RELATIONSHIP OF COST CHARACTERISTICS OF A COOPERATIVE ASSOCIATION TO CONTRACTING VOLUMES OF GRAIN HANDLED

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CHAPTER I

INTRODUCTION

Cooperative elevators, like other marketing firms are confronted with problems dealing with economic adjustment and efficiency. During the past few decades many changes have occurred in the techniques of producing and marketing grain. Many developments which have taken place directly affected the operations of grain associations. These changes have created new problems. Many of these problems have arisen and been intensified by public policies and programs. Since the mid 1920's, numerous efforts have been made to improve farm incomes through government programs. Wheat producers have been involved in or affected by most of these programs. One of the most direct efforts to improve farm income has been through price supports, which have been effected chiefly through non-recourse commodity loans and purchase agreements.

In addition to government programs, the introduction of technological innovations greatly increased the nation's supply of wheat. As a consequence of government programs and technological developments in production and marketing grain, adjustments were needed in the grain industry. These changes established a need for additional storage space to accomodate the rapid expansion of the wheat supplies. With increased emphasis given to grain storage, adjustments were made to increase storage capacity to meet requirements. Incentives, such as occupancy guarantees and accelerated depreciation write-offs, were provided to induce these adjustments.

As a result, bulk storage space in Oklahoma increased from 41.9 million bushels in 1942 to 247.5 million in 1961.[1] Presently existing storage space will handle more than two average Oklahoma wheat crops. The filling of this storage space, therefore, is dependent upon the carry-over from one season to the next of large quantities of wheat.

Problem

The existence of a cooperative association as a planning entity and the need for coordination grows out of dynamic conditions and change or variability which can only be estimated subjectively for the future.

As in other business endeavors, the cooperative association has a variety of input factors, such as physical facilities, equipment, supplies, and labor, which the entrepreneur attempts to combine in a manner minimizing costs of handling given amounts of product. This is a problem in resource substitution which faces the manager in providing desired services and maximizing profit.

In addition to the task of minimizing elevator operating costs, the management has the added problem of structuring cost and operations so that the elevator organization will not be injured by reductions in quantities handled from year-to-year which may result from variations in weather, competition, or government programs.

The fundamental role of the coordinating unit, management in its true sense, is to formulate expectuations of conditions which are likely to prevail in the future, and secondly, after the expectations of the future

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[1] Commercial grain warehouses in Oklahoma January 1, 1961, Extension Service, Oklahoma State University, Stillwater, Oklahoma.

have been established, to formulate a plan of operation which is logical and consistent with expectations.

Methodology

The Red Rock Farmers Cooperative Association was analyzed for the fiscal year of November, 1960 to October, 1961. This association was chosen for this study because of its size and diversification of operation, the favorable relationship between its management and the university research staff, and its close proximity to the university.

From audits of the organization in the department files, association records, and schedules secured by personal interviews with the management and bookkeeping staff, detailed cost and volume information was secured.

The cost information was first evaluated by use of ratios and by comparison of financial statements to determine the financial structure and condition of the organization. Secondly, operations of the organization were divided into five separate departments of activity--elevator, fertilizer, farm supply, feed mill, and petroleum. Specific costs were allocated to individual departments according to the use made of them and in amounts based on one of three apportioning procedures--ability to pay method, sampling method, or benefit or use method.

From detailed observations of the personnel employed, the portion of time engaged in an operation was determined for each department and phase of activity. In addition, the variability of labor inputs for department operations and the stability of labor tasks were analyzed by use of the coefficient of variation.

Using the fixity gradient, fixed and variable expenses were calculated on the fixity and variability of each individual expense item over a

period of ten years. This enabled a means of showing the flexibility of the elevator department under conditions of declining volume over varying lengths of time and an approximation of costs under future operating condtions. The method of procedure is given in more detail at the beginning of each section.

Objectives

The general objective of this study was to determine the utilization of labor, services, equipment, and facilities and the cost of this utilization for an elevator organization. In addition it was intended to show the relative rigidity of cost elements under different decision situations and suggest methods for lessening, insofar as possible, the effects of cost rigidity.

The specific objectives were:

(1) Determine the size and importance of cost items of the association.

(2) Determine the individual job for which these costs are incurred.

(3) Determine the rigidity of individual cost items and of total cost with different volumes of business.

(4) Determine the feasibility of having cost less fixed so that elevator firms may adjust their expenses to declining volumes.

Characteristics of the Association

The size and structure of a business unit affects its cost of operation and helps determine its financial structure. The facilities available and commodities handled are important in that they contribute to the task of analyzing and explaining the cost structure of the operation.

Facilities

Facilities of the association have been expanded in the past few years to meet the needs of the ever increasing activity in the surrounding area. The elevator, which is the primary concern of this study, has a total storage capacity of 550,000 bushels. The elevator is divided into two houses, each house having standard equipment which includes an overhead truck lift, manlift, automatic scale, grain dump pit, and other standard equipment. The houses are connected by an overhead loading conveyor and a lower unloading conveyor.

The association also operates a feed mill which has facilities for grinding, mixing, pelleting, rolling, and crimping. In addition, the association operates a service station and bulk distributing service. Warehouse facilities are available for merchandising of feed, seed, fertilizer, and a variety of farm supplies.

Commodities Handled

The association in this study was found to be widely diversified in the variety of commodities handled. In addition to the grains handled, the association handled several other commodities including feed, seed, fertilizer, gasoline, petroleum products, and a fairly wide selection of farm supplies.

Grain Handled

The seasonality of total grain receipts, which is influenced by kinds and amounts of grains marketed in the area, exerts an important effect upon the operating practices, policies, and cost of the elevator department. The volume of grain received in the month of June, 1961 was 538,270 bushels,

approximately 89 percent of the total grain received in the 1961 fiscal year.[2] This large receipt of volume in such a brief period necessitates a large labor force, costly mechanization and sizable capacity holding facilities to handle the large influx of grain.

Total grain receipts for the 1960-61 fiscal year were 603,983 bushels. With the exception of June, March and October were the only months with receipts in excess of 10,000 bushels. No grain was received in the month of February.

The amount of monthly grain shipments in 1961 ranged from a high of 211,228 bushels in June to a low of 4,629 bushels in August. There were six months that an excess of 45,000 bushels were shipped. The total quantity of grain shipped in the 1960-61 fiscal year was 709,265 bushels.

It was estimated, from the records, that approximately 313,248 bushels were held in the elevator, thus indicating an actual volume of grain handled to be approximately 1,000,000 bushels for the 1960-61 fiscal year. Wheat was the major grain handled, amounting to approximately 72 percent of the total volume. About 17 percent of the grain handled was barley. Milo, oats, and mixed grain made up the remainder 6 percent, 3 percent, and 1 percent, respectively.

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[2]To provide a common denominator and to ease computation, pounds of grain were converted to wheat bushels equivalent.

CHAPTER II

ADJUSTMENT FOR VOLUME VARIABILITY

A firm enjoys a strong competitive position if its operations can be quickly and economically adapted to changes in technology and market conditions. A firm's operating adaptability is largely based on the cost and the ease of adjusting input factors to various levels of volume handled and the time period required for contraction or expansion of the handling capacity.

This study is concerned with the effects of declining volumes on elevator costs--the total costs and per-unit costs--for the existing physical plant. Whether flexible or fixed costs are to be preferred under the physical and economic conditions of Oklahoma was not the question. Inasmuch as the Oklahoma grain elevator plant is largely already built a major concern is what will costs be under conditions of declining volumes.

The first section of this chapter is given over to a discussion of a firm's divisibility of plant and adaptability of variable inputs. The remainder of the chapter is devoted to a brief exposition of short-run flexibility of a firm's operation.

Factors Influencing the Short-Run Cost Curves

The particular shape of short-run cost curves differs from firm to firm. The shapes of the short-run marginal cost and short-run average cost curves are determined by such technological and operating aspects

as the adaptability to variation in variable factors, the divisibility of the firm's facilities, the level of technology and factor prices.[1]

In general, there are two major technical alternatives that may arise in the utilization of the fixed plant. It may be divisible or indivisible. The degree of divisibility in productive facilities and the adaptability to variations in variable inputs (labor, supplies, etc.) in the firm influence the shape of the short-run cost curves, particularly the degree of linearity in average variable cost and in marginal cost. Perfect divisibility is approached in firms where the production departments are comprised of identical or similar machines. Since plant facilities and operations are vertically divisible, output can be easily varied by operating a varying number of machines.

Complete indivisibility, the opposite limiting case, occurs when the product is turned out or handled by a single large facility or by a technically integrated production line comprised of machines and work stations physically linked in the process by a mechanically paced handling system.

In addition to being classed as divisible or indivisible, the fixed plant may also be classed according to another principle:[2] The plant may be adaptable to changing quantities of variable productive inputs or it may not be adaptable, that is varying amounts of variable inputs may be utilized by the fixed facility or variable inputs may only be combined with the fixed facility in direct proportion (i.e., one man-one machine).

Most plant operations ordinarily fall between the concepts of adaptability and unadaptability just as they usually include both divisiable and indivisible facilities.

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[1] The level of technology and factor prices are assumed to be constant in this discussion.

[2] G. Stigler, "Production and Distribution in the Short-Run," Journal of Political Economy, June, 1939, p. 311.

In the case of a divisible plant which is completely adaptable to varying amounts of variable inputs (Figure 1); the marginal cost of the variable factors is constant as the quantities of the variable factors are increased, throughout the whole range of outputs. In the case of Figure 1 there cannot be a region of decreasing average variable cost or increasing marginal cost because of complete divisibility of the fixed plant (assuming the price of the factors to be constant). The productivity of the variable factor can always be increased in such a region by using less of the fixed plant, thus the average total cost and the marginal cost curves, which are one and the same in this case, are constant throughout. In this case of complete adaptability and divisibility the firm would operate only when the price of the product was equal to or exceeded average total cost.

In the case of Figure 2, which depicts indivisibility and complete adaptability, the subsequent analysis of the marginal and average cost is different. In this case the law of diminishing returns is fully applicable. As the ratio of the variable factors to fixed factors increase, the marginal productivities of the variable factors decline. As full plant capacity is attained average unit cost and marginal cost rise because of diminishing returns on the variable factors in the use of the fixed factors. Thus, as plant output increases, the short-run average cost curve tends to assume an U-shaped form and the short-run marginal cost begins to increase at the point of maximum productivity of the variable factor and continues to increase gradually as additional variable factors are added. In this case of indivisibility and complete adaptability (Figure 2), the output must be zero or in excess of X_1 because of the region of decreasing average variable cost. This follows from the fact that in such a region

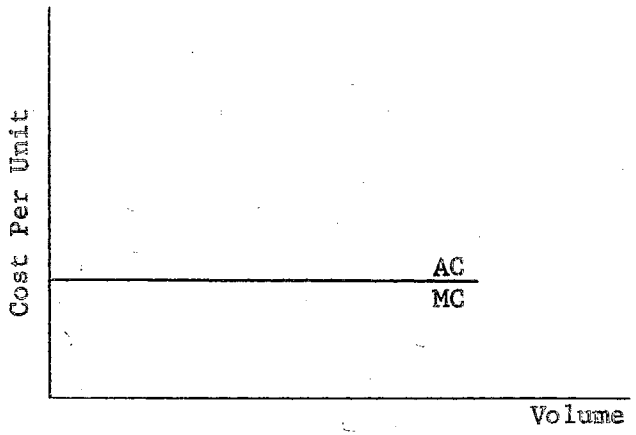

Figure 1. Marginal and Average Cost Curves for a divisible and adaptable firm

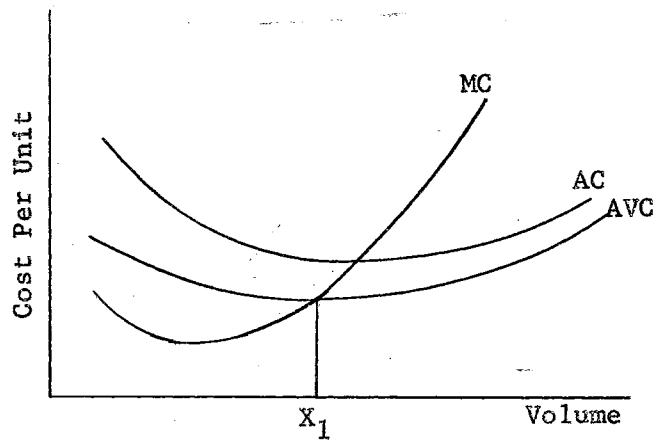

Figure 2. Marginal and Average Cost Curves for an indivisible and adaptable firm

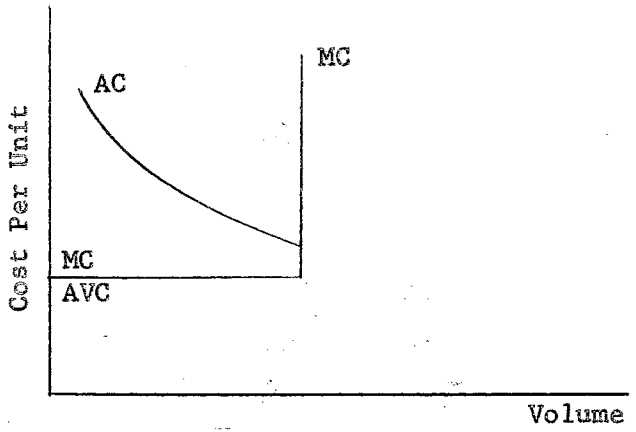

Figure 3. Marginal and Average Cost Curves for a divisible and unadaptable firm

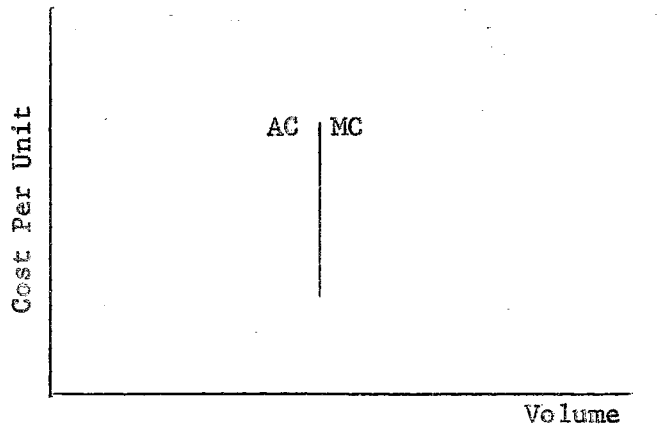

Figure 4. Marginal and Average Cost Curves for an indivisible and unadaptable firm

total variable costs are greater than total revenue. Under pure competition, price will equal marginal cost, but marginal cost is less than average variable cost when the latter is decreasing.

In Figure 3, illustrating an unadaptable firm that is completely divisible, the marginal productivity of the variable factor is constant from zero output to optimum output, therefore marginal cost and average variable cost curves, which will coincide, will be constant horizontal curves. At volumes greater than X_1, marginal cost, shown by the vertical line, rises sharply because the productivities of additional variable factors are zero. Average total cost curve declines to the point of optimum output and then becomes discontinuous. The discontinuity of the average total cost and the sharp rise in marginal cost arise from the fact that if there is no adaptability; the volume of activity cannot be increased in the short-run beyond the point where the fixed plant is fully utilized.

Finally, in the case of the indivisible and unadaptable firm (Figure 4), conclusions are obvious. The reasoning is much the same as in the example above for greater than optimum outputs. In this case the marginal cost and average cost would be a vertical line since the firm could operate at only one level of volume. For outputs that are less than optimum the marginal productivities of the variable factors are zero. Therefore, the resulting marginal cost is infinite. Similarly, for outputs greater than optimum, since additional units of variable factors could not increase output the marginal and average cost curves are identical to those in Figure 3.

Forms of Flexibility

In the previous discussion it was shown how the short-run cost curves were effected by various alternatives in selecting methods of plant operations. Plants and equipment are frequently constructed to handle either a fluctuating output or different types of output rather than a specified volume of product. As output changes minor variations can be made in the plant and its equipment if flexibility has been incorporated into the firm's organization. Since variations in volumes are expected the entrepreneur is interested in at least four forms of flexibility.

The first form consists of flexibility to adjust to seasonal variation in volume. Such changes are common in agriculture, especially in a grain storing and merchandising organization. Variation of this sort may be reasonably certain and can be anticipated in part from past experiences. For plants where the period of volume is at its peak, the most efficient means of obtaining this kind of flexibility is through variations in hours of plant operation. Another common way of securing this type of flexibility is by the use of many smaller scale facilities rather than larger units which would be more efficient if constantly utilized at optimum outputs.

A second form of flexibility, which is closely related to the first, permits a more economical adjustment to changing factor prices and to new innovations. It is obtained by substituting variable factors for fixed factors; for example, by employing technologies that require large amounts of labor relative to equipment. This form of flexibility refers to variations in volume within the structure of the long-lived plant; it is selected to gain time and allow physical adjustments to volume handled. It makes possible economic contraction by reducing overhead cost to a greater degree than if flexibility was absent. It may also be selected to meet variations

in factor prices as there may be times when the management finds that some particular factors may be profitably substituted for some other less costly factor.

A third form of flexibility permits economic change to a somewhat different product or an alteration in the proportions of joint or allied products. It allows an operational structure that enables redirection of products handled as prices change and expectations merit the diversion. This form of flexibility may be obtained by use of flexible machines and facilities rather than of entirely specialized equipment. The non-specialized equipment and facilities may be less efficient for specific combinations and levels of output (i.e., optimum levels), but yet may be more economically efficient if there is considerable variation in product price and levels of volume. An association which handles only grain is an illustration of the absence of this form of flexibility and of the nature of the cost that may result when flexibility is sacrificed.

The fourth form of flexibility permits a firm to prepare for unpredictable changes. This form of flexibility refers to the liquidity of a firm's capital or assets. It can be viewed as a method of preparing to withstand the ravages of economic setbacks. During periods of continued prosperity the firm tends to operate at a disadvantage in some aspects if its competition maintains modern equipment and facilities. But, during periods of contraction the firm has a substantial advantage; it can lay off workmen, cancel contracts, and, if rental agreements permit, it can pay a penalty and abandon the lease. In addition, liquidity permits the firm to take advantage of favorable opportunities which call for immediate purchase of resource services or investment in other more economical assets.

