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ACCOUNTING AS A MEANS OF MEASURING PRODUCTIVITY

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Productivity: The Vital Necessity

Much has been said and written in recent years about productivity. A variety of meanings have been attached to it and it was frequently confused and used interchangeably with terms such as profitability, performance, and efficiency.

Broadly defined, productivity “. . . is a measure of the efficiency with which resources are converted into commodities and services that men want.”¹ Translated into mathematical terms, productivity is the ratio of output, (the volume of products or services produced) to input, (the resources used or the factors of production employed). The more favorable the yield between input and output obtained, the higher the relative efficiency or the productivity in the conversion process.

The degree of productivity in the conversion of resources to useable products and services influences vitally the wealth and economic well-being of nations, industries and individual firms, since “it affects costs, prices, profits, output, employment, and investment, and thus plays part in business fluctuations, in inflation and in the rise and decline of industries and individual firms.”²

Experience has taught that productivity in the long-run is best improved by innovation or changes in the means of production. In the short-run, improvements in quantity or quality of output are facilitated by raising the efficiency with which the resources within an existing system are utilized; in other words, by attempts to produce more, faster for less, or to obtain higher quality output from the resources expended. Human knowledge, skill and motivation are essential prerequisites for success in such attempts.

Clarification of Meaning

Although the definition of productivity is comparatively simple, this simplicity is not reflected in clarity of usage. Besides being used interchangeably with terms such as

profitability, efficiency, and performance, the word, productivity has come to be something of a five-syllable synonym for output and has acquired a kind of moral value, a quality of desirability. It now constantly recurs in all kinds of discussions and is used in a loose sense in all sorts of situations and arguments. As a result thereof, comparisons are freely made between figures which are in fact not comparable, and the false conclusions drawn frequently give rise to serious misunderstanding and friction.

Before proceeding any further the author shall, therefore, attempt to clarify some of the most common misconceptions.

DR. HELENE M. A. RAMANAUSKAS, CPA, Professor of Accountancy, De Paul University, Chicago, Illinois, participated as a National Reporter at the Ninth International Congress of Accountants in Paris, France in September, 1967 under the sponsorship of the American Woman's Society of Certified Public Accountants. Her paper, here printed in full, has been included in condensed form in the book, "The New Horizons of Accounting," published by the Congress.

Dr. Ramanauskas was chairman of a Group Discussion Session and a panel member of a Plenary Session of the Congress. Both Sessions dealt with her assigned topic for reporting.

The author of 25 articles and 3 books on various accounting and auditing subjects, Dr. Ramanauskas has been a frequent contributor to THE WOMAN CPA as well as an active member of a number of accounting and economics groups. Dr. Ramanauskas teaches graduate accounting courses at De Paul University.

She also speaks frequently to student organizations and professional associations locally, nationally and internationally. Immediately after the Congress in Paris she spoke before the Munich Business Economists Association at the University of Munich in Munich, Germany.

In between official engagements in the summer of 1967 Dr. Ramanauskas visited a number of universities and public accounting firms in England, France, Holland, Switzerland, Germany, Austria and Italy in order to collect international accounting material.

¹ Fabricant, Solomon, "Basic Facts on Productivity Change." Occasional Paper No. 63, New York, National Bureau of Economic Research, Inc. 19569

² op. cit.

Productivity vs. Profitability Since productivity is the ratio of output to input, one is inclined to relate in monetary terms the costs of all products or services of an enterprise (the input) to their sales proceeds (the output). This comparison, however, contrary to expectations does not give us any indication as to the productivity of a certain production process, but only shows whether it is profitable or not. A production process is profitable if the sales proceeds for the output obtained on the market exceed the cost. If the market declines the production process will become less profitable, but the productivity might not be affected at all. The quantity of goods produced or services rendered might be still the same as before the market decline, only their salability has changed.

Productivity of an enterprise (or a nation) does not depend upon whether the market proceeds from its product increase or decrease at a different rate than its costs, or whether the output realized is salable at all on the market. It follows, therefore, that "productivity" and "profitability" are not synonyms, but that they describe different matters and can not be used interchangeably.

Productivity vs. Efficiency Another term quite frequently used instead of productivity is efficiency. When employed as equivalent of the productivity of *all* means used compared with the effect obtained, it even represents an acceptable synonym.

In colloquial usage, however, productivity is generally equated with efficiency in the use of only one input factor, namely, the human element labor. Even there people seem uncertain what it is about labor that is being measured, the degree of effort of the individual worker or the degree of the efficiency with which labor is used.

