A STUDY OF COST RELATIONSHIPS IN MICHIGAN COUNTRY ELEVATORS

Thesis for the Degree of M. S.

MICHIGAN STATE UNIVERSITY

George G. Greenleaf

1959

A STUDY OF

COST RELATIONSHIPS IN

MICHIGAN COUNTRY ELEVATORS

By

GEORGE G. GREENLEAF

AN ABSTRACT

Submitted to the College of Agriculture of Michigan
State University of Agriculture and Applied
Science in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE

Department of Agricultural Economics
1959

Approved: Vernon L. Sorenson

ABSTRACT

The objectives of this investigation are twofold: (1) to present a descriptive picture of the cost proportions and patterns of the Michigan elevator and farm supply industry as they existed when the data for this study was obtained; and, (2) to develop and study the relationship of costs to a variety of cost determinants. It is anticipated that these relationships may provide useful guides to elevator owners and managers, boards of directors, management consultants and research or extension personnel in analyzing the operating costs of Michigan country elevators.

Cost data from thirty-four elevator firms were obtained in personal interviews with the managers, and from accounting records. An effort was made to select firms which were typical in terms of products handled and operational technology. Four specific cost categories are developed by combining certain individual cost items. The specific cost categories used are: (1) Labor; (2) Direct Operating; (3) Recurrent Overhead; and, (4) Plant Maintenance. The purpose of the breakdown is to implement the study of cost adjustment to changing output and capacity relationships.

Total operating cost and each of the specific categories are compared graphically to output and percent capacity utilization. The real output of a country elevator is service and the empirical measure of this service is gross margin. To obtain comparability between plants, this output was converted to a computed index.

Capacity utilization is based on the percentage utilization of the feed and grain equipment during an eight hour, three hundred five day year. Graphic analysis is used to relate total and specific costs to output and capacity utilization.

The net relationship of total costs to output is positive and linear, except for a small curvilinear section at the output extremes. There is an increasingly advantageous ratio of costs to output, as gross margin increased over all except the extreme upper limit of output for these thirty-four elevators. Labor costs are the most important component of total costs. The ratio of labor cost to output appears to improve throughout the output range. This same advantage for larger operations, based on gross margins, is true for the other specific cost categories, except at the highest gross margin level. High capacity utilization appears advantageous to the elevator business, although the number of men per plant also plays an important role in defining the nature of the change in unit costs as plant utilization increases.

Several other factors which affect costs were studied. These included: (1) ratio of grain gross income of non-grain gross income; (2) monthly wage prices for labor; (3) gross sales per man; and (4) total plant investment. Comparison of these factors between ten of the plants in the study indicated that the most efficient plants (those with the lowest

ratio of cost to output) had high grain volume, lower wage prices, larger gross sales per man, and greater investment in plant and machinery. All salaries and wage expenses, including commissions, insurance, retirement and social security, were related to total operating cost and total sales volume. Findings indicated that additional categorization as to size of business, investment, and product mix will be necessary for these ratios to be helpful as suggested operational guides. The ratio of the number of men employed to the volume of business, and the actual wage that labor commands, are two cost determinants that appear important in deciding the actual total cost - output relationship.

This investigation points up the need for more detailed study, probing into labor costs and the efficiency of labor use. The relationship of investment in machinery to labor outlay is another area of concern.

A STUDY OF

COST RELATIONSHIPS IN

MICHIGAN COUNTRY ELEVATORS

By

GEORGE G. GREENLEAF

A THESIS

Submitted to the College of Agriculture of Michigan
State University of Agriculture and Applied
Science in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE

Department of Agricultural Economics
1959

ACKNOWLEDGEMENTS

The author takes this opportunity to express sincere appreciation to those individuals who made this thesis possible.

A special thank you is due Dr. Vernon L. Sorenson, the author's major professor, for suggestions and guidance in specifying the problem, and for his encouragement in the development of this thesis.

The interest and assistance given me by Dr. Lawrence L. Boger, Head, Department of Agricultural Economics, and Professor Ralph W. Tenny, Director of Short Courses, have been an important contribution in making this study possible. Arthur J. Pursel, a former graduate student in Agricultural Economics, and many members of the feed and grain trade, have also given freely of their time and assistance when they were sought by the author.

Mrs. Arlene King and members of the statistical pool were helpful in computations necessary in the empirical portion of this study. Thanks are expressed to Mrs. Ione Peeke and Joann Prendergast who typed the original manuscript. The writer is also indebted to Mrs. Beatrice Mott for her effort in typing the final manuscript.

The author greatly appreciates the encouragement and understanding that his wife, Agnes, gave at all times through the course of his studies.

All responsibility for errors which may be present in the completed work belongs to the author.

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

CHAPTER I

INTRODUCTION

The Country Elevator in Michigan. There are presently about five hundred and forty country elevator businesses in the state of Michigan. These firms blanket the agricultural portion of the state, with the heaviest concentration in the thumb counties of Huron, Tuscola, Sanilac and Saginaw. The number of elevators in each region tends to vary with the amount of cash crop farming.[1/]

In general structure the elevator industry in Michigan can be broken into three segments - - the elevator chains, the cooperatives, and elevators of independent ownership. There are ten chain elevator firms in the state which control about ninety outlets. Cooperatives number about one hundred and forty-five with thirty-five of these points under one management. The balance of Michigan country elevators, about three hundred, are independent businesses owned and controlled by individuals, partners or small groups of local businessmen.

Elevator-farm supply firms carry on multiple activities. They function as assembly points for the marketing of grain, and as a major supplier of inputs required in the production of crop and livestock products. Production inputs cover a variety of merchandise, including feeds,

---

1/ Michigan country elevators per county in appendix, Figure XII, p. 30

salt, medicants, petroleum, fertilizer and lime. Feed grinding and mixing, seed treating, grain drying, trucking and various other services are also available.

Basis for Problem. Michigan elevator trade associations, cognizant of the new trends affecting elevator operations, have become increasingly concerned about the competitive pressures within their industry. A price-cost squeeze, diversion of grain marketing volumes, and short margins have been vocally denounced within the industry for several years. These conditions and the accompanying pressure on business management has set the stage for some necessary critical business analysis.

Outside the industry, the farmer-dealer has taken over some of the seed corn, fertilizer and feed business. An apparent trend toward direct selling of fertilizer and feeds by the manufacturer to the farmer has also increased the industries' concern. Vertical integration has directly affected the operation of some elevator-farm supply businesses. For the reasons cited, plus others of less importance, management has been foreced to examine its operation and to inquire earnestly into business efficiency.

Business efficiency can be defined as a ratio of output to input. In monetary terms, this can be expressed as the ratio of total revenue to the total cost of the business - $\frac{TR}{TC}$.[2/] Both numerator and denominator

---

2/ Expression of physical ratios in monetary terms is of course valid only where perfectly competitive pricing is assumed.

of this ratio is influenced by physical volume and unit price. Pursel's study[3/] of Michigan elevators pointed to a greater physical volume rather than high margins as the more appropriate objective, if management desires to increase earnings by increasing revenues. Because gross margins tend to be controlled by competitive conditions, industry leaders have stressed the need for merchandising and more salesmanship to build volume. However, the approach has often failed to produce greater earnings, even though volume is increased, because costs are not controlled.

Elevator management has also been concerned with the denominator of the business efficiency ratio-total cost. For years auditors have broken down operating costs in some detail, to provide the basis for using numerous cost ratios in decision making. Management has accepted this accounting cost breakdown and the pertinent business ratios as operational guides. Two examples of such ratios are the relation of costs to output or labor cost to total costs.[4/]

These cost or operating ratios are helpful in the description of the past or historical performance. However, they are of limited

---

3/ Arthur J. Pursel, "The Use of Functional Analysis in Evaluating the Operations of Michigan Elevator-Farm Supply Businesses". (Unpublished Master's Thesis 1957) Michigan State University, 1957, p. 58

4/ H. E. Larzelere and R. M. King, Ratios as Measuring Sticks for Elevator and Farm Supply Organizations. Special Bulletin 380, Agricultural Experiment, Michigan State College, August, 1952.

value in suggesting corrective solutions because of the fragmentary nature of the analysis and the lack of any consistent analytical framework for evaluations of the ratios either individually or collectively.

The elevator trade is in need of analytical methods which can provide the basis for developing meaningful relationships between specific cost components and relevant factors which influence cost levels. Costs can usually be controlled and manipulated more precisely and often more effectively than sales or margins. Hence, effective guides for cost analysis and adjustment can often be of greater value in the improvement of net revenues than a program to increase volume or net margins.

This study was taken to provide such guides by attempting to discover factors that affect costs, and in turn business efficiencies. Efforts will be made to develop meaningful cost relationships that can be of use to the industry in obtaining a better understanding and evaluation of it's enterprise. The initial step in such an effort is to provide a picture of "what is" before making any decisions on "what should be".[5/] Hence, the major effort of this study will be a descriptive picture of industry cost patterns and proportions as they existed when the data in the study were obtained. It is also designed to provide some definitions

---

5/ Frank Knight, Risk, Uncertainty and Profit, (New York: Houghton-Mifflin Co., 1921). p.p. 206-208

and possible tools for developing understandable cost relationships, as they exist; but must necessarily fall short of a comprehensive cost analysis. This is basically a probing descriptive study of existing cost patterns. Shortage of the necessary detailed data will not permit a complete evaluation of technology, personnel, and other factors which influence costs.

The Sample. Data were obtained from forty-two elevators, which represent about 8% of the country elevators in the state. Financial records of the firms were obtained along with additional data in the form of a questionnaire which was completed during a personal interview with the manager of each firm.[6/] Efforts were made to select businesses which were typical of the country elevator - typical in the sense that the sample would reflect the kind of product and resource mix most common throughout the state.

Firms with a business volume of less than $200,000 were not included in the sample. Organizations with unusual operations, such as egg buying stations or lumber yard operations were also excluded. The sample included the businesses regardless as to net gains or losses in their annual operating statement.

Several of the plants visited were later excluded from the study because of questionable accuracy of the data. In most cases, these were small plants without adequate records and considerable estimating

---

6/ A copy of the questionnaire is included in the appendix. p.p. 59-68

would have been necessary to break down cost and revenue items into useful categories. The final sample contained thirty-four firms with an average volume of business of $712,028.77.[7/] They operated with a total gross margin of $100,156.73, expenses of $88,309.25, and an average net income of $13,006.47.[8/]

In Chapter II the analytical framework of the problem will be laid out in detail. Classification of costs, the definition of output and its measurement and the definitions of cost categories are included in the discussion. The relationships of costs to value of services performed and percent of capacity operation are the subject of Chapter III. Certain other factors which affect costs and business efficiency are the basis of the work in Chapter IV. The fifth and last chapter is a summation of the work included in the study with a suggestion concerning additional research.

7/ Sales and income summary is in the appendix, Table VI, p. 53

8/ Net income includes "other revenue".

CHAPTER II

The Analytical Framework

Classification. Country elevator firms may differ widely in their operations. These variations may appear in the volume of business, organizational structure, technology employed, nature of marketing services, and quality of personnel. The thirty-four plants included in this study are selected with reference to their degree of homogeneity in the following respects: only firms which handled both grain and feed were included in the sample, and care has been taken to select organizations with a substantial degree of likeness as to the nature of the other marketing services performed. Though technical differences exist among the plants, in terms of size and kind of equipment, the overall technology of the plants is quite similar.

Relevance of Economic Theory. Economic theory is relevant to the study in several respects. First, it is a necessary preliminary step to development of conditions which are of direct concern to the analysis of cost behavior. Theoretical analysis provides guidance in choosing the most likely shape of the cost-output relation. Then by building graphic and statistical evidence on a theoretical foundation, it is possible to compare the theory with the actual results. The theoretical cost curves and models lead to a systematic study of cost behavior which should be of value to management.

When dealing with cost as a function of output, theory distinguished between the long run and the short run.[9/] In the long run, all input factors are considered variable so that the output results from different combinations of inputs without limitation because of the fixedity of some factors. Inputs are assumed to be completely adapted for minimum total cost at the firms optimum rate of output.[10/] In the short run, inputs are partially fixed and partially variable, i.e., output can result from more than one combination of inputs, but one or more factors is fixed.[11/]

There exists a relationship between cost and a number of independent variables which include output, capacity utilization, price of inputs, variety of services and others. In the empirical treatment of economics of the individual firm, the short run cost function refers to the relationship between cost and rate of output, with a given physical plant. It is further implied that all other factors which affect cost remain unchanged. More particularly, any measurement of the relationship between costs and output, for an existing firm, is intended to show what costs would be at various volumes, if there are no changes in factor prices, selling costs and the nature of physical output-input relationships. Such a cost

---

9/ Joel Dean, Managerial Economics, New York; Prentice Hall, Inc., p. 272.