These four forms of flexibility have a profound influence on the cost any firm or association will incur. Flexibility is most likely to be desirable under conditions of uncertainty which are obviously prevalent in the grain industry. Under conditions of perfect knowledge the firm would always adopt the lowest cost method of operation; the production function and cost structure would always be those which gave the lowest average unit cost.[3] The entrepreneur may, however, select a short-run producing plant, because of his inadequacy to foresee the future, which does not give minimum average cost, i.e., some form of flexibility.

Flexibility in the firm and organization means organization which is not optimal for one volume level but offers better prospects of net receipts for a perspective varying level of volume than would an organization adapted to a constant volume of activity.[4]

Securing Flexibility

When flexibility is incorporated into the organization it permits management to revise the operations as time passes, as added information is obtained and as the ability to foresee the future improves at a lower cost sacrifice than would be possible if all flexibility was absent since

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[3] E. O. Heady, Economics of Agricultural Production and Resource Use, New Jersey: Prentice-Hall, Inc., 1952, p. 345.

[4] The formulation of this point was offered in G. Stigler, "Production and Distribution in the Short-Run," Journal of Political Economy, June, 1939, pp. 305-27. "The best technology for combining X, a fixed plant, with (say) Z units of the variable service, with a product of Y units, need not be, and for non-optimum outputs generally will not be, the same technology which (given the prices of the productive services) would minimize the cost of producing a product of Y. This latter technology will almost certainly require a different quantity of fixed services. Flexibility permits this best technology for producing Y, and other non-optimum outputs, to be approximated, but at the cost of not being able to use the best-known technology for any output."

flexible plants are adaptable to a wider range of opportunities than inflexible types of operation.[5] If it were not for the flexibility built into plants, outputs in excess of optimum would involve prohibitive marginal cost, while volumes at less-than-optimum would be very unprofitable.[6]

The management may select any one or a combination of techniques in its attempt to attain some degree of flexibility. One method that could be utilized is based on the divisibility of the plant, which would reduce variable cost of suboptimum levels of volume. Divisibility could be ordinarily achieved by constructing numerous smaller but identical facilities, as smaller duplicate storage houses, rather than one gigantic storage unit in which the equipment must be used fully or not at all. Another method is to reduce fixed cost relative to variable cost while still maintaining relatively low initial productivity of the variable factor (i.e., by building relatively inexpensive flat storage). The differences between the production functions and cost curves of a flexible plant (utilizing the two methods), and those of a comparatively inflexible plant are illustrated on page 16.

The dotted line in Figure 5 represents a short-run production function for variable factors when an outlay for facilities with high fixed cost are employed. The function depicts a rather inflexible plant in the sense that the productivity of the variable factors declines rapidly in

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[5] E. O. Heady, Economics of Agricultural Production and Resource Use, New Jersey: Prentice-Hall, Inc., 1952, p. 524.

[6] In the range of outputs in excess of optimum, the marginal productivities of the variable factors become increasingly small as additional units of factor are added, thus causing marginal cost to rise steeply, the degree of steepness depending upon the amount of flexibility built into the firm. For outputs that are less than optimum, in the area of decreasing average variable cost, the marginal revenue does not cover the average cost of the variable factors, thus an unprofitable volume.

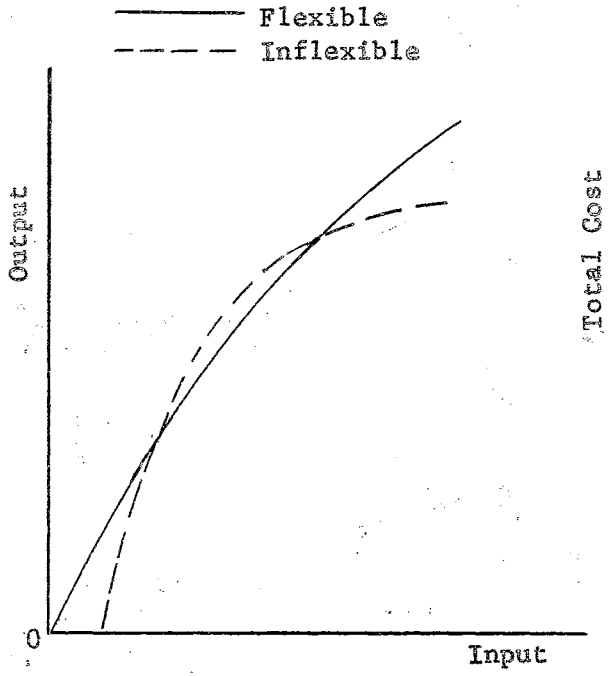

Figure 5. Flexible and Inflexible Producing Units

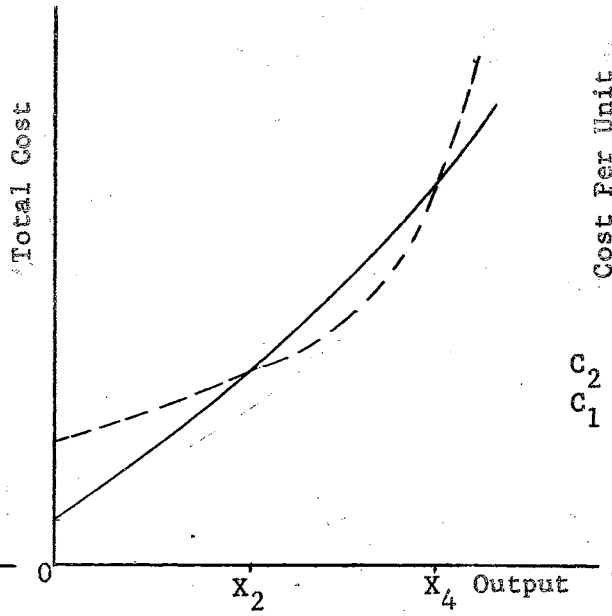

Figure 6. Flexible and Inflexible Short-Run Total Cost Structures

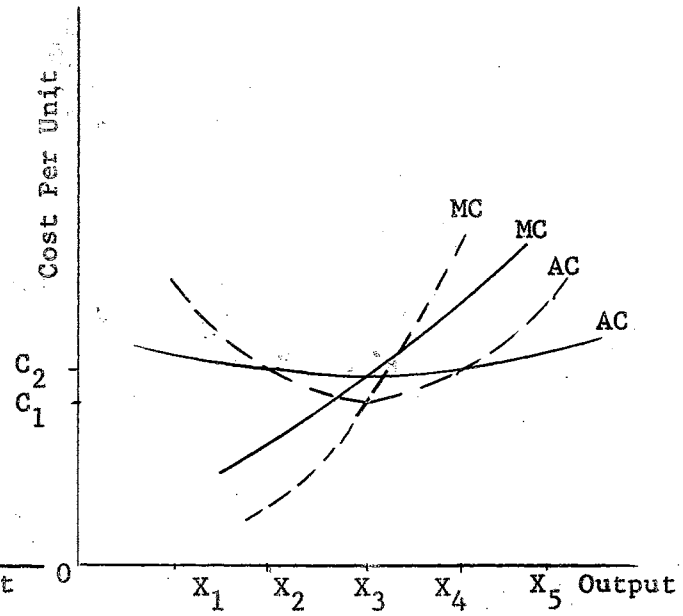

Figure 7. Flexible and Inflexible Short-Run Unit Cost Structures

the final range of inputs as compared to the earlier range of variable inputs. The costly vertical grain storage units would partly characterize this situation.

The solid line in Figure 5 represents the short-run production for variable resources when relatively less fixed resources are used. The function is flexible in the sense that the marginal productivity is more nearly constant throughout all ranges of variable input, although it is lower in the earlier ranges of input than for the inflexible firm.

The total cost relationships arising under the flexible and inflexible productions of Figure 5 are illustrated in Figure 6. If the volume is between X_2 and X_4 the inflexible cost function is the most efficient since it allows the lowest cost. For this range of outputs the fixed cost is distributed over a large number of product units and the variable factor input is not yet great enough to cause sharply rising cost due to the higher marginal productivity of the factor. However, if the volume is less than X_2 or greater than X_4 the most efficient plant would be the flexible one.

These same relationships are depicted in the form of short-run unit cost curves in Figure 7. If the output were to be exactly X_3, the optimum output, the inflexible firm would have the lowest average and marginal cost. The flexible firm's average cost would be larger by OC_2 minus OC_1. However, if the volume was reduced to X_1 the flexible firm would have much smaller losses and the inflexible plant would close down if it were in a competitive market because the marginal return would not cover the average variable cost. While marginal cost is greater for small volumes in the flexible firm the fixed costs are much higher in the inflexible firm. If volume was increased to X_5, the profits of the flexible firm would be

exceedingly greater than the inflexible firm. With large volumes the inflexible firms would require prohibitive marginal revenue to cover marginal cost due to the sharply decreasing marginal productivity of the variable resources. If volumes were to vary between X_2 and X_4, the less flexible plant would be desired. However, if volume fluctuates regularly between X_1 and X_5 the flexible plant would allow lower cost than the inflexible plant.

Under conditions of uncertainty the entrepreneur must make a subjective decision in respect to choice of flexibility. The management must anticipate future volumes in each production period. They must estimate prices of variable and fixed resources in each such period. They must foresee technology that may increase the productivity of the resources. Finally, the entrepreneurs must evaluate this anticipation in light of the economic efficiency that may or may not be gained by incorporating flexibility into their operations. The formal solution is apparent; flexibility should be added until its marginal cost equals the discounted marginal returns from savings due to that additional flexibility.[7] If carried too far, flexibility can cause undue cost sacrifices for each unit of output attained.

Flexibility is desirable when volumes are contracted involuntarily; it usually means that cost fall in greater proportion to contraction of volume, particularly fixed cost, than for inflexible systems.[8] While the same conclusions can be drawn about expansion, the grain industry is mostly interested in the falling side.

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[7] Stigler, p. 316.

[8] Heady, p. 347.

CHAPTER III

ANALYSIS OF FINANCIAL DATA

The financial statements of a firm present important information regarding its operation and financial condition. In this chapter an analysis of the balance sheet and operating statement is presented to help determine the rigidity or variation of the costs that make up the financial structure. In addition, selected ratios were calculated to evaluate the nature of the association's current and fixed investment. The financial data were secured from the annual audit reports of the association.

Balance Sheet

The summary of the balance sheet presented in this section is a listing of the assets of the organization together with a list of creditors' claims (liabilities), over the period of years 1958-59 to 1960-61, the difference reflecting the equity of the organization, commonly called the net worth of the organization. For this analysis it was of value to look at the proportions of various classifications of assets and liabilities to determine the nature of the equity and the degree of liquidity of the organization. To get a view undistorted by dollar volumes, the figures were reduced to percentages of total assets and total liabilities and net worth.

There were some changes in balance sheet composition between 1958-59 and 1960-61. The percentage committed to current assets increased

TABLE I

COMPARATIVE BALANCE SHEETS, 1958-59 THROUGH 1960-61

	1958-59		1959-60		1960-61	
	Amount	Percent Total Assets	Amount	Percent Total Assets	Amount	Percent Total Assets
Current Assets	$152,519.08	24.01	$183,973.97	27.18	$187,670.20	27.07
Cash	22,851.58		4,664.46		70,636.09	
Receivables	38,321.96		43,575.87		39,386.39	
Inventory	91,345.54		135,733.64		77,647.72	
Other Assets	116,792.86	18.39	130,623.41	19.30	147,657.79	21.30
Permanent Assets	365,909.24	57.60	362,175.55	53.52	357,836.22	51.63
Total	635,221.18	100.00	676,772.93	100.00	693,164.21	100.00
		Percent Total Liabilities and Net Worth		Percent Total Liabilities and Net Worth		Percent Total Liabilities and Net Worth
Current Liabilities	30,340.16	4.78	96,731.89	14.29	77,891.64	11.24
Accruals and Reserves	5,147.31	.81	4,876.81	.72	4,715.99	.68
Other Liabilities	177,750.00	27.98	146,900.00	21.71	144,450.00	20.84
Member Equities	55,478.07	8.73	20,735.72	3.07	35,946.90	5.19
Capital and Surplus	366,505.64	57.70	407,528.51	60.21	430,159.68	62.05
Total Liabilities and Net Worth	635,221.18	100.00	676,772.93	100.00	693,164.21	100.00

Source: Annual audits of the association.

slightly. In general, this may mean improved liquidity, indicating additional amounts available for general business purposes.

In face of a substantial new investment in total assets, the percentage invested in permanent assets declined. This may point out a more flexible structure.

The percentage of current liabilities was sharply up after 1958-59, which may indicate that slow turnover has made it harder to pay current debts. It may also indicate a decision to maintain a substantial cash position.

The percentage of total liabilities and net worth represented by other liabilities (long-term debts) dropped sharply between 1958-59 and 1960-61. This is generally favorable, at least a safe development, since it means less fixed interest charges. Furthermore, there was a percentage decrease in total liabilities as compared with the total liabilities and net worth.

Operating Statement

In this section, the operating statement, reporting the results of the operations of the organization, is discussed and analyzed. To evaluate the operating statement, the comparative income and expense statement with columns showing operating results for the current and preceding periods (1958-59 through 1960-61) and columns showing the percentage increase or decrease in each item was utilized.

Sales increased 59.7 percent during the 1960-61 fiscal year. Total cost of commodities sold, despite a sales increase, increased even more sharply so that the margin on sales decreased. The large increase in sales could be a result of either an increase in prices or an increase in physical quantities sold. It is quite likely to have resulted in part

TABLE II

COMPARATIVE OPERATING STATEMENTS, 1958-59 THROUGH 1960-61

	1958-59	1959-60	1960-61	Change 1958-59 to 1959-60	Change 1959-60 to 1960-61
				Percent	
Sales	$1,192,388.09	$1,050,098.13	$1,676,613.87	-14.5	59.7
Cost of Sales	1,141,070.61	998,283.32	1,628,645.87	-14.3	63.1
Gross Earning on Sales	51,317.48	51,809.81	47,968.00	.09	-8.0
Other Operating Income	88,042.64	85,087.36	96,395.72	-3.5	13.3
Total Gross Earnings	139,360.12	136,897.17	144,363.72	-1.8	5.5
Expenses	93,098.86	119,352.38	118,752.65	28.2	-.05
Other Deductions	14,883.70	15,204.47	14,837.27	2.2	-2.5
Other Additions	1,619.94	1,333.66	1,039.49	-21.5	-29.3
Local Net Earnings	32,997.50	3,673.98	11,813.29	-798.1	221.5
Patronage Refund and Dividend Received	39,748.84	33,174.60	42,634.38	-19.8	28.5
Total Net Earnings	72,746.34	36,848.58	54,447.67	-97.4	47.7

Source: Annual audits of the association.

from increases in both prices and quantities sold, thus accounting for the increase in cost of commodities sold.

The decrease in gross earnings from sales was accompanied by a 13.3 percent increase in other operating income, thus showing a slight increase in total gross earnings of 5.5 percent. This increase in gross earnings was accompanied by a .05 percent decrease in expenses and a 2.5 percent decrease in other deductions. This situation resulted in local net earnings of more than thrice the amount for the preceding year. Patronage refunds and dividends received increased 28.6 percent. This was largely the result of increased volume of business.

A decrease in sales coupled with a decrease in other operating income, and accompanied by an increase in expenses resulted in sharp reductions of total net earnings during the 1959-60 fiscal year.

Selected Financial Ratios

In this section ratios obtained were used in an attempt to evaluate the association's position, its long-range prospects, and to foresee conditions that could lead to financial instability. Three ratios were selected which were used in determining the financial structure of the association. By use of these ratios, the association's liquidity of assets and the nature of its fixed investment were evaluated.

Current Assets to Current Liabilities

Current assets to current liabilities ratio measures the ability to pay current liabilities. The ratio indicates the number of times cash and items which will shortly be converted into cash, usually within one year, cover the items which will have to be paid within one year. There should generally be a considerable margin of safety, because losses from

bad debts or a decline in inventory values could make it impossible for the association to meet its currently maturing obligations without resorting to borrowing. Two to one, is usually given as a standard for the ratio.

The major current asset items other than bank accounts are inventories, storage due, and prepaid freight. All of these are liquid and particularly so is the inventory, which could be sold in a matter of minutes. The ratios in Table III indicate that the association's debt paying ability is adequate.

TABLE III

SELECTED RATIOS

	1958-59	1959-60	1960-61
Current Assets / Current Liabilities	5:1	1.9:1	2.4:1
Net Worth / Fixed Assets	1.2:1	1.2:1	1.3:1
Sales / Fixed Assets	3.3:1	2.9:1	4.7:1

Net Worth to Fixed Assets and Sales to Fixed Assets

Together these ratios provide information concerning the nature of the association's fixed investment. A greater upward trend in fixed assets relative to net worth and sales could put a firm in a dangerous financial position. In addition, because of its permanence, every

acquisition of fixed assets represents an irretrievable cash wager that present volume of business will be as great as or greater than present volume.

It seems reasonable to assume that conditions could arise (i.e., factors causing reduction in volume), which might force the association into a shaky financial position. This is a result of the sizeable fixed assets relative to the sales and net worth.

Summary

Total assets of the association increased from $635,221.18 in 1959 to $683,164.24 in 1961. The current assets increased from 24 percent to 27 percent of the total assets in the same period, while permanent assets decreased from 58.6 percent to 51.6 percent of the total.

Total liabilities increased from $213,237.47 in 1959 to $227,057.63 in 1961. The long-term debts accounted for the major portion of the association's total liabilities. The current ratio (ability to pay current liabilities) indicated that the association could meet its currently maturing obligations without resorting to borrowing. Other financial ratios indicated sizeable investment in fixed assets relative to sales and net worth.

