9-15-1924

Operating Ratios and Costs as Guides to Management

Urban F. von Rosen

NATIONAL ASSOCIATION
of
COST ACCOUNTANTS
Affiliated with The Canadian Society of Cost Accountants

Official Publications

Vol. VI September 15, 1924 No. 2

Operating Ratios and Costs as Guides to Management

BUSH TERMINAL BUILDING
130 WEST 42nd STREET, NEW YORK

NATIONAL ASSOCIATION OF
COST ACCOUNTANTS

Affiliated with The Canadian Society of Cost Accountants

Official Publications

Vol. VI, No. 2. September 15, 1924.

Operating Ratios and Costs as Guides to Management

URBAN F. von ROSEN
Cleveland, Ohio

BUSH TERMINAL BUILDING
130 WEST 42nd STREET, NEW YORK CITY

The National Association of Cost Accountants does not stand sponsor for views expressed by the writers of articles issued as Publications. The object of the Official Publications of the Association is to place before the members ideas which it is hoped may prove interesting and suggestive. The articles will cover a wide range of subjects and present many different viewpoints. It is not intended that they shall reflect the particular ideas of any individual or group. Constructive comments on any of the Publications will be welcome.

♣

Additional copies of this Publication may be obtained from the office of the Secretary. The price to members is twenty-five cents per copy and to non-members seventy-five cents per copy

♣

PUBLICATIONS DEPARTMENT NOTE

The author of this article is a certified public accountant (Ohio) and a member of the American Institute of Accountants practicing in the city of Cleveland. He received his education in Washington, D. C., attending grammar school, the Central High School and the George Washington University there. His first position of any duration was that of general ledger clerk for the Maxwell Motor Company, Detroit, Michigan, in 1912. Since that time he has held the position of auditor for the R-C-H Corporation, an automobile manufacturing company, and for Traugott Schmidt and Sons, dealers in wool, furs and leather. In 1918 he went to Cleveland to take a position installing uniform cost systems in the fourteen plants of The Standard Parts Company. When this company met with financial reverses, he joined the staff of the Cleveland Office of Scovell, Wellington and Company as a senior accountant and engineer. He served in this capacity for a period of somewhat more than three years when he accepted the position of manager of The Audit Company of Cleveland. In March of the current year he entered upon the practice of public accounting in his own name. He has been active in the affairs of the Cleveland Chapter of the National Association of Cost Accountants since its inception about four years ago and has at various times during this period held the offices of Director and Vice-President in addition to having delivered talks to this body on several occasions. He is also an instructor in the evening classes on the subject of accounting of the School of Business Administration of The Cleveland Y. M. C. A. School of Technology.

OPERATING RATIOS AND COSTS AS GUIDES TO MANAGEMENT

This article is based upon a paper presented at the April, 1924, meeting of the Cleveland Chapter.

The basic principle of successful management is to plan one's course before acting. Many volumes on methods of planning production have been published. Budgetary control is also receiving a considerable amount of attention. But both production and financial plans have to do with the ordinary operations of a business. It seems that before any business concern begins operations, in fact, even before the enterprise is promoted, that a definite plan must exist in regard to the capital required and the means by which a fair return on this investment may be realized.

EQUATION SHOWING RELATIONSHIP OF CERTAIN VITAL RATIOS

The promoter of a successful business enterprise must make a very careful calculation before he can be reasonably sure that the business will yield a fair return on the investment. This calculation may be expressed as follows: (Refer to Figure 1 on page 4) That the percentage of net profit to total capital invested equals the percentage of net profit to total cost of sales, multiplied by the ratio of the total cost of sales to the working capital which is known as the working capital turnover, multiplied by the ratio that the

working capital bears to the total capital. The truth of this equation is readily proved by cancelling out similar expressions in the numerators and denominators of the last three terms. The first and second expressions are ratios which are very commonly used. Probably every stockholder who gets a published copy of the corporation's balance sheet and statement of profit and loss determines the percentage of net earnings to the combined capital stock and surplus as shown by the balance sheet. The percentage of net profit to total cost, or the percentage of net profit to net sales, from which the percentage of net profit to total cost can be determined, is frequently set forth in the statement of profit and loss. The third and fourth expressions are not so commonly used but are every bit as important.