10/ Ibid, p. 273

11/ It should also be realized that there exists a great many short runs, depending upon the fixed factors and the adjustment of the variable inputs.

function excludes cost differences, due to independent external influences (for instance the bargaining force of labor unions), and also any secondary or derived changes caused directly or indirectly by changes in output by the firm. For example, although factor prices might be initially constant, a variation in output could be so significant to the particular factor market, as to influence prices, and thus indirectly affect costs. An increase in output also could lead to additional wages on an overtime basis. An opposite effect would result if materials could be purchased at a lower price because of quantity discounts on the increased size of order, or costs may vary with output owing to induced changes in the productivity of variable factors, as for example, if lower quality labor were employed at higher output levels. A proper determination of the cost - output relationship eliminates such indirect or induced effects on cost variation, associated with volume.

This study, using as it does, cross sectional data for the basic cost dimension, does not lend itself to complete specification of this theory. In terms of the major criteria established above, it is reasonable to assert that there is no relation between volume and increased costs due to the need for employment of overtime labor or lower quality labor. There appears to be little, if any, relationship between volume and level of factor prices. Factor prices relationships may, however, differ due to location. Plants located near metropolitan centers may pay higher wages, due to the influence of union wage rates,

than plants in a more distant rural community. Transportation costs vary fifteen to twenty-five cents per cwt. across the state, and cause cost differences in certain inputs. However, this lack of uniformity is relatively minor and is not directly related to size of business, e.g., there appears to be no correlation between volume of business and factor prices.

A major problem in evaluating the data is that associated with differences in plant size. It is extremely difficult to determine a precise measurement of plant size. Several suggestions are: dollar volume of feed and grain plus service income, total investment in plant and equipment, and the rated capacity of the feed and grain operation. The use of dollar volume gives spurious results because of product - price variations, differences in nature of business due to crop production characteristics and government grain storage regulations. Total investment in plant and equipment is an inadequate measure because of variations in original cost due to age and price levels. Rated capacities of grain and feed handling equipment appear to give the most accurate measure of plant size. Necessarily, these capacity ratings do not fully take into account actual bottlenecks which influence the speed with which the plants can handle customers, nor do they account for variations in the proportion of volume in the different plants which results from grain and feed operation relative to side lines.

The theoretical short run cost relationship, therefore, does not hold completely in the analysis which follows, nor in fact does the long run where complete flexibility of all factors is assumed. However, it is felt that the theoretical framework for short run cost analysis is a useful analytical guide for evaluation of the data which are available for the study.

The Measurement of Output. The measurement of output for a marketing firm such as an elevator, with its multiple activities, is not immediately obvious. Some economists feel that the output of a marketing firm is the package of services through which time, place and possession utilities are added to the commodities in the marketing process. 12/ The Dean and James study on cost behavior in the retail shoe industry derived this definition: "that the output of a retail enterprise consists of the services which it renders to purchaser". 13/ Gross margin, the difference between the purchase price and the sales price of goods, appears to best represent the amount of money the purchaser pays for the marketing services performed. It is roughly analogous to value added in manufacturing.

12/ Robert G. Seymour, "Cost Concepts in Marketing", (Unpublished Ph.D. Dissertation, 1953) University of Illinois, 1953, p. 147.

13/ Joel Dean and R. Warren James, "The Long Run Behavior of Costs in a Chain of Shoe Stores, A Statistical Analysis", The Journal of Business of the University of Chicago, Studies in Business Administration, XII, April, 1942, p. 35.

Gross margin is derived from many sources in the elevator. These are aggregated into a single dollar output category. Pursel, in his functional analysis work with these elevators, decided gross margin was the best index of marketing services although certain computations had to be made so that competitive situations, location factors, and managerial policy differences were eliminated.[14/] This places all firms on an equal basis so that inter-firm comparisons are of added value.

Computation of the index was made after the data from the elevators had been summarized and the gross margins determined along with the physical amount of each input or investment category. The gross margins for each item were aggregated for the thirty-four elevators along with the physical quantities handled. The total gross margin was then divided by the quantities sold to obtain the weighted average unit gross margin for each of the many output categories. The weighted average unit gross margin was then multiplied by each firm's physical quantity to get the index value of marketing service for that commodity or service. The individual index values were then added together for each firm to get an aggregate value of its marketing services. Hereafter, this index will be referred to as gross margin.

14/ Pursel, Op. cit., p. 9

Grain operations are the primary source of service revenue for elevator firms. Table I has been developed below to show the major sources of the elevator's gross margin. It is apparent that nearly 2/3 of the total gross margin of these firms comes from merchandised grain, processed grain or services pertaining to the grain operation.

TABLE I
Percentage of Total Gross Margin from Different Sources

All Grain Operations 60.4%			Farm Production Supplies 39.6%		
Merchandised Grain	Processed Grain	Service Income	Fertilizer	Seeds and Petroleum	Misc. Farm Supplies
%	%	%	%	%	%
18.08	20.09	22.25	6.56	15.79	17.23

The proportion of the gross margin obtained from these two different sources is fairly consistent for all firms. Only thirty percent of the firms obtained less than fifty percent or more than seventy-five percent of their gross margin from all grain operations. Analysis of the cross sectional cost data from these firms is undertaken to provide a general picture of at least a few elements in the cost relationships of the elevator firm.[15/] The study provides a basis for analyzing some of the important reasons for cost differences between plants within the

15/ Cost Behavior and Price Policy. Committee on Price Determination for the conference on price research, National Bureau of Economic Research, New York, 1943, pp. 28 - 32.

sample and should provide management with additional insight in the problem of cost adjustment.

Cost Categories. The breakdown of total costs in this study was made as follows: Labor, Direct Operating, Recurrent Overhead, and Plant Maintenance. Labor costs includes all outlays for labor with the exception of management and bookkeeping. It includes salaries, wages, pension plans, and social security. Direct operating costs are those items which vary with volume of business in the short run. Items in this category include power, fuel, telephone, bad debts, advertising and hired trucking. Recurrent overhead costs are those costs not directly variable with volume. Included in this list are interest, property tax, management and bookkeeping expenses. Plant maintenance represents the cost of maintaining plant and equipment. The category includes insurance, repairs and depreciation.[16/]

Why was this breakdown used? One purpose of this study is to develop more meaningful specific cost categories for the purpose of analyzing adjustment to changing output and capacity relationships. Labor costs make up nearly one-half of all operating expenses, and are easily adjusted through the managerial process. This is sufficient to place labor in a separate cost category. Plant maintenance is an expense unique in nature and appears to be most useful when isolated.

16/ Components of the specific cost categories is included in the appendix, Table IX.

The remainder of the costs have been categorized into two groups on the basis of flexibility in the short run.

The following chapter will develop in detail the relationship of both total costs and the specific costs mentioned above to output and to capacity utilization. The technique of graphic analysis will be used to show the results. Graphic analysis is a method of using graphics as an equivalent to the mathematical method of correlation analysis.[17/] The first approximations to the partial regressions are obtained and then successive approximations modify the initial relationship until the correlation is accurately obtained.

17/ Mordecai Ezekiel, Methods of Correlation Analysis, Edition 2, New York, 1941.

CHAPTER III

Relationship of Costs to Value of Services Performed and Percent Capacity Utilization

Methodology. The graphic method of multiple correlation is an offshoot of the standard mathematical method. The simplest form of the standard method involves the assumption that the data are related in a straight line fashion. If this assumption is not valid and the regressions actually are curvilinear, the linear mathematical method yields inaccurate results. Few relationships in economics are strictly linear in either arithmetical or logarithmic terms. Therefore, graphics can often give more meaningful results than those obtained by mathematical computation.[18/]

One of the aims of this study is to discover the shape of the existing cost relationships, not to decide their nature and then derive them statistically. The first step in the graphic method of correlation is the plotting of the dependent variable X_1, against one of the independent variables, such as X_2, in an ordinary scatter diagram. A regression line is approximated from these data. This first approximation indicates the gross relationship between X_1 and X_2. In order to take account of additional independent variables, a second diagram is developed in

---

18/ Frederick V. Waugh, "Graphic Analysis in Economic Research", Agricultural Handbook No. 84, USDA, Agricultural Marketing Service, Washington, D. C., June, 1955, p. 2.

which the vertical deviations of the observations from the regression line in the X_1 - X_2 chart are plotted against the second independent variable X_3. The best visual estimate of the regression line, linear or curved, can then be drawn through these points.

Successive approximations, contributed by the "Bean" method of graphic analysis provides a means of progressively improving the first approximations.[19/] In order to accomplish this, the vertical deviations from the second chart are plotted about the initial regression line on the X_1 - X_2 chart. Then a regression line is drawn through the new points in such a way that the scatter is reduced. This gives a second approximation to the partial regression between X_1 and X_2. These new deviations from this second approximation line are now plotted about the original regression in the second chart. A new regression line is approximated and these steps are repeated, as necessary. The last set of observations about the final regression line represent the partial correlation between X_1 and X_2.[20/]

Total Cost Relationships. The first relationship of concern is that of total cost to value of services performed with capacity utilization held constant. Table VII on page of the appendix gives the basic data for the thirty-four plants used in the study. Note should be

---

19/ Louis H. Bean, "A Simplified Method of Graphic Curvilinear Correlation", Journal of American Statistics Association, Vol. 24, 1929, pp. 386 - 397.

20/ Detailed description of the graphic method of analysis can be found in Frederick L. Thomsen and Richard J. Foote, Agricultural Prices, 2nd Edition, McGraw-Hill Company, New York, 1952, pp. 296 - 304

taken that the value of services performed is the output of the firm and is a computed figure. The capacity utilization is the figure derived from the feed and grain operation only.

The regression is shown graphically on the following page as Figure I. A linear relationship exists except at the upper and lower extremes. The upper curvature is largely the result of only two large country elevator operations. The sharp decline at the lower limit is affected by several plants. No explanation can be given at this point for these variations at the output extremities. The graphic relationship, on the whole, does resemble the typical total cost-curve set forth by economic theorists.

Figure II illustrates the partial relationship between total costs (X_1) and percent of capacity utilized (X_3). Twelve plants operated at or below fifteen percent of capacity. The balance or twenty-two firms were between the fifteenth and fortieth percentils. The expected result was a negatively sloping relationship between total costs and capacity utilization. It was suggested that as percent of capacity utilization increased, the partial relationship with total cost would also decrease. A glance at Figure II shows a much different situation. It is curvilinear with two distinct negative slopes connected by a short intermediate positive slope.

A study of these two groups of twelve and twenty-two firms does not provide a complete explanation of the form of this relationship, but

