73.7 percent; 1952, 74.1 percent; and 1963, 73.3 percent as reported by American Meat Institute, Financial Facts About the Meat Packing Industry, Chicago, 1963, p. 1.

[4/] Agnew, Donald B., Meatpackers' Costs in Fresh Beef Operation--A Pilot Survey, Marketing Economics Division, Economic Research Service U.S.D.A., Washington, D.C., 1963.

accounting data and is concerned with the cost of fresh beef operations. Preliminary data releases indicate that meat packers were converting cattle into beef at an average total cost of $26.70 per head. This included buying costs, slaughter, grading, loading, selling and delivery. The total cost reported by packers varied from $21.04 to $33.90 per head, equivalent to about 2.4 to 3.3 cents per pound liveweight.

A further breakdown of these costs indicate that in-plant costs averaged $15.45 per head, divided into $7.42 for labor, $6.78 for plant and administration, $1.25 for grading and packaging. Other costs averaged $11.24 per head. This included $1.00 for procurement expense and $10.24 for selling and delivery.

The American Meat Institute publishes Financial Facts About the Meat Packing Industry. 5/ This report is prepared annually and the costs for the entire industry are estimated. Expense figures are estimated from a survey conducted among 135 companies consisting of a cross-section of the entire industry and the Census of Manufacturers for Meat Packing.

A comprehensive study of the characteristics of the Indiana meat packing plants was conducted by Schneidau.6/ Emphasis was placed on labor efficiency as it was related to such factors as size of operation, degree of automation, labor specialization and plant schedules. Special emphasis was placed on the cattle killing and dressing operation.

5/American Meat Institute, op. cit.

6/Schneidau, Robert Emil, Operating Efficiency and Labor Productivity in Selected Indiana Meat Packing Plants,(unpublished thesis) Department of Agricultural Economics, Purdue University, January 1963

Results of the comparative analysis showed a wide range in output per man hour between plants. The analysis indicated that there was no apparent relationship between size of plant and labor productivity (excluding on-the-rail beef dressing processes) in the cattle killing and dressing operation.

A study was conducted among Virginia meat packing firms in which costs and production records were analyzed by departments to obtain interfirm variations in man hours required and in costs of labor and other selected resources.[7/] The study showed that considerable variation existed in all departments in costs and labor efficiency, and that considerable variation also existed in costs and labor efficiency on a total firm basis, but this was not as great as inter-departmental variation. It was also interesting to note that there was no meaningful relationship between volume and costs in any of the departmental analysis, and no meaningful relationship between volume and labor efficiency nor volume and costs in the total analysis.

The author reported that labor cost of dressed beef ranged from a low of $.39 to a high of $1.05 per hundredweight with an average of $.80.[8/] Total costs for all firms were reported at a low of $5.19 per hundredweight of dressed beef. This included: labor, supplies maintenance, insurance, office, sales, depreciation, rent and utilities.[9/]

A study was conducted by Logan and King to determine the long-run and short-run average cost functions for specialized beef slaughter

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[7/] Crowder, Richard T. and Juillerat, Monte E., Variations in Labor Efficiency and Selected Costs Among Virginia Meat Packing Firms, Bul, No. 542, Virginia Agricultural Experiment Station, Virginia Polytechnic Institute, Blacksburg, Virginia, 1962.

[8/] Ibid., p. 17.

[9/] Ibid., p. 31.

plants in California.[10/] They estimated the cost function by synthesizing the construction of eight model plants of various size and using two technologies (1) conventional or bed-type slaughtering and (2) intermittent on-the-rail dressing. The bed-type slaughtering appeared to offer a cost advantage over the intermittent on-the-rail system in the range of output between 17 and 50 head per hour. Costs, in general, tended to decrease over the range in output studied from $9.48 per head in a one-bed conventional plant operating at 17 head per hour to $7.28 per head in a completely conveyorized on-the-rail system operating at 120 head per hour. Figures included all plant costs including buying, selling and delivery.

Hammons and Miller[11/] conducted a study on work methods and plant layout of all basic types of materials-handling equipment currently used in Texas. They found that costs for a typical plant slaughtering 100 cattle daily could be reduced 50 cents a head or $13,000 annually through improved work methods and plant layout. The total labor and equipment cost per 100 cattle for performing plant operation with typical work methods was $235.22 as compared to $184.68 with improved work methods. All of the recuction in the costs for slaughtering with improved methods and layout occurred in the cost of labor. Labor costs were reduced from $216.37 to $165.21 with improved work methods while the costs of equipment are slightly higher.

10/ Logan, Samuel H., and King, Gorden A., Economics of Scale in Beef Slaughter Plants, Giannini Foundation Research Report No. 260, California Agricultural Experiment Station, Giannini Foundation of Agricultural Economics, December 1962.

11/ Hammons, Donald A., and Miller, Jarvis E., Improving Methods and Facilities for Cattle Slaughtering Plants in the Southwest, Marketing Research Report No. 436, U.S. Department of Agriculture. Agricultural Marketing Service, Washington, D. C., February 1961.

A further study was conducted by Hammons[12/] to compare the relative efficiency of the conventional bed-type system with the on-the-rail systems and to develop a layout for each system that provides for maximum operating efficiency. Hammons study showed that killing-floor operations in plants with a rail system (either power or gravity) cost about $13,000 to $15,000 a year less than a conventional bed-type system in plants with a volume of 50,000 head per year. Average costs for labor and equipment per 100 head were $203.56 for the 3-bed system, $177.64 for the powered system, and $173.33 for the gravity system.

The Problem and Purpose

There is a real need for more information concerning operational problems and comparative costs in the Michigan beef packing industry. Rural development planners and farmer cooperative groups are interested in cost figures for economic feasibility studies and planning investment in new plants. Meat packers presently operating in high-cost plants must decide whether to re-design their old plants or to build new ones. They want to know if they do expand their present volume whether they can expect a corresponding decrease in operating costs. New technology such as on-the-rail dressing operations raises questions as to the cost advantages of the more automated system over the conventional bed-type system commonly employed in Michigan packinghouse operations.

12/Hammons, Donald R., Cattle Killing - Floor System and Layouts, Marketing Research Report No. 657, U. S. Department of Agriculture, Agricultural Marketing Service, Washington, D. C., May 1964.

Also, in a study conducted by McLeod[13] several of the packers interviewed indicated that they would like to have some relative cost figures so that they would have a basis for determining how their plant compares with other plants of the same size slaughtering the same species of livestock.

Information necessary to answer these questions is generally limited and is especially lacking concerning the characteristics of Michigan's beef packing industry. To tackle all the problems of the operational efficiency and cost analysis would be an impossible task for this study. With the tremendous variation evident among various plants and within the plants themselves, one hardly knows where to concentrate his efforts. Attention in this study was focused on labor cost in selected beef packing plants in Michigan. The American Meat Institute reports that 46.3 percent of the total operating expenses went for wages and salaries and an additional 7.7 percent went for employee benefit programs comprising a total of 54 percent of the total operating expenses.[14]

Not only does direct labor comprise a very large segment of the total cost of operation, but also according to some meat packing officials and industrial engineers, much improvement is usually obtainable through closer assignment and supervision of labor and scheduling of work. This is generally possible without requiring changes in wage rates or added equipment. Furthermore the use of labor as the variable input factor provides the most useful "common denominator" for comparing the

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[13] McLeod, Willard L., A Study of Wage Rates and Unionization In The Meat Packing Industry in Michigan (unpublished research paper) Department of Agricultural Economics, Michigan State University, 1963, p. 52.

[14] American Meat Institute, op. cit., p. 3.

efficiency of production methods and techniques between various firms in the same industry.[15/]

The purpose of this study was to provide some information which packers can use as a bench mark in comparing slaughtering costs. It is also hoped that packers will benefit by increasing their awareness of using cost analysis for the purpose of cost reduction and managerial decision making. Also, an increased knowledge of time requirements for slaughtering cattle under Michigan's conditions may assist packers in decreasing labor costs through more efficient work scheduling.

Before further and more comprehensive studies can be made, it is useful and necessary to identify some of the characteristics of the industry in Michigan, the nature of costs, and something of the nature of the operational problems faced by Michigan packers. Hopefully then, this study will provide the beginning and some necessary background information for further research. The specific objectives were as follows:

1. To identify the nature of costs involved in the meat packing industry of Michigan.
2. To develop methods of cost comparison based upon accounting records and supplementary direct observations of plant operation.
3. To make a comparative cost analysis for four medium size beef packing plants.
4. To identify some of the problems involved in a study of this type, and to suggest appropriate methodologies for future studies.

15/U.S. Department of Labor, Plant Operation Report for Meat Processing, BLS, Report No. 89, Washington, D.C., June 1955 (inside front cover).

Methodology and Procedure

Plant Selection

Data used in this study was collected from five medium-sized meat packing plants in Michigan. Of the total list of packing plants, those which slaughtered only cattle and at the rate of 300-800 head per week were considered. Of this group a list of potential cooperators was developed through consultation with M.S.U. research and extension staff.

Initial contact was made with the owners or managers of the plants either by telephone or by a personal contact from Mr. Don Hine, District Marketing Agent, Michigan State University. Follow up visits were then made and an explanation was given as to the nature of and purpose of the study. Subsequent visits were then made as necessary to obtain the accounting data and accomplish the necessary time studies.

All of the palnts that were finally selected, and asked, were willing to allow the author to carry out a time study of the slaughter operation. A great deal of reluctance was shown by some of the managers; however, when asked for a summary of the cost accounting records of their slaughter operation. This reluctance was based on two factors: 1) because of poor or inadequate accounting systems some managers did not have the information readily available and did not have the time to obtain it from the plant records, and 2) because costs represent a sensitive portion of their operation, they were unwilling to release them.

Methods of Comparing Costs

The problem of measuring and comparing costs may be approached in a number of different ways. It was felt that for the objectives

of this study an analysis of average costs based on accounting records combined with an actual time study analysis would give a useful approximation of variation in relative costs among plants.