	(1) $\frac{NP}{TC}$		(2) $\frac{NP}{TCS}$		(3) $\frac{TCS}{WC}$		(4) $\frac{WC}{TC}$
(A)	75%	=	10%	×	10	×	75%
(B)	2%	=	10%	×	1	×	20%
(C)	16%	=	1%	×	20	×	80%

FIGURE 1

EQUATION SHOWING RELATIONSHIP OF CERTAIN VITAL RATIOS

NP stands for net profit; TC for total capital; TCS for total cost of sales; and WC for working capital.

Two incidents will serve to illustrate the importance of these last two ratios. During the war it was very noticeable that in the case of different industries, each with its plants operating to capacity with government contracts, based on cost plus a definite percentage, that some concerns made a most fabulous return on their investment while some barely made a fair return or less. This phenomenon was due first to the number of times that the working capital was turned over each year, and second to the percentage of working capital to the total capital required by that particular industry. Now we know from the equation which appears in Figure 1 that, in the case of government cost-plus contracts, what would be a fair percentage on cost in one type of industry where the investment consisted principally of working capital and where the turnover of this working capital was rapid, would be far too small a percentage in the type of industry where the reverse is true. For example, in an industry where the working capital could be turned over ten times a year and where only one-fourth of the total capital was invested in fixed assets, a cost plus 10% contract would yield 75% on the investment, as shown by calculation (A) in Figure 1, whereas in an industry where the working capital could be turned over only once a year and four-fifths of the total

capital was invested in fixed assets, a cost-plus 10% contract would yield only 2% on the investment, as shown by calculation (B) in Figure 1.

Another incident which illustrates the importance of the equation was the national advertising on the part of the meat packers showing graphically what a very small part of each dollar spent for meat represented their profit. Now we know from the equation that it is perfectly possible for an industry to make a very small percentage of cost on each transaction and yet make a very exorbitant return on their investment. Suppose that the packers are able to turn over their working capital twenty times a year and that 80% of their capital is invested in merchandise and accounts receivable, which is easily possible, then only 1% on the total cost of sales represents 16% on the stockholders' investment as shown by calculation (C) in Figure 1.

The four ratios shown are used independently in various statistics but the relationship between them has not been sufficiently emphasized. That this relationship is not generally understood is evidenced by the number of times one hears the question asked, "What percentage of profit on cost should a business of this type expect to realize?". Now the manager of the enterprise knows roughly what percentage return the stockholders would legitimately expect in that type of business. He also knows the ratio of working capital to the total investment. From these he can immediately calculate the required turnover on a certain margin of profit, or the required percentage of profit on cost for a given turnover.

A very substantial contribution to accounting literature entitled "Financial and Operating Ratios" has been published by the Ronald Press Co. Mr. J. H. Bliss, the author, not only mentioned these four ratios and many others and proved their value and use, but compiled many comparative statistics for different industries. This fundamental relationship, however, I believe he missed.

"Stop Loss" or "Point of Profit" Chart

It is generally accepted that the prime object of business is to make money. True, the public's interest as well as the employees' interest should be considered, that is, the product should be sold at as low a price as is consistent with fair wages to the workers and a fair return to the owners. Nevertheless, the first consideration of the manager is that the enterprise be made to pay dividends. We might therefore say that the endeavor of every manager is to keep the value of the first term of the equation stated in Figure 1 well above the prevailing interest rate.

After a company has constructed its plant and begun operations, the fourth term of the equation becomes fairly constant, the working capital is reasonably constant, and the total amount invested may be considered as fixed for the time at least. This leaves only two variables: the net profit and the total cost. These two are in turn dependent upon three things: (1) the volume of pro-

duction or sales, (2) the sales price per unit, and (3) the total cost per unit. So we might say that after the enterprise has been financed, the plant constructed and operations begun, that these three things are the principal consideration of the manager. These are not independent variables but each one varies to some extent with the other two. First, the quantity of units that can be sold increases as we lower the unit sales price, depending upon the elasticity of the demand. Second, the total cost per unit decreases as the volume of production is increased. Of course, in this case, we consider unabsorbed burden as part of the total cost.