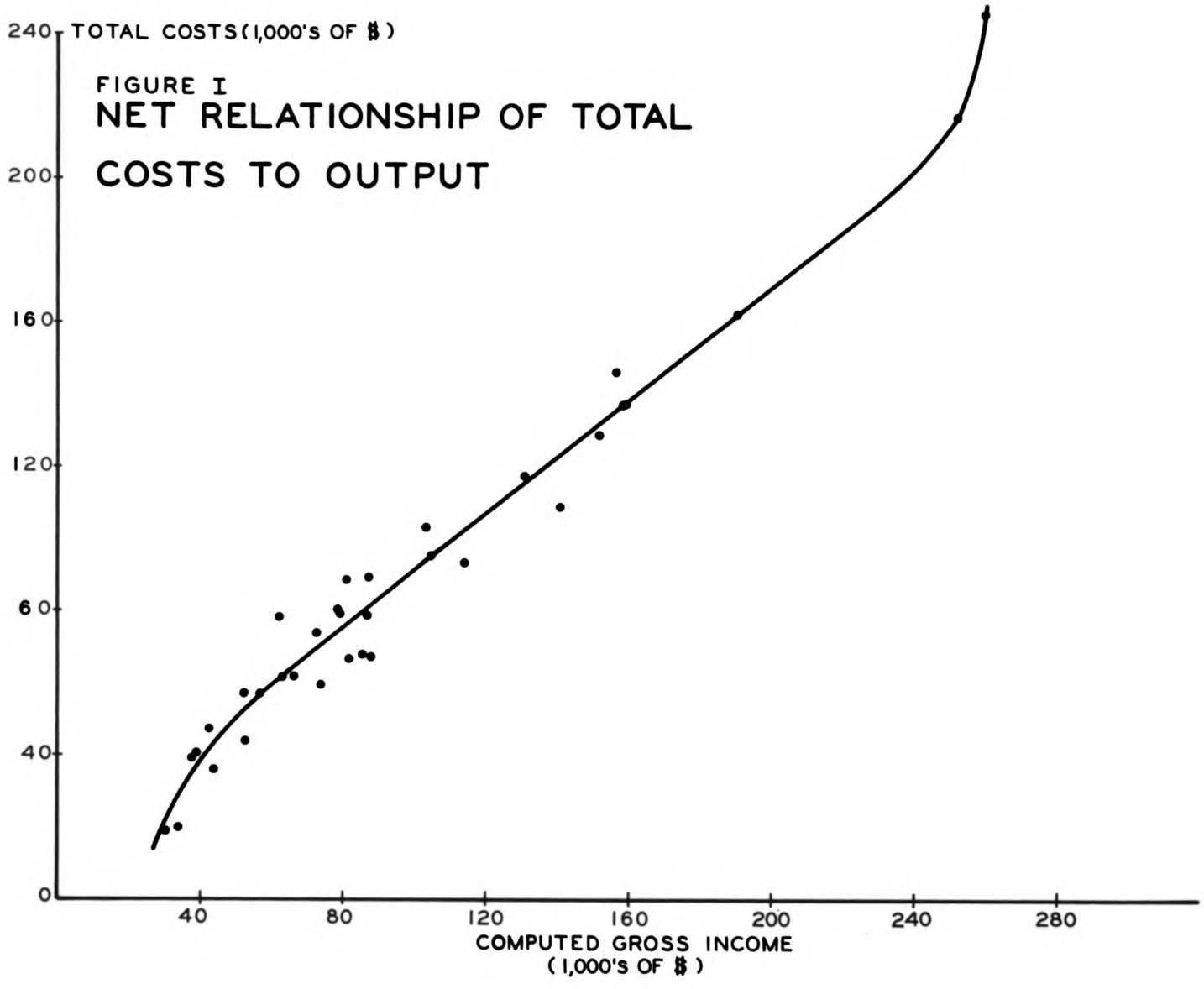
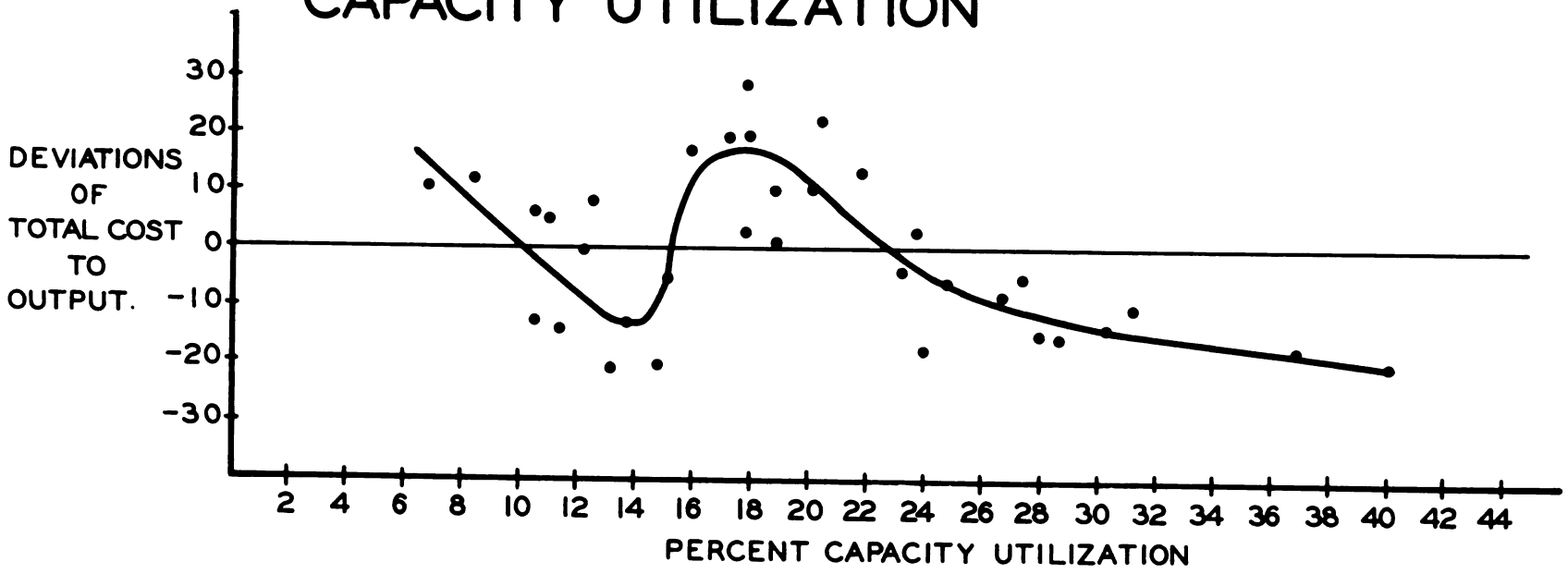


FIGURE I
NET RELATIONSHIP OF TOTAL COSTS TO OUTPUT

FIGURE II

PARTIAL RELATIONSHIP BETWEEN TOTAL COSTS AND PERCENT CAPACITY UTILIZATION



some factors can be discussed. The twelve plants which operated below the fifteen percent of capacity level, hereafter designated as Group I, have some similarities to the twenty-two plants operating above the fifteen percent mark, hereafter called Group II. The type of business enterprise, as found by the grain-feed ratio was much the same for both groups. Also the total replacement value of plant and machinery was nearly the same; Group II's average of $175,000 exceeding Group I by only $9,000. Differences were found in actual capacity available, number of men per firm, inventory turn and the monthly wage price of labor. The actual group averages are given in the Table II below.

TABLE II

Comparison of Low and High Capacity Utilization Firms

	Replacement Value of Plant and Machinery	Ton's Capacity Available	Manpower per Plant	Inventory Turn	Monthly Wage Price
Group I	$166,000	68,600	10	12	$309
Group II	$175,000	55,700	14	15	$338

There were also some striking differences between the plants with positive deviations and those with negative, regardless of their group. For instance, those firms above the zero value line showed a lower volume of business, more personnel, a lower inventory turn, and fewer sale dollars per man. The plants with the negative deviations in each group were opposites in these comparisons - they had more volume, less personnel, higher inventory turn and larger sale figures

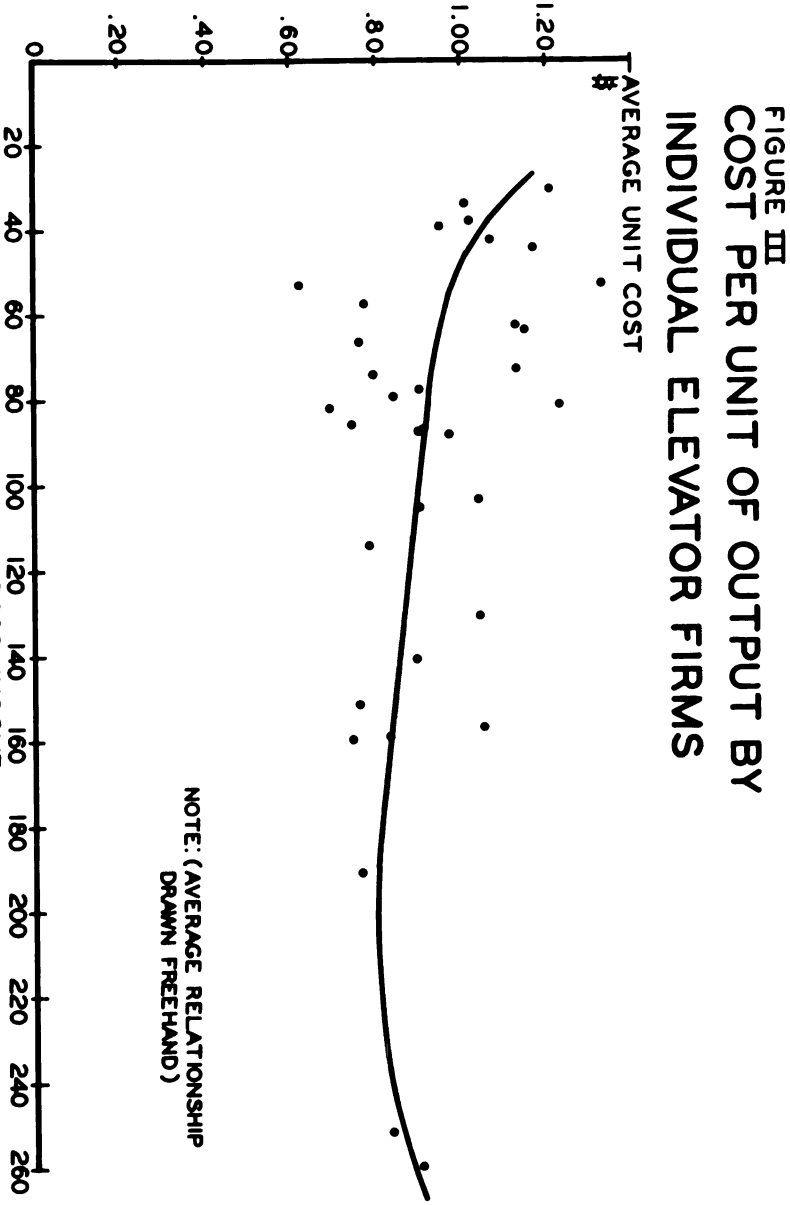
per man when compared with the other plants. In both Group I and II, the plants with the higher percent capacity utilization had larger total gross margins. This contributed to the two similar negative slopes shown in Figure II. Additional research will be necessary before this relationship can be fully explained, particularly the sharp positive slope between the fourteenth and eighteenth percent capacity.

Figure III depicts the average unit costs of these firms as found by using the cost regression figures in Figure I, and dividing these costs by their respective computed outputs. This curve illustrates one of the basic cost theories of economics - a rising level of costs at both the lower and higher levels of output. Insufficient output in relation to overhead costs results in high unit costs where volume is small. On the other hand, at the higher levels of output, the necessary services and facilities required to bring about this large output often raises the average total cost. Figure III demonstrates this quite well, although it should be pointed out again that only two of the firms operated beyond the $200,000 output level, and any specific conclusions drawn at this higher output might prove inaccurate with additional plants and data.

SPECIFIC COST CATEGORIES. The largest single component of total cost for all of the thirty-four plants is the cost of labor. This cost, which includes all labor expenses except management and bookkeeping, is about forty-six percent of the total operating cost or $41,000 for the average firm. Recurrent overhead and direct operating cost

FIGURE III

COST PER UNIT OF OUTPUT BY INDIVIDUAL ELEVATOR FIRMS



NOTE: (AVERAGE RELATIONSHIP DRAWN FREEHAND)

categories average eighteen and five tenths percent each, and plant maintenance averages seventeen percent of total costs. Table VII in the appendix has been developed to point out the specific cost categories and their distribution for each plant. While the averages quoted above seem to substantiate the importance of labor to total costs, it also serves to point out the almost equal impact of each of the other three cost categories. In the short run, only the labor and direct operating expense categories can be manipulated to any extent by management. Management can affect short run changes in the costs that make up nearly two-thirds of the total cost structure.

Labor Costs. The net relationship between labor cost and output is shown in Figure IV. The regression is linear throughout most of its range, with downward curvatures at high outputs. This is largely the result of low labor costs in one large country elevator. Labor costs as a proportion of total costs vary from fifty-eight to thirty-eight percent. However, a comparison between the six high total cost plants and the six low total cost plants reveals only one-tenth of one percent variation in labor as a proportion of total costs; forty-three and six tenths to forty-three and five tenths percent, respectively. However, the net regression in Figure IV shows that the labor to output efficiency increases gradually as output increases; at least over the range of this data.