Cost Accounting Records Method.--The cost accounting records method uses as basic information the historical cost data from the existing records of the plants. The main advantage of this method is that it allows one to obtain considerable information in a short amount of time and at a relatively low cost. Where the objectives of the study are broad and the resources limited, careful analysis of average cost based on accounting records may give a rough but useful approximation to economies of scale or variations in relative costs among plants.

When considering the cost for utilities, supplies, and especially repair and maintenance, which tend to fluctuate considerable, a more accurate average can be obtained if the data is observed over a period of a year. The accounting approach involves some other special problems such as segregating operations, computing interest and depreciation charges, assuring uniform accounting procedures and most basic of all obtaining the necessary detailed account data from the firm to make a meaningful study.

Each firm was asked for a summary of their in-plant costs for their beef cattle slaughter and dressing operation. All costs were to be included from the time the cattle arrived at the plant until the carcass left the plant for delivery. External costs (for procurement, selling and delivery) were omitted in this study. The costs were to

cover a 12-month period from July 1, 1963 through June 30, 1964. The data from Plant A covered the period from October 3, 1963 to September 30, 1964 because of their method of accounting. It was felt that if the reporting period would cover a 12-month period, seasonal fluctuation and other irregularities would tend to average out. Costs for special processing, such as sausage manufacture, boning or hide processing were not included.

One of the firms contacted was able to provide a detailed record of their in-plant costs and had this data readily available to use for managerial decisions. Limited data were obtained from three other plants and is incorporated in this study to provide a basis for the cost relationships among the various plants.

Plant managers generally utilized the following breakdown of costs in some form or another.

a. Labor

b. Fringe benefits

c. General manufacturing cost or overhead (sometimes separated into direct and general manufacturing costs)

d. Administrative costs

The problem encountered, however, was that summaries contained costs from all functions of the plant operation including buying, selling and delivery. The task was to properly classify the costs in order to provide meaningful information for management. One of the first essentials in establishing a good accounting system to best serve the needs of management is to identify and establish cost centers in

accordance with the various stages of the operation.[16] The expense records should provide sufficient detail to enable the manager to obtain an accurate picture of the costs for each separate department. These figures can then be summarized to provide records for the business as a whole. To be of maximum value, the expense records should summarize separately the total expenses for each major operation performed in the different stages.[17] This is necessary so that the manager can separately evaluate each operation. They should summarize separately total expenses of each major input so the cost of the input can be compared with its productivity. Fixed and variable costs should be summarized separately to facilitate planning.

Supplementary Time Studies.--Actual time studies were conducted on four slaughter operations. This consisted of stop watch measurement of the unit time requirement of each operation in the killing and dressing stage.[18] Prior to the actual measurement, the stage was analyzed and separated into operational work areas. These operational work areas were further divided into various jobs and each job timed. Individual measurement was made of the elapsed time between the beginning and end of work on each production unit. The disadvantage of this type of study is that only one worker can be effectively observed at one time and they are observed over a short period of time.

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[16] Phillips, Richard, Managing For Greater Returns in Grain Feed and Other Retail Businesses Serving Agriculture, Manhattan, Kansas, 1962, p. 151.

[17] Op. cit., Phillips, p. 157.

[18] Stages of operation in a slaughter plant include: 1) procurement, 2) holding, 3) killing and dressing, 4) cooler operation, 5) special processing, 6) selling and delivery. A complete discussion of the stages of operation is included in Chapter III.

The actual time study conducted at each plant took place over six to eight hour periods with observations both in the morning and in the afternoon. In cases where the crew was kosher killing, working with one or two men short of their regular crew, or exceedingly fatigued due to a heavy kill, another series of observations was made on a following day. It was felt that by conducting observations at different times of the day and/or on different days any such irregularities would tend to be averaged out.

From three to seven observations were made at each plant of each specific job, and with the same job being performed by different workers in those cases where the task was not performed by one specific worker. This method was used to approximate a "normal" rate of activity.

The task of obtaining an accurate measurement was made more difficult when during certain major functions such as "flooring" or "rumping," a job would be left undone while the worker would assist in a different operation requiring two men such as lowering or hoisting a second carcass. The job on the first animal would then be completed by a second worker. In some cases the task of accurate measurement of that job was further complicated by the introduction of a third worker who would complete the task. This type of switching was prevelant when a member of the killing crew was absent and the job switching was performed to replace the missing worker and to "keep the line moving".

CHAPTER II

COST COMPARISONS BASED ON ACCOUNTING RECORDS

Classification of Costs

For the purposes of this study costs were separated into 12 component parts which correspond closely to those listed by the packing firms. There is, however, considerable variation in the classification of costs among the various firms in the study. The cost components are:

1. Wages and salaries
2. Supplies
3. Repairs and maintenance
4. Transportation
5. Utilities
6. Professional fees (grading and inspection)
7. Advertisement and public relations
8. Insurance
9. Taxes
10. Depreciation
11. Interest
12. Other

Wages and Salaries

Plant payroll records were used to obtain data concerning the wages paid to production workers. The disadvantage of payroll records

is that they usually reveal little of the specific details of the plant job. For example, in all plants involved in the study the killing crew were guaranteed a 36 hour work week under union contract and in one case a 40 hour week was guaranteed.[19/] When the day's kill is completed, the manager may have the men do yard work (cleaning and repairing holding pens, etc.), work in the cooler, accomplish general plant maintenance and clean up, spend the remainder of the work day doing nothing or even send them home early. Plant records would generally conceal the fact that a considerable portion of the man-hours involved in the performance of a particular job may be spent doing other things and would not reflect a true rate of performance.

Other problems encountered in using only plant payroll records would be a lack of a uniform job description for the task performed. Moreover, accounting procedures are far from standardized among the different firms.

Fringe benefits paid to the workers were included and varied from approximately 20 to 30 percent of total wages paid. This is because of 1) variation in labor contracts, 2) employers oftentimes gave fringe benefits in excess of those stated in the labor contract, 3) different accounting procedures were used to prorate the cost of fringes.[20/] Some plant managers included the cost of vacation and holiday pay into the direct labor costs, others included it along with other fringes such as pensions and retirement, workman compensation, Federal Insurance Contribution Act, and Blue Cross. Implicit costs such as

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[19/] Employees unionized under the MCBW (amalgamated Meat Cutters) and Butcher Workmen of North America AFL-CIO) and the UPNA (United Packinghouse, Food and Allied Workers AFL-CIO) guaranteed a 36-hour week and those unionized under the Teamsters are guaranteed a 40-hour week. McLeod, op. cit., p. 20.

[20/] McLeod, op. cit., pp. 50-51.

free meals, clothing allowance, laundry, Christmas bonus, rest periods, personal clean-up time, etc. should be measured and converted into dollars and charged against the per head labor cost of slaughter. This was attempted whenever possible but such costs are numerous and varied and are oftentimes very difficult to define and measure accurately.

Salaries paid to managers and executives were also included in the total labor costs. Accounting records were the chief source of these data, but frequently the needed information is considered "confidential" and not easily obtained. In cases where there is an owner-manager arrangement, it is difficult to separate salaries and profits. Another problem was encountered in attempting to allocate the proper proportion of time spent in the various functions of the total operation and thereby allocating the proper costs. In [illegible] operations, and especially under an owner-manager arrangement, the owner-manager would spend time buying, managing in-plant operations, selling and, in one case sausage manufacturing. These men usually worked long hours and on an irregular basis making any sort of time allocation difficult. In all cases when a problem such as this occurred an estimate was made as to the allocation of time for the in-plant operations on the basis of a study of the available plant records.

Salaries of personnel working in the office were included in the total labor costs. In the case where the same office staff performed the necessary functions for both a slaughtering operation and sausage manufacturing operation, an estimate was made as to the proportion of time which should be allocated to the slaughtering operation.

Supplies

Whenever possible costs of supplies were separated into manufacturing, administrative and corral. Manufacturing supplies consisted of such things as containers, shrouds, pins, tags, cleaning supplies, and all other supply costs used in manufacturing. Supplies needed for maintenance and repair were included under maintenance costs. Administrative supplies included all those items necessary for the operation of the offices. Costs for livestock feed and other supplies necessary for the corral operations were included and consisted of a rather significant expense. No problems were encountered in obtaining these figures.

Utilities

Utilities included costs such as heat, lights, power, water, sewage, refrigeration and telephone. Telephone charges generally amount to a substantial cost, as a result of most buying and selling being transacted over the phone. No attempt was made to separate the calls pertaining to buying, selling and plant operation, so all were included in in-plant costs.

Transportation

This category included all transportation costs pertaining to the plant activities excluding transportation expense incurred in the procurement and selling and delivery stages, such as manager's car, etc.

Repair and Maintenance

Repair and maintenance is composed of both variable and fixed cost components. A certain amount of maintenance is required to keep machinery in working order even if the plant is not currently in

operation. Such a cost is a fixed cost. Maintenance and repair which is a direct result of machine useage is a variable cost.[21/]

All plants in the study operated on a year around basis so it would be an impossible task to empirically attempt to separate the expense result of wear and that of a time factor. For this reason repair and maintenance were combined.

Repair and maintenance were separated into costs used for equipment such as replacement parts, drive belts etc. and those used for building and ground. This would include re-roofing, yard maintenance, snow removal, sanding, etc.

Professional Fees

No problem was encountered in obtaining the data for professional fees which included costs for grading and inspection. This cost accounted for approximately five percent of total operating expense.

Public Relations

None of the plants in question employed any direct advertising; however one plant, a branch of a larger corporation, would indirectly pay for advertising through the budget allotted to the central office. Costs that were included were such things as gifts to charities, community projects, and expenses incurred by the management in attending professional conferences, entertainment, etc.