This relationship can best be shown graphically by plotting the volume of production or sales against the value in dollars. (Refer to Figure 2 on page 7.)* Figure 2 shows the relation of the different elements of total cost to the volume of production in a certain manufacturing business. The first or horizontal line indicates the total cost for "fixed charges," that is, those manufacturing expenses which do not vary with the volume of production. In this case, it includes not only the usual items of taxes, insurance and depreciation but also includes such items as superintendent's salary, salaries of an organization nucleus, cost of heating the building, watchman's wages and all items of expense which would continue whether a single unit was manufactured or not. In this instance, the fixed charges amount to $3,000. The next solid line, which is a diagonal one, indicates the sum of the fixed charges and the material cost. In this case, it will be observed that the unit material cost is 15 cents, the material cost varying in direct proportion with the production. To illustrate, this line intersects the perpendicular corresponding to 10,000 units at a distance from the horizontal axis which corresponds to $4,500. This amount consists of fixed charges to the amount of $3,000 and material cost to the amount of $1,500 or a unit material cost of fifteen cents. The addition of the labor cost is shown by the third solid line. The unit labor cost is also 15 cents, the labor cost varying directly with production. It will be noted that this line cuts the perpendicular representing 10,000 units at a distance from the horizontal axis which corresponds to $6,000. The combined cost of fixed charges and material, as already stated amounts to $4,500 for this quantity, leaving $1,500 as representing the labor cost, or a unit labor cost of fifteen cents. Those manufacturing expenses, such as power, oil, waste, small tools, and supplies which vary almost directly with the volume are shown by the distance between the third and fourth lines, representing an additional cost of 10 cents each. The fourth solid line represents, therefore, the manufacturing cost of the article.

The other expenses of the business which consist of expenses incidental to the sale of the product and the general administration of the business consist of two classes, those which are constant

*See also Official Publication, Vol. IV, No. 9, "Prices, Profits and Production," by A. F. Stock and M. B. Gordon; and also article by H. R. Boston in the November 1, 1921, issue of *Industrial Management.*"