The partial relationship between labor costs (X_1) and percent of

FIGURE IV

NET RELATIONSHIP OF LABOR COSTS TO OUTPUT

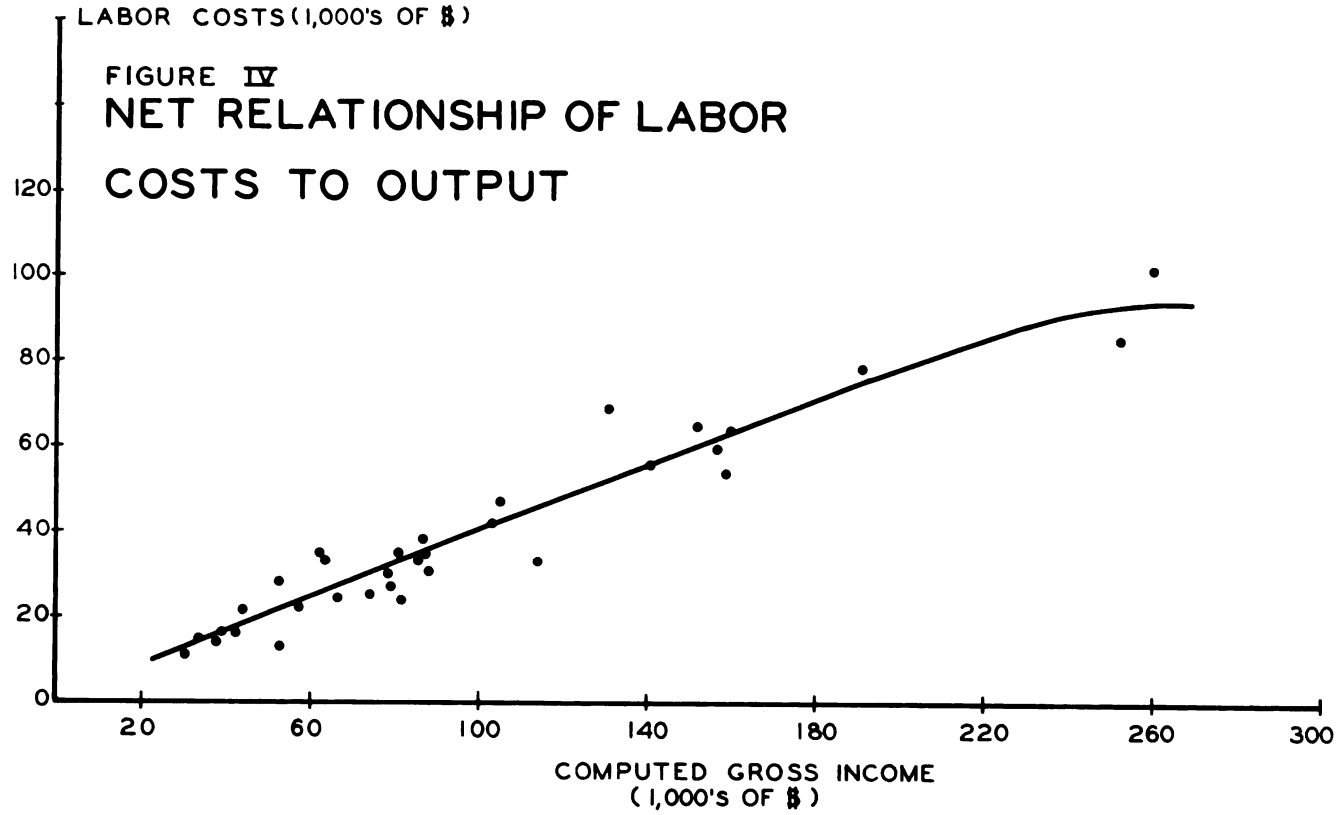
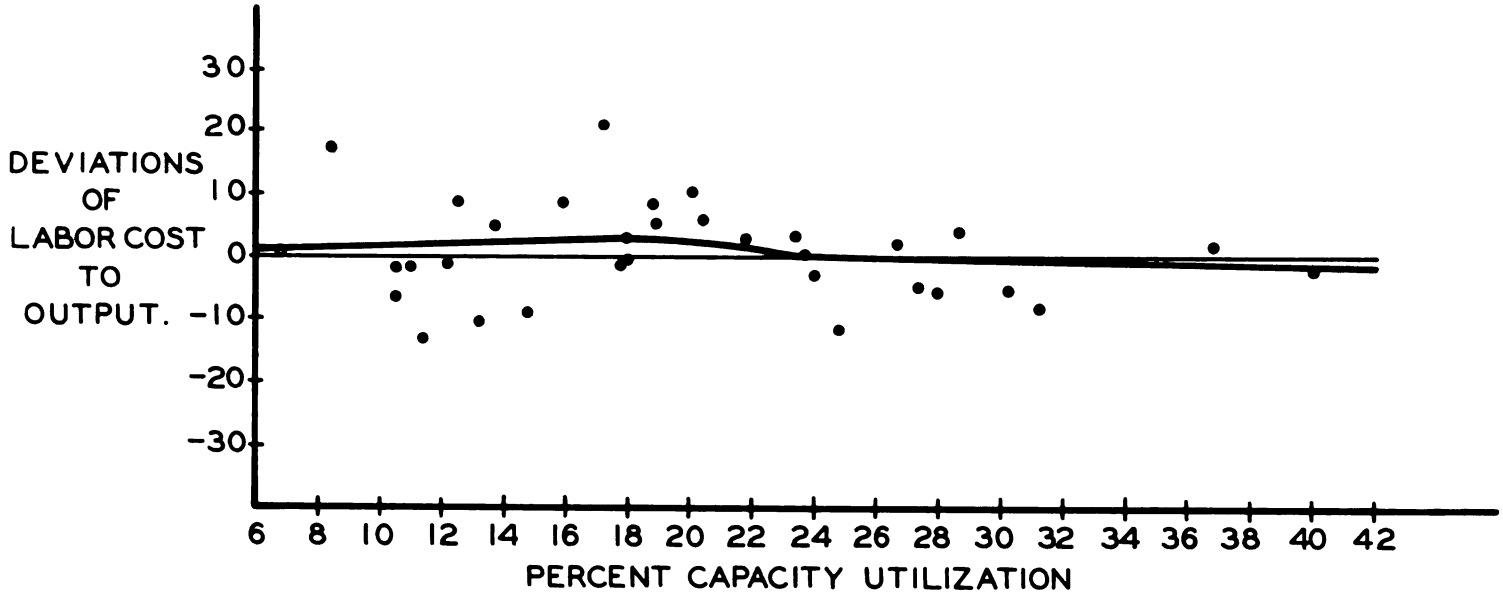


FIGURE V

PARTIAL RELATIONSHIP BETWEEN LABOR COST AND PERCENT CAPACITY UTILIZATION

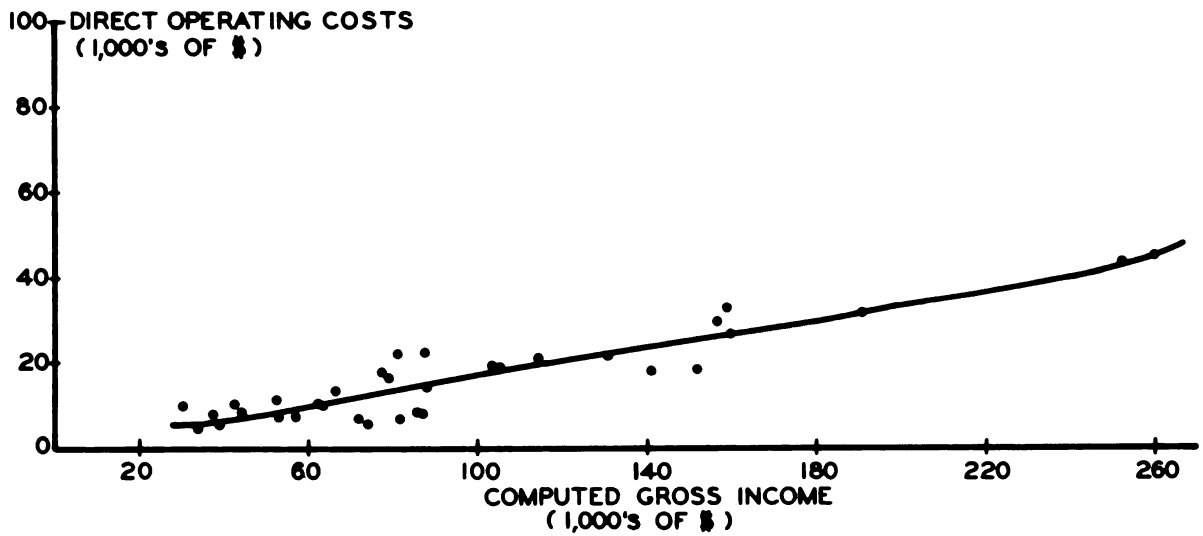


capacity utilization (X_3) is graphically presented in Figure V. The regression is slightly positive at the lower ranges, but becomes negatively sloped at the higher capacity utilizations. The regression as drawn reflects very little labor economy because of variance in plant utilization. Extremely high labor costs of plants one and five, at the low capacity range, have considerable effect on the shape of the regression. Nevertheless the effective use of labor by several of the firms in the lower capacity utilization group is noticeable from the figure. They appear to have hired capable men, paid them more wages and averaged less men per plant.

Direct Operating Costs. These expenses are those items, such as power and supplies, which should vary with volume of business in the short run. The relationship of costs to output is developed in Figure VI. The regression is linear except for a slight curvature at the upper extreme of output. The direct operating costs appear to level slightly off at low output and increase noticeably at the largest output. The weighted average of direct operating costs to total costs for all plants is eighteen and five tenths percent with extreme values in individual plants of twenty-eight and nine percent. The regression shows only a slight benefit at higher output levels for the use of direct operating funds and even this disappears at the extreme upper range. The percent capacity utilization relationship to the deviations of direct operating costs and output is not significant. Only at higher capacity utilization is

FIGURE VI

NET RELATIONSHIP OF DIRECT OPERATING COSTS TO OUTPUT



direct operating cost reduced and even then only slightly.

Recurrent Overhead Costs. This category includes taxes, bookkeeping and management costs, and other items which are recurrent, but do not vary directly with volume of business in the year's time. A graphic presentation of this cost relationship to output is shown in Figure VII. This regression is linear throughout the range with a moderate positive slope. There is a tendency for new plants, or those with new facilities to have the positive deviations. For instance, the plant with the highest percentage recurrent expenses is one with a completely new facility. However, other factors such as large indebtedness, higher bookkeeping expenses, and a higher tax base, can increase the amount of recurrent overhead expense appreciably. It has been suggested that the older plants have a lower tax base in most instances, and that lower priced management in the older plants has had an effect on cost relationships in the sample of plants studied. The percent capacity utilization relationship to the deviations of recurrent overhead costs and output is not significant. The slope indicates that percent of capacity utilization does not materially affect recurrent costs within the range of the data included in this study.

Plant Maintenance Costs. These costs include repairs, depreciation and insurance. The relationship of this cost category to output is shown in Figure VIII. It has a positive linear relationship over most of its range. At the high output a noticeable upward curvature is found

FIGURE VII

NET RELATIONSHIP OF RECURRENT OVERHEAD COSTS TO OUTPUT

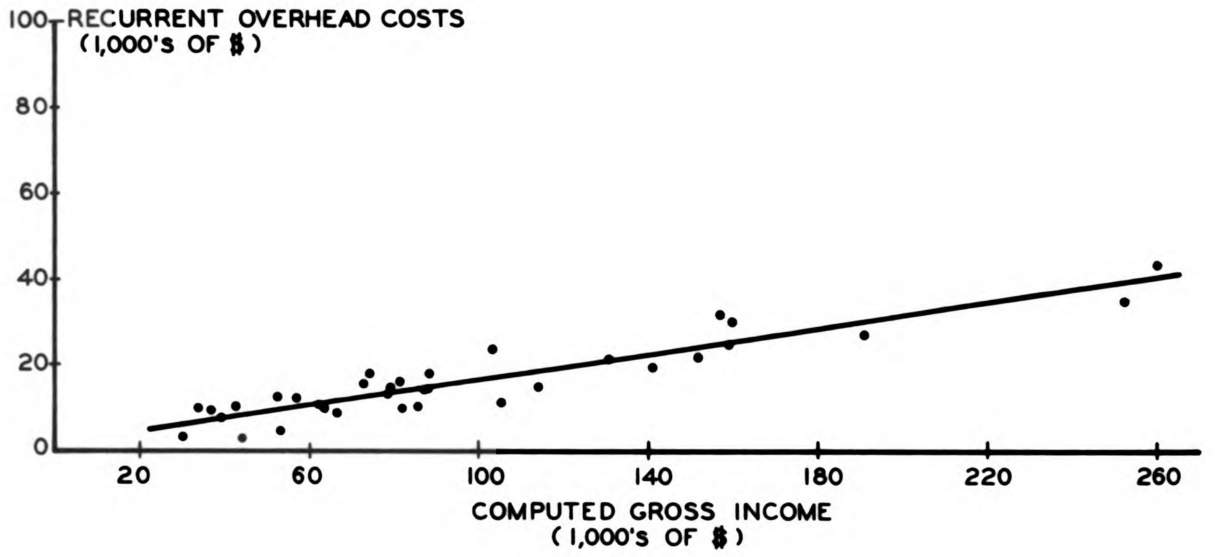
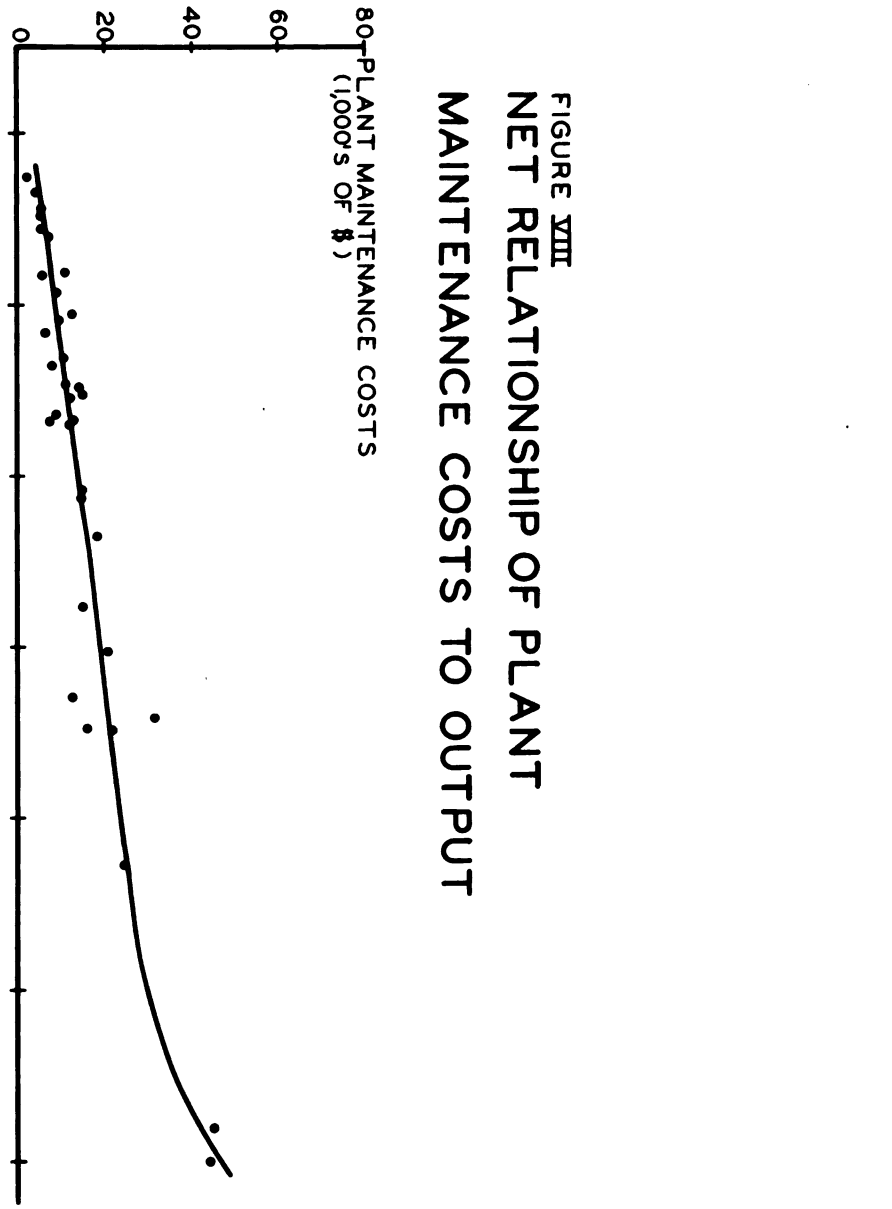