CHAPTER IV

THE OPERATING EXPENSES OF THE ASSOCIATION

The overhead costs of a firm which are defined as operating expenses, are those expenses that are incurred throughout the fiscal year of business activity. In this section the cost items were allocated to the respective departments for the purpose of analyzing the cost of operating the five major departments and to determine elevator costs which are used in a later analysis.

Since these costs cannot be identified with particular units of production, and since there are not statistical means of exact allocation, each element of cost was analyzed in the light of the circumstances existing in the particular year. In this study, three methods of apportioning cost--one method predominately or a combination of all three for each particular phase of activity--were utilized.

In cases where it could be accurately determined, the allocation was based on the service or use; that is the greater the amount of service or benefit received by a department from a phase of cost activity, the larger the share of the expense borne by that department.

The second method used in allocating cost was a sampling technique.[1] It was used in distributing certain types of expenses that were not closely related to departments and whose remoteness necessitated an arbitrary distribution. For example, the wages for certain employees whose activities were varied and not closely related to individual departments were distributed by this method.

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[1] See Chapter V for a discussion of this method.

When the benefit could not be accurately determined by either of the previous methods, the expense was allocated on an ability to pay method. The ability to pay principle as a bases of distributing cost is: those departments having the largest income may be charged the largest portion of the overhead, the allocation being proportional to income. In this case gross income was used as the basis for allocation.

A complete listing of the cost items is presented to demonstrate the methods of allocation and to illustrate the amount of cost attributed to each department (Table IV). The following larger expense items were analyzed and apportioned in the following manner and amounts. Salaries and wages, which comprise the largest expenditures of the association, were examined in great detail by use of work sampling which is discussed fully in a later section. By use of this sampling technique the portion of time spent and the amount of cost accrued in the operation of each department was determined. The salaries and wages figure consist of management's salaries and bonuses, offices salaries, wages to operating personnel, and other bonuses. The total salaries ($7,862.52) and wages ($50,214.14) amounted to over one-third of the total operating expense. The elevator department accounted for 25 percent ($1,965.62) of the salaries and fertilizer, farm supply, feed, and petroleum departments accrued 12 percent, 15 percent, 36 percent, and 12 percent, respectively.

Because of the considerable amount of mechanization in the elevator department and the resulting low operating labor requirement, 18 percent of the total wages was attributed to the elevator department. The relative large percentage of 36 percent ascribed to the feed department was chiefly a result of the large amount of manual handling. Twelve percent of the labor cost was accounted for by the fertilizer department, 15

TABLE IV

ANNUAL OPERATING EXPENSES FOR FIVE MAJOR DEPARTMENTS FOR THE FISCAL YEAR 1960-61

Cost Item	Department					
	Elevator	Fertilizer	Farm Supply	Feed	Petroleum	Total
Salaries	$1,965.62 (25)[1]	$ 943.51 (12)	$1,179.37 (15)	$2,830.51 (36)	$ 943.51 (12)	$ 7,862.52**
Wages	9,038.54 (18)	6,025.70 (12)	6,025.70 (12)	18,077.09 (36)	11,047.11 (22)	50,214.14**
Advertising	35.05 (5)	455.61 (65)	35.05 (5)	140.18 (20)	35.05 (5)	700.94*
Auditing & Legal	253.09 (52)	38.94 (8)	14.60 (3)	131.42 (27)	48.67 (10)	486.72***
Dues and Subscriptions	142.22 (52)	21.88 (8)	8.20 (3)	73.85 (27)	27.35 (10)	273.50***
Employees Insurance	14.59 (18)	9.73 (12)	9.73 (12)	29.18 (36)	17.83 (22)	81.06**
Employees Retirement	147.12 (18)	98.07 (12)	98.07 (12)	294.24 (36)	179.82 (22)	817.32**
Goodwill Expenses	673.09 (52)	103.55 (8)	38.83 (3)	349.49 (27)	129.45 (10)	1,294.41***
General Expenses	40.30 (25)	29.02 (18)	29.02 (18)	33.86 (21)	29.02 (18)	161.22*
Insurance and Bonds	1,122.04 (26)	517.86 (12)	345.25 (8)	1,510.43 (35)	819.95 (19)	4,315.53*
Inventory Expenses	427.85 (52)	65.83 (8)	24.68 (3)	222.15 (27)	83.27 (10)	822.78***
Janitor Supplies	67.33 (52)	10.36 (8)	3.88 (3)	34.97 (27)	12.95 (10)	129.49***
Leases & Rentals	54.07 (100)	0 (0)	0 (0)	0 (0)	0 (0)	54.07*
Office Supplies	377.54 (25)	271.83 (18)	271.83 (18)	317.12 (21)	271.83 (18)	1,510.15*
Office Machine Maintenance	102.24 (25)	73.61 (18)	73.61 (18)	85.88 (21)	73.62 (18)	408.96*
Plant Supplies	1,940.08 (90)	43.11 (2)	64.67 (3)	107.78 (5)	0 (0)	2,155.64*
Propane	121.53 (5)	121.53 (5)	170.15 (7)	1,895.94 (78)	121.53 (5)	2,430.68*
Repair Elevator	1,205.42 (100)	0 (0)	0 (0)	0 (0)	0 (0)	1,205.42*
Repair Mill	0 (0)	0 (0)	0 (0)	1,205.43 (100)	0 (0)	1,205.43*
Rodent Extermination	43.56 (33)	43.56 (33)	0 (0)	44.88 (34)	0 (0)	132.00*
Scale and Warehouse	185.55 (65)	2.84 (1)	2.84 (1)	94.18 (33)	0 (0)	285.41*

(Continued)

TABLE IV (Continued)

Cost Item	Department					
	Elevator	Fertilizer	Farm Supply	Feed	Petroleum	Total
Station Repair	0 (0)	0 (0)	0 (0)	0 (0)	898.47 (100)	898.47*
Telegraph and Telephone	181.64 (20)	181.64 (20)	45.41 (5)	317.87 (35)	181.64 (20)	908.20*
Travel	293.08 (50)	82.06 (14)	17.58 (3)	164.13 (28)	29.31 (5)	586.16*
Truck Expenses	149.88 (5)	569.56 (19)	59.95 (2)	719.44 (24)	1,498.83 (50)	2,997.66*
Utilities	1,862.58 (38)	49.01 (1)	392.12 (8)	2,352.73 (48)	245.08 (5)	4,901.52*
Wheat Expenses	931.72 (100)	0 (0)	0 (0)	0 (0)	0 (0)	931.72*
Yard Improvements	259.13 (52)	39.86 (8)	14.95 (3)	134.56 (27)	49.82 (10)	498.32***
Ad Valorem Tax	2,204.78 (55)	200.43 (5)	200.43 (5)	1,202.59 (30)	200.43 (5)	4,008.66*
Franchise Tax	367.20 (51)	57.60 (8)	7.20 (1)	259.20 (36)	28.80 (4)	720.00*
Payroll Taxes	461.93 (18)	307.95 (12)	307.95 (12)	423.86 (36)	564.59 (22)	2,566.28**
Truck Licenses	17.35 (5)	65.93 (19)	6.94 (2)	83.28 (24)	173.50 (50)	347.00*
Other Taxes and Licenses	0 (0)	0 (0)	2.00 (10)	0 (0)	18.00 (90)	20.00*
Feed Tonnage Tax	0 (0)	0 (0)	0 (0)	73.01 (100)	0 (0)	73.01*
Director Fees	253.76 (52)	39.04 (8)	14.64 (3)	131.76 (27)	48.80 (10)	488.00***
Bad Accounts	0 (0)	18.85 (5)	18.86 (5)	169.69 (45)	169.69 (45)	377.09*
Depreciation	9,817.41 (44)	2,231.23 (10)	223.12 (1)	9,371.16 (42)	669.37 (3)	22,312.29*
Interest Expenses						
Operating	3,756.83 (73)	308.78 (6)	308.78 (6)	617.57 (12)	154.39 (3)	5,146.35*
Commodity	3,300.03 (100)					3,300.03*
Facility	10,474.10 (44)	2,380.48 (10)	238.05 (1)	9,998.01 (42)	714.14 (3)	23,804.78*
Total	52,288.25 (34)	15,408.96 (10)	10,253.46 (7)	53,997.44 (36)	19,484.82 (13)	151,432.93

*Allocation made on the basis of benefit received.

**Allocation made on the basis of sampling.

***Allocation made on the ability to pay basis.

[1]Number in parenthesis is percentage of expense attributed to the particular department.

Source: Annual audits, association records and manager estimates.

percent by the farm supply and the petroleum department was responsible for the remaining 12 percent.

The interest expense is not entirely comparable to the interest expense found in the operating statement. In actual practice, the audits list interest expense only when it has been incurred by borrowing money from a credit agency. However, to bring out the opportunity cost which was otherwise omitted, the assocation was charged an amount that its assets would earn in an alternative enterprise or investment. Although the association occasionally borrows from other agencies, the Bank of Cooperatives at Wichita is the primary source of credit.

The Wichita Bank of Cooperatives makes three types of loans: (1) operating capital loans--to finance current operations, (2) facility loans--for buying or constructing buildings, and (3) commodity loans--to provide the cooperative with funds to enable it to make advances to growers on commodities delivered to the association. The rates of interest charged by the bank vary, depending upon the type of loan. To arrive at the calculated interest expense, the assets of the association were broken down into the three loan categories and the appropriate interest charge was applied to the amount (Table V).

TABLE V

EFFECTIVE INTEREST RATES, JANUARY, 1961

Loan Categories	Interest Rates
Operating	4.25%
Facility	4.75%
Commodity	4.50%

Source: Wichita Bank of Cooperatives.

Facility interest constituted the largest share of the total interest expense ($23,804.78). The elevator department and the feed department, both of which utilized many thousands of dollars worth of facilities, were responsible for 44 percent and 42 percent of the facility interest expense, respectively. Approximately 10 percent of the remaining facility interest was attributed to the fertilizer department; 1 percent was allocated to farm supply and 3 percent to the petroleum department.

The entire commodity interest expense ($3,300.03) was ascribed to the elevator department since it was the interest charge on the advances made to growers on the delivered commodities.

The elevator department was also responsible for the larger share of the operating interest expense, 73 percent, while the fertilizer department and farm supply each accounted for 6 percent or $308.78. The feed department was responsible for $617.57 and the remainder, $154.39, was ascribed to the petroleum department.

Depreciation expense was a function of the facilities cost and rate of depreciation. The initial cost of the facilities and equipment were obtained from the audits and given rates were applied to determine the actual depreciation allowance. The allocation of this expense was made separately for buildings and equipment to each department because of the different depreciation rates. The calculations showed that 44 percent or $9,817.41 of the expense was attributable to the elevator department. The feed department was responsible for 42 percent or $9,371.16 of the expense. The fertilizer department, farm supply department, and the petroleum department incurred the remaining ten percent, one percent, and three percent of the expense, respectively.

The utilities expense included power for lighting office area, warehouses, and elevator, and the power used in preparing feeds and elevating grain, the latter uses accounting for the major share of the expense. It was estimated that the elevator department accounted for $1,862.58 (38 percent) of the expense. The feed department was responsible for $2,352.78 (48 percent) of the expense.

The insurance total consist of prepaid fire and extended coverage insurance on all facilities, equipment, and merchandise of the association plus crime and liability insurance. The coverage of each policy was reviewed and the cost allocated to the appropriate department on basis of insurance received. The insurance cost incurred by the elevator department was $1,122.04 while the feed department incurred $1,510.43, together accounting for over one-half of the insurance cost. This was necessary because of numerous buildings, type of machines in use, and the number of employees in these departments.

From the ad valorem tax records and consultations with the manager and the bookkeeper, estimates of the proper allocations among departments were determined. The tax records showed the total ad valorem tax paid for the 1961 fiscal year to be $4,008.66. Because of the number of facilities and amount of grain held, the elevator department incurred the largest portion of the expense, $2,204.78 or 55 percent. The feed department's share of the ad valorem tax amounted to $1,202.59 or 30 percent of the total. The remaining $601.29 was incurred equally by fertilizer, farm supply, and petroleum departments.

Truck expense consisted of gasoline, oil, lubrication, tires, maintenance, and other tiems which were incurred in the operation of the vehicles. This expense was allocated to departments on the basis of

benefit received as determined by estimates by the manager and the author's evaluation. The petroleum department accounted for one-half of the truck expense because of the bulk petroleum delivery service. The fertilizer department and feed department also incurred sizeable truck expenses, because of the delivery service, amounting to $569.53 and $719.44, respectively. The elevator department and farm supply department were responsible for the remaining portion of the truck expense, five percent or $149.88 was incurred by the elevator and two percent of $59.95 by the farm supply.

Payroll taxes, which consist of social security tax and unemployment tax, are a direct function of wages paid, were therefore approtioned to the individual departments in the same manner as were wages. The feed department and the petroleum department, because of their relative larger labor requirement, accounted for 36 percent and 22 percent, respectively. The elevator incurred $461.93 of the payroll tax and the remaining $615.90 (24 percent) was divided equally between the fertilizer department and the farm supply department.

Propane expense, $2,430.68, was incurred by two uses, heating the office area and in the preparation of some feeds, the latter accounting for the major portion of the expense. The expense incurred in heating the office area was allocated proportionately to the individual departments--the elevator department, the fertilizer department, and the petroleum department. Farm supply department was allocated 7 percent of the expense or $170.15 and the remaining 78 percent was ascribed to the feed department.

Plant supply expense included such items as lumber for coopering cars, fumigants, grain scoops, fuses, bulbs, fire extinguisher refills, containers and many other supplies of a miscellaneious nature. Plant

supply expenses were incurred largely by the elevator department and were allocated accordingly with $1,940.08 going to the elevator department. The remaining ten percent was divided between the fertilizer, farm supply and feed departments; $43.11 was allocated to the fertilizer, $64.67 and $107.78 was ascribed to the farm supply and feed departments, respectively.

The total expense incurred by the association for the fiscal year of 1961, as illustrated in Table VI, was $151,432.93. The total gross income received amounted to $188,037.59.

While the feed department incurred the largest portion of the expenditures, 36 percent or $53,997.44, the department's total gross receipts amounted to only $40,352.77 or 21 percent of the total, thus showing a loss of $13,644.67 or a return of 75 cents for each dollar expenditure. The expenditures incurred in the operation of the elevator department were $52,288.25, while the department's gross receipts amounted to $107,127.28, a net return of $54,839.03. The fertilizer department, the only department besides the elevator department showing a net savings, had a return of $1.18 for each dollar expenditure. The petroleum department's cost of operation for the year was $19,484.82; gross receipts were $16,786.12, thus showing a loss of $2,698.70.

The farm supply department had the poorest return per dollar expenditure, amounting to only 55 cents. The department's gross returns were $5,609.56, while the cost of operation was $10,253.46.

Summary

For the 1960-61 fiscal year, total expenses amounted to $151,432.93, while gross income was $188,037.59. The feed department and elevator

TABLE VI

TOTAL OPERATING EXPENSES AND TOTAL GROSS INCOME BY DEPARTMENT FOR FISCAL YEAR 1960-61

	Total Departmental Expenses	Total Departmental Gross Income[1]	Return Per Dollar Expenditure
Elevator Department	$52,288.25 (34)[2]	$107,127.28 (57)[3]	$2.05
Fertilizer Department	15,408.96 (10)	18,161.86 (10)	1.18
Farm Supply Department	10,253.46 (7)	5,609.56 (3)	.55
Feed Department	53,997.44 (36)	40,352.77 (21)	.75
Petroleum Department	19,484.82 (13)	16,786.12 (9)	.86
Total	$151,432.93	$188,037.59	1.24

[1]Includes patronage refunds and dividends on stock.

[2]Percent of total expense attributed to the particular department.

[3]Percent of total gross income received from the particular department.

Source: Annual audit from the association and estimates from the manager.

department were responsible for over two-thirds of the total expense. The elevator department and the fertilizer departments showed net savings of $54,839.03 and $2,752.90, respectively, while each of the other departments incurred losses in operation.

The elevator department is "carrying" the rest of the association. The implications of this situation could prove to be far reaching should conditions arise (i.e., decrease in grain receipts) which would reduce total income to the elevator department.

CHAPTER V

ANALYSIS OF LABOR ACTIVITY

In this chapter, an analysis of variability of labor inputs and the allocation of personnel to individual departments are discussed. Management must consider many factors in making decisions in the allocation of labor and capital inputs. Consideration of the possibility that labor cost incurred in performing an operation may be relatively more expensive than an alternative method of performing the same operation but using a different combination of inputs (labor vs. capital) must be taken into account. Since labor represents about 38 percent of the total cost of operating the association, an analysis of the labor inputs is extremely helpful to management in making these decisions.

In the absence of measured day-work standards, the management has little protection against a creeping increase in time loss, increasing difficulty of supervision in planning, and general rise in labor requirements.

In addition to these factors, there was and is the problem of control of cost in the major departments. In many cases, since all departments' operations are carried on by the same employees at different times, much poor planning and consequential high cost can result.

The major problem here was the difficulty in estimating or determining exactly how the employees' time was being spent. At first view, this may seem to be simply a matter of reviewing time cards and cost reports, but the disadvantage of time cards is that they reveal little

of the specific detail of the various departmental jobs. For example, they may conceal the fact that a considerable portion of the man-hours involved in performing a particular job may consist of idle time and that a higher rate of performance or output could be attained under other circumstances. In addition, the classifications of employees to types of work performed were often ambiguous.

Even with these obstacles, the problems of planning and control were frequently not so complex as they appeared. However, it was also true that there was great difficulty in evaluating just how well planned, supervised, and controlled the work really was, and in getting a grip on the actual inherent cost-saving potential.

Why Work Sampling Was Used

Work sampling seemed an obvious tool to obtain the type of information desired for the following reasons.

(1) It was an extremely useful technique to make an inexpensive overall survey of various departmental activity. The estimated cost of determining allowances by ratio delay (work sampling) is about one-fourth to one-half that of a time study.[1]

(2) Work sampling was particularly useful in this analysis because of the nature of the activities being non-repetitive and occurring irregularly.

(3) The results could be statistically tested for reliability.