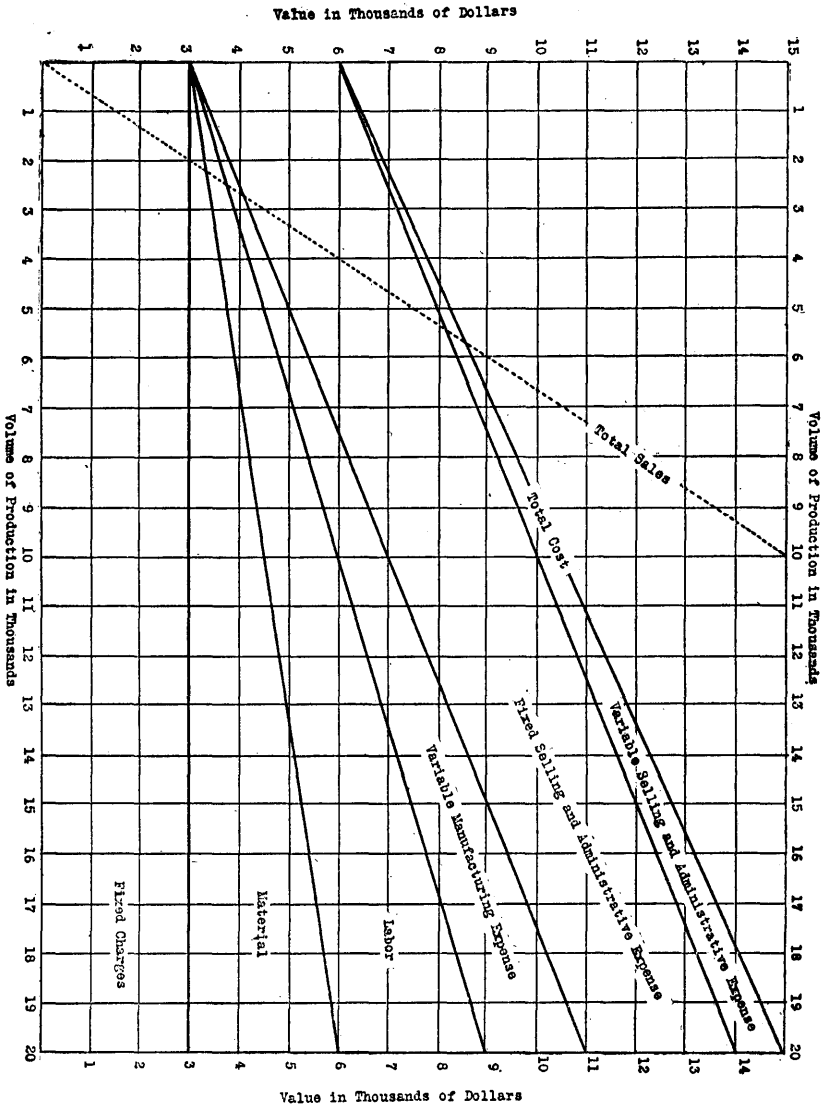

FIGURE 2
"STOP LOSS" OR "POINT OF PROFIT" CHART

and those which vary with the volume. The sales manager's salary, for example, does not usually vary with the volume of goods sold, while the commission paid salesmen on sales would usually vary directly with the volume. The fifth and sixth solid lines represent these classes of expenses. It is to be noted that the fixed selling and administrative expense amounts to $3,000 while the variable selling and administrative expense equals 5 cents a unit. The topmost or

sixth solid line, therefore, represents the total cost to make and sell.

The dotted line, starting at zero and ending at "10" at the top of the chart, represents the sales based on a unit selling price of $1.50. Attention is directed to the point of intersection of this dotted line representing the sales with the top solid line which represents the total cost. This point which has been termed the "stop-loss" point or "point of profit" determines the volume of production, at a definite unit selling price and for definite elements of cost, where the business will just break even. Any smaller volume means a loss, any greater volume produces a profit. This point, it will be noted, is about 5,700 units. This chart shows graphically, therefore, the relationship between the three variables deduced from the first equation shown in Figure 1 on page 4.

Now let us consider the use of this chart in the actual management of any business. The manager knows from the first equation what return must be earned on the working capital of the business, that is the product of the second and third terms of the equation, the first and fourth terms being fixed. The required net profit, of course, can be expressed in dollars and cents. Therefore, he knows that in order to realize this amount sufficient units must be sold at such a price that the difference between the top solid line and the dotted one will equal the required return. Suppose the required return is $3,000. Then the total sales must equal the sum of his costs for fixed charges, $3,000, for fixed selling and administrative expenses, $3,000, and for profit, $3,000, plus the rate per unit for variable costs multiplied by the number of units sold. In this instance, the total sales must equal $9,000 plus the number of units sold multiplied by forty-five cents, the latter item to cover his variable costs. To meet this requirement, he can sell 10,000 units at $1.35, 5,000 units at $2.25, or any other combination that can be worked taking into consideration the known demand for his product. This fact can be illustrated graphically by drawing a line parallel to the top solid line at a distance from it corresponding to $3,000. This line would show the total proceeds that must be obtained for any quantity sold to net a total profit of $3,000. If such a line were drawn on the chart it would intersect the 10,000 unit perpendicular at the ordinate corresponding to $13,500 and the 5,000 unit perpendicular at $11,250, the unit selling prices in these instances being $1.35 and $2.25 as already stated.

Suppose, however, on the other hand, the manager knows that he cannot dispose of more than 10,000 units and that he cannot obtain a greater price for them than $1.20 each. In that case, he can determine from the chart, to what extent he must cut his costs in order to make the required return. The total sales proceeds in this instance would be $12,000 while the total cost would be $10,500. Therefore, in order to net a profit of $3,000 the cost must be cut to $9,000 or reduced by the amount of $1,500.

While the relationship between the factors as shown on the

chart is very interesting when expressed graphically, the same relationship can be expressed algebraically with reasonable accuracy. The total cost in any case is the sum of the fixed expenses plus the unit cost for variable expenses multiplied by the volume. In this example, the total cost at any volume is equal to $6,000 plus the number of units produced times $.45. While we hear occasionally of semi-variable expenses, it is my opinion that any type of expense can be expressed as the sum of a constant and the product of a variable, times the units produced with reasonable accuracy.

Another point of interest in the present assumed case, is that the selling price could be cut as low as $.45, just sufficient to cover the actual cash outlay traceable directly to the manufacture of the article, without the business being better off from having made the sale than having lost it. Of course, such sales could not be made in any locality where the price would hurt the established market for the article.

By noticing simply the top solid line, it is observed that the total cost of 5,000 units is $8,250 or $1.65 each, the cost of 10,000 units is $10,500 or $1.05 each, and the cost of 20,000 units is $15,000 or $.75 each. Now when one speaks of unit cost in an accounting sense, just what does he mean? Usually, I believe, that he means the unit cost at normal production. Obviously, it is impossible to obtain comparative unit costs unless one uses predetermined burden rates based on normal production.