Insurance

Insurance costs covered all types of insurance carried by the management in connection with the slaughter house operation. This included fire and comprehensive on the building and its contents.

[21/]Logan and King, op. cit., p. 89.

Insurance costs pertaining directly to the labor force such as workman's compensation, unemployment insurance, health and accident insurance were not included in this category but were considered directly a part of the labor cost and were included under fringe benefits.

Taxes

Taxes included property tax and any other tax incurred resulting from the plant operations. The only exception was social security tax which was included in total labor cost under fringe benefits. This category also included any license fees required by law to operate a slaughter operation.

Depreciation Costs

The depreciation of a durable asset can be divided into 1) depreciation from wear and useage, 2) depreciation over time resulting from age and 3) depreciation due to obsolesence.[22/] For the purposes of this study where accurate depreciation costs were not obtained for more than one plant, it was felt that even if depreciation cost could empirically be separated into the above categories, little would be gained. Methods used in depreciating facilities varied so greatly between plants that any comparison of actual plant data would be virtually impossible.

One possible solution to this situation in future studies is to calculate 1) the total cost of the building and equipment including installation charges, sales tax and freight charges; 2) subtract the estimated salvage value of each item from the original cost to obtain

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[22/] Logan and King, op. cit., p. 73.

the balance for depreciation; 3) divide the balance for depreciation by the useful life of the item.[23/]

An alternative method would be to use the replacement value instead of actual cost.[24/] This method, however, would give a bias in favor of the plants with relatively new buildings and equipment which may be more efficient in labor utilization. Managers may be aware that in their old facilities labor costs would be relatively higher, but may be willing to trade higher labor costs for lower fixed buildings and equipment costs. If these older plants were depreciated on the basis of replacement costs, they would be penalized both for high labor costs and high plant costs.

Normally buildings are depreciated at the rate of 20 to 30 years, the average used by most managers in this study was 25 years. Equipment varied considerably depending on manufacturer's recommendation, normally within the range of 10 to 15 years.

Interest

Interest is a cost not normally found in the accounting records of slaughtering plants, but interest foregone on money invested must be considered. Generally an interest rate of 6 percent is used as the base rate applicable to the nondepreciating land investment and salvage value of the equipment, and a 3 percent figure is applied to the depreciable balance of the equipment and buildings.[25/]

[23/] Ibid., 73

[24/] Gibb, Richard Dean, Economics of Scale in Michigan Livestock Auctions, (unpublished thesis), Department of Agricultural Economics, Michigan State University, 1959, p. 33

[25/] Logan and King, op. cit., p. 77.

Other

This category would include all other costs involved by the firm not applicable to the foregoing. This would normally cover such things as legal fees, auditor or accountant fees, bank charges, head office budget.

Cost Relationships Among Four Michigan Packers

Total Cost and Average Cost

Table 2 shows that total costs of operation, excluding buying, selling and delivery costs, ranged from $228,436 at Plant A to $435,758 at Plant B. Average cost per animal was $13.46 with a low of $12.19 per head at the largest plant to a high of $15.42 at the smallest of the four plants. There are some general considerations concerning the data obtained from the four plants that should be considered at this time.

Plant A was a small highly organized subsidiary of a larger company which employed a centralized IBM accounting system. Very accurate data were kept on all in-plant costs and summaries were readily available for managerial decision making. A large portion of "other" costs consisted of IBM rental fees and the head office budget. Only cattle were slaughtered at Plant A; however the plant included a sausage manufacturing operation. Expenses such as the manager's salary, utilities, repair and maintenance of the building and grounds, insurance, taxes, depreciation, and interest were prorated to the slaughter operation on the basis of the best judgement of the manager and available plant records. To the extent that items of expense are allocated

to departments by some method of approximation the expenses of the slaughter operation is affected by the accuracy of the estimate.

Detailed cost figures for those in-plant costs other than labor were not available from Plant B. The plant is owned and operated by the present manager and all accounting records and receipts are kept by him and one bookkeeper. As a result, accurate cost accounting data and monthly statements are not available. The manager explained "We don't have time to develop a good accounting system and are not big enough and can't afford to have the accounting work done." Therefore, the total cost figure is based on the manager's personal knowledge and judgment. Here again one must keep in mind the element of guesswork in this method of approximation.

A workable accounting system was again lacking in Plant C. Monthly summaries were not prepared and it was necessary for the manager to "dig" through the records to obtain the information which was received for the study. Accurate labor cost data were obtained along with the costs of utilities, repair and maintenance. Complete information was not available on cost of manufacturing supplies, inspection fees, taxes, depreciation and interest. As a result, total cost figures were not computed and only those figures pertaining to labor costs are meaningful.

No cost information was available from Plant D, but a time study of Stage III, killing and dressing was completed.

Only summary information was obtained from Plant E.

Wages and Salaries

Total labor costs composed the largest segment of in-plant costs representing 44 percent of the total operating costs with a range of 36 percent of Plant A to 49.1 percent at Plant E. Although labor costs

per hundredweight of dressed beef were relatively uniform throughout all plant studies (see Table 4), the low production cost of plant E could account for a larger percentage of total cost being shown in labor.

Lowest labor costs were experienced in Plant A with an average labor cost of $5.54 per head (see Table 3) and $.96 per hundredweight of dressed beef (see Table 4). Even though Plant A was the lowest volume plant with 13,232 head slaughtered over the 12-month period covered by the study they experienced the most efficient labor use. This can partially be explained by the group incentive system which they employ for their killing gang. It is based on an engineered time study from which a standard time per unit was computed. Their standard hour per unit is based on the average number of man hours it takes to slaughter and dress one unit. If the killing gang exceeds their Standard Hour Per Unit, a bonus is given which represents their increase in productivity. The resulting effect is that all workers must work together to receive the bonus, and a greater amount of teamwork is encountered on the kill floor. Both management and workers indicated that they were well satisfied with the system.

Plant A has a substantial manufacturing operation, and salaries to management and office personnel are allocated to the sausage operation on a proportionate basis. The resulting effect that costs for management and office personnel for the slaughtering operation would tend to be lowered.

Another reason for the difference in costs would arise from the possible difference in wage rates. A detailed analysis

of wage rates is very complex and beyond the scope of this study because of the difference in 1) fringe benefits and 2) the method of payment (the Detroit plants paid their skilled butchers on a per head basis while the outstate plant paid on an hourly rate). Furthermore wage rates can be considered an exogenous variable for the purpose of this study in cost efficiency.

Plant C showed the highest labor cost per head at $6.57. Further analysis shows that the average dressed weight per animal is 689.4 pounds which is considerably higher than the average of 583.5. Cost per hundredweight is $.95 which is the lowest of the four plants. The reason for this is a large number of bulls are slaughtered, increasing the average weight per animal and also increasing the slaughtering cost per animal because of the increased difficulty in handling, etc.

When cost per hundredweight is compared with volume in total pounds of dressed beef, there appears to be certain diseconomies of scale; however when considered in the light of the above analysis, it would appear that there is no significant cost-volume relationship.

Plant Operation

Because of the lack of detail in the available data, only a general analysis of plant operation costs can be made. An average of 56.3 percent of the total costs involved were attributed to plant operation which include supplies, utilities, transportation, repairs and maintenance, professional fees, public relations, insurance, taxes, depreciation, and interest and other. There appears to be an inverse relationship between volume and plant operating costs. Highest operating costs were incurred in the lowest volume Plant A at $9.86 per head. Lowest operating costs were incurred in Plant E at $6.21 per head which had the highest volume of 34,380 over the period covered.

Table 2. Costs of Operation of Four Beef Packinghouses in Michigan, 1963-1964

Item	Plant A		Plant B		Plant C		Plant E		Total cost[b]	Percent of cost
	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent		
Salaries & Wages										
Union	42,820.21	21.0	91,166.00	27.3	59,738.94					
Manager	8,000.00	3.9	12,000.00	3.6	13,417.93					
Office	7,313.46	3.6	15,000.00	4.5	15,709.27					
Fringe	15,146.87	7.5	18,233.32	5.4	11,947.60					
Total labor	73,280.54	36.0	136,399.32	40.8	100,813.74		2,055.93	49.1	438,115.86	43.7
Supplies										
Manufacturing	3,321.03				[a]					
Administrative	545.45				850.90					
Feed & corral	4,627.68				5,650.61					
Total supplies	8,494.16	4.2			[a]					
Utilities										
Heat, light, power water, sewage & refrigeration	13,009.40				7,938.30					
Telephone	1,950.57				1,421.24					
Total utilities	14,959.97	7.3								
Transportation	140.32	.1			---					
Repair & Maintenance										
Equipment	1,752.97				3,385.21					
Building	3,792.54				1,371.03					
Total repair & maint.	5,545.51	2.7			4,756.24					

[a] Figures not available.

[b] Figures from Plant C are omitted in the total cost.

Table 2 (continued) --

Item	Plant A		Plant B		Plant C		Plant E		Total cost[b]	Percent of cost
	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent		
Professional Fees										
Grading	2,032.18				1,945.98					
Inspection	9,003.56				[a]					
Total professional fees	11,035.74	5.4			[a]					
Public Relations	765.55	.4			[a]					
Insurance	1,273.57	.6			[a]					
Taxes	6,786.84	3.3			[a]					
Depreciation										
Equipment	12,207.84				[a]					
Building	5,776.24									
Total depreciation	17,984.08	8.8			[a]					
Interest	281.25	.1			[a]					
Other	64,182.92	31.5			[a]					
Total plant operation	130,549.91	64.0	197,779.56	59.2	[a]		213,500.00	50.9	565,551.67	56.3
Total cost	203,830.45		334,178.88	100.0	[a]		429,093.00	100.0	1,003,667.53	100.0
Total number of animals	13,232		23,080		15,233		34,380		74,512	
Av. total cost per head	15.40	100.0	14.47				12.19		13.46	
Av. labor cost per head	5.54		5.90		6.57		5.98		5.88	

Table 3.--Costs of Operation of Four Packinghouses on a Per Head Basis, 1963-1964

	Plant A	Plant B	Plant C	Plant E	Average[b]	U.S.D.A.[c] Average
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Salaries and wages	5.54	5.90	6.57	5.98	6.00	7.42
Plant operation	9.86	8.57	a	6.21	7.58	8.03
Total cost per animal	15.40	14.47	a	12.19	13.58	15.45
Number of animals	13,232	23,080	15,333	34,380	21,506	

[a]Figures unavailable.