(4) Observations could be taken over a period of weeks or months, thus decreasing the chance of day-to-day variation affecting the results, but still provide information on seasonal variations.

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[1] R. M. Barnes, Work Sampling, New York: John Wiley and Sons, 1957, p. 191.

(5) This type of study could be interrupted at any time without effecting the results.

(6) Employees did not need to be interrupted or disturbed in their work.

Theory of Work Sampling

The underlying theory of work sampling is that the percentage of observations of an employee as idle, working, or in any other condition reflects to a probable degree of accuracy the average percentage of time actually spent engaged in that activity. The observations are randomly distributed over a long period of time. If a sample is drawn in such a way that each time an item is selected, each item in the population (or universe) has an equal chance of being selected, the sample is said to be a random one.

Under these conditions, each combination of a specified number of activities will have the same probability of being selected. From the sample inferences are made about the aggregate or population. It is the sample that is observed, but it is the population which is desired to be known. If these conditions are met, and enough observations are taken, inferences of known reliability can be made through work sampling.

Precautions Taken in Selecting Sample

To assure randomness and non-biasing of the sample a few precautions were effected. To counteract the possibility of bias, observations were taken uniformly over the entire day. This in effect weighted each hour of the day proportionately. Secondly, the observations were randomized relative to the activity. This was achieved by observing at random intervals to offset any effect due to cyclic activity. In most instances

this was a minor problem because of the non-repetitive nature of the operations. Care was taken not to affect the employees adversely. If during the study, any worker questioned the observer's actions, the purpose was briefly explained to him. After becoming accustomed to the observer the workers appeared to perform in a normal manner. Finally, no observations were recorded during cyclical delays such as authorized rest periods or lunch periods.

Selection of Categories

The mechanics of work sampling require that the observers gather data by observing the state or activity of the employees being studied, classify this into one of several categories of activity, and record the observations by writing the designated number or letter which represents that category. Since the initial classification of activity governs the utility of the study, it was necessary to select categories with circumspect.

In this study it was decided to separate the work into the categories as follows:

1. Supervisory (conferences, travel, supervision of employees)
2. Cleaning up (general policing of departmental areas)
3. Miscellaneous grain activities (testing, coopering and positioning cars, etc.)
4. Delivery or pickup
5. Dumping-unloading
6. Loading out
7. Rearranging or replacing stocks
8. Office work (secretarial and clerical duties)
9. Repair, maintenance and construction
10. Preparing feed (grinding, crimping, pelleting, etc.)
11. Sacking and sewing
12. Turning grain
13. Weighting (operating scales)
14. Waiting on customer
15. Cleaning grain
16. Idle time
17. Other

It was felt that these categories would provide the information considered necessary for the analysis. Further, these categories met general requirements in that they were (a) easily recognizable by sight, (b) capable of fairly precise definition, and (c) consistent with the end use of the study.

In addition to categories of activity, a breakdown was made of departments which enabled the observer to identify specific jobs done in specific departments. One of the desired results was to determine work load variations in individual departments which were somewhat disguised because of shifting of personnel from job to job between departments.

The breakdown of departmens was as follows:

A. Elevator

B. Farm Supply

C. Feed

D. Fertilizer

E. Office

F. Other (yard improvements, fire department, etc.)

Evaluating the Reliability of the Data

In evaluating the reliability of the results, the end uses and objectives must serve as the ultimate criteria. At the beginning of the study it was necessary to decide what level of confidence was to be desired in the final results. The 95 percent level of confidence was used, because in this study it represents a practical level of reliability and is well understood. This means that one is confident that, on the average, the random observations will represent the true population parameter 95 percent of the time, and 5 percent of the time they will not.

In addition to the confidence limits, a degree of accuracy was required. Generally, the reliability of work sampling should be consistent with the known reliability of other time standards. At the 95 percent confidence level both stop watch time study and predetermined human work times usually exhibit reliability of no better than plus or minus 10 percent.[2] For this study a degree of accuracy of $\pm$ 10 percent was considered satisfactory to be statistically significant.

After the study was completed, calculations were made to determine if the results were within the desired accuracy. This was done by calculating S' in the following formula.[3]

$$S \cdot Pm = 1.96 \sqrt{\frac{Pm(1 - Pm)}{N}}$$

where:

S = desired accuracy

Pm = percentage occurrence of activity or departmental element being measured. Pm is expressed as a percentage of the total number of observations. Also, it is expressed as a decimal (i.e., 3.27 percent = .0327)

N = number of random observations (sample size).

A confidence level of 95 percent with corresponding standard deviation of 1.96 and an accuracy of $\pm$ 10 percent is used. Binominal distribution is assumed to be used as the basis of determining the error.

A summary of results is shown in Table VII on page 42. Selecting element 12 (turning grain) as an example, the calculations were as follows.

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[2] B. L. Hansen, Work Sampling for Modern Management, Prentice-Hall, Inc., Englewoods Cliffs, N. J., 1960, p. 122.

[3] Barnes, p. 12.

TABLE VII

SUMMARY OF OBSERVATIONS OF WORK SAMPLING STUDY OF EMPLOYEE ACTIVITY BY ELEMENT AND DEPARTMENT
(VALUES EXPRESSED AS PERCENT OF TOTAL OBSERVATIONS)

Department Element of Activity	A Elevator	B Farm Supply	C Feed	D Fertilizer	E Office	F Other	Total
Supervisory[1]	.46	.12	1.25	.14	2.05	.07	4.09*
Cleaning Up	1.42	.68	2.21	.33	.76	.10	5.50*
Miscellaneous Wheat Activities[2]	1.41	-	-	-	-	-	1.41
Delivery or Pickup	.76	.95	2.95	.91	.02	-	5.59*
Dumping-Unloading	2.02	.47	1.76	3.69	-	-	7.94*
Loading Out	1.71	.19	4.03	2.77	-	-	8.70**
Rearranging or Replacing	.14	1.22	1.60	.40	.53	-	3.89*
Office Work	.01	.10	.05	-	20.90	-	21.06**
Repair, Maintenance and Construction	1.01	.95	4.11	.30	.53	1.19	8.09**
Preparing Feed	-	-	9.61	-	-	-	9.61**
Sacking and Sewing	-	-	4.30	.17	-	-	4.47*
Turning Grain	3.27	-	-	-	-	-	3.27*
Weighing	.95	.12	.83	.01	.19	-	2.10*
Waiting on Customer	.31	3.01	.79	.25	2.18	-	6.54*
Cleaning Grain	.03	-	1.62	-	-	-	1.65
Idle Time	.72	.52	1.25	.67	2.16	.04	5.36*
Other	.12	.09	.34	.11	.07	-	.73
Totals	14.34**	8.42**	36.71**	9.74**	29.39**	1.40	100.00

**Significant at 95 percent confidence level with less than ± 5 percent accuracy.

*Significant at 95 percent confidence level with less than ± 10 percent accuracy.

[1]Includes conferences, travel, supervision of employees, etc.

[2]Includes testing grain, positioning cars, coopering cars, etc.

Given:

$Pm = 3.27$

$N = 18,910$

$S \cdot Pm = 1.95 \sqrt{\frac{P(1 - P)}{N}}$

$S(.0327) = 1.96 \sqrt{\frac{0.0327\ (1 - 0.0327)}{18,910}} = 1.96 \sqrt{\frac{0.0327\ (.6973)}{18,910}} =$

$196 \sqrt{\frac{.0316307}{18,910}}$

$S(.0327) = 1.96 \sqrt{.0000016727}$

$S(.0327) = 1.96\ (.0012929) = 0.002534$

$S = \pm \frac{.002534}{.0327} = \pm .0775 = \pm 7.75$ percent.

Since $\pm$ 7.75 percent is less than the $\pm$ 10 percent desired accuracy, the result is sufficiently reliable.

In this case the statement could be made, with 95 percent confidence, that on the average 3.25 percent of the employees time is spent turning grain. The accuracy of $\pm$ 7.75 percent means that the results are within $\pm$ 7.75 percent of 3.25 percent ($\pm$ 7.75 x .0325 = $\pm$ .25), or the true value was between 3.0 percent and 3.5 percent.

Allocation of Time

The portion of time employees spent working in the various departments of operation and the portion of time engaged in specific activities are discussed in this section. An attempt was made to evaluate how well the work was planned and controled in order to get a grip on the actual inherent cost-saving potential.

Table VII is a summary of the observations of employee activity by element and department, expressed as a percentage of the total observations, taken by the observer over the 1960-61 fiscal year. The table was divided

into six departmental operations (elevator, farm supply, etc.) and then subdivided into the seventeen task categories or elements of activity within each department. All elements of activity were statistically significant at the 95 percent level with the exception of miscellaneous wheat activities, cleaning grain, and "other". The departmental operations were also statistically significant at the 95 percent level allowing the exclusion of department (F) "other".

It was found through the work sampling technique that employees spent 14.34 percent of their time engaged in operation of the elevator, 8.42 percent in farm supply, and 36.71 percent, the largest portion, in the operation of the feed department. In addition, 9.74 percent of this time was involved with the operation of the fertilizer department and 29.39 percent was spent in the operation of the office. The remaining 1.40 percent was attributed to other activities.

The portion of time spent in supervisory activities amounted to 4.09 percent. It was observed that 5.50 percent of the employee's time was used in cleaning up the departmental areas. Cleaning up time could probably be reduced as it is frequently unnecessary and is done as a result of idle time. The percentage of time workers spent loading-out was 8.70 percent. Approximately one-half of this percentage or 4.03 percent was attributed to the feed department. The relatively large percentage of 4.03 of loading out compared to 1.76 percent of unloading arises from design of loading equipment in the feed department.

The portion of time attributed to office work was 21.06 percent, amounting to over one-fifth of the total employees time. Element 9, repair, maintenance and construction, accounted for 8.09 percent of the employees time. This percentage was slightly greater than normally would

be expected due to the construction of additional facilities adjoining the feed mill which were constructed by the association's employees. Idle time, which was observed to be 5.36 percent, considered only that idle time which was within the control of the employees, i.e., idle time arising from equipment failure was not considered.

Conversion to Man-Equivalents

Because of the varying number of employees from month to month, and within months, and the unequal number of hours worked by these employees, (i.e., overtime and short time), some modifications were required to make the data obtained uniform and comparable over the entire period it was secured. It was decided to establish a common denominator by converting total monthly hours worked by the employees into a number of man equivalent. One man equivalent was determined to be equal to 190.5 hours per month. For example, to arrive at the actual number of men used to operate the association in the month of November, the total hours worked (2,668.5) were divided by (190.5) one man equivalent. Thus, the actual number of men used in the association for the month of November was fourteen. The number of man equivalents, in this case 14, was then applied in the percentage breakdown between departments and the various phases of activity, i.e., 14 man equivalents times 11.19 percent observed in elevator department (Appendix Table V) equals 1.6 men (Table IX) used per day for the month of November.

Labor Input and Variability

In this section, labor input and variability for department was measured and for each category of activity a reflection of stability or rigidity was presented. Management was undoubtedly aware of cyclic

variations and "peak load" periods in each of the departmental operations existing, but because of the lack of quantitative measures it was difficult to gauge the actual degree of variation. In many cases, management was aware that excess personnel were being employed. But, in absence of specific knowledge, there was a natural reluctance to lay off employees who might have to be rehired almost immediately.

In many instances, the end of the production period or other similar regularly occurring events tended to obscure the problems of provision of proper personnel level. Management knew that these situations existed; the problem was to measure the effect.

The empirical evidence compiled enables measurement of variations and rigidities in the labor inputs. For each category or element of activity a reflection of stability or rigidity over the fiscal year of 1960-61 is presented (Table VIII). The percentage of time spent performing each activity was arrived at by work sampling technique, then converted to man-equivalents. The standard deviation was calculated then divided by the mean to determine the coefficient of variation, which was used as an indicator of the variability of the elements of activity.[4]

As indicated by the coefficient of variation the elements of activity that were related to the harvest period tended to be the least stable. For example, wheat activities, which included coopering, positioning cars, testing grain, had a coefficient of variation of 203.38 percent. Weighing, cleaning and the unloading of grain had coefficients of 157.59 percent, 114.47 percent, and 99.13 percent, respectively.

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[4]The coefficient of variation (standard deviation divided by the mean) can be used as an index of the degree of variability.

TABLE VIII

STABILITY OF LABOR USAGE FOR ELEMENTS OF ACTIVITY FOR THE FISCAL YEAR 1960-61, RANKED ACCORDING TO AMOUNT OF VARIATION (VALUES EXPRESSED AS MAN-EQUIVALENTS PER MONTH)

Element of Activity	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Mean	Coefficient of Variation
														Percent
Wheat Activities	.1	.2	-	-	-	-	.9	1.2	-	-	-	-	.20	203.38
Other	.2	-	-	-	-	-	-	-	.8	.2	1.3	.8	.28	160.48
Weighing	.2	.4	.4	.3	.2	-	.1	2.0	.2	-	.1	.2	.34	157.59
Cleaning Grain	-	-	-	-	.1	-	.1	.2	.1	.4	.2	.2	.11	114.47
Dumping-Unloading	.9	1.1	.7	1.3	1.0	.2	.9	4.7	.2	.3	2.0	1.4	1.23	99.13
Rearranging or Replacing	.9	1.2	1.1	1.1	.4	.2	.5	.2	.3	.4	-	.1	.53	80.08
Idle Time	.5	-	.1	.1	.8	.6	.8	1.3	1.3	1.2	1.4	1.5	.80	68.05
Turning Grain	.7	.8	.9	.5	-	.2	-	.4	.7	.5	.3	.7	.48	63.56
Loading Out	1.7	1.3	1.8	1.2	.6	.8	.5	1.2	.8	.4	3.0	2.2	1.29	59.83
Supervisory	.6	.6	.5	.4	.1	.3	.4	.9	1.4	.8	.6	.7	.6	54.50
Delivery or Pickup	.4	-	.8	.9	1.0	.7	1.2	.5	.8	.5	.9	1.6	.78	52.81
Preparing Feed	2.0	2.0	1.3	1.0	.7	1.0	.8	.4	1.7	1.2	1.5	3.0	1.38	51.56
Repair, Maintenance	.8	1.0	.9	.9	1.8	1.4	1.3	.8	.5	2.0	.7	.7	1.07	43.49
Cleaning Up	.8	.7	.6	.3	1.0	1.4	.3	.6	.6	.9	1.1	.7	.75	42.35
Sacking and Sewing	.7	.9	.8	.5	.6	.5	.6	.3	.7	.5	.4	.9	.62	30.79
Waiting on Customers	.7	1.3	1.2	1.1	.9	1.0	1.0	1.0	.7	.4	.6	1.0	.91	28.73
Office Work	2.8	3.1	2.3	2.3	3.1	2.3	2.5	3.8	4.6	3.1	2.8	2.8	2.96	22.90
Total	14.0	14.6	13.4	11.9	12.3	10.6	11.9	19.5	15.4	12.8	16.9	18.5	14.32	19.43

The element of activity classified as "other" also listed a relatively high coefficient of variation. This was primarily due to the nature of the element which was made up of general yard policing and fire maintenance, both of which call for increased activity during the summer months.

Office work was by far the most stable element of activity listed, as shown by the coefficient of variation of 22.90 percent. The increase in number of personnel in July (4.6) from June (3.8) was probably the result of heightened activity related to the harvest period.

The amount of idle time showed a sharp increase beginning in June and continued at a rather high level through October. Although a superficial indicant, this suggest that excess personnel were employed through these months. Attention should be called to the amount of time that was spent for cleaning up. A considerable portion of this type of work was frequently unnecessary and was only a menas by which workers kept themselves busy when higher priority work was not available.

Table IX shows the labor input distribution between departments and variability of this labor during the fiscal year November, 1960 to October, 1961. The percentage of time spent in each department was determined by the work sampling technique and then converted into man-equivalents, as discussed previously.

The coefficient of variation was calculated for the labor usage in each department as well as total labor usage in the entire association to determine the percentage variability. In addition, a frequency distribution of labor variability for each department, expressed as percentage deviations from the mean, was constructed to depict graphically the seasonal or cyclic fluctuation.

TABLE IX

LABOR INPUT DISTRIBUTION AND VARIABILITY OVER TIME FOR INDIVIDUAL DEPARTMENTS, VALUES EXPRESSED AS MAN-EQUIVALENTS (NOVEMBER 1960 - OCTOBER 1961)

Department	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Mean	Coefficient of Variation
														Percent
Other	-	-	-	.4	-	-	.6	-	.1	.6	-	.5	.18	141.16
Elevator	1.6	1.8	2.1	1.4	1.0	.8	1.3	11.0	1.6	1.2	1.2	1.8	2.23	124.71
Fertilizer	.8	.3	.4	1.7	1.5	1.1	.9	.7	.5	.5	6.2	2.7	1.44	114.22
Feed	6.7	6.3	5.6	3.9	4.1	3.7	4.3	2.0	6.6	5.0	5.5	8.6	5.19	33.60
Farm Supply	1.2	1.9	1.8	.8	.8	1.0	1.2	1.0	1.0	1.7	.5	1.1	1.17	36.79
Office	3.7	4.3	3.5	3.7	4.9	4.0	3.6	4.8	5.6	3.8	3.5	3.8	4.1	16.28
Total	14.0	14.6	13.4	11.9	12.3	10.6	11.9	19.5	15.4	12.8	16.9	18.5	14.32	19.43

Excluding the findings of department F (other) which were not statistically significant, variability was greatest for the elevator department. However, the fertilizer department also shows great variability. This variability, as depicted graphically in Figure 8, was primarily the result of the seasonal production associated with the respective department. The elevator department labor usage varied from .8 men in April to the seasonal peak of 11 men in June (the harvest period); the mean was 2.23 men. As illustrated in Figure 8, the number of men working in the elevator department was less than the mean in all months except June.

The number of men working in the fertilizer department increased in February and March to 1.7 and 1.5, respectively, then declined until September, when the number of men working reached a high of 6.2.

The farm supply department and the feed department appeared to be relatively stable, as indicated by the coefficients of variation of 36.79 and 33.60 percent. The farm supply operation showed a slight increase in labor usage in December and January, then remained fairly constant through the following months, until August when the number of men working increased to 1.7. This increase was most likely a result of the post-harvest period lag associated with the elevator department.