FIGURE VIII

NET RELATIONSHIP OF PLANT MAINTENANCE COSTS TO OUTPUT



are responsible. The two elevators mentioned above are old plants with several buildings which carry high insurable rates and need repairs continually.[21/] New plants built with long life fire preventive materials tend to lower costs in this category. There is no discernible relationship in the percent capacity utilization and the deviations of this category.

Summary. Because of the relative importance and variation of labor costs, it would seem that labor management is an important key to efficient elevator operation. It appears that additional research could provide the basis for more effective use of labor. In no other specific cost category is variation as great between plants.

An important guide for elevator management may be the gross sales per man. The goals of $50,000 per man, a current trade figure, should probably be doubled if a top grade labor force is to be maintained. Pursel found that labor in Michigan elevators returned barely enough to cover its cost.[22/] Additional study of these categories and their returns per dollar expended should be useful to elevator managers.

21/ The deviations about this regression line represent the smallest extreme variation of any of the specific cost categories.

22/ Arthur J. Pursel, "The Use of Functional Analysis in Evaluating the Operations of Michigan Elevators - Farm Supply Businesses", Unpublished Master's Thesis, Michigan State University, 1957, p. 35.

CHAPTER IV

Other Cost Variation Factors

Introduction. Cost behavior results from other factors than those discussed in Chapter III. These cost elements and even their relative importance will vary from one firm to another and from one type of business to another. Joel Dean lists several additional determinants of cost that appear important in most any modern firm.[23/]

1. Prices of input factors
2. Technology
3. Size of transaction
4. Stability of output
5. Labor Efficiency

There is insufficient data to discuss either the effect of transaction size or output stability, although both of these appear to be important in determining the cost structure of the elevator. That elevator management is concerned with these aspects of costs is revealed in several ways. For instance, many managers have endeavored to increase the lot size through the promotion of bulk sales and selling techniques. The problem of output stability has become increasingly important in recent years because of the effects of the governmental farm programs and the dynamic trend of agricultural technology. The industry has used resale

---

23/ Joel Dean, Managerial Economics, Prentice Hall, New York, 1951, p. 253.

men, the grain bank, and a diversified farm service program in an effort to make their business stable and insure a more equal month to month volume. Looking to the future, vertical integration may become an important element in this picture.

The balance of the cost determinants suggested by Dean; price of inputs, technology, and labor efficiency are in part reflected in certain variables which can be obtained from the available data. Two approaches suggest themselves in attempting to further explain cost variations between plants. First, derive the estimated costs from the regression relating total costs to the two independent variables - output and percent capacity utilization. Then compute the residuals from the actual cost and attempt to relate these differences to additional cost variables. The second approach is to study in some detail variability in the independent cost categories. Both methods will be used to develop a better insight into the nature of costs in elevators.

Total Cost. Consideration will first be given to the total cost relationship, then a more detailed analysis of labor costs will be undertaken. Labor costs are considered in more detail, because of their influence on the total cost structure. The residuals studied in this section are those developed from the correlations graphically pictured on pages nineteen and twenty. They are the result of the relationship of total costs to output, as represented by computed gross income (the value of services performed), and plant utilization as depicted by

percent capacity utilization in the feed and grain operation.[24/] The total cost is then estimated from the two regression lines and the values of the independent factors for the respective plants. The amount of variation between the actual total cost and the estimated total cost represents the total cost variation unexplained by the correlation. The objective is to locate and further develop other cost determinants that would explain, in part at least, these residuals.

Only those variables which seem appropriate and measurable are studied. Those finally employed are:

1. Percent grain gross income of non-grain gross income
2. Monthly wage prices (all labor)
3. Gross sales per man
4. Total plant investment

These independent variables in part reflect some of the important cost determinants mentioned previously. Wages reflect the price differentials in the most important input category. Investment will, in part, reflect differences in level of technology while gross sales per man should suggest the overall efficiency of the labor force. The other variable - ratio of gross income from grain merchandising to gross income in all other operations is included in an attempt to measure enterprise cost differences which are not reflected in the charge or gross margin obtained from each type of activity.

24/ These data with resultant residuals are shown in the appendix Table VIII, p. 47.

The following tabular analysis of the additional cost factors mentioned on page 35 is given to provide some indication of their effect on total costs. Ten plants, five with the highest negative residuals and five with the largest positive residuals are compared to the average of the thirty-four plants studied.[25/]

TABLE III

Comparison of Additional Cost Factors in Firms with Large Negative or Positive Residuals

	Ratio of Gross Income from Mdse. Grain to all Other Gross Income	Monthly Wage Rate (Dollars)	Gross Sales per man $1,000's	Total Plant Investment $1,000's
5 Negative Residuals	54.3	$315	84	379.5
Average of all 34 plants	29.3	$328	56	263.7
5 Positive Residuals	19.3	$361	48	286.8

The comparison of these additional cost factors present some interesting relationships between the two groups of cost residuals. It is quite apparent that the plants with the largest negative residuals obtained more gross income from grain, paid lower wages, had more gross sales per employee, and invested more in plant facilities than those with the positive variations. It is also significant to note that the

---

25/ Plants 26,27,28,31 and 33 make up the negative residuals, with plants 6,13,16,23 and 30 representing the positive residuals.

average of the thirty-four plants lies between the results of these two residual groups. This tends to verify the opinion that the positive residual results were nearly opposite in each of these cost contrasts.

The five largest negative residual firms operated at an average cost of only eighty-three cents for each dollar of gross margin. The five positive residual plants averaged $1.05 for each gross margin dollar. This would appear to point out the value of operating the elevator with management's eye on the achievements of the negative residual group, at least as far as the cost factors above are concerned. It is probable that the addition of certain other variables, either unknown or unmeasurable, could further explain much of this cost variation between plants.

Labor Costs. This section is developed to make observations into labor cost factors for the purpose of developing additional information about both variation of labor and total costs. Figure IX compares labor in man months to the grain and feed volume in physical terms. There is considerable variation between plants in quantity of labor per ton. For example, approximately two hundred and fifty man months are used in individual plants where quantity of grain and feed handled varies from 7,800 to over 20,000 tons. The exact causes for these wide variations cannot be pinpointed precisely, however, some of the plants with the more efficient labor utilization (according to Figure IX) appear to be those operations with higher paid management, better than average sales

program, and the facilities to take care of a peak crop handily. The two less efficient grain and feed plants, shown at the upper left in Figure IX, have an average positive cost residual of thirty-seven, while the two most efficient plants, shown at the lower right of the figure, have an average negative residual of fifty-eight.[26/] This would seem to indicate that the more efficient plants, total costs relative to output, need proper facilities to effectively make use of their manpower.

The second part of this labor cost analysis involves the study of total salaries and wages paid to all employees, including office help and management.[27/] This expense is first compared to total operating expense, and then to total sales volume of the thirty-four plants studied. Figure X depicts the relationship of salary and wage payments to the total operating cost for each elevator, individually. The graphic presentation has a minimum of scatter which seems to indicate a rather consistent relationship between these two factors. Further study shows that salary and wage payments, which average fifty-four percent of total costs for all elevators, varies from a high of sixty-eight to a low of only forty-six percent. Michigan elevator management has a "rule of thumb", which suggests a top limit of fifty-five cents for salaries and

---

26/ These residuals are those computed from a regression of total costs to the two independent variables - output and plant utilization.

27/ This differs from previous analysis in that only plant labor has been included until now.

FIGURE IX

RATIO OF MAN MONTHS OF LABOR TO GRAIN AND FEED VOLUME.