One final point that might be made is the relationship between the subjects of economics and finance and those of accounting and statistics. Text-books on economics and on finance are strikingly devoid of mathematical formulæ and of solutions to specific problems. Is it not possible that the accountant, particularly the cost accountant, the statistician and the mathematician may by their combined efforts transform both of these subjects into exact sciences, or at least into sciences more exact than they are at present?

Vol. II

No. 9—Cost Accounting for Public Utilities, *E. D. Bistline*

No. 15—What Is Wrong with Cost Accounting? *G. Charter Harrison*

No. 16—A Method of Distributing Factory Payroll, *Matthew Porosky*

No. 17—Coal Production Costs, *R. W. Gardiner*

No. 18—Uniform Cost Accounting Methods in the Printing Industry, *W. B. Lawrence*

No. 19—A Cost System for an Electric Cable Plant, *Fred F. Benke*

Vol. III

No. 4—Some Cost Problems in the Hawaiian Sugar Industry, *F. A. Haenisch*

No. 6—Some Phases of Cost Accounting in the Chemical Industry, *C. B. B. Rosén*

No. 10—List of References on Interest as an Element of Cost

No. 19—Normal Burden Rates, *Charles Van Zandt*

Vol. IV

No. 3—First New England Regional Cost Conference.

No. 5—Steamship Operating and Terminal Costs, *Joseph J. Mulhern and Urbain Robert*

No. 6—Cost Practices and Problems in the Production of Coke, *C. C. Sheppard*

No. 7—Production Costs in the Manufacture of Phonograph Records, *C. J. Borton*

No. 8—Cost Problems in the Wrought Iron Industry, *Carl G. Jensen, Comp.*

No. 10—Cost Accounting for Cranes and Hoists, *P. E. Stotenbur*

No. 11—Cost Accounting in the Tool Steel Industry, *John J. Keefe*

No. 16—Standard Costs—How to Establish and Apply Them. *William F. Worrall*

No. 17—A Method of Collecting Direct Labor Costs and Statistics, *George H. Friesel*

No. 18—Cost Accounting for Self Laying Track Tractors, *Percy Ehrenfeldt*

No. 19—Papers and Discussions—Third New England Regional Cost Conference

No. 20—Radio Educational Campaign

No. 21—Cost Accounting in Relation to Business Cycles, *John R. Wildman*

No. 22—Cotton Mill Costs, *W. A. Musgrave*

No. 23—A. Punched Card System of Inventory Control, *W. V. Davidson*

Vol. V

No. 3—A Method of Costing Partially Completed Orders, *C. B. Williams*

No. 6—Cost Accounting in the Production of Motion Pictures, *William R. Donaldson*

No. 7—An Introduction to Predetermined Costs, *George Rea*

No. 8—A Practical Method of Cost Accounting in a Shipbuilding or Ship Repair Plant, *L. V. Hedrick.*

No. 9—Getting the Most Out of Business Records, *Matthew L. Carey.*

No. 10—The Expense of Power and Building Service, *James P. Kendall.*

No. 11.—Indirect Labor, *Harry J. Ostlund*

No. 13.—Fourth New England Regional Cost Conference.

No. 15.—Construction Cost Accounting From the Viewpoint of Both the Contractor and the Customer, *Weston J. Hibbs.*

No. 16.—Budgetary Control, *William Carswell*

No. 17.—A Foundry Cost System, *Machinery Builders' Society.*

No. 18.—Methods of Supplying Cost Information to Foremen, *Hugo Diemer.*

No. 19.—Cost Accounting in a Metal Stamping Plant, *E. H. Wildt.*

No. 20.—Use of Accounting Information and Statistical Data in a Department Store, *A. C. Hodge*

No. 21.—A Basis for Cost Accounting in Banks, *Gordon Wilson*

No. 22.—Importance of the Cost of Idleness in Equipment Industries, *E. F. Du Brul*

No. 23.—Controlling the Labor, *W. O. Cutter and others.*

Vol. VI

No. 1—Executive Uses of Costs, *Howard Berry.*

No. 2—Operating Ratios and Costs as Guides to Management, *Urban F. von Rosen*

Copies of the above publications which are not out of print may be obtained from the office of the Secretary of the Association, 130 W. 42nd Street, New York City, at the price of 75 cents per copy.