The feed department's labor utilization decreased from 6.7 men in November to the seasonal low of two in June, during wheat harvest, then increased sharply to 6.6 men immediately following harvest in July. There was a slight decline in August and September then an increase in October to the seasonal high of 8.6 men. This increase was largely attributed to the increase of grain cleaning and treating. The office labor usage was comparatively stable over the entire fiscal year. There was, however, a slight increase in numbers of personnel during the post-harvest period.

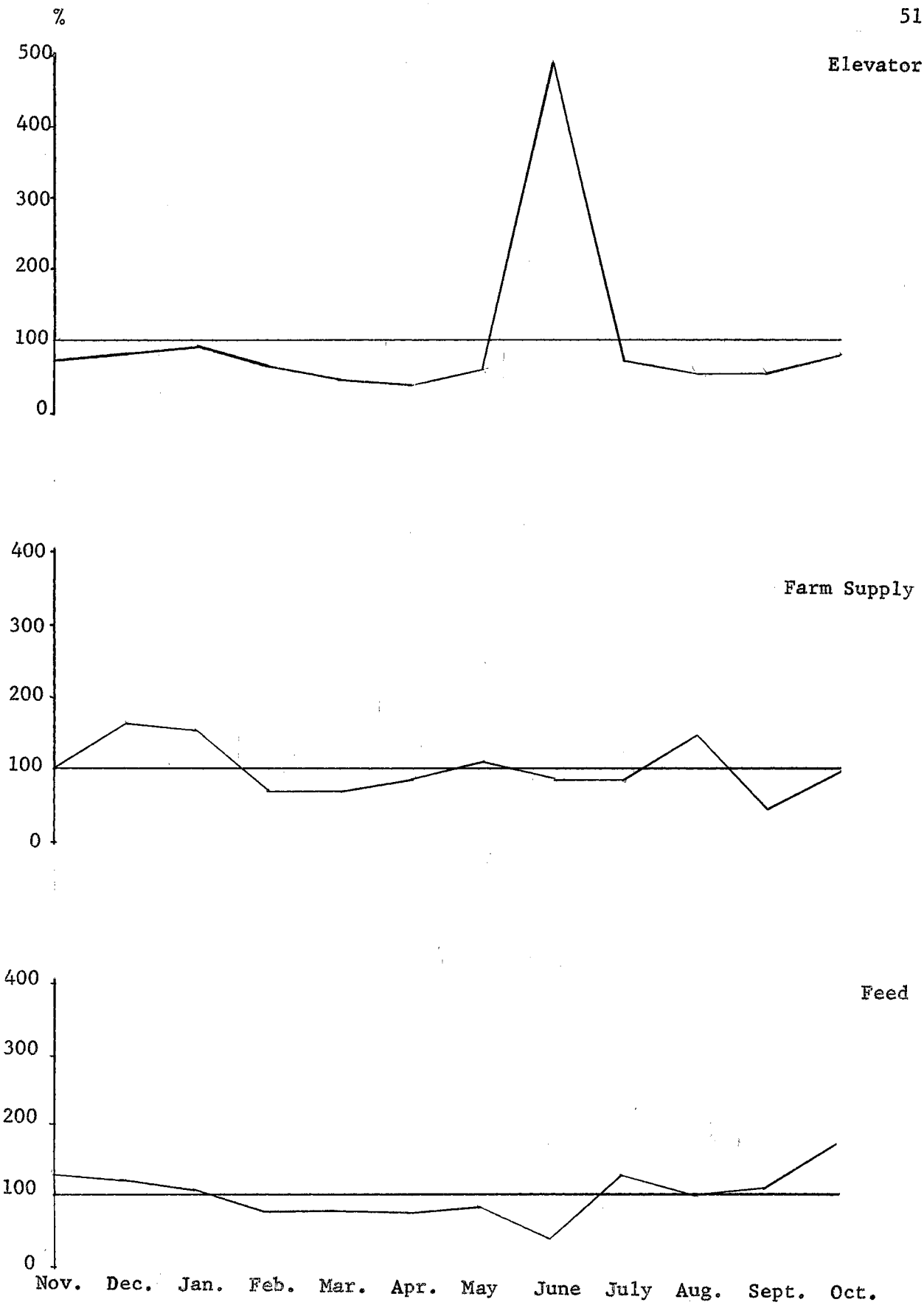

Figure 8. Labor Variability for Departments, Frequency Distribution of Monthly Labor Inputs Expressed as Percentage Deviation from Mean

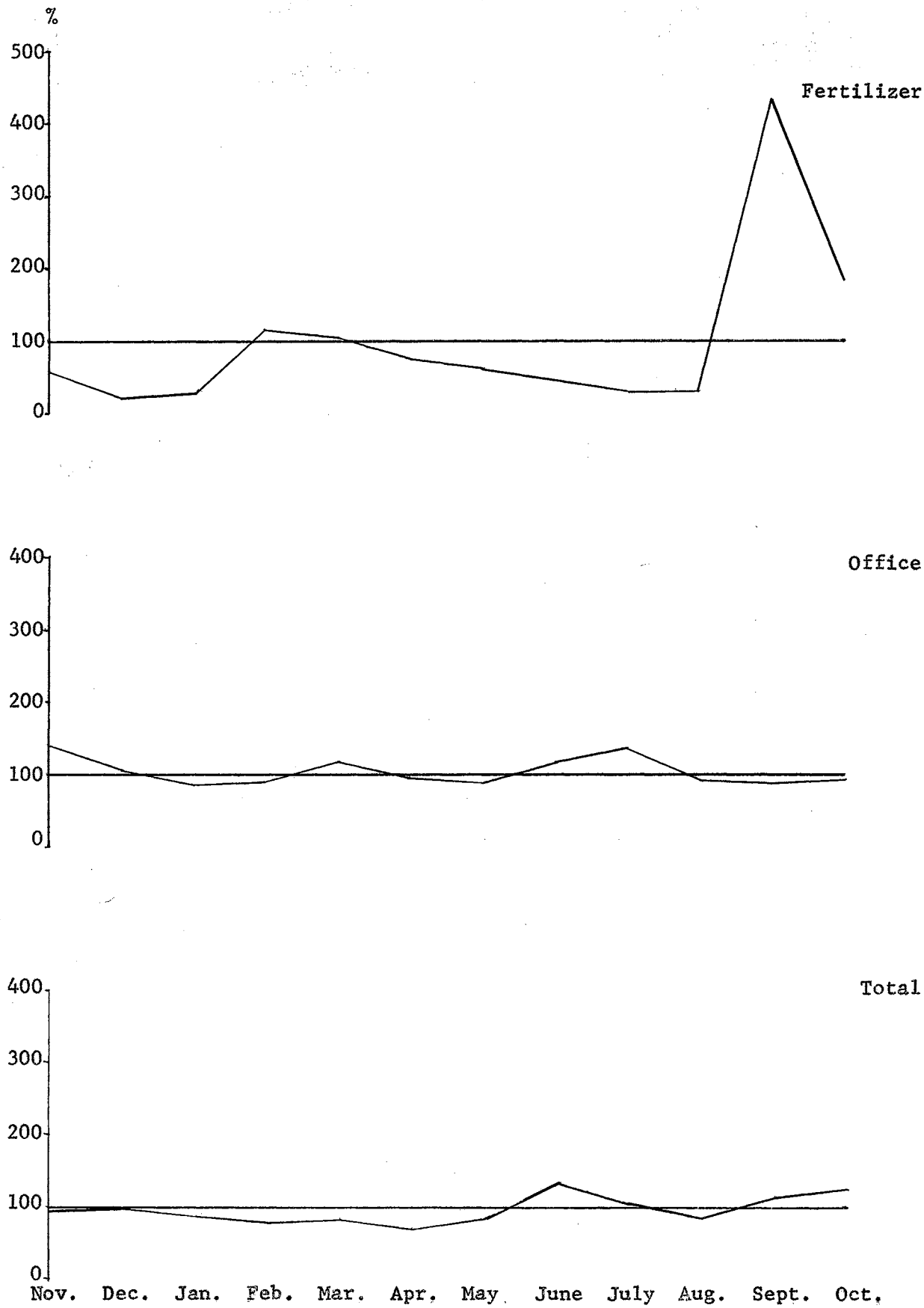

Figure 8. Labor Variability for Departments, Frequency Distribution of Monthly Labor Inputs Expressed as Percentage Deviation from Mean

This was primarily due to the increase in activity of payments, receipts, and other transactions for grain that was received during the harvest period.

The data indicated that the number of personnel utilized by each individual department was subject to a large degree of variation within the department, but, was relatively stable for the entire association. It appeared that this situation was a result of offsetting high and low fluctuations in the activity in the various departments. Thus, a relatively stable personnel level was achieved.

While labor is commonly viewed as variable with volume, both operating conditions and employee relationship consideration may cause direct labor to be fixed in part. As an example of the first, the number of employees needed to operate certain types of equipment does not change when output of the equipment is varied. Hence, if the unit in question is operated at all, a crew of definite size must be on hand. An example of the second is found in the practice of keeping employees on the payroll through temporary periods of low volume when difficulty in securing sufficient labor to meet the needs of high volume period is anticipated. In general, two alternatives are available and management tends to choose the one which promises the smaller total cost over the period of time considered. These alternatives are, first, to control labor cost with volume and to accept the offsetting costs of obtaining flexibility (e.g., dismissal, rehiring, retraining cost and cost resulting from effect of uncertain employment on employee morale, etc.) or second to keep labor force intact despite the fact that a full load of productive work may be lacking at times.

Summary

In the work sampling study of employee activity, the feed department accounted for approximately 36 percent of the personnel utilization, office about 29 percent, and elevator about 14 percent. The fertilizer department was responsible for approximately 10 percent and farm supply for about 8 percent of the personnel utilization.

Large variations in personnel requirements, in some departments, were indicated by the coefficient of variation. Variation in the elevator and fertilizer departments was especially large. However, even though the data indicated that the number of personnel utilized by individual departments was subject to a large degree of variation within the department, the number of personnel utilized by the entire association was relatively stable because of offsetting "peak load" periods among departments.

The amount of idle time increased markedly in June and continued at a high level through October. Although a superficial indicant, it suggests that excess personnel were employed through these months.

CHAPTER VI

FIXITY GRADIENT ANALYSIS

While there are many factors which bring changes in cost, volume of activity is one of the most significant causal factors in cost variation. The techniques for analyzing the relationships between volume and cost are numerous, but few techniques measure effects on the size and nature of the cost over periods longer than the initial production period. To estimate production cost characteristics under varying production conditions, Larson developed the fixity gradient; a method by which fixity of cost can be measured. "It provides a means of showing the flexibility of a firm in expansion and contraction, the elasticity of cost over periods of varying lengths of time, and an approximation of cost under future operating conditions."[1] An understanding of such cost-volume relationships enable entrepreneurs to determine their objectives on a realistic basis and with some assurance that these objectives will be obtained. This is accomplished through improved planning and improved control which are made possible when factual information about behavior of cost factors under conditions of changing volume is available.

Larson defines the major uses which can be made of the fixity gradient as an aid to management in planning the future operations of a firm as the following:[2]

(1) It aids in showing the rigidity of cost in a future production period, and in suggesting a possibility of cost adjustment.

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[1]Adlowe L. Larson, "The Fixity Gradient: A Tool for Fixed and Variable Cost Analysis," Journal of Farm Economics, August, 1946, p. 826.

[2]Larson, p. 834.

(2) With a given set of conditions and cost, it makes possible approximations of cost under future operating conditions.

(3) The curve shows that the fixed and variable shares of cost are a schedule just as supply may be represented by a schedule.

(4) The gradient helps explain why a firm may or may not hesitate to make a heavy long-term fixed investment because of the uncertainty of the future--in terms of the market and related conditions.

(5) It may act as a guide to a firm that wants to keep its cost within a given flexibility range--to keep its curve below a certain maximum or norm curve which may vary with business conditions.

Categories of Cost

An unequivocal distinction between variable costs (which vary with volume) and fixed costs (which remain fixed in amount when volume fluctuates) is extremely difficult to make because of their mixed characteristics.[3] Some part of a cost item might be relatively fixed, some intermediate, and some relatively variable.[4] The relative degree of fixity or variability of specific cost items is dependent upon specific assumptions set forth. The classification of cost into categories of fixed and variable must be made in any study of cost-volume relationships. To make this classification, conditions of plant and equipment to be employed, prices paid for factors, and managerial policies with respect to maintenance of the organization must be known. These conditions are always subject to change and the cost classification must be revised when underlying factors do change. Stigler[5] states, "Normally the individual elements of plant will be fixed for a whole array of periods. The longer the short-run

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[3]Unless otherwise specified, discussion of the relationship between volume and cost assumes that other influences on cost, excluding time, are inoperative--in Marshallian terms--Ceteris Paribus.

[4]Larson, p. 831.

[5]G. J. Stigler, The Theory of Competitive Price, New York: Macmillan, 1942, p. 170.

period, the greater will be the number of costs that become variable. Any particular classification of cost between fixed and variable is valid only for one specified time period." Moreover, it is recognized that most costs do not vary simply because of volume variability. Rather, changes in volume, while being an initial casual factor, lead management to make certain decisions which influence cost. Thus, when it is stated that costs vary with volume, it is assumed that such variation results from the nature of cost or from entrepreneurial decisions which affect the activities underlying the cost.

Fixed Cost

An entrepreneur makes commitments in relation to the level of output which he expects. In order to carry on a merchandising and storage operation it is necessary to have buildings, equipment, and an organization. Some of these facilities must be acquired and kept in a state of readiness more or less regardless of volume handled at present, for once the entrepreneur has committed himself to expenses appropriate to some level, he finds that some of his commitments cannot be altered rapidly even if volume contracts or expands permanently to some given level.

On the other hand, there are certain factors of production (e.g., supplies, some labor and services) which need not be used unless some level of volume is actually being handled. It is thus evident that fixed costs originate principally from the initial provision of capacity to do business while variable costs represent the additional cost of utilizing the capacity for merchandising and storage.

Costs are not inherently fixed but acquire this characterisitc as a result of commitments to contracts and certain policies established by the management and the board of directors.

Acquiring long-lived assets or commitments to long term contracts for the use of facilities for handling and storage result in recurring cash outlays[6] and charges to amortize earlier expenditure (e.g., depreciation). Ordinarily these fixed items are the least controllable of any cost items in the fixed category, in terms of contraction, for once permanent assets have been acquired the commitment usually cannot quickly be altered or modified without substantial loss. Many of these costs still remain in amount even when the activity is completely suspended and the association is "shut down". Nevertheless, such fixed cost can be materially changed over a period of time by managerial control over additional commitments, retirements and replacements. If the circumstances warrant such action, facilities can be sold or depreciated out, contracts can be discharged, transferred or temporarily continued until expiration, tax revisions can be negotiated, etc. In a sense every fixed cost is variable at some time; as time is allowed to approach infinify complete variability of cost is approached.[7]

If the association is to remain a going concern, management and employees as well as permanent facilities are required. Hence, an association must maintain an organization of some size, even if it is not fully utilized in the present period. Retention of at least a minimum number of personnel on the payroll constitutes a source of fixed cost. Portions of this cost are fixed only within a limited range of volume and a relative shorter time than permanent assets (e.g., cost attributed to unskilled labor). However, key employees (e.g., manager, skilled operators) must be retained for longer periods of time if the association is to remain

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[6] Certain taxes, of which local property taxes are typical, are usually independent of output, and are of increasing importance in the cost structure.

[7] Larson, p. 828.

a going concern, their fixity may be greater than for facilities. Substantial reductions in activity ordinarily bring some adjustments in numbers of managerial and key employees and also in wage and salary scales, although the change in cost may not be in proportion to the change in activity because of the indivisibility of these costs.

Another area of fixed cost is the expenditures incurred to maintain present or to obtain future volume (e.g., good will, advertising, educational programs, dues and subscriptions, etc.). These expenditures are not necessarily correlated to volume during short periods of run. Cost of this nature can be reduced or eliminated within the production period when the problem is one of short period survival. However, when management embarks upon such a policy it must be aware that such action is a form of borrowing from the future.[8]

There is nothing in a cost itself that makes it variable or fixed; it is the period of time in relation to use of the factors and specific policy decisions by the management that give rise to the distinction. The concept of fixed cost has definiteness and practical significance only under specified conditions. They cannot be considered as being "just fixed" without some reference to some particular standard or benchmark.[9]

Variable Cost

In addition to the costs associated with the productive facilities which are provided and kept in readiness more or less without regard to

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[8]Management may be unwilling to cut these costs because the long-run marginal prospective may be greater than the cost even though at the moment volume may be relatively small.

[9]Larson, p. 827.

the actual volume of activity at a given time, there also are factors of cost which are provided in a quantity related to the volume of activity. Among these costs are usually some types of labor, supplies, and services. The cost of these factors tend to vary with volume, but not necessarily proportionately, in contract to fixed cost which remain constant in total amount when volume fluctuates within a limited range.[10] These costs that tend to increase or decrease with volume fluctuations are defined as variable cost.

Fixity of Cost as Related to Time

The actual costs incurred in the 1961 fiscal year are presented in Table X to demonstrate how the fixity gradient of the association was determined. The percentage of the cost considered fixed was estimated for each of the time periods at the current rate of volume handled.[11] The dollar values appearing in the table are the annual rates for the period indicated. Thus, for one week the fixed cost is at an annual rate of $48,463.95 compared to the total annual cost of $52,288.25.

For a period of time when the length of time approaches zero, a period of time so short that no cost item could be varied in amount, all costs are fixed as there is no opportunity for change. As the time period under consideration is lengthened, it becomes possible to vary the quantity of one cost item. As the time period is progressively lengthened the costs become increasingly variable in amount until ultimately they all fall into the variable category.

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[10] Because of the nature of some cost items, costs may increase as increasing or decreasing rates relative to volume (e.g., repairs on machines).