[b]Figures from Plant C are not included in the computation of average cost of plant operation.

[c]Obtained from study by Agnew, Donald B., Meatpackers' Cost in Fresh Beef Operation--A Pilot Survey, Marketing Economic Division, Economic Research Service, U.S.D.A., 1963, p. 1.

Table 4.--Costs of Operation of Four Packinghouses, Per Hundredweight of Dressed Beef, 1963-64

	Plant A	Plant B	Plant C	Plant E	Average[a]
Total pounds dressed beef	7,612,493	12,507,092	10,570,080	19,291,014	12,477,011
Number of animals	12,232	23,080	15,333	34,380	21,506
Average weight per animal	575.3	554.9	689.41	561.1	583.5
Salaries and wages	$ .96	$1.07	$.95	$1.06	$1.03
Plant operation	$1.71	$1.54	*	$1.11	$1.35
Total cost per cwt.	$2.67	$2.61	*	$2.17	$2.38

[a]Cost of plant operation in Plant C is omitted from the average cost figure.

Fixed and Variable Cost

Cost can generally be separated into two major categories: fixed costs and variable costs. Fixed costs can be defined as the costs which are not a function of (or do not vary with) output. They are costs that require a fixed outlay of funds for each time period. Variable costs are those costs that are a function of output in the production period.[26/] The sum of fixed and variable costs, at any given output yields the total cost at that output. When total cost is derived from various levels of output, a functional relationship between total cost and output is obtained.

By definition all costs are variable in the long run and a shorter run situation is recognized in which one or more factors are fixed. The number of factors which are fixed would depend upon the length of the time period considered. The short run[27/] then, is a period in which fixed costs remain unchanged but variable costs can fluctuate with output. With a given plant the problem became one of finding the optimum combination of variable factors to employ at various levels of output.

In the study by Rust and Harston, fixed costs of Montana meat packing plants were regarded as 1) interest on real estate and building loans, 2) insurance on buildings and equipment, 3) real estate taxes and 4) depreciation.[28/] In addition there are other fixed costs such as

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[26/] Rust, Charles H., and Harston, Clive R., The Survival and Growth Potential of Small Meatpacking Business in Montana, Tech. Bul. 580, Montana Agricultural Experiment Station, Montana State College, 1963, p. 62.

[27/] Ibid., p. 62.

[28/] Ibid., p. 76-76.

management salaries, office worker salaries and accountant fees which must be covered if the plant is to remain in operation and seldom vary with output in a given plant.[29]

Variable costs can be considered as: production worker's salaries, supplies, utilities, transportation expense, repair and maintenance, public relations.

No attempt was made to analyze the relationships of fixed and variable costs of the plants in the study because of the lack of detailed cost information.

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[29] Logan and King, op. cit., p. 10.

CHAPTER III

STAGES OF OPERATION

Description of Stages

A meat-packing plant consists of a given set of buildings, equipment and layout. Operations within a given plant are composed of a number of stages in each of which specific transformations take place. French[29/] defines a stage as, "all productive services - durable or nondurable - that cooperate in performing a single operation or a group of minor but closely related operations." The basic function of a packing plant is the transformation of the live animal into a final product or products or into a good that in itself is an intermediate product in further productive processes.

For the purposes of this study it is convenient to consider the product moving through various stages of production each of which perform some distinct phase of the production process. These stages may be independent of each other with each stage having its own separate cost function or they may be interdependent.[30/] For example, in some of the plants workers who are primarily assigned to Stage III (killing and dressing) perform tasks in other stages of operation.

[29/] French, op. cit., p. 545.

[30/] Logan and King, op. cit., p. 9.

For a comparative analysis of various packinghouses it is convenient to separate each plant's operation into stages. The fact that at one plant the average cost per head of livestock slaughtered is lower than at a second plant is of little value in management decision making. A more meaningful analysis can be accomplished if each plant's operation is divided into stages and each stage analyzed to discover the difference in productivity or in the costs involved. If each stage of the operation is regarded as a separate cost center, then an analysis by stages can pinpoint that area of excess costs. Total plant cost is the sum of the costs of the various stages.

Similarly, a manager can analyze his own operation by stages to determine where production bottlenecks occur. A low production capacity or "bottleneck" in one phase of the productive process can become a limit on the total production of the plant and the other stages may then exhibit excess capacity.[31/] One such production bottleneck in the slaughter operation could be hide removal. Only a limited number of men can work on one animal and each man can accomplish only a limited amount of work.

The activities of the packing plant can be divided into six separate stages. They are:

I. Procurement

II. Holding

III. Killing and dressing

IV. Cooler operation

V. Special processing

VI. Selling and delivery

[31/] Logan and King, op. cit., p. 9.

Although a detailed analysis of each of the above stages is not within the scope of this study, a general description will be given. This provides an insight into the general nature of slaughter house operations and some of the problems encountered in estimating the costs of the various stages. The technology in each of the plants studied was basically the same; although there were small differences in some of the procedures utilized.

Stage I - Procurement

Although not an in-plant function, the procurement stage is the beginning of the production process. This stage includes all activities involved in purchasing the cattle and hauling them to the plant. Costs involved in this stage are such that they can be readily identified thus enabling Stage I to be considered as a separate cost function. Specific costs would include buyer's salary or commission, transportation, per diem, and entertainment expense. All charges for transporting the livestock from point of purchase to the plant would be included. Procurement costs would vary greatly with the distance from which animals are purchased and the area covered by the buyers. For example, one firm purchased cattle from Chicago, Detroit, local markets, and directly from local producers. The majority of purchases by all plants were made from the Detroit terminal stockyards. In-transit shrinkage and hauling losses are also a cost. In cases where the manager is involved in purchasing animals (in one case the manager purchased all animals) an estimate of the percentage of time spent in procurement should be made and that cost allocated to the procurement stage.

Stage II - Holding

The holding function begins when the cattle are unloaded from the carrier and extends until the cattle are chased from the holding pens into the chute leading to the kill floor. Normally the bulk of the cattle arrive at the plant during the beginning of the week when the livestock market is the most active and are held until slaughtered. The slaughtering operation generally extends for a normal five-day work week. The largest single expense in Stage II is the feed supplies necessary to maintain the cattle the duration of the holding period. Feed and grain supplies vary depending on the feeding program of each individual plant, but average approximately 35 cents per head.

Other costs involved include repair and maintenance of the holding pens, cleaning expense and general yard work. Frequently a portion of the kill crew is used to accomplish the bulk of the necessary yard work and cleaning on days when there is a low kill. Care must be taken to separate this labor cost from the labor cost which would normally be charged to the killing and dressing stage. Expenses incurred in this stage are readily identified and can be considered as a separate cost center, with the exception of some labor utilization as indicated above.

Stage III - Killing and Dressing

Stage III begins when the animal to be slaughtered is removed from the holding pen and ends when the dressed carcass is placed in the chill room. Stage III is a separate cost center in the total plant operation; however, for the time study analysis Stage III was divided into 10 dressing line functions and 5 supporting functions.

Dressing Line Operations

The dressing line operations are the major work to be performed to prepare the finished carcasses. They include: immobilizing the animal; bleeding it; removing the head, legs, hide and viscera; splitting the carcass into sides; washing; shrouding; and weighing the sides. Each operation is completed in sequence and can begin only when the preceding operation is completed. Thus the operation requiring the longest elapsed time sets the pace for all operations.[32/]

All four plants in this study were using the conventional two or three bed-type slaughtering system, and killing crew varied from 7 to 13 men. With the exception of crew size and volume of cattle slaughtered, all systems were very similar in operation although there were some minor variations from plant to plant.

Driving, Immobilizing, Dry Landing.--One worker begins this function by driving 3 or 4 cattle from the holding pens into the chute leading to the stunning pen. Another worker known as a "knocker" drives one animal at a time into the stunning pen and stuns or kills it with the use of a captive bolt stunner. Other methods used are a 22 calibre rifle or a 4 to 5 pound hammer. A large side-opening door in the stunning pen allows the animal to slide into a "dry-loading area." Next the knocker lowers the landing hoist, places the shackle chain around one hind leg and hoists the carcass mechanically to the bleeding rail. During this cycle the worker reloads the captive bolt stunner or rifle, and periodically throughout the day washes the dry landing area.

[32/] Hammons, op. cit., p. 4.

Bleeding, Skinning Head.--A "sticker" severs the cartroid artery in the neck and allows the blood to drain from the carcass. Once the initial flow of blood subsides, the head is severed. He allows the head to remain on the carcass attached by the trechea and esophogus. The head is then removed by a support worker and taken to the head washing and work-up area. Throughout the operation the sticker performs other operations such as moving the carcass along the line and attaching identification tags on the head and carcass.

Flooring.--Flooring involves moving the carcass from the bleeding rail to the skinning beds where the carcass is lowered on to cradles and positioned on its back by the use of metal rods or pritch bars. In this position the hooves are removed, the hide removed from the belly and sides of the animal, the brisket bones are split or sawed and the aitch bone (pelvic bone) opened. After the sides of the carcass have been skinned, trolley hooks are inserted in the gams (area between the large tendon and the bone of the hind leg) of both hind legs.

Two to four workers perform this function depending upon the number of beds. Workers in this area are trained in all tasks involved and work alternately on the various jobs as needed. This system allows delay time to be kept at a minimum and is more efficient than if each worker was assigned a specific task.