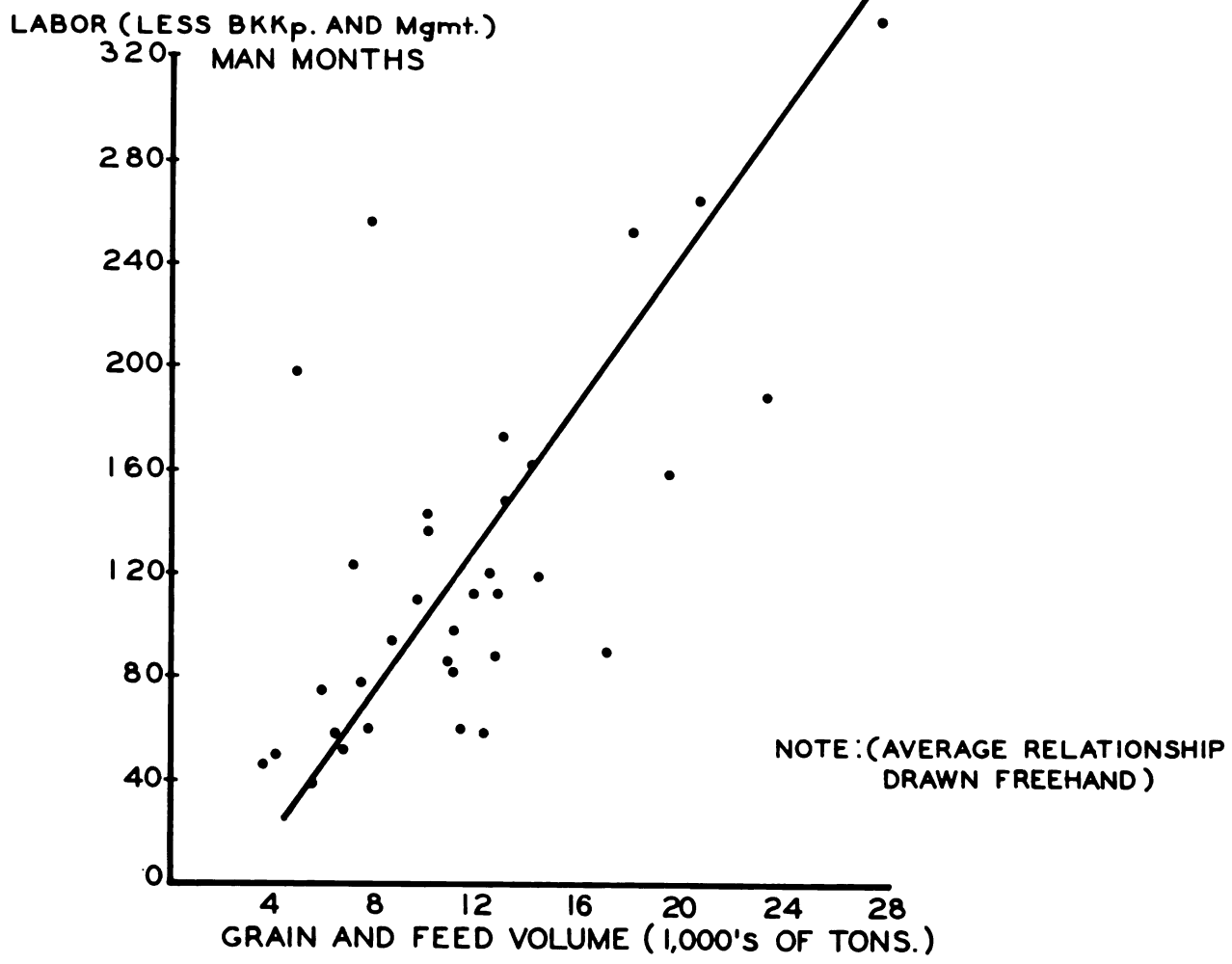
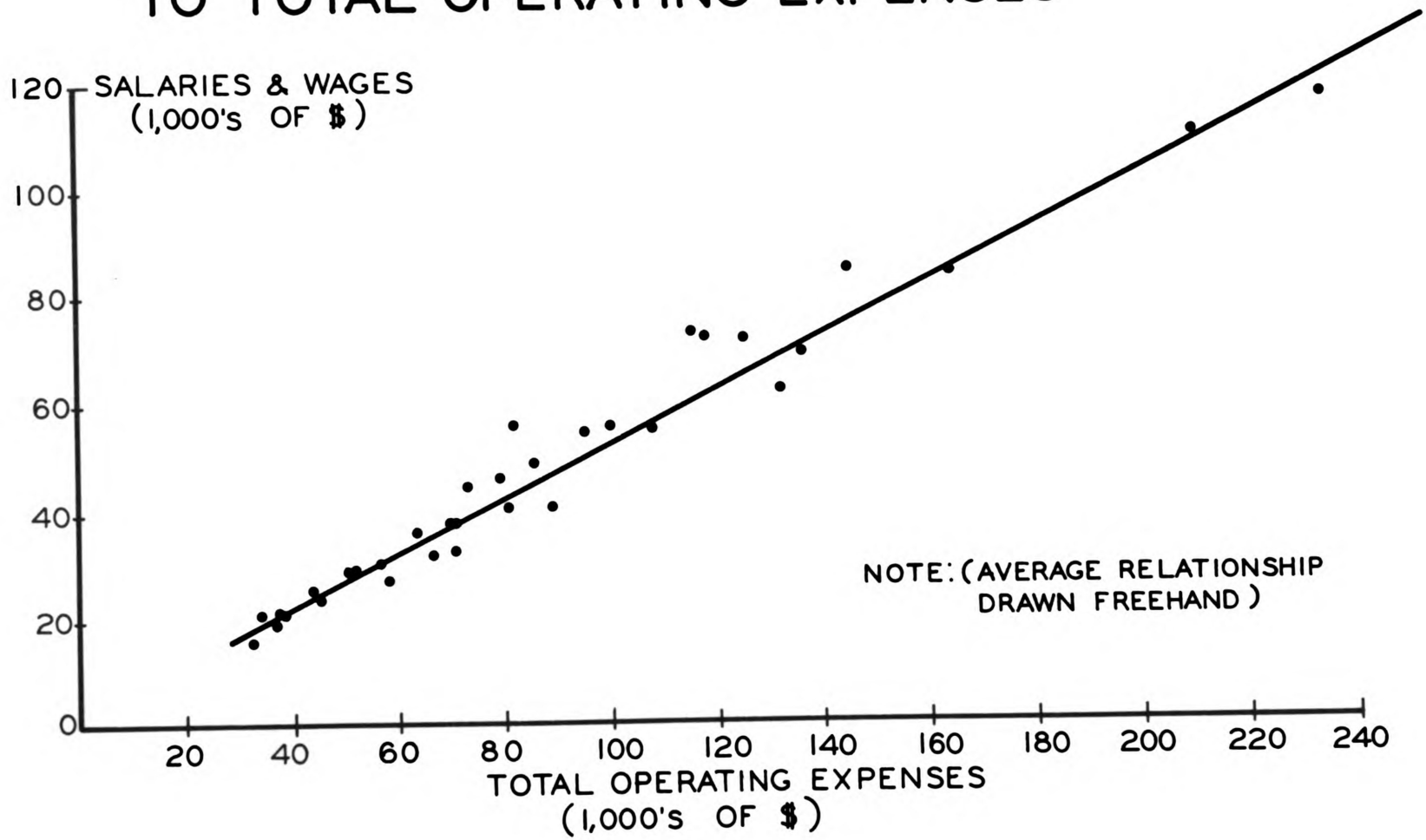


FIGURE X

RATIO OF SALARIES AND WAGES PER PLANT TO TOTAL OPERATING EXPENSES



wages of each expense dollar. This "top limit" was equalled or excelled by exactly one half of the plants in the study. A check with the two cost residual groups, previously studied, revealed that both the high and low plants spent on the average of fifty-four cents for salaries and wages of each dollar of total expense. Apparently, this relationship is not as critical as many industry people have presumed. At least it does not seem an important cost relationship in this sample of plants.

The relationship of salaries and wages to sales volume of the thirty-four elevators is shown in Figure XI.[28/] There appears to be a wide variation between plants. Actually, the weighted average of all elevators in the sample is six and seven tenths percent of salaries and wages to total sales volume. The individual high and low vary from eleven and four tenths to two and nine tenths percent, respectively. Many managers use a suggested danger zone of eight percent or over for this relationship and fifteen of these plants were in this "zone".

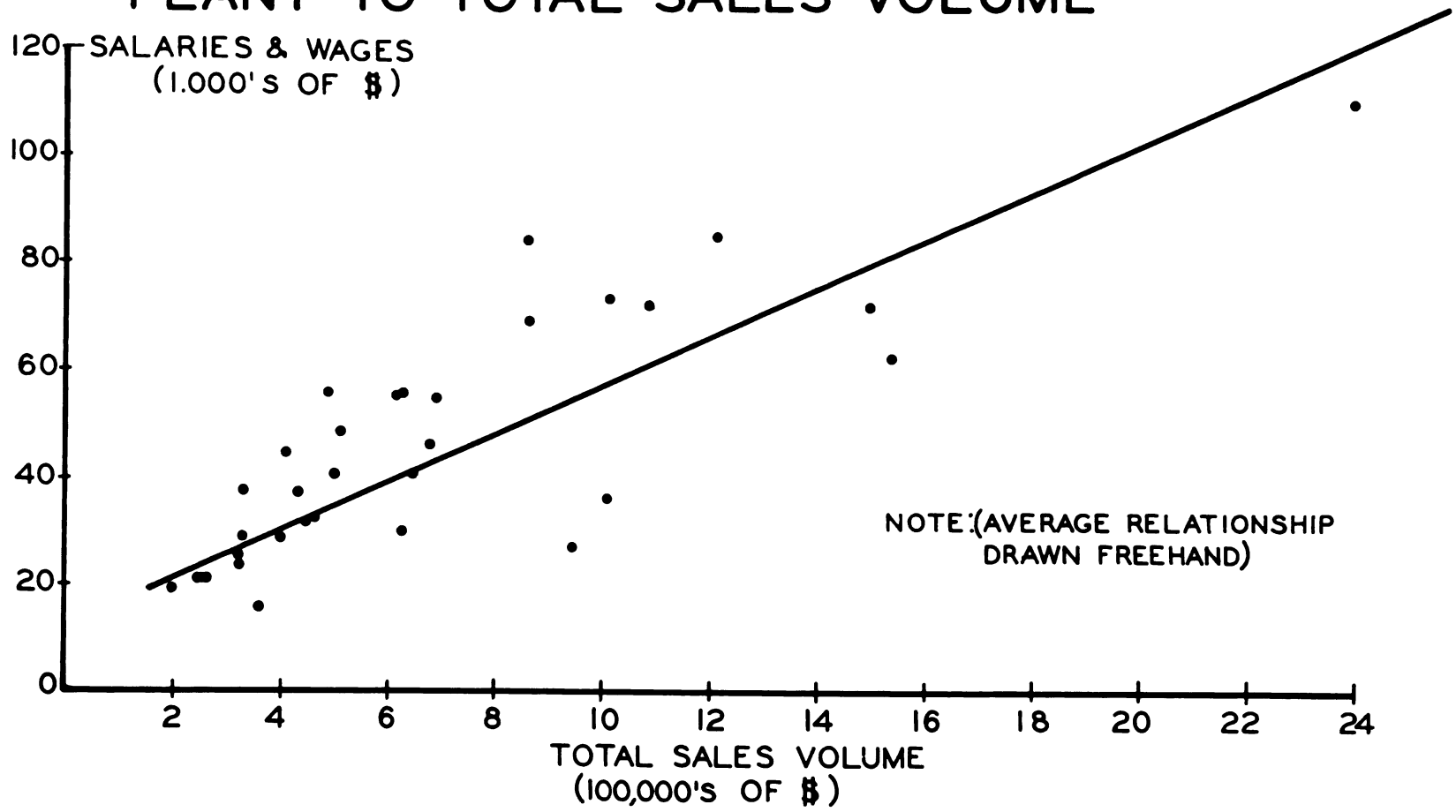
The seven plants with lower wage payment to sales, as shown at the lower right in the figure, are firms which averaged sixty percent of their sales volume from grain marketing. The four elevators which had a high salary and wage to sales volume, shown at the upper left in Figure XI, averaged only twenty-eight percent of their sales from

---

28/ Sales volume represents total dollar volume and includes both wholesale and retail business.

FIGURE XI

RATIO OF SALARIES AND WAGES PER PLANT TO TOTAL SALES VOLUME



grain. Grain handling produces dollar volume much more rapidly than feed or farm supplies and produces relatively less gross income per dollar of sales, because of the small margin maintained in grain merchandising. Salary and wage payments to dollar volume appear of little value for comparative cost analysis, unless the commodity mix of the volume is known.

In summary of the labor cost relationships, at least two important findings should be emphasized. First, the cost of labor is paramount to management as an important determinant of total costs. The cost of this input can be modified by elevator management through wage price, as well as, by ratio of men to output. Both of these factors have a direct influence on labor costs as developed previously. More attention to these two labor cost criteria would appear beneficial to management. The second issue is the apparent breakdown of the two "rules of thumb" commonly used by the elevator trade. Both ratios of salaries and wage payments to total operating cost, and then to total sales volume, did not seem capable of representing relevant cost patterns or boundaries in themselves. Additional information regarding the size of business, investment in plant facilities, and the product or commodity mix are needed if these ratios are to be meaningful. Evidence of the differences that arise in operating ratios is shown in Table IV, where several labor cost ratios are compared at different levels of sales volume to the average of all plants.

TABLE IV

Labor Cost Ratios Comparisons by Sales Volume

	Number of Plants	Labor Cost as a % of Total Cost	Labor Cost per Dollars of Sales	Labor Cost as a % of Output (Gross Margin)
Up to $500,000	16	40.3	.062	38.7
$500,000 to $950,000	10	41.5	.047	38.6
Over $950,000	8	46.0	.041	37.1
All Plants	34	43.0	.053	37.9

Only the labor cost to output appears to have stability and even in this case individual plants vary in this study from thirty to fifty percent.

Summary. In summary of this chapter, discussion of other cost variation factors, Table V has been developed. Comparison of the positive and negative residual groups to the average of all plants for the purpose of demonstrating, and at the same time summarizing the trends of pertinent cost determinants is useful at this point.

It is noticeable that the plants which have the larger negative residuals operate at a lower cost with high sales. Their number of employees is low. It would appear that investment per man should be sufficient to efficiently handle the farmers products and farm needs. The five plants in the high positive residual group have not been as

successful in keeping their costs low, or in expanding sales. These operational figures in themselves are not set up as standards, however, they do establish trends for elevator management to consider, if they wish to operate an effective business firm. Because of unique features in a multiple purpose firm, such as a country elevator, there is some question as to whether any specific cost criteria can be selected as a bench-mark for the trade. Individual differences must first be specified, and then cost boundaries developed.