[11] It was estimated from the annual audit and the association records that approximately 1,000,000 wheat bushels equivalent were handled in the fiscal year November, 1960 to October, 1961.

TABLE X

CALCULATED FIXITY OF COST FOR THE ASSOCIATION ACCORDING TO TIME PERIODS
(COST BASED ON 1960-61 FISCAL YEAR)

Cost Item	Total	1 Week	3 Months	6 Months	1 Year	3 Years	5 Years	10 Years	10 Years Plus[3]
					Dollars[2]				
Salaries	1,965.62	1,965.62 (100)[1]	1,965.62 (100)	1,965.62 (100)	1,965.62 (100)	1,965.62 (100)	1,572.49 (80)	1,572.49 (80)	1,572.49 (80)
Wages	9,038.54	6,778.91 (75)	4,067.34 (45)	4,067.34 (45)	4,067.34 (45)	4,067.34 (45)	3,163.49 (35)	1,807.71 (20)	1,807.71 (20)
Advertising	35.05	35.05 (100)	35.05 (100)	31.55 (90)	17.53 (50)	0 (0)	0 (0)	0 (0)	0 (0)
Auditing & Legal	253.09	253.09 (100)	253.09 (100)	253.09 (100)	253.09 (100)	253.09 (100)	126.55 (50)	126.55 (50)	126.55 (50)
Dues & Subscriptions	142.22	142.22 (100)	142.22 (100)	142.22 (100)	142.22 (100)	0 (0)	0 (0)	0 (0)	0 (0)
Employees Insurance	14.59	11.38 (78)	7.59 (52)	7.59 (52)	7.59 (52)	7.59 (52)	6.27 (43)	4.52 (31)	4.52 (31)
Employees Retirement	147.12	114.75 (78)	76.50 (52)	76.50 (52)	76.50 (52)	76.50 (52)	63.26 (43)	45.61 (31)	45.61 (31)
General Expenses	40.30	10.08 (25)	10.08 (25)	10.08 (25)	10.08 (25)	10.08 (25)	10.08 (25)	10.08 (25)	10.08 (25)
Goodwill Expenses	673.09	673.09 (100)	673.09 (100)	673.09 (100)	673.09 (100)	0 (0)	0 (0)	0 (0)	0 (0)
Insurance & Bonds	1,122.04	1,122.04 (100)	1,122.04 (100)	1,122.04 (100)	493.70 (44)	381.49 (34)	0 (0)	0 (0)	0 (0)
Inventory Expenses	427.85	427.85 (100)	427.85 (100)	427.85 (100)	427.85 (100)	213.92 (50)	213.92 (50)	0 (0)	0 (0)
Janitor Supplies	67.33	67.33 (100)	67.33 (100)	67.33 (100)	67.33 (100)	67.33 (100)	67.33 (100)	6.73 (10)	6.73 (10)

(Continued)

TABLE X (Continued)

Cost Item	Total	1 Week	3 Months	6 Months	1 Year	3 Years	5 Years	10 Years	10 Years Plus[3]
					Dollars[2]				
Leases & Rentals	54.07	54.07	54.07	54.07	54.07	54.07	54.07	54.07	54.07
		(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)
Office Supplies	377.54	377.54	377.54	188.77	188.77	37.75	37.75	18.88	18.88
		(100)	(100)	(50)	(50)	(10)	(10)	(5)	(5)
Office Machine Maintenance	102.24	102.24	102.24	102.24	102.24	10.22	10.22	10.22	10.22
		(100)	(100)	(100)	(100)	(10)	(10)	(10)	(10)
Plant Supplies	1,940.08	1,940.08	1,940.08	970.04	970.04	194.01	97.00	0	0
		(100)	(100)	(50)	(50)	(10)	(5)	(0)	(0)
Propane	121.53	121.53	121.53	121.53	121.53	121.53	121.53	121.53	121.53
		(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)
Repair Elevator	1,205.42	1,084.88	180.81	180.81	180.81	180.81	180.81	180.81	180.81
		(90)	(15)	(15)	(15)	(15)	(15)	(15)	(15)
Rodent Extermination	43.56	43.56	26.14	17.42	17.42	4.36	4.36	4.36	4.36
		(100)	(60)	(40)	(40)	(10)	(10)	(10)	(10)
Scales & Warehouse	185.55	185.55	185.55	185.55	185.55	92.78	92.78	0	0
		(100)	(100)	(100)	(100)	(50)	(50)	(0)	(0)
Telephone & Telegraph	181.64	136.23	45.41	45.41	45.41	45.41	45.41	18.16	18.16
		(75)	(25)	(25)	(25)	(25)	(25)	(10)	(10)
Travel	293.08	73.27	73.27	73.27	73.27	73.27	29.31	0	0
		(25)	(25)	(25)	(25)	(25)	(10)	(0)	(0)
Truck Expenses	149.88	134.89	14.99	14.99	14.99	14.99	14.99	0	0
		(90)	(10)	(10)	(10)	(10)	(10)	(0)	(0)
Utilities	1,862.58	1,862.58	93.13	93.13	93.13	93.13	93.13	93.13	93.13
		(100)	(5)	(5)	(5)	(5)	(5)	(5)	(5)
Wheat Expenses	931.72	0	0	0	0	0	0	0	0
		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Yard Improvements	259.13	194.35	64.78	64.78	64.78	64.78	64.78	25.91	0
		(75)	(25)	(25)	(25)	(25)	(25)	(10)	(0)

(Continued)

TABLE X (Continued)

Cost Item	Total	1 Week	3 Months	6 Months	1 Year	3 Years	5 Years	10 Years	10 Years Plus[3]
					Dollars[2]				
Ad Valorem Tax	2,204.78	2,204.78 (100)	2,204.78 (100)	2,204.78 (100)	2,204.78 (100)	1,984.30 (90)	1,984.30 (90)	1,984.30 (90)	1,984.30 (90)
Franchise Tax	367.20	367.20 (100)	367.20 (100)	367.20 (100)	367.20 (100)	367.20 (100)	367.20 (100)	367.20 (100)	367.20 (100)
Payroll Taxes	461.93	360.31 (78)	240.20 (52)	240.20 (52)	240.20 (52)	240.20 (52)	198.62 (43)	143.20 (31)	143.20 (31)
Truck Licenses	17.35	17.35 (100)	17.35 (100)	17.35 (100)	17.35 (100)	17.35 (100)	17.35 (100)	0 (0)	0 (0)
Interest Expenses									
Operating	3,756.83	3,756.83 (100)	3,756.83 (100)	3,756.83 (100)	3,756.83 (100)	1,878.41 (50)	375.68 (10)	375.68 (10)	375.68 (10)
Commodity	3,300.03	3,300.03 (100)	1,650.15 (50)	1,650.15 (50)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Facility	10,474.10	10,474.10 (100)	10,474.10 (100)	10,474.10 (100)	10,474.10 (100)	10,474.10 (100)	10,474.10 (100)	10,474.10 (100)	0 (0)
Director Fees	253.76	253.76 (100)	253.76 (100)	253.76 (100)	253.76 (100)	253.76 (100)	253.76 (100)	253.76 (100)	253.76 (100)
Depreciation	9,817.41	9,817.41 (100)	9,817.41 (100)	9,817.41 (100)	9,817.41 (100)	9,817.41 (100)	9,817.41 (100)	9,817.41 (100)	0 (0)
Total	52,288.25	48,463.95	41,008.85	39,837.82	37,445.58	33,062.80	29,557.95	27,149.21	7,198.99
Percent Fixed		(92.69)	(78.43)	(76.18)	(71.61)	(63.23)	(56.53)	(51.92)	(13.77)

[1]Number in parenthesis is percentage fixed.

[2]Calculated at the annual rate (the figures are annual rates for the periods shown).

[3]Assuming that all facilities are depreciated out and no new facilities were purchased.

Source: Annual audits of association and estimates of manager.

For example, when the period of three months was used, salaries were calculated to be 100 percent fixed for the period because management was necessary for the association to operate and would be retained even though volume might be lowered. Wages were estimated to be 45 percent fixed as seasonal labor could be dropped without notice. Advertising was determined to be 100 percent fixed for the period of three months because of the policy of the association contracting approximately six months to one year in advance for its advertising material. Auditing and legal expenses were also considered to be 100 percent fixed because of the necessity of the annual audit. Dues and subscriptions expenses were incurred on an annual basis and were consequently 100 percent fixed for the period of three months. Employees insurance and employees retirement were directly related to salaries and wages paid and were estimated to be 52 percent fixed for the period. General expense was determined to be 25 percent fixed for the cost was comprised of minor miscellaneious items purchased arbitrarily. Goodwill, insurance and bonds, inventory, janitor supplies, leases and rentals, office supplies, office machine maintenance, plant supply, propane, rodent extermination and scales and warehouse inspection were all rated as being 100 percent fixed for the period of three months. Contracts and commitments for these goods and services were usually made for a period of six months or more. Telephone and telegraph costs were listed as being 25 percent fixed for a large share of the communications was related to volume handled. General maintenance was required to keep trucks in operating condition; this amount was calculated to be 10 percent. Utilities were wholly variable with volume except for the 5 percent which was required for lighting the facilities. Wheat expense (miscellaneous

expenses incurred during harvest) was the most variable cost listed, being entirely variable for the three month period. Ad valorem and franchise tax, definitely the most rigid costs indicated, were entirely fixed for the period. As a result of indivisibility, truck licenses were listed as 100 percent fixed. Interest expense was divided into three categories; operating and facility interest being 100 percent fixed for the period of three months while commodity interest was considered to be 50 percent variable because of its direct relationship to volume handled. Director fees were rated as being 100 percent fixed for this expense was not directly related to volume. Depreciation was definitely 100 percent fixed for the period of three months. Fixed costs amounted to 78 percent of all costs for the three month period.

As the period of time was lengthened the opportunity for change was increased. By extending the time period to one year, the amount of fixed cost decreased to 72 percent. Most of the decrease below the three month period was attributed to the commodity interest expense which dropped from 50 percent to 0 percent during the interval between the time periods. As the period of time was increasingly extended to three years, five years and ten years the amount fixed cost declines to 63 percent, 57 percent and 52 percent, respectively.

If the period of time is lengthened beyond 10 years the percentage of fixed cost drops sharply to 14 percent. This fall in fixed expenditures is primarily due to the accelerated depreciation write-offs and the accompanying interest charges on the physical facilities. This decline in depreciation and interest cost is valid only if no new facilities are acquired in the preceding periods. If the facilities actually depreciated fully in the 10 years, new facilities would be required. However, in most

instances the facilities would not actually be fully depreciated even though the book value would indicate so.

If time were further lengthened, the association could be liquidated and all costs would cease, thus becoming completely variable. This points up the fact, that as the time period is allowed to approach infinity complete variability of cost is approached.

The fixity gradient curve was derived by connecting the points showing the percentage of costs which were fixed (Figure 9). The percentage of costs which were fixed tend to decline rapidly in the immediate time periods and then taper off gradually to the ten year plus period where the percentage of the costs fixed drops abruptly to 14 percent. Then, if the period was extended further, fixity of the cost would continue to decline slowly until complete variability would ultimately be reached.

Influence of Decreasing Volume on Cost

Long-run problems center primarily around those costs which are fixed for shorter periods, but which are variable with volume over a longer period of time. As previously mentioned, such costs are largely those connected with the provision of long-lived assets, contractual arrangements, etc. The purpose of this cost-volume analysis is to study the probable effects on cost, over a period of time long enough to allow the opportunity of change in fixed cost, if volume reductions become a reality.

The association's volume may decline because of newly instigated government programs, unfavorable climatic conditions or a decline in the firms competitive position. The volume may also drop as a result of seasonal variation or an imposition of a new type of quality standard.

If the association's volume declines over an extended period, management must look for ways to ferret out inefficiencies and to curtail cost.

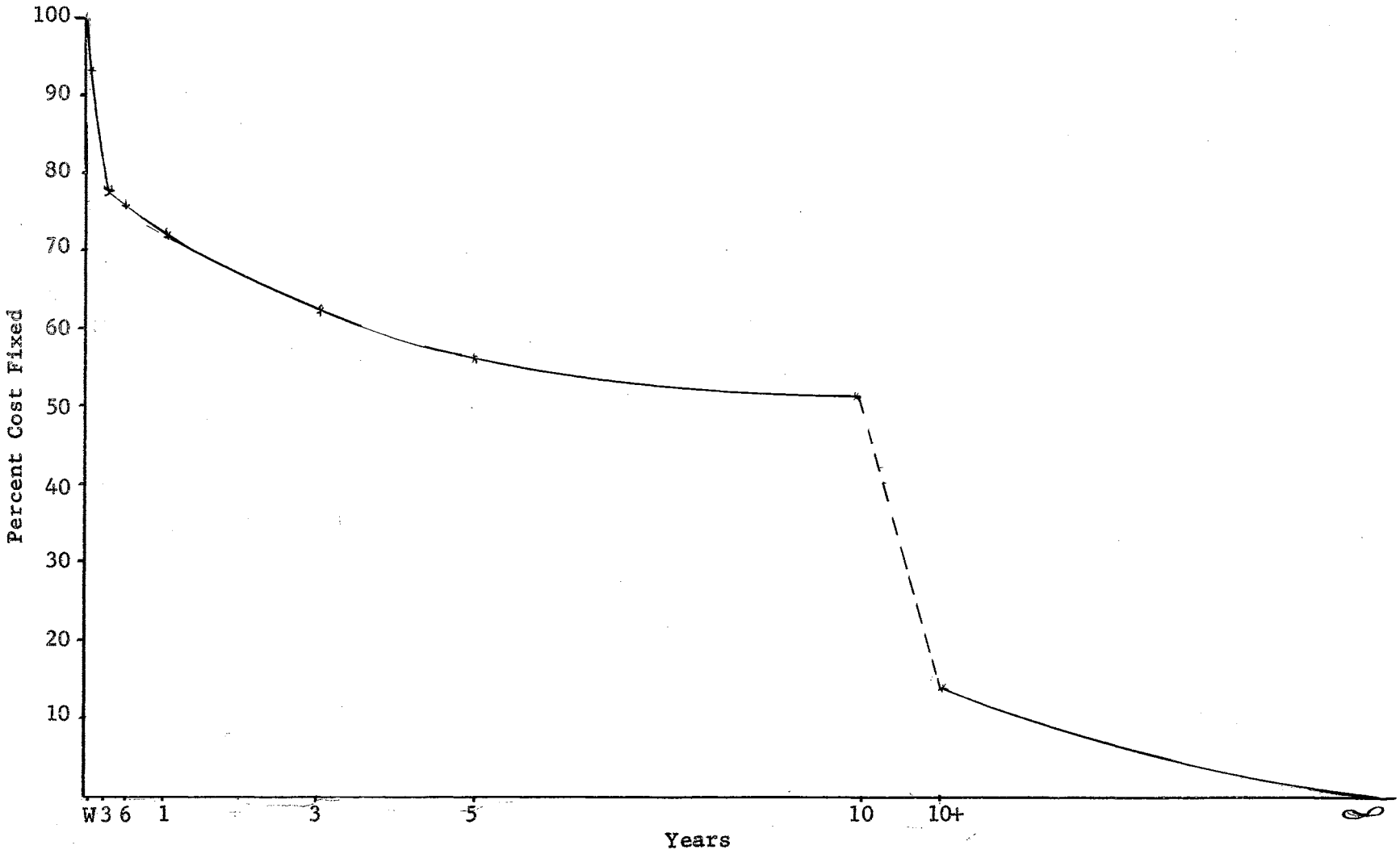

Figure 9. Calculated Fixity Gradient of Cost for the Association in Table X

The method management uses to achieve a downward adjustment depends upon the certainty and magnitude of the decline in volume. The method selected for curtailing cost also depends on the outlays for supply inventories, divisibility of the plant, extent which skilled workers are employed, and the reduction obtainable by alternative methods of curtailing cost.

If the management is not certain the shrinkage in volume will persist, it should generally eliminate overtime work or decrease the number of hours worked per week. The cutting back of working hours is generally the fastest and the most flexible method for adjusting labor input, and it minimizes the disruption of the trained work force. The firm may cut back on its outlays for advertising, goodwill, and promotional activities. In addition, management can postpone the replacement of equipment and reduce supply inventories. If volume persists at a constant low level or is expected to decline further, management must seek methods for further manipulation and curtailment of certain cost. Facilities may be sold or depreciated out; contracts may be discharged or temporarily suspended until expiration; and tax revisions may be negotiated if time period is long enough to allow the opportunity for these changes.

When a firm curtails cost by laying off workers and shuts down portions of the facilities, it reduces the variable cost of the operation, but it must cover the fixed cost. As pointed out earlier in the text, fixed costs become variable if management is allowed sufficient time to effect its decisions of reducing these costs.