Rumping, Backing and Evicerating.--Following completion of the legging and siding, one worker lowers a hoist from the rumping, backing and eviscerating area while another carries a spreader that is attached to the hoist across to the flooring area. Hooks on a round trolley are inserted through the gams, the trolleys are placed on the spreader and the carcass raised to the "half-hoist" position. Two workers then rump,

tie bung, and pull the hide from the tail. The animal is then hoisted off the ground, a paunch or "gut" truck is pushed under it by a "trucker" and a "gutter" eviscerates the animal. The viscera is taken in a paunch truck to a tripe table where it is separated. The pluck (lungs, heart and liver) are taken to the pluck work-up area.

Before the spreader is removed, a worker uses an electric beef carcass saw to halve the carcass up to the point where the hide is attached to the neck. The saw is suspended at the carcass work area and is counter-balanced for easy manueverability. The carcass is then hoisted to the dressing rail and the spreader removed. Upon completion of this job, a worker pushes the carcass, suspended by the trolleys, on the dressing rail to the hide dropping area.

The rumping, backing and eviscerating operation required the longest elasped time in all plants observed, with the exception of Plant A, thereby, making it the controlling operation. A reduction in the elapsed time for the operation would decrease the amount of delay time all along the line.

Dropping Hide.--A worker removes the hide from the neck of the carcass and allows the hide to drop to the floor. The hide is then removed and placed in barrels or dropped through a hide chute to a hide cellar for curing or to a shipping dock for direct pick-up.

Splitting, Scribing and Bruise Trimming.--The splitting of the carcass is completed either manually or with the use of a small suspended electric carcass saw.[33/] Following the splitting a worker uses a

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[33/] In some plants the splitting operation is done by a worker standing on a hydraulic lift platform which decends slowly as the worker saws through the animal's spine with a power saw. The platform is at floor level when the carcass is split completely.

hand scribe to scribe each side. A heavy hand-type saw (the scribe) is pulled down each of the exposed inside portions of the backbone and separates the top side the backbone from the lower portion. The scribe is then used to pound the chine bone flat to give the back a thicker appearance. A worker trims any bruises with a hand knife and removes the spinal cord. The carcass is then moved to the washing area. Splitting, scribing and bruise trimming does not require all of the worker's time and he is assigned part-time to supporting operations.

Washing.--A worker standing on a stationary platform washes each side of the carcass with a high pressure water spray. The carcass is thoroughly washed to remove blood, bone scraps and any foreign material which may have accumulated. The washer moves the carcass to his work area and when the washing is completed, moves it down the line to the shrouder.

Shrouding.--A heavy muslin cloth soaked in a brine solution is pinned on each carcass side by one worker. The worker places the heavy cloth first around the hind shank, then stretches and pins it at various places so that the entire outside portion of each half is covered. This gives the carcass a smoother appearance after cooling and prevents drying. Intermittently the worker replenishes his stock of shrouds, neck pins and shroud pins. When the shrouding is completed the animal is moved to the weighing area.

Weighing.--The last operation before the carcass is pushed into the chill room is weighing. Both halves are pushed onto an overhead track scale to determine the total weight of the carcass. The worker then records the weight on the tally sheet, stamps and tags each half and pushes them into the chill room. The carcasses generally remain in

the chill cooler over night, then are moved to the sales cooler the following day.

Supporting Operations

Supporting operations consist of work performed on those parts of the carcass such as heads and offal that are removed in preparing the sides. All the supporting operations in this four-plant study were performed on the kill floor, although in larger plants some of the operation may be performed in separate work-up areas. They include: 1) head work up, 2) viscera removal, 3) hide removal, 4) pluck work up and 4) paunch work up. Supporting operations are not carried out in a sequence as are the line operations, but it is necessary that they be carried out at the same rate to prevent delays in the dressing line.

Head Work Up.--One worker is usually assigned to this area which includes removing the head from the carcass, transporting it to the work-up area, flushing and dehorning, dropping tongue and removing the head and cheek meat. The jaws are separated and head bones are thrown into barrels for removal.

Viscera Removal.--Viscera is removed in a paunch truck from the rumping, backing and eviscerating area to the pluck table where the pluck (heart, liver, lungs and trachea) is removed. The paunch truck is then moved to the paunch table lift where the paunch is dumped on the lift, the remaining viscera is dumped into a barrel for removal. The cycle is completed when the worker rinses the truck and pushes it back to the eviscerating area. He also washes the floor of the supporting operation work area and transports drums of offal (udder, pizzles, tripe, trimmings) on a drum truck off the kill floor.

Hide Removal.--Removing the hide simply consists of transporting the hide from the dropping area and putting it in the hide chute where it falls through to the hide celler or to the load-out dock for immediate pick up. In some operations the hide is placed in barrels and transported off the floor on a drum truck.

Pluck Work Up.--The pluck includes the heart, lungs, and trachea. These items, plus the tails and livers which are processed with the pluck, are separated and washed. They are then placed in storage containers located at the work up station.

Paunch Work Up.--The paunch is dumped from the paunch truck onto the paunch lift and hoisted onto a stainless steel table. Here the paunch is opened with a hand knife and the contents washed into a hopper. The tripe is scraped and placed on an umbrella type washer for further cleaning. When the tripe is thoroughly cleaned a worker hangs the tripe on a hook rack.

Stage IV Cooler and Load-Out Dock Operation

Only casual observations were made of the cooler operations and dock loading procedures. Labor requirements include shroud removal, transporting carcass from chilling cooler to the sales cooler, order assembly, transporting the carcass to the loading dock, weighing, separating the fore and hind quarters and transporting the quarters onto the delivery truck.

Cooler Operation

Carcasses are generally held in the chilling cooler overnight at temperatures of 30° to 32° to remove the initial body heat. The shrouds are then removed from the sides of the carcass after the carcass has been chilled. Normally a worker removes the pins holding the shrouds

to the sides of the carcass and allows the shrouds to drop to the floor. He then either carries the shrouds to the load-out dock or transports them in a tub truck.

Carcasses are moved by the use of an overhead rail from the chilling cooler to the holding cooler where they are held until sold. Order assembly involves two or three workers. Normally, one worker locates the carcasses necessary to fill a sales order and calls the information to the others who transport the carcass to the working rail.

Load-Out Dock Operations

Carcass sides are transported from the sales cooler working rail to the dock area where they are weighed and the appropriate recordings made. The carcasses are then loaded in trucks for shipment. Two methods are used to load the carcasses for shipment, the quarter-stacking and the side-rail carcass truck.[33/]

Quarter-Stacking Method.--Carcasses are transported on the overhead rail to the truck scale on the load-out dock and weighed. While one worker weighs the carcass and records the weight data, a second partially severs the carcass. When the two transportation workers are ready to move the carcass to the truck, the worker finishes quartering the carcass, removes the trolleys with a pike pole and throws the trolley into a storage barrel. The transportation workers then carry the carcass to the truck and stack the carcasses in layers separated by paper sheets.

Carcass Side-Rail Truck Method.--The carcass side-rail truck method uses essentially the same procedure as the quarter-stacking method except in loading. Here carcasses are loaded into trucks equipped with

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[33/]Hammons and Miller, op. cit., pp. 28-29.

overhead rails. Carcasses are moved on-the-rail to the load-out dock where they are weighed and the weights recorded. A rail is extended to the truck and bolted into position to allow the carcasses to be transported into the truck on the rail. The system is designed to handle both halves and quarters. In the case where the halves are quartered prior to the loading, the front quarter is stacked on the floor while the hind quarters are suspended by rail.

General Considerations

Labor comprises the largest single variable expense in the cooler and dock load-out operation. During slack loading periods workers are also required to perform other additional jobs required in normal packinghouse operations. These include working and oiling the trolleys and transporting them back to the kill floor; and transporting and loading edible offal (liver, tongue, tails, etc.).

The second major variable expense in the cooler and dock load-out operations is refrigeration costs. Other costs involved are the normal fixed plant costs such a depreciation, taxes, interest, etc. and should be calculated out and prorated to Stage IV on an equitable basis realtive to the other plant operations.

Stage V Special Processing

Although not considered a direct part of this study, some general comments will be made concerning the slaughter plants special processing operations. Stage V includes operations such as sausage manufacturing, boning, hide curing and rendering. Of all the plants studied only one had a sausage manufacturing operation and three of the four managers indicated at one time their plants had boning operations but have discontinued them.

Two of the four studied plants stored and cured hides. Again the managers indicated this practice is declining among the smaller packers. This process consists of spreading the hides (hair down) in vats, spreading a layer of salt over each hide and allowing them to cure for a 30-day period. At the end of the curing period, the hides are normally taken out and sold.

Each special processing operation included in Stage V should be established having its own separate cost function. This will enable the manager to determine the profitability of each operation so that if the process should become unprofitable, it can immediately be corrected or discontinued. It is possible that these special processes could be used during slack periods to utilize some of the labor resulting from the guaranteed work week.

Stage VI Selling and Delivery

The final stage of the manufacturing process is selling and delivery. The major expenses incurred in Stage VI usually include wages paid to salesmen and deliverymen and the cost of operating and maintaining the delivery vehicles. Again the nature of costs involved in Stage VI are such that a separate cost function should be set up. Expenses will show a great deal of variability depending on how many different products are sold, the extent to which the products are contracted for by large retail or wholesale outlets and the extent of delivery service given.

Other costs included in this category include shipping supplies such as twine, butcher paper for lining truck floors and placing between carcasses, tags, ink, telephone and laundering of driver coats. Most of the selling in a cattle slaughter plant is done via the telephone. Depending on the widespreading nature of the marketing area, the telephone may be a major selling expense.

CHAPTER IV

TIME REQUIREMENTS

Stage III Time Studies

Time studies were conducted in four slaughter plants to determine the total man-minutes[34] required in Stage III, killing and dressing. To perform the time study Stage III was divided into 10 dressing line operations and five support operations. Each operation was divided into specific jobs. Three to seven observations were made of each job and these observations were used to "build" time requirements for each operation. The times required for each operation were averaged and the total base time[35] was computed for one animal by summing the average time required for each of the 14 different operations.