TABLE V

Comparative Operational Criteria in
Firms with Large Negative or Positive Residuals

	Salaries and Wages $1,000's	Total Operating Costs $1,000's	Volume of Business $1,000's	Invest-ment per man $1,000's	Number of Employ-ees
5 Negative Residuals	52.8	77.9	918	6.9	11.6
Average of all 34 plants	49.0	88.3	712	5.9	12.6
5 Positive Residuals	57.4	107.6	640	6.5	13.4

CHAPTER V

Summary and Conclusions

In this study of costs and their relationships, an attempt is made to isolate certain meaningful cost relations. Cost data from a sample of thirty-four Michigan elevator and farm supply firms have been arranged and re-arranged from their original accounting setting for the purpose of examination and analysis. A detailed picture of costs and cost proportions as they exist today in elevator and farm supply firms is developed. The primary objective is to study the relation of costs to a variety of business cost determinants and to attempt to discover by graphical means the actual cost regressions. A second aim is to alert the trade to the more pertinent cost relationships discovered through this study. New areas which need additional research may be opened through the presentation of this analysis.

The operating structure of the country elevator and the nature of its activities indicates that the real product of such firms is service. Further, the best measure of this service available with present data is the gross margin obtained by the business. In an operating context three factors are involved in determining a proper business efficiency ratio $\frac{M \times V}{TC}$, unit gross margin times physical volume as the numerator with total operating costs as the denominator. This study deals almost exclusively with the total costs or some portion of this denominator. Special attention is given to the relationship of costs to service

rendered, as measured by gross margin.

Four specific cost categories are developed from total cost by combining individual cost items from the plants accounting records. In some cases the individual items were split between two categories, ie., salaries and wages were divided between labor and recurrent overhead cost in order that management and bookkeeping would not be included as a labor charge. The labor cost category included all plant labor expenses including payroll taxes and commissions. Direct operating expense included those costs which vary in the short run with the volume of business. Recurrent overhead costs contain certain items of expense not directly variable with volume in the short run. Finally, plant maintenance cost represented the cost of maintaining the plant and equipment.

Total operating costs are compared graphically to output after adjusting for differences in percent of capacity utilization. Each of the specific costs mentioned above are also related to output by the use of graphic correlation analysis. Output is the computed gross margin of these elevators and percent capacity utilization represents the level of feed and grain equipment usage during a year. The graphic method was used in order that the regressions would take the shape which fitted the relationship. Determination of the nature of the curve or line was one of the objectives of the thesis.

The net relationship of total costs to output is a positive linear

relation - except for the sloping decline at the low output and the sharp rise at the highest limit. This relationship points to an increasingly advantageous ratio of total cost to output as gross margin increased. However, at the maximum output the costs rise rapidly with no appreciable increase in output. Labor costs are the most important component of total costs. The net regression shows that the labor cost to output decreased in very large plants. Capacity utilization did not affect labor costs materially. Apparently, many of the elevators have been able to develop enough flexibility in their operation that they can adjust to a wide range of feed and grain machinery utilization. Gross sale goals per man probably should climb substantially as volume of sales becomes a more important business necessity.

Other cost determinants besides output and capacity utilization play a part in the cost structure and its variances. Several cost factors were developed with the following determinants chosen for study.

1. Percent grain gross income of non-grain gross income
2. Monthly wage prices (all labor)
3. Gross sales per man
4. Total plant investment

Comparison of these factors between ten of the plants in the study[29/] indicated that the most efficient plants (total cost to output) had the high grain volume, lower wage prices, the greatest gross sales per

---

29/ Five largest positive and negative residual plants by the estimated cost from the actual cost of these plants.

man and had approximately one-fourth more invested in plant and machinery. These additional determinants appear to have an effect on the costs of elevators and additional work may be necessary to subscribe their actions and boundaries more concretely.

All salaries and wages, including commissions and insurance, and retirement programs were related to total operating cost and total sales volume. Findings indicated that these ratios were not sufficient in themselves for comparative analysis of elevator operations. Additional categorization as to size of business (volume), the investment in plant and facilities, and the product mix would be necessary for these ratios to be helpful in decision making. Evidently the number of men employed to the volume of business and the actual wage price that they command are two ratios that appear to be more meaningful.

There is a need for continuing research into costs and cost relationships. The efficiency with which labor is used needs close scrutiny on the part of management. There is the problem of investment in machinery and its relation to both total costs and labor expense. Possibly there are meaningful relationships not included in this study which could be useful as a basis for managerial decisions. This study points out some of the complex and challenging conditions which face an elevator manager as he meets the daily responsibilities of management. These men hold key roles in agriculture, and the necessary

research to assist them can provide useful assistance which will be of direct benefit to the business men involved, but at the same time beneficial to agriculture in total.

APPENDIX

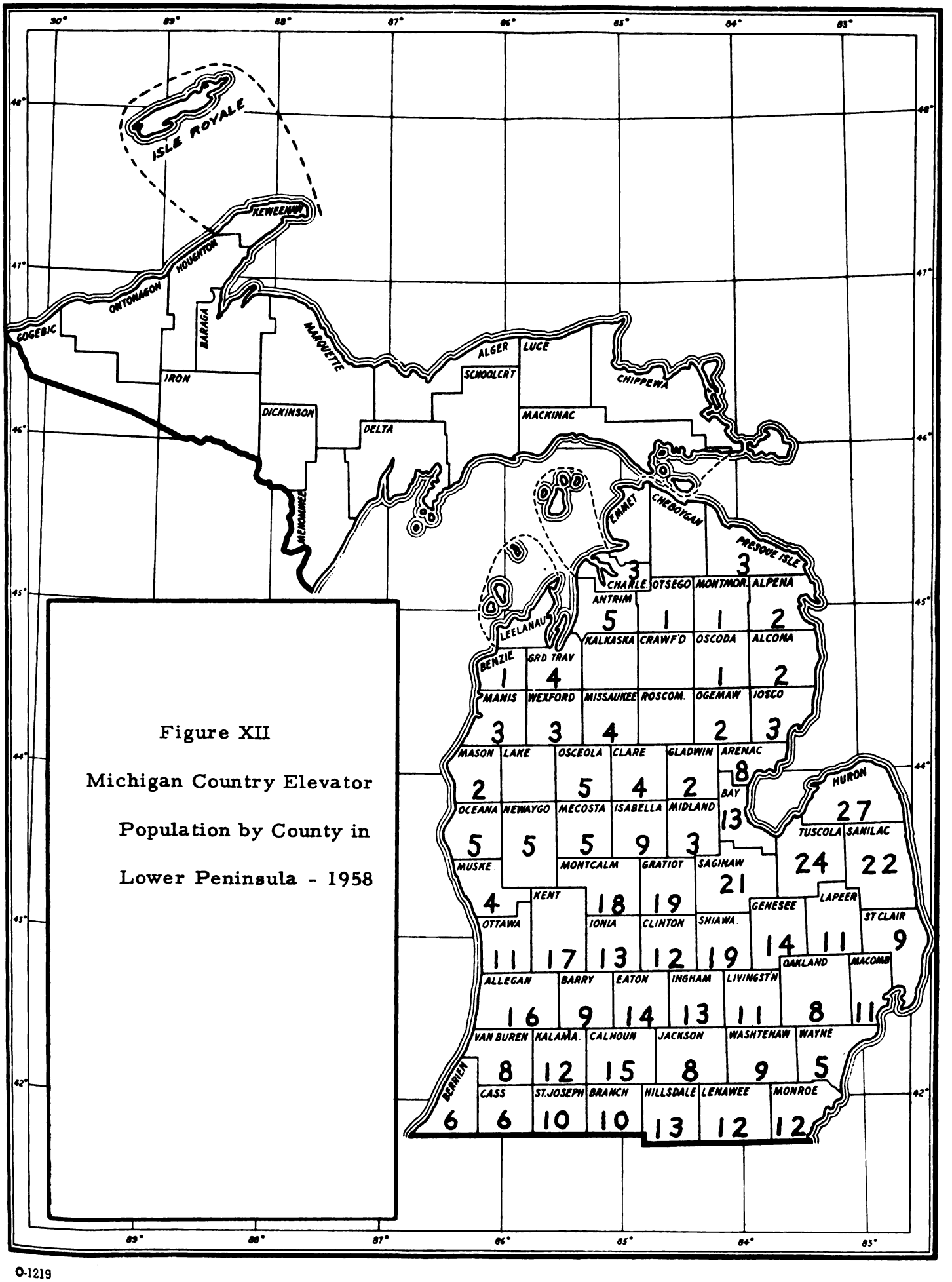


Figure XII

Michigan Country Elevator Population by County in Lower Peninsula - 1958

TABLE VI

Raw Income and Sales Data of the Thirty-four Elevators Studied

Plant No.	Grain and Feed Sales	All Other Sales Volume	Service Income	Total Sales & Service Volume	Actual Gross Margin	Net Margin
1	$ 202,000	$ 288,055	$ 8,822	$ 498,878	$ 84,561	$ 2,541
2	261,543	201,493	24,547	487,583	78,001	7,252
3	167,633	163,277	16,052	346,962	55,632	(14,025)
4	139,039	61,809	7,273	208,121	33,073	3,841
5	359,687	507,332	13,529	880,548	134,811	(1,494)
6	403,272	215,087	30,840	649,199	115,803	7,052
7	319,626	129,791	24,872	474,289	69,400	2,856
8	468,464	526,015	20,178	1,014,657	173,433	57,721
9	172,243	317,931	15,728	505,902	87,985	7,030
10	132,921	124,477	7,924	265,322	34,193	(55)
11	456,383	760,188	14,775	1,231,346	181,067	36,048
12	766,802	323,060	45,608	1,135,470	171,584	53,552
13	620,661	239,706	65,574	925,941	155,269	(9,054)
14	163,712	102,423	9,404	275,539	34,722	(3,896)
15	238,693	171,570	14,502	424,765	76,142	3,089
16	265,433	167,827	17,322	450,582	71,473	913
17	267,623	132,126	22,719	422,468	65,738	15,075
18	190,505	134,425	11,689	336,619	40,393	(4,941)
19	167,733	78,071	12,120	257,924	40,907	3,492
20	243,137	120,609	14,636	378,382	46,753	14,094
21	917,538	647,131	70,527	1,635,196	258,522	24,142
22	358,224	296,390	33,222	687,836	96,409	7,509
23	346,770	350,265	24,129	721,164	102,589	7,438
24	952,135	589,998	26,350	1,568,483	144,109	11,826
25	231,021	92,583	26,309	349,913	54,990	11,115
26	256,962	255,374	25,850	538,186	104,921	19,182
27	434,268	195,099	26,532	655,899	88,246	31,483
28	843,173	168,295	10,157	1,021,625	66,108	2,374
29	1,624,286	770,056	23,363	2,417,705	297,040	86,779
30	449,936	179,255	14,269	643,460	108,473	8,400
31	1,003,842	497,304	25,499	1,526,645	159,978	34,845
32	259,366	69,631	19,594	348,591	54,897	2,972
33	657,873	278,375	9,736	945,984	64,200	5,915
34	440,674	241,022	11,603	693,299	94,034	14,832
Ave.	$434,799	$ 276,354	$ 21,919	$ 733,072	$ 100,157	$ 13,006

TABLE VII

Cost Data by Category for Elevators Studied

Plant No.	Labor Cost	Direct Operating Cost	Recurrent Overhead Cost	Plant Maintenance	Total Operating Cost
1	$ 47,858	$ 7,400	$ 15,873	$ 10,889	$ 82,020
2	29,425	17,383	12,473	11,648	70,747
3	31,848	11,216	14,547	12,047	69,658
4	15,875	10,468	6,143	4,428	36,914
5	73,859	21,814	23,693	16,939	136,305
6	45,798	19,769	25,600	16,864	108,031
7	25,906	14,519	12,329	13,790	66,544
8	64,422	17,811	20,531	12,948	115,712
9	35,938	22,739	14,787	7,491	80,955
10	15,152	4,722	10,033	4,341	34,248
11	76,252	27,140	19,454	22,173	145,019
12	60,832	19,812	18,506	18,881	118,032
13	65,564	29,940	34,848	33,871	164,323
14	14,804	8,191	9,644	5,979	38,618
15	38,971	10,191	12,182	11,709	73,053
16	36,084	10,835	10,852	12,789	70,560
17	23,757	12,479	7,816	6,611	50,663
18	17,242	10,581	10,506	7,005	45,334
19	17,412	5,909	8,574	5,520	37,415
20	14,494	7,394	4,942	5,829	32,659
21	101,453	44,428	43,664	44,835	234,830
22	33,680	21,533	15,362	18,325	88,900
23	49,334	19,201	11,714	14,902	95,151
24	56,355	33,383	25,667	16,878	132,283
25	19,941	5,686	10,126	8,572	43,875
26	36,264	14,439	20,723	14,313	85,739
27	26,260	7,038	10,967	12,498	56,763
28	33,570	8,785	11,168	10,211	63,734
29	85,149	44,058	35,158	45,896	210,261
30	40,843	22,314	19,537	17,379	100,073
31	61,525	18,402	22,319	22,887	125,133
32	27,864	8,934	5,889	9,238	51,925
33	25,719	6,067	18,524	8,245	58,285
34	40,461	8,553	15,784	14,404	79,202
Average	$40,861	$ 16,269	$ 16,461	$ 14,719	$ 88,300