Retrenchment in volume of activity involves not merely a curtailment in variable costs but a reallocation of work loads and costs among various operating units. The reallocation of work and a rise in the costs of some units may partially offset the reduction of variable costs in the

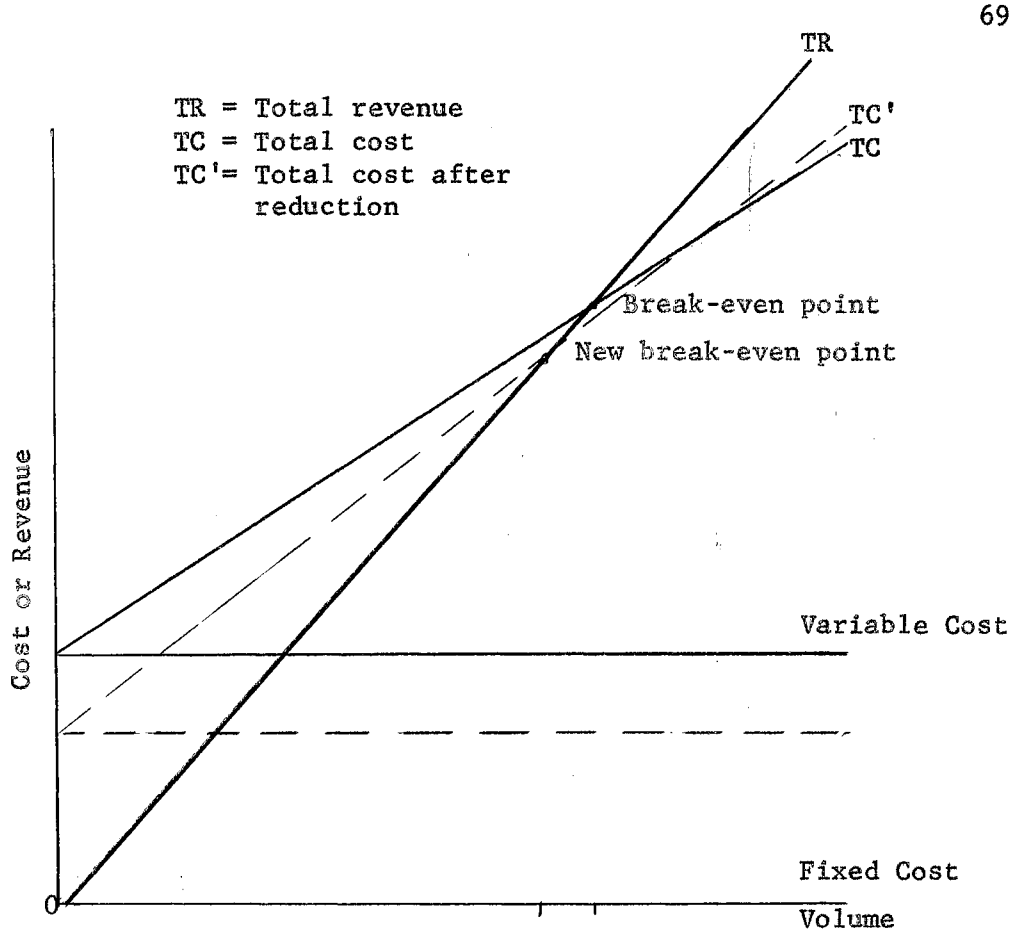

Figure 10. Break-Even Chart Showing How a Reduction in Fixed Cost May Achieve a Lower Break-Even Point

units that have been cut back to lower levels. It is therefore the net effect on the total cost of the operation that is relevant and not just the direct outlays that are avoided.

For a given revenue curve, the relative magnitude of fixed cost and the ratio of fixed to variable cost determined the volume at which a firm breaks even. As illustrated in Figure 10, a firm that can reduce its fixed cost, may achieve a lower break-even point which would enable the firm to operate at a decreased level of volume.

As the association's volume declines, it would lose revenue from its operation. Its losses in revenue may be relatively greater than the shrinkage in the volume handled. The association could continue to

operate for some time if its cash receipts covered its minimum current cash expenditures (i.e., its total variable cost) since the association need not make payments on its imputed cost (interest on capital, etc.). But if the firm continued to operate at such a low level of volume, it would eventually fail.

Examples Showing Effects of Decreases in Volume on Costs

In order to portray more clearly the results which fixed costs have on unit costs of the association, three situations are presented. These situations deal with possible results which the management of the association might face in future years. The situations concern:

Situation I: Influence of a 25 percent reduction in volume on cost in designated lengths of run of one year, five years and ten + years allowing management different time periods to effect its decisions on the curtailment of certain cost items.

Situation II: Influence of a 50 percent reduction in volume on cost in designated lengths of run of one year, five years and ten + years.

Situation III: Influence of a 75 percent reduction in volume on cost in designated lengths of run of one year, five years and ten + years.

The illustrations use the following assumptions: (1) The normal volume (approximate capacity) handled was approximately one million bushels and the cost of handling was $52,288.25. (2) Variable costs were divisible and varied proportionately with volume handled, i.e., if volume decreased 10 percent total variable cost could likewise be curtailed by 10 percent.

TABLE XI

INFLUENCE OF VOLUME LEVELS OF 75, 50, AND 25 PERCENT OF NORMAL ON COST, ALLOWING LENGTHS OF RUNS OF ONE YEAR, FIVE YEARS, AND TEN YEARS FOR MANAGEMENT TO ADJUST THESE COSTS

Normal Volume	Normal Capacity			Situation I			Situation II			Situation III		
	100 Percent			75 Percent			50 Percent			25 Percent		
Length of Run	1 Year	5 Years	10+ Years	1 Year	5 Years	10+ Years	1 Year	5 Years	10+ Years	1 Year	5 Years	10+ Years
	Dollars											
Fixed Cost	37,445.58	29,557.95	7,198.99	37,445.58	29,557.95	7,198.99	37,445.58	29,557.95	7,198.99	37,445.58	29,557.95	7,198.99
Variable Cost	14,842.67	22,730.30	45,089.26	11,132.00	17,047.73	18,598.31	7,421.34	11,365.15	12,398.88	3,710.67	5,682.58	6,199.44
Total Cost	52,288.25	52,288.25	52,288.25	48,577.58	46,605.68	25,797.30	44,866.92	40,923.10	19,597.87	41,156.25	35,240.53	13,398.43
Percent Reduction in Total Cost	0	0	0	7.1	10.9	50.7	14.2	21.7	62.5	21.3	32.7	74.4
Units of Volume*	1,000,000			750,000			500,000			250,000		
Average Unit Cost**	.052	.052	.052	.065	.062	.034	.090	.082	.039	.165	.141	.054
Average Unit Fixed Cost**	.037	.030	.007	.050	.039	.009	.075	.059	.014	.150	.118	.029
Average Unit Variable Cost**	.015	.023	.045	.015	.023	.025	.015	.023	.025	.015	.023	.025

*Wheat-bushels-equivalent.

**Per wheat-bushel-equivalent.

(3) Fixed cost could be escaped as prescribed by the fixity gradient (Table X). (4) Prices of factors of production were constant in all time periods. (5) The reductions in volume were considered by management to be permanent.

Situation I

The fixed cost of the association, for the period of one year was estimated to be $37,445.58. With a 25 percent reduction in volume, variable cost dropped proportionately to $11,132.00. Total cost of handling the 750,000 bushels of grain was $48,577.58, a reduction in cost of only 7.1 percent. This was a relatively small decrease compared to the decrease in volume handled. The rather small decrease in cost was attributed to the high fixed cost of the association for the period, thus allowing management little opportunity to curtail cost. The total average unit cost amounted to 6.5 cents, made up of 5 cents of average fixed unit cost and 1.5 cents of average variable unit cost. As the length of run was extended to 5 years and then to 10 years the fixed cost dropped to $29,557.95 and $7,198.99, respectively. Total cost of handling the grain decreases to $46,605.68 and to $25,797.30. For the length of run of 5 years the total reduction in cost amounted to 10.9 percent. When the run was extended to 10 years the total reduction in cost was 50.7 percent, where most of the drop was due to depreciating out of facilities and the discontinuance of accompanying interest charges. The total average unit cost was 6.2 cents in the 5 year period and 3.4 cents in the 10+ year period.

Situation II

In the second situation it was hypothesized that the volume decreased by 50 percent. Variable cost in the one year period was calculated to be

$7,421.34 and total cost was $44,866.92. The total cost of $44,866.92 amounted to a 14.2 percent decrease in the total cost accompanying the 50 percent reduction in total grain handled. For the 500,000 bushels of grain handled the total average unit cost increased to 9 cents per bushel in the one year period.

As the length of run was extended to five years the total cost dropped to $40,923.10. This amounted to a 21.7 percent curtailment in cost compared to the 50 percent retrenchment in volume. The total average unit cost decreased from 9 cents per bushel in the one year period to 8.2 cents per bushel in the five year period. When the length of run was extended to 10+ years the total cost was pared by 62.5 percent. The total average unit cost decreased to 3.9 cents per bushel.

Situation III

With a decrease in volume of 75 percent allowing one year for management to adjust, costs were reduced to $41,156.26 or a percentage decrease of 21.3 percent. The total average unit cost of handling the 250,000 bushels was 16.5 cents; average unit fixed cost was 15 cents and the average unit variable cost of 1.5 accounted for the remainder. As the time period was increased to 5 years in length the total cost declined to $35,240.53 or 32.7 percent of the total cost at the one million bushel level. The total average unit cost decreased, from the time period of one year, to 14.1 cents per bushel. When the management was allowed the period of greater than ten years to curtail the cost, it was able to decrease total cost of handling the 250,000 bushels to $13,398.43, which amounted to a 74.4 percent reduction in total cost. The total average unit cost amounted to 5.4 cents per bushel.

Implications and Summary

If the elevator's volume were to decline, the elevator would lose revenue from its operation. The gross income the association received in the fiscal year 1960-61 for the storage and handling of 1,000,000 wheat bushels equivalent was $107,127.28 or approximately 10.7 cents per bushel. Assuming the losses in gross income were proportional to the shrinkage in the volume handled, the elevator could continue to operate indefinitely if its average total cost did not exceed 10.7 cents per bushel. As indicated by the data, a cut in volume of 75 percent in one year increases average total cost to 16.5 cents, exceeding the average total revenue by 5.8 cents.

The approximate break-even point for 10.7 cents per bushel (i.e., total revenue equal to total cost) would be about 39 percent of normal volume (392,000 wheat bushel equivalent). However, the elevator department could continue to operate for a short period of time if its cash receipts covered its minimum cash expenditures (i.e., its total variable cost), since the association need not make payments on its imputed cost (interest on capital, etc.). But if the elevator department continued to operate at a level below 392,000 bushels, it would eventually fail unless some type of cost curtailment was effected.

However, since much of the association's other operations are being "carried" by the elevator's merchandising and storage income, reductions in volume of grain handled would have a much more serious effect on the rest of the association. In the 1960-61 fiscal year, expenses for departments other than the elevator were $99,144.68 while gross income was $80,910.31. In light of these circumstances, assuming no change in the operations of other departments income-expense wise, the elevator's total

revenue must exceed its own total cost by $18,234.37 for the association to continue as a sound economic unit. This would necessitate that the elevator operation maintain a volume of approximately 562,000 bushels to maintain the entire association's financial solvency and continued operation.

Since the association's cost structure is composed largely of fixed cost, its continued operation depends upon moderately high levels of volume. It is therefore necessary for the association to strive to increase its market share and to improve its competitive position. It may be possible that increased volumes may be accomplished through such methods of competition as advertising and promotion, service to customers, reduction in margins, and possibly the giving of free storage of grain for some periods of the year.

CHAPTER VII

SUMMARY AND CONCLUSIONS

The general objective of this study was to determine the utilization of labor, equipment, and facilities and the cost of this utilization for the association. In addition, it was intended to show the relative rigidity of cost elements under different decision situations.

The facilities of the association have been expanded in the past few years to meet the needs of the ever increasing activity in the surrounding area. The association now operates a feedmill, a service station and bulk distributing service, and has warehouse facilities available for the merchandising of feed, seed, fertilizer and a numerous variety of farm supplies. The elevator has a total storage capacity of 550,000 bushels.

Total assets of the association increased from $635,221.18 in 1959 to $693,164.21 in 1961. The current assets increased from 24 percent to 27 percent of the total assets in the same period, while permanent assets decreased from 57.6 percent to 51.6 percent of the total. Total liabilities increased from $213,237.47 in 1959 to $227,057.63 in 1961. The long-term debts accounted for the major portion of the association's total liabilities. The current ratio (ability to pay current liabilities) indicated that the association could meet its currently maturing obligations without resorting to borrowing. Other financial ratios indicated sizeable investment in fixed assets relative to sales and net worth.

For the 1960-61 fiscal year, total expenses amounted to $151,432.93, while gross income was $188,037.59. The feed department and the elevator

department were responsible for about two-thirds of the total expenses. The elevator and the fertilizer departments showed net savings of $54,839.03 and $2,752.90, respectively, while each of the other departments incurred losses in operation. The elevator department is carrying the rest of the association. The implications of this situation could prove to be far reaching should conditions arise (e.g., decrease in grain receipts) which would reduce the total income to the elevator operation.

An analysis of the labor inputs indicated that the feed department accounted for approximately 36 percent of the personnel utilization, office about 29 percent and the elevator department about 14 percent. Large variations in personnel requirements were indicated in some departments, especially the elevator department and fertilizer departments. However, even though the number of personnel utilized by individual departments was subject to a large degree of variation within the department, the number of personnel utilized by the entire association was relatively stable because of offsetting "peak load" periods among departments. The amount of idle time increased markedly in June and continued at a high level through October. Although a superficial indicant, this suggests that excess personnel were employed through these months.

An analysis of fixity of cost for the elevator operation, in extended time periods, disclosed that more of the cost were fixed than variable. The percentage of cost considered fixed was estimated for each of the time periods at the current rate of volume handled. For the period of one year, 71.61 percent of the cost were fixed, with 28.29 percent of the cost being variable. As the time periods were extended, thus allowing management time to effect certain cost changes, the fixity of the cost declined. The

cost items which caused more of the total cost to be fixed than variable were: depreciation, interest charges, and certain taxes.

Situations were analyzed to show the flexibility of the elevator department in contraction and to approximate cost under future operating conditions. If the elevator's volume declines, it would lose revenue from its operation. The revenue the association received in the fiscal year 1960-61 for the storage and handling of approximately 1,000,000 wheat bushels equivalent was $107,127.28 or about 10.7 cents per bushel. Assuming the losses in revenue were proportional to the shrinkage in the volume, the elevator operation could continue indefinitely if its average total cost did not exceed 10.7 cents per bushel. The approximate break-even point for 10.7 cents per bushel (i.e., average total revenue equal to average total cost) would be about 39 percent of normal volume or about 392,000 wheat bushels equivalent. However, the elevator department could continue to operate for a short period of time if its cash receipts covered its minimum cost expenditures, (i.e., its total variable cost), since the association need not make payments on its imputed cost. But if the elevator department continued to operate at a level below 392,000 bushels, it would eventually fail unless some type of cost curtailment was effected. However, since much of the association's other operations are being "carried" by the elevator's merchandising and storage income, reductions in volume of grain handled would have a much more serious effect on the rest of the association. In the 1960-61 fiscal year, expenses for departments other than the elevator were $99,144.68 while gross income was $80,910.31. In light of these circumstances, assuming no change in the other departments operations income-expense wise, the elevator's total revenue must exceed its own total cost by $18,234.37 for the association

to continue as a sound economic unit. This would necessitate the elevator operation to maintain a volume of approximately 562,000 bushels to maintain the entire association's financial solvency and continued operation.

Since the association cost structure is composed largely of fixed cost, its continued operation depends upon moderately high levels of volume. It is therefore necessary for the association to strive to increase its market share and to improve its competitive position. It is possible that increased volumes may be accomplished through such methods of competition as advertising and promotion, service to customers, reduction in margins, and possibly the letting of free storage of grain for some periods of the year.

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A P P E N D I X

APPENDIX TABLE I

VOLUME OF FERTILIZER HANDLED BY THE ASSOCIATION FISCAL YEAR 1960-61

Month	Received	Shipped	Total
		Tons	
November	48.60	80.76	129.36
December	0	3.80	3.80
January	7.00	16.75	23.75
February	145.45	24.10	169.55
March	260.55	191.90	452.45
April	136.75	81.65	218.40
May	241.00	146.50	387.50
June	108.00	198.20	306.20
July	116.00	49.55	165.55
August	56.00	65.25	121.25
September	898.05	1,483.10	2,381.15
October	1,339.20	1,394.15	2,733.35
Total	3,356.60	3,735.71	7,092.31

Source: Association records.

APPENDIX TABLE II

VOLUME OF FEED PREPARED BY THE ASSOCIATION FISCAL YEAR 1960-61

Month	Custom or Contract Feed Prepared				Feed Prepared for Future Sale	Total
	Grinding	Crimping	Rolling	Pelleting		
	Pounds					
November	68,880	197,140	8,080	74,280	53,800	402,180
December	85,350	225,120	32,920	40,160	13,900	397,450
January	138,520	275,340	6,320	18,050	34,800	473,030
February	77,080	228,100	10,620	13,840	58,250	387,890
March	70,120	134,640	12,300	22,140	74,300	313,500
April	62,160	139,900	7,240	20,080	28,500	257,880
May	71,070	97,300	2,340	13,580	47,750	232,040
June	45,880	42,800	3,000	21,870	0	113,550
July	28,157	108,850	8,040	12,580	24,550	182,170
August	31,460	113,100	740	9,260	15,600	170,160
September	40,860	109,080	1,720	17,040	14,200	182,900
October	17,160	557,590	4,620	6,500	13,800	599,670
Total	736,690	2,228,960	97,940	269,380	379,450	3,712,420

Source: Scale tickets from the association.

APPENDIX TABLE III

POUNDS OF GRAIN SHIPPED BY MONTH WITH TOTALS CONVERTED TO WHEAT BUSHELS EQUIVALENT, FISCAL YEAR 1960-61

Month Shipped	Type of Grain					
	Wheat	Barley	Oats	Milo	Mixed Grain	Total Shipped
November	658,980	856,580	66,155	142,580	94,400	1,818,695 (30,311.58)[1]
December	149,840	0	60,460	1,424,260	12,120	1,646,680 (27,444.66)
January	3,975,000	970,860	55,000	738,230	11,660	5,750,750 (94,845.83)
February	624,760	252,850	51,760	258,680	10,000	1,198,050 (19,967.50)
March	419,600	359,220	45,640	223,500	11,580	1,059,540 (17,659.00)
April	0	168,060	23,220	157,480	11,040	359,800 (5,996.60)
May	7,060,260	295,840	29,180	509,950	4,380	7,899,610 (131,660.16)
June	8,216,720	3,997,660	89,020	370,280		12,673,680 (211,228.00)
July	2,310,400	133,320	271,700	190,030	83.500	2,988,950 (49,815.83)
August	0	101,480	69,670	80,900	25,730	277,780 (4,629.66)
September	2,663,560	273,340	49,010	33,500	29,160	3,048,570 (50,809.50)
October	3,636,100	0	121,400	69,740	6,600	3,833,840 (63,897.33)
Total	29,715,220	7,409,210	932,215	4,199,130	300,170	42,555,945 (709,265.75)

[1]Number in parenthesis refers to wheat bushels equivalent.