Consideration was given to fatigue and personal time allowances. Five percent of the base time was included for personal needs and from 5 to 15 percent of the base time was included to compensate for weariness induced by the work.[36] Fatigue and personal allowances were added to the base time to arrive at productive time.[37]

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[34] One man working for one minute constitutes one man-minute. The term man-minute was used instead of man-hour because of the many small elements of work required in the slaughter operation.

[35] Base time is the time required for an operation to be performed at a normal pace by an operator skilled in the work.

[36] Fatigue and personal allowances were taken from Hammons and Miller, op. cit., pp. 42-51.

[37] Productive time is base time adjusted for fatigue and personal allowances. Ibid., p. iii.

Daily allowances which include: "start" time in the morning, rest periods, plant clean up, and personal clean up were added to the total productive time. A uniform rate of 5 minutes per man was allowed for "start" time in the morning. This would cover the period from "punch in" to the time the worker is on the floor and engaged in his assigned task. One worker at each plant normally arrived 15 minutes early to bring up the cattle, immobilize and hoist them before the other workers arrived on the floor. A rest period of 15 minutes was included in calculation of the total time requirements in those plants where it was required by the union contract. A 10-minute period was allowed for each worker in each plant for general plant clean up at the end of the working day. This figure was arrived at through observation of the general clean-up operation. The union contract in all plants required that workers be allowed 15 minutes for personal clean-up time at the end of the working day. With the addition of these daily time requirements to the total productive time, the total time required for the operation, on a per head basis, can be determined. Normal rate of activity, or 100 percent productivity, is considered to be the total time required to perform the operation under normal conditions.

Delay time represented the difference in total time required to kill and dress one animal and the total elapsed time.[38] This delay time could be the result of a production line "bottleneck" which causes some workers to have excess time, the time required to perform additional odd jobs, breakdowns or excess personal time.

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[38] Elapsed time is the amount of time consumed from the beginning to the end of the operation. Taken from Hammons and Miller, op. cit., p. iii.

Plant A: General Consideration.--A crew of seven workers killed and dressed 62 head with a total elapsed time of 52 man hours or 51.29 man-minutes per head. Total time required at a normal rate of activity is 52.05 man-minutes indicating that the workers performed at a rate of 101.5 percent of normal productivity (see Table 5). The normal rate of kill, as considered by the manager, is 8 to 10 head per hour.

The workers in Plant A are paid on the basis of a group incentive plan as described in Chapter II. One of the resulting effects of this payment system is an increase in the productivity of the killing crew. Table 12 shows that Plant A is the only plant at which actual productivity rate is over 100 percent with the other plants ranging from a low of 78 to a high of 94. Because the entire crew is paid on their actual productivity, they are provided with a monetary incentive to keep their delay time at a minimum.

Table 9 indicates, however, that total productive time was the longest of all plants studied. This can be attributed to the general plant layout. Two of the functions which require the most difficult movement of the carcass, that is the flooring and scribing operations, exceed the average time requirement of the four plants. The bottleneck occurs in the flooring operation where the carcass is lowered onto cradles and positioned on its back. The difficulty of this job is compounded because the carcass must be maneuvered around a right angle corner in the process. The scribing operation requires maneuvering the carcass around another difficult corner in the movement from the area where it is split and scribed to the washing area.

Plant B: General Consideration.--Plant B employed a crew of 11 workers consisting of 5 butchers, paid on a per head basis, and 6

Table 5. Summary of Time Requirements Per Head for Stage III, Killing and Dressing, Plant A

	Observations					Average man minutes	Fatigue and personal allowance percent	Total productive man minutes
	1	2	3	4	5			
	Man-minutes							
Bring up	.37	.33	.62	.38		.43	10	.47
Immobilizing	1.58	2.00	1.42	2.02	1.93	1.79	10	1.92
Bleeding, skinning head and forelegs	2.07	2.33	2.42			2.27	15	2.61
Flooring	9.68	10.18	11.47	9.55		10.22	20	12.26
Rumping	7.90	8.17	7.07	8.08		7.80	15	8.97
Dropping hide	2.08	2.12	2.18	2.05		2.11	15	2.43
Scribing	2.88	2.85	2.85	2.89		2.87	15	3.30
Washing	.93	1.37	1.37			1.22	10	1.34
Shrouding	1.43	1.82	1.75			1.68	15	1.93
Weighing, tagging & placing in cooler	1.93	1.13	2.70	1.63		1.61	10	1.71
Total line time						32.00		36.94
Head work-up	2.90	2.57	2.70			2.72	10	2.99
Hide removal	.57	.65	.68			.63	15	.72
Eviscera removal	2.28	3.02	3.12			2.80	10	3.08
Pluck work-up	.98	.98	.97			.98	10	1.08
Paunch work-up	2.03	1.70	2.13			1.95	10	2.18
Total support time						9.08		10.05
Total prod. time								
Start time; 7 men 5 min. each								.56
Rest period; 7 men 15 min. each								1.68
Plant clean-up; 7 men 10 min. each								1.12
Personal clean-up; 7 men 15 min each								1.68
Total daily allowances								5.04
Total time required								52.05
Total time elapsed								51.29
Delay time								-.56
Percent productivity								101.5
Normal rate of kill (head per hour)								8-10
Crew size								7.0
No. head killed								62.0
Total man-hours required								52.0

workers of semi-skilled and laborer classification, paid on an hourly rate basis.[39] The butchers were guaranteed a minimum of $75.00 per week and the workers on hourly rate were guaranteed a 36 hour work week.

Total elapsed time was 82.5 man hours for a kill of 101 head or 49 man-minutes per head, the lowest of the four plants studied. Total time required for the operation was computed to be 46.16 man-minutes per head indicating that the workers performed at a rate of 94.2 percent of productivity (Table 6). The time required for line operations was 33.08 man-minutes per head which is slightly above the average. This can be attributed to the Kosher killing process which requires a longer time requirement in the immobilizing and head skinning operations.[40]

"Other" time allowances were considerably less than the average. This could be attributed to the higher volume and smaller kill crew in relation to Plant A and also because a 15 minute crew rest period was not given. The owner-manager of Plant B was a very aggressive individual who managed the entire plant by himself including the buying of cattle. He worked extremely long hours and on occasion would work on the kill floor operation. Frequently he would check on the killing operation and make an on-the-spot correction of any discrepency. The overall effect was a well-run killing operation with the lowest total elapsed time of the four plants studied (see Table 9).

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[39] Workers in Michigan packing plants are classified almost entirely upon performance and ability. The most common classifications are, in descending order from most to least skilled: skilled butcher, boner, butcher, semi-skilled and laborer. A skilled butcher is considered "any employee who is able to skillfully perform any job on cut, kill or boning operation. Taken from McLeod, op. cit., pp. 32-33.

[40] In the Kosher killing process the animal is not stunned before bleeding and generally requires an additional time requirement of 1-2 man-minutes per head because of the increased difficulty in handling the animal.

Table 6. Summary of Time Requirements Per Head for Stage III, Killing and Dressing, Plant B

	Observations					Average man minutes	Fatigue and personal allowance percent	Total productive man minutes
	1	2	3	4	5			
	Man-minutes							
Bring up	.72	.42	.53	.42	.45	.44	10	.48
Immobilizing	1.30	2.00	2.18	2.63	4.00	2.60	10	2.86
	6	7	8					
	3.65	2.97	3.90					
Bleeding, skinning head & forelegs	3.20	3.33	3.10	2.47	3.07	3.03	15	3.48
Flooring	5.65	6.83	7.00	6.15		6.42	20	7.70
Rumping	7.27	7.92	8.25	6.90	8.20	7.70	15	8.85
Dropping hide	1.75	1.83	1.53	1.33		1.61	15	1.85
Scribing	1.42	1.50	1.43	1.93		1.57	15	1.80
Washing	1.75	1.92	2.00	1.83	1.90	1.88	10	2.06
Shrouding	2.35	2.42	2.50	2.65	2.40	2.46	15	2.86
Weighing, tagging, place in cooler	1.13	.78	1.45	.78		1.04	10	1.14
Total line time						28.75		33.08
Head work-up	2.97	2.22	2.52	2.65		2.59	10	2.85
Removing viscera	2.57	3.07	2.87			2.83	10	3.11
Removing hide	.38	.75	.53	.65		.57	15	.66
Pluck work-up	1.25	1.33	.87	1.03		1.12	10	1.23
Paunch work-up	1.20	1.93	1.78			1.80	10	1.98
Total support time						8.91		9.83
Total productive time								42.91
Start time; 11 men, 5 min. each								.54
Plant clean-up; 11 men, 10 min. each								1.08
Personal clean-up, 11 men, 15 min. each								1.63
Total daily allowances								3.25
Total time required								46.16
Total time elapsed								49.00
Delay time								2.84
Percent productivity								94.2
Normal rate of kill (head per hour)								12-14
Crew size								11
No. head killed								101
Total man-hours required								82.5

Plant C: General Considerations.--Plant C employed a 9-man killing crew with 4 butchers and 5 with semi-skilled or laborer classification. As in Plant B, the butchers were paid on a per head basis and the remaining 5 workers received an hourly wage. The union contract guarantees the workers a 40-hour week. On this basis the manager said their normal rate of operation is 70 head per day with a total elapsed time of 72 hours or 62 man-minutes per head. Total time required as indicated by the study was 48.21 man-minutes per head which was very close to the average of 48.34 for all four plants (see Table 9). Delay time was the highest of all plants studied at the rate of 13.79 man-minutes per head which indicates that the crew operates at 78 percent of productivity (Table 7). This low rate of productivity is due in part to the union contract which requires a 40-hour guarantee. The men are employed for the full eight-hour period even though they may have completed the killing operation in less time. They would then spend the balance of their time doing additional jobs around the plant such as; cleaning chill cooler, yards, etc. or just waiting till the required length of time was completed. It was not determined in the study what percent of the delay time was actually spent on other assigned duties.