TABLE VIII

Basic Data for Total Cost Correlation with Comparison of Estimated to Actual Costs

Plant No.	Total Operating Cost - X_1	Computed Gross Income - X_2	Percent Plant Capacity Utilization - X_3	Actuals Estimated Cost Residuals
1	82,020	72,724	8.4	39
2	70,749	78,767	27.4	68
3	69,658	52,554	15.9	57
4	36,914	30,371	17.9	-16
5	136,305	130,938	17.2	35
6	108,031	103,611	21.8	100
7	66,544	79,366	31.3	57
8	115,712	151,947	28.7	-33
9	80,955	87,571	12.2	79
10	34,248	33,898	6.8	-85
11	145,019	191,291	36.9	5
12	118,032	159,929	40.1	0
13	164,323	156,998	17.8	113
14	38,618	37,796	10.5	58
15	73,053	63,580	20.1	- 7
16	70,560	62,397	12.5	189
17	50,663	66,577	28.0	-36
18	45,334	42,407	11.0	83
19	37,415	39,183	23.7	50
20	32,569	52,994	13.2	-73
21	234,380	260,457	26.7	-14
22	88,900	114,293	11.4	-85
23	95,151	105,228	13.7	130
24	132,283	159,209	15.1	3
25	43,875	57,168	30.3	5
26	85,739	88,134	17.8	-137
27	56,763	81,821	14.8	-106
28	63,734	85,749	24.0	-121
29	210,261	252,656	24.8	- 3
30	100,073	81,198	20.4	137
31	125,133	141,089	18.9	-139
32	51,925	44,240	18.8	-68
33	58,285	74,241	10.5	-117
34	79,202	87,078	23.4	- 3
Average	88,300	100,200	19.8	+ 5

TABLE IX

Labor Costs	Direct Operating Costs	Recurrent Overhead Costs	Plant Maintenance Costs
Labor	Power	Taxes	Repairs
Bonus Commissions	Office Supplies	Bookkeeping Expense	Depreciation
Retirement	Advertising	Management Expense	Insurance
Social Security	Truck	Retirement, share of book-keeping and management	Rent
Unemployment Insurance	Postage	Legal Dues	
	Heat	Subscriptions	
	Light	Interest	
	Freight	Meeting Expense	
	Express	Board Expense	
	Travel	Miscellaneous	

BIBLIOGRAPHY

1. Bean, Louis H., A Simplified Method of Graphic Curvilinear Correlation, Journal of American Statistical Association, Vol. 24, December, 1929.

2. Dean, Joel, Managerial Economics, New York: Prentice-Hall, Inc., Third Printing, 1954.

3. Dean, Joel, and James, Warren R., The Long Run Behavior of Costs in a Chain of Shoe Stores, University of Chicago Press, Chicago, 1942.

4. Ezekiel, Mordecai, Methods of Correlation Analysis, Edition 2, New York, John Wiley & Sons, 1941.

5. French, B. C., Sammet, L. L., and Bressler, R. G., Economic Efficiency in Plant Operations with Special Reference to the Marketing of California Pears, Hilgardia, Vol. 24, Number 19, July, 1956, University of California, Berkeley, California.

6. Gold, Bela, Foundations of Productivity Analysis, University of Pittsburgh Press, 1955.

7. Knight, Frank, Risk, Uncertainty and Profit, London School of Economics and Political Science, Reprint No. 16, London, 1937.

8. Larzelere, H. E. and King, R. M., Ratios as Measuring Sticks for Elevator and Farm Supply Organizations, Special Bulletin 380, Agricultural Experiment Station, Michigan State College, August, 1952.

9. National Bureau of Economic Research, Cost Behavior and Price Policy, 1943, Committee on Price Determination, Edward S. Mason, Chairman.

10. Phillips, Richard, Managing for Greater Returns in Country Elevator and Retail Farm Supply Businesses, Des Moines, Iowa, Farmers Grain Dealers Association of Iowa, (Cooperative), 1957.

11. Pursel, Arthur J., The Use of Functional Analysis in Evaluating the Operations of Michigan Elevator - Farm Supply Businesses, Unpublished M.S. Thesis, Michigan State University, 1957.

12. Seymour, Robert G., Cost Concepts in Marketing: A Study of the Application of Theoretical Concepts of Cost to the Empirical Determination of Cost Behavior in the Individual Marketing Firm, Unpublished Ph.D Thesis, University of Illinois, 1953.

13. Shepherd, Geoffrey S., Agricultural Price Analysis, Ames, Iowa, The Iowa State College Press, Second Edition, Revised, 1947.

14. Stigler, George J., The Theory of Price, Revised Edition, 1952, New York, The MacMillan Company.

15. Thomsen, Frederick L. and Foote, Richard J., Agricultural Prices, New York, 2nd Edition, McGraw-Hill, 1952.

16. Waugh, Frederick V., Graphic Analysis in Economic Research, Agricultural Handbook, N. 84, USDA, AMS, Washington, D. C., June, 1955.

CONFIDENTIAL CONFIDENTIAL

Questionnaire on Elevator Farm Supply Businesses

The information asked for on this questionnaire is for research purposes only. It will never be divulged in such a manner that the information can be identified with your business.

Name of Business _____ Date _____

Address _____
Post Office County State

GENERAL INFORMATION

Kind of Ownership
Individual proprietor _____
Regular Corporation _____
Cooperative Corporation _____

How large a trade territory do you cover (miles in each direction)
East _____
South _____
West _____
North _____

EMPLOYMENT RECORD

How many full time Employees do you have exclusive of the manager?

_____

How much seasonal hiring did you do last year? _____

_____

_____

Can you give a job classification for each individual you employ as asked for in the table below? If one individual works at two jobs, for example: if an office employee waits on customers, or if a mill man drives truck part-time, please estimate the time spent on each job as closely as possible.

Classification of Jobs by Individuals

Employee and Department	Time Employed in Months	Duties	Salary
Feed			
1			
2			
3			
4			
5			
6			
7			
Grain			
1			
2			
3			
4			
5			
6			
Truck Drivers			
1			
2			
3			
4			
5			
Bookkeeping			
1			
2			
3			
4			
5			
Other			
1			
2			
3			
4			
5			
6			

Managers Name_____. Do you operate on a straight salary_____or on a salary plus commissions, or a bonus_____?

What is the basis for payment of commissions or bonuses, if any_____
_____?

How much of the salary item in the operating statement of your audit represents a payment to you for management?_____

Do any other employees receive commissions or bonuses? If yes, explain_____
_____

What percent of managers time is spent:

1. Waiting on customers?_____
2. Buying grain or beans?_____
3. Doing clerical work?_____
4. Studying markets, attending meetings, learning about feeding or fertilization practices, studying past operating records, otherwise acquiring information needed for management decisions?_____
5. Other activities?_____

FARM PRODUCTS MARKETED

	Quantity bought	Cars Shipped	Cost of Sales	Average mark-up taken
Beans (navy)				
Corn				
Oats				
Wheat				
Barley				
Soybeans				
Other				

FARM SUPPLIES SOLD

Supplies	Units Sold	Sales	Cost of Sales	Mark up taken	Average Price Rec'd.
Gasoline					
Tractor Fuel					
Kerosene & Fuel oil					
Lubrication oil					
Feed					
Seed					
Fertilizer High					
Low					
Coal					
Other Farm Supplies					

	Receipts	Charge
Receipts from services rendered:		
Grain and seed treating and cleaning		
Grinding and mixing		
Warehousing (Storage)		
Trucking		

MONTHLY STATEMENT OF INVENTORIES AND ACCOUNTS RECEIVABLE

Month	Accounts Receivable	Inventories
January		
February		
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		

Marketing inventories include wheat and other grains, poultry, eggs, etc. Farm supply inventories include feed, seed, fertilizer, farm machinery, miscellaneous farm supplies, etc.

BORROWING DURING LAST FISCAL YEAR

(List each loan separately)

Loan No.	1	2	3	4	5	6
Term of loan in months						
Source (type of lender)						
Purpose (oper., cap., etc.)						
Security (Mort., etc.)						
Method of repayment						
Maximum amount outstanding during fiscal year						
Amount outstanding at close of year						
Interest rate						

How much did you owe on trade accounts payable during seasonal peak operations?

Spring_____ Fall_____

What is the maximum amount which can borrow on a seasonal basis from banks, patrons, relatives, etc.?_____

KIND OF ADVERTISING OR FARMER RELATIONS USED

Method	Frequency	Expenditure
Newspaper advertising		
Direct Mail		
Radio or T.V.		
Call on Farmers		
Other		
_____		
_____		
_____		

Under what conditions in the past two or three years have you been hard pressed for capital?_____

_____

Could you have increased your volume if you had had additional operating capital this past year? Yes___ No___ How much_____.

Explain_____

_____

_____

Which of the plants previously mentioned give you the strongest competition? (Name in order)

1. _____
2. _____
3. _____
4. _____
5. _____

What do these businesses do that cause you trouble? _____

_____

_____

How do you meet this competition? _____

_____

_____

How much government grain did you handle last year? _____

_____

_____

Did you suffer any unusual losses on commodities handled last year? _____

_____

_____

_____

Considering now the amount of business available and your competitive situation what maximum volume of business do you think you ought to have in the trade territory you operate in.

	Feed	Grain	Others
About right	_____	_____	_____
Should increase	_____	_____	_____
(How much - in percent)	_____	_____	_____

If you feel you should increase - - what has prevented it? _____

_____

_____

_____

How much capital would be needed? _____ How much additional would this bring in? _____

Which phase of your operation do you consider most profitable? _____

Have you aggressively attempted to push it in anyway? _____ How? _____

Have you held grain for higher prices or bought future contracts throughout the year? _____

Do you pick up or deliver many commodities which you handle?

Item	Percent picked up from suppliers or farmers		Percent delivered To Buyers	To Farmers	Others
Feed			X		
Fertilizer		X	X		
Grain				X	
Petroleum		X	X		
Other____					

What percent of your feed volume is from your mixing operation? _____

What percent is from merchandised feeds? _____

What percent of your feed volume is for

		Average Price for each kind of feed
1. Poultry		
2. Dairy cattle		
3. Beef cattle		
4. Hogs		
5. Other		

What kind of a pricing policy do you have?

	Grain	Feed	Other Supplies	Other services, mixing, cleaning, etc.
Take supplies or buyers suggested mark-up				
Try to meet competitors price				
Base mark-up on est. cost irrespective of competitors				
Try to beat competitors				

What community projects does your business sponsor or support? _____

Who has the authority in practice for the following types of problems?

	Owner	Manager	Directors	Others
a. Setting prices				
b. Pricing feed and supplies				
c. Selecting sales outlet				
d. Buying major equipment				
e. Hiring employees				
f. Complaints				
_____				
_____				
_____				

How many competitors do you have? _____

Location	Kind of Ownership	Estimated Total Volume of Sales	
		Grain	Other

BUILDING AND FIXTURES RECORD

Elevator

Grain Storage Capacity _____ Bu.
Bag Storage Capacity _____
Cost Value of Bldg. _____
Present Book Value _____
Age of Building _____

Mill

Bulk Storage Capacity _____
Bag Storage Capacity _____
Cost Value _____
Present Book Value _____
Age of Building _____

Office and Retail

Size of Building _____ x _____ ft.
Cost Value _____
Present Book Value _____
Age of Building _____

Warehouse No. 1

Use _____
Capacity _____
Cost Value _____
Present Book Value _____
Age of Building _____

Warehouse No. 2

Use _____
Capacity _____
Cost Value _____
Present Book Value _____
Age of Building _____

Warehouse No. 3

Use _____
Capacity _____
Cost Value _____
Present Book Value _____
Age of Building _____

Other Buildings

_____ _____
_____ _____
_____ _____
_____ _____

Other Buildings

_____ _____
_____ _____
_____ _____
_____ _____

EQUIPMENT RECORDS

Elevator or Grain Handling

Cost Value _____
Present Book Value _____
Average Age _____
Daily Grain Capacity _____

Trucks

_____
_____
_____
_____

Mill

Cost Value _____
Present Book Value _____
Average Age _____
Grinding and mixing capacity _____

_____
_____
_____
_____

Office and Retail

Cost Value _____
Present Book Value _____
Average Age _____

_____
_____
_____

Warehouse Equipment (Include loading - unloading equipment, such as coal loader Petroleum handling equipment, etc.

Cost Value _____
Present Book Value _____
Average Age _____

Other Equipment

_____
_____
_____