Source: Association records.

APPENDIX TABLE IV

POUNDS OF GRAIN RECEIVED BY MONTH WITH TOTALS CONVERTED TO WHEAT BUSHELS EQUIVALENT, FISCAL YEAR 1960-61

Month Received	Type of Grain					
	Wheat	Barley	Oats	Milo	Mixed Grain	Total Received
November	212,180	79,540	0	260,960	7,340	560,020 (9,333.66)[1]
December	135,160	54,920	14,240	0	0	204,320 (3,405.33)
January	115,770	124,240	31,810	6,560	13,060	291,440 (4,857.33)
February	0	0	0	0	0	0 0
March	99,060	327,780	94,140	89,900	129,320	740,200 (12,336.66)
April	111,340	94,120	42,740	9,600	30,800	288,600 (4,810.00)
May	42,680	105,510	5,940	42,440	20,700	217,270 (3,621.16)
June	25,718,370	4,972,250	1,405,440	18,480	181,680	32,296,220 (538,270.33)
July	367,990	53,480	49,140	1,300	39,850	511,760 (8,529.33)
August	53,920	8,720	2,520	18,100	0	83,260 (1,387.66)
September	94,360	48,220	39,830	3,340	42,140	227,890 (3,789.16)
October	85,560	17,380	15,480	699,620	0	818,040 (13,634.00)
Total	27,036,390	5,886,160	1,701,280	1,150,300	464,890	36,239,020 (603,983.66)

[1]Number in parenthesis refers to wheat bushels equivalent.

Source: Association records.

APPENDIX TABLE V

OBSERVATIONS OF WORK SAMPLING STUDY OF EMPLOYEE ACTIVITY BY ELEMENT AND DEPARTMENT FOR MONTH OF NOVEMBER, 1960-61 FISCAL YEAR

Department	A		B		C		D		E		F		Total	
Element of Activity	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage
1	5	.44	1	.09	29	2.53			15	1.31			50	4.37
2	9	.78	4	.35	32	2.80			17	1.48			62	5.41
3	4	.35											4	.35
4			1	.09	32	2.71							32	2.80
5	3	.26	8	.70	35	3.05	30	2.62					76	6.63
6	34	2.97	3	.26	81	7.08	21	1.84					139	12.15
7	4	.35	44	3.85	18	1.57							66	5.77
8									231	20.19			231	20.19
9	8	.70	13	1.14	39	3.41			5	.44			65	5.69
10					164	14.34							164	14.34
11					65	5.69							65	5.69
12	56	4.90											56	4.90
13	1	.09			15	1.31			1	.09			17	1.49
14	2	.18	22	1.92	10	.87			23	2.01			57	4.98
15					1	.09							1	.09
16	2	.17	5	.43	9	.79	12	1.05	13	1.14			41	3.58
17					18	1.57							18	1.57
Total	128	11.19	101	8.83	547	47.81	63	5.51	305	26.66			1,144	100.00

APPENDIX TABLE VI

OBSERVATIONS OF WORK SAMPLING STUDY OF EMPLOYEE ACTIVITY BY ELEMENT AND DEPARTMENT FOR MONTH OF DECEMBER, 1960-61 FISCAL YEAR

Department / Element of Activity	A		B		C		D		E		F		Total	
	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage
1	10	.59	3	.18	52	3.06			13	.76			78	4.59
2	18	1.06	2	.12	22	1.29			37	2.17			79	4.64
3	19	1.12											19	1.12
4			1	.06									1	.06
5	4	.23	20	1.18	70	4.11	30	1.76					124	8.27
6	33	1.93	1	.06	120	7.04							154	9.03
7	9	.53	65	3.81	30	1.76			42	2.46			146	8.56
8			5	.29					358	21.01			363	21.30
9	12	.70	17	1.00	73	4.28			12	.70			114	6.68
10					231	13.56							231	13.56
11					101	5.92							101	5.92
12	96	5.63											96	5.63
13	1	.06	13	.76	28	1.64			1	.06			43	2.52
14	2	.12	98	5.75	12	.71			43	2.53			155	9.11
15														
16														
17														
Total	204	11.97	225	13.21	739	43.37	30	1.76	506	29.69			1,704	100.00

APPENDIX TABLE VII

OBSERVATIONS OF WORK SAMPLING STUDY OF EMPLOYEE ACTIVITY BY ELEMENT AND DEPARTMENT FOR MONTH OF JANUARY, 1960-61 FISCAL YEAR

Department	A		B		C		D		E		F		Total	
Element of Activity	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage
1	8	.39	2	.10	38	1.82			28	1.35			76	3.66
2	14	.67	9	.43	48	2.31			28	1.35			99	4.76
3	14	.68											14	.68
4	40	1.93	60	2.89	24	1.16							124	5.98
5	3	.14	26	1.25	64	3.08	23	1.11					116	5.58
6	46	2.21			185	8.92	40	1.93					271	13.06
7	11	.53	54	2.60	79	3.81			28	1.35			172	8.29
8									359	17.30			359	17.30
9	60	2.89	16	.77	61	2.94			8	.38			145	6.98
10					200	9.64							200	9.64
11					116	5.59							116	5.59
12	136	6.55											136	6.55
13	1	.05	9	.43	34	1.64			12	.58			56	2.70
14	2	.10	98	4.73	12	.58			70	3.38			182	8.79
15			1	.05									1	.05
16					2	.10			6	.29			8	.39
17														
Total	335	16.14	275	13.25	863	41.59	63	3.04	539	25.98			2,075	100.00

APPENDIX TABLE VIII

OBSERVATIONS OF WORK SAMPLING STUDY OF EMPLOYEE ACTIVITY BY ELEMENT AND DEPARTMENT FOR MONTH OF FEBRUARY, 1960-61 FISCAL YEAR

Department	A		B		C		D		E		F		Total	
Element of Activity	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage
1	1	.05			4	.20	14	.69	29	1.41			48	2.35
2			9	.44	43	2.10			5	.25			57	2.79
3														
4	48	2.35	81	3.96	32	1.56							161	7.87
5			24	1.18	27	1.32	168	8.22					219	10.72
6	29	1.42			123	6.02	47	2.30					199	9.74
7	5	.24	7	.34	105	5.13	57	2.79					174	8.50
8									402	19.67			402	19.67
9	68	3.33	5	.24	12	.59					74	3.62	159	7.78
10					172	8.42							172	8.42
11					96	4.70							96	4.70
12	93	4.55											93	4.55
13			2	.10	39	1.91			14	.69			55	2.70
14			15	.73	8	.39	5	.24	172	8.41			200	9.77
15			1	.05									1	.05
16					2	.10			6	.29			8	.39
17														
Total	244	11.94	144	7.04	663	32.44	291	14.24	628	30.72	74	3.62	2,044	100.00

APPENDIX TABLE IX

OBSERVATIONS OF WORK SAMPLING STUDY OF EMPLOYEE ACTIVITY BY ELEMENT AND DEPARTMENT FOR MONTH OF MARCH, 1960-61 FISCAL YEAR

Department	A		B		C		D		E		F		Total	
Element of Activity	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage
1					3	.42			6	.83			9	1.25
2	23	3.16	18	2.48	15	2.06	2	.28					58	7.98
3					16	2.20							16	2.20
4	30	4.13	4	.55	23	3.16							57	7.84
5							41	5.64					41	5.64
6					19	2.61	16	2.20					35	4.81
7					14	1.93			10	1.38			24	3.31
8									186	25.57			186	25.57
9					57	7.84	20	2.75	30	4.13			107	14.72
10					39	5.36							39	5.36
11					38	5.23							38	5.23
12														
13					9	1.25							9	1.24
14			26	3.58	8	1.10	5	.69	14	1.93			53	7.30
15							3	.41	3	.41			6	.82
16	3	.41			3	.41	3	.41	40	5.50			49	6.73
17														
Total	56	7.70	48	6.61	244	33.56	90	12.38	289	39.75			727	100.00

APPENDIX TABLE X

OBSERVATIONS OF WORK SAMPLING STUDY OF EMPLOYEE ACTIVITY BY ELEMENT AND DEPARTMENT FOR MONTH OF APRIL, 1960-61 FISCAL YEAR

Department / Element of Activity	A		B		C		D		E		F		Total	
	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage
1							3	.33	19	2.11			22	2.44
2	47	5.22	11	1.22	20	2.22	17	1.89	23	2.55			118	13.10
3														
4					43	4.77	13	1.44	2	.22			58	6.43
5							14	1.55					14	1.55
6			1	.11	26	2.89	39	4.34					66	7.34
7					5	.55	4	.44	9	1.00			18	1.99
8									200	22.20			200	22.20
9	5	.55	46	5.11	66	7.34			5	.55			122	13.55
10					87	9.66							87	9.66
11					45	4.99							45	4.99
12	13	1.44											13	1.44
13									4	.44			4	.44
14	1	.11	23	2.55	8	.88	1	.11	50	5.55			83	9.20
15									2	.22			2	.22
16	6	.67			13	1.44			30	3.34			49	5.45
17														
Total	72	7.99	81	8.99	313	34.74	91	10.10	344	38.18			901	100.00

APPENDIX TABLE XI

OBSERVATIONS OF WORK SAMPLING STUDY OF EMPLOYEE ACTIVITY BY ELEMENT AND DEPARTMENT FOR MONTH OF MAY, 1960-61 FISCAL YEAR

Department / Element of Activity	A		B		C		D		E		F		Total	
	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage
1	29	2.32			3	.24			23	1.84			55	4.40
2			12	.96	1	.08			7	.56	12	.96	32	2.56
3	98	7.84											98	7.84
4			26	2.08	72	5.76	30	2.40					128	10.24
5	6	.48			55	4.40	36	2.88					97	7.76
6			8	.64	30	2.40	14	1.12					52	4.16
7			13	1.04	20	1.60	12	.96					45	3.60
8									265	21.20			265	21.20
9					81	6.48			2	.16	50	4.00	133	10.64
10					85	6.80							85	6.80
11					54	4.32							54	4.32
12														
13	1	.08			3	.24			3	.24			7	.56
14			62	4.96	21	1.68	5	.40	14	1.12			102	8.16
15	2	.16			5	.40			1	.08			8	.64
16	5	.40	1	.08	19	1.52			61	4.88	3	.24	89	7.12
17														
Total	141	11.28	122	9.76	449	35.92	97	7.76	376	30.08	65	5.20	1,250	100.00

APPENDIX TABLE XII

OBSERVATIONS OF WORK SAMPLING STUDY OF EMPLOYEE ACTIVITY BY ELEMENT AND DEPARTMENT FOR MONTH OF JUNE, 1960-61 FISCAL YEAR

Department	A		B		C		D		E		F		Total	
Element of Activity	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage
1	22	.65	3	.09	15	.43			89	2.60			129	3.77
2	62	1.81	16	.46	6	.17			18	.52	4	.12	106	3.08
3	219	6.38											219	6.38
4	25	.73	14	.41	45	1.31							84	2.45
5	760	22.15			8	.24	69	2.01					837	24.40
6	150	4.37			20	.58	33	.96					203	5.91
7	1	.03	10	.29	7	.20	10	.30	6	.17			34	.99
8	3	.09	1	.03					671	19.55			675	19.67
9	27	.79	45	1.31	63	1.84			1	.03			136	3.97
10					71	2.07							71	2.07
11					58	1.69							58	1.69
12	70	2.04											70	2.04
13	347	10.11	3	.09	4	.12			4	.12			358	10.44
14	83	2.41	62	1.80	3	.09	2	.06	20	5.8			170	4.94
15	19	.56	12	.35	3	.09	7	.20	2	.06			43	1.26
16	151	4.40	6	.18	37	1.07	7	.20	29	.85			230	6.71
17					8	.23							8	.32
Total	1,939	56.52	172	5.01	348	10.14	127	3.73	840	24.48	4	.12	3,431	100.00

APPENDIX TABLE XIII

OBSERVATIONS OF WORK SAMPLING STUDY OF EMPLOYEE ACTIVITY BY ELEMENT AND DEPARTMENT FOR MONTH OF JULY, 1960-61 FISCAL YEAR

Department	A		B		C		D		E		F		Total	
Element of Activity	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage
1	12	.57	7	.34	83	3.98			86	4.12			188	9.01
2	32	1.54	14	.67	30	1.44	2	.10	6	.29			84	4.40
3	2	.10											2	.10
4					63	3.02	52	2.49					115	5.51
5	17	.81			13	.62							30	1.43
6	13	.62	5	.24	81	3.88	8	.38					107	5.12
7			21	1.01	13	.62							34	1.63
8			5	.24	13	.62			602	28.83			620	29.69
9			1	.05	47	2.25					17	.81	65	3.11
10					232	11.11							232	11.11
11					94	4.51							94	4.51
12	90	4.31											90	4.31
13	13	.62			16	.77							29	1.39
14	6	.28	52	2.49	23	1.10	2	.10	5	.24			88	4.21
15	7	.34	3	.14	8	.38			1	.05			19	.91
16	28	1.34	30	1.43	61	2.92	6	.29	55	2.63			180	8.61
17					111	5.31							111	5.31
Total	220	10.53	138	6.61	888	42.53	80	3.36	755	36.16	17	.81	2,088	100.00

APPENDIX TABLE XIV

OBSERVATIONS OF WORK SAMPLING STUDY OF EMPLOYEE ACTIVITY BY ELEMENT AND DEPARTMENT FOR MONTH OF AUGUST, 1960-61 FISCAL YEAR

Department	A		B		C		D		E		F		Total	
Element of Activity	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage
1	6	.35	10	.57	32	1.81			53	3.01	14	.80	115	6.54
2	38	2.16	4	.23	85	4.84					2	.11	129	7.34
3	4	.23											4	.23
4			23	1.31	12	.68	37	2.10					72	4.09
5	3	.17	24	1.37	10	.57							37	2.11
6	6	.34	6	.34	36	2.05	1	.06					49	2.79
7			31	1.76	25	1.42							56	3.18
8			11	.63					417	23.72			428	24.35
9	35	1.99	31	1.76	134	7.62	14	.79			60	3.41	274	15.57
10					164	9.33							164	9.33
11					58	3.30	9	.51					67	3.81
12	67	3.81											67	3.81
13	1	.06			5	.29							6	.35
14	2	.11	43	2.45	9	.51	4	.23	3	.17			61	3.47
15	1	.06	9	.51	40	2.28	1	.06	1	.06			52	2.97
16	8	.45	34	1.93	63	3.58			48	2.73	5	.29	158	8.98
17					19	1.08							19	1.08
Total	171	9.73	226	12.86	692	39.36	66	3.75	522	29.69	81	4.61	1,758	100.00

APPENDIX TABLE XV

OBSERVATIONS OF WORK SAMPLING STUDY OF EMPLOYEE ACTIVITY BY ELEMENT AND DEPARTMENT FOR MONTH OF SEPTEMBER, 1960-61 FISCAL YEAR

Department / Element of Activity	A		B		C		D		E		F		Total	
	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage
1					2	.18	5	.47	28	2.64			35	3.29
2	6	.57			43	4.05	18	1.70					67	6.32
3	3	.28											3	.28
4					28	2.64	27	2.54					55	5.18
5					9	.85	119	11.22					128	12.07
6	19	1.79			12	1.13	162	15.27					193	18.19
7					2	.19	2	.19					4	.38
8									174	16.40			174	16.40
9	8	.75			39	3.68							47	4.43
10					92	8.67							92	8.67
11					10	.94	16	1.51					26	2.45
12	22	2.07											22	2.07
13					4	.38	1	.09					5	.47
14	4	.38	16	1.51	7	.66	7	.66					34	3.21
15	4	.38			3	.28	4	.38					11	1.04
16	6	.56	16	1.51	18	1.70	31	2,92	15	1.41			85	8.10
17	4	.38			75	7.07							79	7.45
Total	76	7.16	32	3.02	344	32.42	392	36.95	217	20.45			1,061	100.00

APPENDIX TABLE XVI

OBSERVATIONS OF WORK SAMPLING STUDY OF EMPLOYEE ACTIVITY BY ELEMENT AND DEPARTMENT FOR MONTH OF OCTOBER, 1960-61 FISCAL YEAR

Department	A		B		C		D		E		F		Total	
Element of Activity	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage of Total	Observations	Percentage
1					3	.41	1	.14	19	2.62			23	3.17
2			6	.83	23	3.17							29	4.00
3														
4					63	8.67							63	8.67
5					5	.69	53	7.29					58	7.98
6	35	4.82	5	.69	27	3.71	21	2.89					88	12.11
7					3	.41							3	.41
8									110	15.13			110	15.13
9	3	.41			8	1.10					18	2.48	29	3.99
10					118	16.23							118	16.23
11					34	4.68							34	4.68
12	29	3.99											29	3.99
13	3	.41			3	.41							6	.82
14			27	3.70	6	.83	4	.55	2	.27			39	5.35
15					4	.55	2	.27					6	.82
16	2	.28	5	.68	11	1.51	23	3.16	20	2.76			61	8.39
17					31	4.26							31	4.26
Total	72	9.91	43	5.90	339	46.63	104	14.30	151	20.78	18	2.48	727	100.00

VITA

Roby Lee Sloan

Candidate for the Degree of

Master of Science

Thesis: RELATIONSHIP OF COST CHARACTERISTICS OF A COOPERATIVE ASSOCIATION TO CONTRACTING VOLUMES OF GRAIN HANDLED

Major Field: Agricultural Economics

Biographical:

Personal Data: Born in Moline, Illinois, August 29, 1938, the son of Milton and Opal Sloan.

Education: Attended grade school at Joy, Illinois; attended high school at New Boston, Illinois; graduated from high school in 1956; attended Western Illinois State University 1956-1957; Macomb, Illinois; received the Bachelor of Science degree from the College of Agriculture, Oklahoma State University, Stillwater, Oklahoma, with a major in Agricultural Education, in May, 1960; completed requirements for the Master of Science degree in May, 1962, at Oklahoma State University in Stillwater, Oklahoma.

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