Plant D: General Consideration.--The largest killing crew was employed by Plant D with 5 butchers and 8 semi-skilled laborers. The butchers are paid on a per head basis and the 8 laborers are paid on an hourly rate with a 40-hour weekly guarantee. The normal capacity of Plant A is considered to be 13-15 head per hour but on the day the study was conducted only 59 head were killed. The total elapsed time was 48.75 hours (this was the time the men were actually observed

Table 7. Summary of Time Requirements Per Head for Stage III, Killing and Dressing, Plant C

	Observations					Average man minutes	Fatigue and personal allowance percent	Total productive man minutes
	1	2	3	4	5			
	Man-minutes							
Bring up	.37	.37	.37	.53		.41	10	.44
Immobilizing	2.50	1.85	2.03	2.20		2.14	10	2.35
Bleeding, skinning head & forelegs	2.10	2.17	2.65			2.30	15	2.65
Flooring	6.33	5.25	6.42	4.67	6.27	5.79	20	6.95
Rumping	6.38	7.32	7.07	7.58		7.09	15	8.15
Dropping hide	1.48	1.58	1.70	1.88		1.66	15	1.95
Scribing	1.38	1.52	1.38	1.53		1.45	15	1.67
Washington	2.33	2.43	2.15	1.88		2.20	10	2.42
Shrouding	2.30	2.90	2.65	2.40		2.56	15	2.95
Weighing, tagging, place in cooler	1.20	1.35	1.65			1.40	10	1.54
Total line time						27.00		31.07
Head work-up	3.08	2.78	3.21			3.02	10	3.32
Hide removal	.80	1.00	1.07			.96	15	1.10
Eviscera removal	2.65	2.30	2.47			2.47	10	2.72
Pluck work-up	1.75	1.98	1.88			1.87	10	2.06
Paunch work-up	2.12	1.87	1.97			1.99	10	2.19
Total support time						10.31		11.39
Total productive time								42.46
Start time; 9 men, 5 min. each								.60
Rest period; 9 men, 15 min. each								.93
Plant clean-up; 9 men 10 min. each								1.29
Personal clean-up; 9 men 15 min. each								1.93
Total daily allowances								5.75
Total time required								48.21
Total time elapsed								62.00
Delay time								13.79
Percent productivity								77.7
Normal rate of kill (head per hour)								8-10
Crew size								9
No. head killed								70
Total man-hours required								72

on the kill floor). Total time required (Table 8) is 46.10 man-minutes which indicates a productivity rate of 94 percent.

If the productivity index was calculated using the guaranteed 40-hour week, for 59 head it would be only 44 percent. The manager indicated that the normal day's kill is 100-120 head. Assuming that 120 head are killed in an 8-hour day, a productivity index of 90 percent would result. On the basis of the productivity indexes of the other plants studied, it would seem that at least a kill of 120 head per day is needed to justify a 13-man killing crew. A kill of 140 head per day is necessary to indicate a productivity rate of 100 percent.

Once the killing operation is finished and the required 8 hours per man has not elapsed the workers are assigned other duties such as cooler clean up, yard work, and other additional duties that are required around a slaughter plant or they are frequently allowed to leave early. Gain in increased labor productivity on the kill floor would be lost or reduced considerably if this occurs frequently. With a fixed wage at 40 hours per week the most effective method to increase productivity would be to increase the kill and attempt to keep the workers fully employed for the full 8-hour period or to reduce the size of the killing crew.

Plant D had the newest plant of the four observed and also the most efficient layout. This is indicated by the total productive time requirement being the lowest of all plants studied. At 40.00 man-minutesper head, productive time requirements is 3.32 man-minutes lower than the average of the four plants and 7.01 man-minutes less than Plant A, the highest observed.

Summary of Stage III Time Requirements

The average time required to kill and dress one animal was found to be 48.34 man-minutes with a low of 46.16 at Plant B to a high of 51.29 at Plant A (see Table 9). Total average time elapsed was 53.96 man-minutes with a range of 49.00 to 62.00 man-minutes indicating an average productivity of 91.3 percent. There appears to be no definite relationship between volume and time required to kill and dress one animal, but the variation can be attributed to other reasons as discussed below.

Plant A has one of the lowest rates of kill at 8-10 head per hour and also the longest line operation time requirement of 36.94 man-minutes per head. Plant D, with the highest rate of 13-15 head per hour, has the lowest time requirement of 29.56 man-minutes per head. This would seem to indicate an inverse relationship between volume and time required for line operations. But further analysis shows that Plant A is an older plant with some design problems while Plant D is the newest and most efficiently designed. Plant C with a kill rate of 8-10 head per hour requires 31.07 man-minutes per head while Plant B required 33.08 man-minutes per head with a kill rate of 12-14. This would indicate that no definite relationship between volume and time required for line operations could be derived from this study.

A further comparison of the individual line operations shows that the immobilizing and bleeding operations required some additional time in Plant B. This is due to the Kosher killing process which generally requires an additional time requirement of 1-2 man-minutes per head. Flooring and scribing took an additional five man-minutes to complete

in Plant A; this can be attributed to the general plant layout. Plant D was able to reduce the time required for line operations by 3.4 man-minutes less than the average. This can be attributed to the efficient plant layout and increased crew specialization (Plant D had the largest crew with 13).

Supporting operations averaged 10.41 man-minutes per head with a low of 9.83 at Plant B and a high of 11.39 at Plant C. There appeared to be no relationship between volume and time requirements in the supporting functions. No significant variations existed with the exception of hide removal. The shortest time existed in Plant D where the hide was moved only a few feet and dropped into a chute. The longest time required for hide removal was in Plant C where the hide was moved from the kill floor to an ajoining room.

Considerable variation existed in daily allowances on a per head basis. The lowest allowance was in Plant B with 3.25 minutes and highest in Plant D with 6.60 minutes. The average daily allowance was 5.02 minutes per head. With the exception of the 15-minute rest period, all other allowances were identical on a per man basis. The variations are a result of the number of men on the killing crew and the number of head killed per day Plant B, with the lowest allowance, did not give a 15-minute rest period and employed a crew of 11 for a kill of 101. Plant D, with the highest allowance employed 13 men for a kill of 59 and also provided a 15-minute rest period.

The shortest time required was experienced in Plant B with 46.16 man-minutes per head. A two man-minute time advantage was obtained in the daily allowances which directly contributed to the time advantage of Plant B. Plant A, with the longest required time in the line

Table 8. Summary of Time Requirements Per Head for Stage III, Killing and Dressing, Plant D

	Observations				Average man minutes	Fatigue and personal allowance percent	Total Productive man minutes
	1	2	3	4			
	Man-minutes						
Bring up	.70	.58	.52		.60	10	.66
Immobilizing	2.67	2.35	2.40		2.47	10	2.71
Bleeding, skinning head and forelegs	2.12	2.07	2.48		2.20	15	2.53
Flooring	4.93	4.98	5.68	5.27	5.21	20	6.25
Rumping	7.07	6.83	6.95		6.95	15	7.99
Dropping hide	1.87	1.73	1.17		1.59	15	1.83
Scribing	1.03	1.08	1.12		1.08	15	1.24
Washing	2.43	2.67	2.50		2.53	10	2.78
Shrouding	2.12	1.98	2.18		2.09	15	2.40
Weighing, tagging & placing in cooler	.87	1.12	1.20		1.06	10	1.17
Total line time					25.78		29.56
Head work-up	3.08	3.10	2.80		2.99	10	3.29
Eviscera removal	2.53	2.35	2.47		2.45	10	2.70
Hide removal	.32	.40	.30		.34	15	.39
Pluck work-up	1.70	1.40	1.60		1.57	10	1.73
Paunch work-up	2.15	2.03	2.18		2.12	10	2.33
Total support time					9.47		10.44
Total productive time							40.00
Start time; 13 men, 5 min. each							1.10
Plant clean-up; 13 men, 10 min. each							2.20
Personal clean-up; 13 men, 15 min. each							3.30
Total daily allowances							6.60
Total time required							46.60
Total time elapsed							49.57
Delay time							2.97
Percent productivity							94.0
Normal rate of kill (head per hour)							13-15
Crew size							13
No. head killed							59
Total man-hours required							48.75

Table 9. Summary of Time Requirements for Stage III, Killing and Dressing, All Plants

	Plant A	Plant B	Plant C	Plant D	Average
	-- Man-minutes --				
Normal rate of kill (head per hour)	8-10	12-14	8-10	13-15	--
Bring up	.47	.48	.44	.66	.51
Immobilizing	1.92	2.86	2.35	2.71	2.46
Bleeding, skinning head and forelegs	2.61	3.48	2.65	2.53	2.81
Flooring	12.26	7.70	6.95	6.25	8.29
Rumping	8.97	8.85	8.15	7.99	8.49
Dropping hide	2.43	1.85	1.95	1.83	2.02
Scribing	3.30	1.80	1.67	1.24	2.00
Washing	1.34	2.06	2.42	2.78	2.15
Shrouding	1.93	2.86	3.95	2.40	2.79
Weighing, tagging, place in cooler	1.71	1.14	1.54	1.17	1.39
Total line	36.94	33.08	31.07	29.56	32.91
Head work up	2.99	2.85	3.32	3.29	3.11
Remove viscera	3.05	3.11	2.72	2.70	2.90
Remove hide	.72	.66	1.10	.39	.71
Pluck work up	1.08	1.23	2.06	1.73	1.52
Paunch work up	2.18	1.98	2.19	2.33	2.17
Total support	10.05	9.83	11.39	10.44	10.41
Total prod. time	47.01	42.91	42.46	40.00	43.32
Daily allowances	5.04	3.25	5.75	6.60	5.02
Total time required	52.05	46.16	48.21	46.60	48.34
Total time elapsed	51.29	49.00	62.00	49.57	52.96
Delay time	-.56	2.84	12.79	2.97	4.62
Percent productivity	101.5	94.2	77.7	94.0	91.3

operations required the longest total time for Stage III. Delay time was the lowest in Plant A which employed an incentive payment plan for their kill crew and highest in Plant C with a guaranteed 40-hour work week. Plant B and D had approximately the same amount of delay time with 2.84 man-minutes and 2.97 man-minutes per head, respectively. Percent productivity is inversely related to delay time and exhibits no apparent relationship to volume but can be attributed mainly to management practices.

Stage IV Time Requirements

Productive labor requirements outlined by Hammons and Miller[41] indicate cooler and dock operations, for a plant operating in a range of 10-17 head per hour, require a three-man crew.[42] If the average weight of the carcasses was increased from 350 to 599 pounds to 600 to 900 pounds, a four-man crew would be required.

Cooler Operation

One man can remove and pick up shrouds (using a hand truck) at the rate of 80 per hour and move carcasses from the chilling cooler to the sales cooler at the rate of 200 per hour (see Table 10). An order for a hundred carcasses can be assembled by three workers in one hour. One worker locates the carcasses and calls out the number while the other two men move the carcasses to the working rail. The same job can be accomplished with the heavier carcasses in 1.82 hours using a four-man crew.

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[41] Hammons and Miller, op. cit., pp. 20-25 and 48-51.

[42] In calculating crew requirements an eight-hour shift was assumed with 30 minutes allocated for rest periods.

Table 10. Productive Labor Requirements for Stage IV Per 100 Cattle

	350 to 599 pounds (dressed weight)				600 to 900 pounds (dressed weight)			
	Frequency of occurrence	Base time	Fatigue & personal allowance	Productive time	Frequency of occurrence	Base time	Fatigue & personal allowance	Productive time
	Number	Man hours	Percent	Man hours	Number	Man hours	Percent	Man hours
Removing Shrouds								
Remove shrouds	100	.91	10	1.00	100	.91	10	1.00
Pick up shrouds (truck method)	1	.23	10	.25	1	.23	10	.25
Total		1.14		1.25		1.14		1.25
Transport Carcasses								
From chill to sales cooler	50	.56	10	.51	50	.87	15	1.00
Order Assembly								
Transport carcasses (transport carcasses on overhead rail to cooler working rail)	100	4.23	10	4.65	100	5.19	15	5.97
Call out order (worker calls out order and helps locate carcasses)	100	1.20	10	1.32	100	1.20	10	1.32
Total		5.43		5.97		6.39		7.29
Weighing and Loading								
Transport carcasses (transport carcasses on overhead rail from working rail in holding cooler to dock scale)	50	.32	10	.35	50	.40	15	.46
Weigh and record	100	.41	10	.45	100	.41	10	.45
Transport carcasses off scale (roll grade on carcass sides and partially quarter side)	100	.84	10	.93	100	.84	10	.93
Transport carcasses (on rail to truck)	50	.32	10	.32	50	.41	15	.47
Load trucks (worker severs fore and hind quarters with knife and saw, remove trolleys with pike pole and place in barrel. Loaders manually carry quarters from rail to truck and stack them inside)	100	4.11	15	4.52	100	5.38	20	6.45
Total		6.00		6.57		7.44		8.78

Table 10 (continued) --

	350 to 599 pounds (dressed weight)				600 to 900 pounds (dressed weight)			
	Frequency of occurrence	Base time	Fatigue & personal allowance	Productive time	Frequency of occurrence	Base time	Fatigue & personal allowance	Productive time
	Number	Man hours	Percent	Man hours	Number	Man hours	Percent	Man hours
Cleaning Trolleys								
Transport trolleys to washroom (transfer 200 trolleys from barrel on load-out dock to 2-wheel hand truck and transport to washroom)	4	.69	15	.79	4	.69	15	.79
Wash, rinse and oil trolleys (transfer 200 trolleys from 2-wheel hand truck to hoist in turn, dip trolleys into vat with rinsing fluid and into vat with oil)	8	.72	15	.83	8	.72	15	.83
Transport trolleys to skinning bed area (transfer 200 trolleys from hoist to 2-wheel hand truck, transport to skinning bed area, transfer trolleys to rod)	4	.85	15	.98	4	.85	15	.98
Total		2.26		2.60		2.26		2.60
Total Time Requirement		15.39		16.82		18.10		20.90

Source: Hammons and Miller, op. cit., pp. 48-51.

Load-Out Dock Operations

Once the orders are assembled on the working rail in the sales cooler, they can be weighed and loaded at the rate of 45 per hour (see Table 10). Three men are required for the smaller carcasses and a four-man crew is needed for the heavier ones. If the load-out truck is equipped with an overhead rail, the productive work requirements would be reduced by approximately 40 percent.[43/] During slack loading periods workers are required to wash and oil the trolleys and transport them back to the kill floor for re-use. One worker can perform this job in approximately two and one-half hours.

43/Hammons and Miller, op. cit., p. 51.

CHAPTER V

SUMMARY AND CONCLUSIONS

The meat packing industry has been faced with an unsatisfactory profit situation for the past several years. Information is needed that will enable them to adapt to the changing economic conditions. Presently only limited information is available concerning costs and operational characteristics of the Michigan meat packing industry. This study was undertaken to obtain additional information that packers can use as a bench mark in comparing slaughter costs and labor requirements of their own operation with other plants slaughtering the same species of livestock. It was also to provide necessary background information for further research. The study includes a comparative analysis of medium-size beef packing plants based on accounting records and supplementary direct observation of plant operations.

In-plant costs were separated into 12 component parts for this analysis with major emphasis placed on wages and salaries. Of the plants studied total in-plant costs (excluding procurement, selling and delivery costs) ranged from a low of $203,830.00 at Plant A to a high of $429,093.00 at Plant E. The average cost of slaughtering one animal was $13.46 with a low of $12.19 at the largest plant to a high of $15.42 at the smallest.

Wages and salaries composed the largest segment of in-plant costs averaging 44 percent of the total. An average of $6.00 per head was spent for labor with a range of $5.54 to $6.57. When compared on a hundredweight of dressed beef basis, labor costs averaged $1.03.

Individual plants ranged from a low of $.95 to a high of $1.07 per hundredweight. Average carcass weight was 561 pounds. No definite relationship between size and labor costs could be derived from this study, and variation which existed between the plants were largely the result of management practices.

Only a general analysis of plant operation costs was made. An average of 56 percent of the in-plant costs were attributed to plant operation which includes supplies, utilities, transportation, repairs and maintenance, professional fees, public relations, insurance, taxes, depreciation and interest. Lowest operating costs were incurred in the highest volume plant at $6.21 per head or $1.11 per hundredweight. Highest costs were experienced in the lowest volume plant at $9.86 per head or $1.71 per hundredweight. Average cost was $7.58 per head or $1.35 per hundredweight. There is a definite inverse relationship between volume and plant operating costs.

A more meaningful analysis can be accomplished if each plant's operation is divided into stages and each stage analyzed to discover the difference in productivity or in the costs involved. The stages of a beef packing plant are: I - Procurement; II - Holding; III - Killing and Dressing: IV - Cooler Operation; V - Special Processing; and VI - Selling and Delivery.

Time studies were conducted in four slaughter plants to determine the total man-minutes required in Stage III - Killing and Dressing. To perform the time study, Stage III was divided into 10 dressing line

operations and five supporting operations. Consideration was given to fatigue, personal and daily allowances in figuring total time requirements. The average time required to kill and dress one animal was found to be 48.34 man-minutes with a range of 46.16 to 51.29. The average time elapsed per head was 53.96 man-minutes with a range of 49.00 to 62.00 indicating an average productivity of 91.3 percent. There were no definite relationships between volume and time required to kill and dress one animal or between volume and productivity. Variation that existed were found to be the result of plant layout and management practices.

Possible Future Studies

The information presented in this study has established some relative cost figures for slaughtering beef cattle and helped point out some of the operational problems facing Michigan beef packers. Hopefully, it has helped lay the foundation for future research programs in the Michigan meat packing industry.

One such program for which a very definite need exists is providing assistance to packers in establishing and maintaining an accounting system which will provide useful information by stages of operation. This type of program would make packers more aware of, and provide the necessary information to use cost analysis for the purpose of cost reduction and managerial decision making. This information could also be used by the university (in a form that no individual operation could be recognized) to provide information in sufficient detail and on a continuing basis for more comprehensive comparative analyses and economies of scale studies.

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APPENDIX A

SAMPLE FORM USED IN CONDUCTING TIME STUDIES

Plant A

Crew Size 7
Kill 57 steers
5 cows

Operation	Job	Specie	Men	Minutes	Total Man-Minutes Per Head	Total Man-Minutes for Operation
Bring up		5 steers	2	:55	:22	:22
Bleeding and Skinning head	Bleeding	1	1	:10	:10	
	Skinning head	1	1	:45	:45	
	Forelegs	1	1	:30	:30	
	Removing head + tag	1	1	:20	:20	
	Move carcass	1	1	:19	:19	2:04
Flooring	Flooring	1	2	2:00	4:00	
	Skinning	1	1	1:48	1:48	
	"	1	2	1:18	2:36	
	"	1	1	:30	:30	
	Splitting	1	1	2:16	2:16	10:10
Rumping	Wash floor	1	1	:27	:27	
	Lift	1	1	:20	:20	
	Backing	1	1	3:10	3:10	
	Eviscerating and sawing	1	1	3:22	3:22	
	Moving	1	1	:15	:15	8:14
Scribing	Sawing and trimming	1	1	:48	:48	
	Scribing	1	1	:43	:43	
	Moving	1	1	:35	:35	2:06

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