A change in overall productivity can be the result of a change in the effort of labor, but as experience taught us, it is by no means limited to this cause. A baker, for example, making doughnuts by hand may be able to increase his hourly output by increasing his effort. His increased output represents an increase in productivity, and is a result of increased effort of labor. If the baker, however, is provided with a doughnut machine, he may increase his hourly output and thus his productivity without increasing (or even decreasing) his effort, simply because he can work more efficiently.

Thus productivity of labor is more a measure of the efficiency with which labor is used, than it is a measure of the effort of labor, although the effort of labor remains one of the ingredients affecting labor effectiveness.

To use the term efficiency interchangeably with productivity of all production factors without clarification of the intended meaning, invites, therefore, only misunderstanding and confusion.

Factors Affecting Productivity

Productivity, being a ratio relating output to input, measures the efficiency in the use of all factors of production. It not merely expresses labor effectiveness (efficiency and effort) but also reflects varying degrees of mechanization, changing levels of managerial efficiency, utilization of plant facilities and technical processes. It is even affected by factors such as standardization of products, availability of parts and components, the economic climate and government policies, etc.

Although it is still a common belief (strongly exploited by labor union leaders and politicians) that labor is the most important single factor instrumental in productivity improvements, studies of the U.S. Bureau of Labor Statistics came to different conclusions. The findings showed that the most important single factor determining the level of productivity in the long-run is technology, while the most important single influence in short-run productivity changes is the degree of plant capacity utilization. While improvements in technology result in improved output quantity and quality, improved capacity utilization results in per unit cost reductions and frequently also in improved output per man-hour.

Because of the multiplicity of the factors affecting productivity, changes in the productivity ratio can not be attributed to a change in one factor only, but are to be thought of as the algebraic sum of individual and perhaps divergent changes in the separate factors.

Productivity Measurement in General

Because of the vital effects of the degree of productivity, it is no surprise that interest in and measurement of it, is by no means a recent innovation. The history of productivity measurement at the national and industry level through indices (physical units of output per man-hour or per unit of capital employed) goes back into the nineteenth century. At the firm level, as a tool for management of individual organizations, however, it is comparatively new.

The measurement of productivity in the past has been largely in the hands of economists and industrial engineers.³ The economists have

³ Beta Gold, "Foundations of Production Analysis," University of Pittsburg Press.



DR. HELENE M. A. RAMANAUSKAS, in the picture to the left, is seated amid unidentified fellow accountants from unidentified countries at the elegant Official Delegates Dinner of the Ninth International Congress of Accountants at the Galerie des Batailles in the Chateau des Versailles.

been specializing in defining the concepts of productivity, in determining the causes of productivity changes and their individual effects, and in ascertaining productivity trends for whole industries and nations. The industrial engineers have concentrated on measuring efficiency of performance at the job level through the development of work measurement techniques and labor incentive programs.

It is only since the late forties that accountants also became concerned with the problem and urged the development of tools that "will indicate increases or decreases in the productivity of individual firms,"⁴ because they became aware that periodical profits and losses used up till then as sole indicators of productivity reflect too much. Profit and Loss, as shown on income statements, is not only affected by changes in productivity, but also by changes of the output selling price at a different rate than the input cost, by attainment or loss of a sheltered market for products, and by various other conditions inside and outside of the firm.

At The Firm Level

Although each individual firm has its own characteristics which make it different from every other, it has one thing in common with all other firms; it must maintain sufficient productivity and efficiency in its operations in order to prosper or at least to survive in the competitive struggle. Continued and careful measurement of the degree of productivity attained and the knowledge of the extent and direction of actual changes are essential, if management is to evaluate the effects of past actions and to determine appropriate future actions with confidence in the results to be expected.

There exist at present two fundamentally different ways to measure productivity in an

individual firm.⁵ One is through construction of productivity indices (output per man-hour or per dollar of capital employed) like those used to measure progress in the whole economy or at the industry level. The other is by construction of efficiency ratios, which are expressed either in monetary terms, time or physical units.

While productivity indices represent a single yardstick for evaluation of overall performance and do not permit conclusions as to efficiency changes in the use of individual input factors, efficiency ratios are tools to measure the degree of efficiency in the use of the various factors of production.

The productivity index is historical in concept. It is useful in discovering the firm's productivity level within its own industry, or where data are available, in regard to the nation. Although the national and industry "yardstick" data are usually quite old because of the time necessary to collect them, they are still useful in bringing to management's attention what actually happened, even though nothing can be done with all the wisdom of hindsight, to change the past. Its only usefulness is that it invites positive actions for future improvements.

The other way of measuring productivity, by construction of efficiency ratios, is more directly applicable to the present and future. It is based on the premise that in order to arrive at a satisfactory overall productivity level, all input or factors of production must be used with maximum obtainable efficiency and that the degree of attained productivity becomes meaningful only when compared with a predetermined standard of efficient performance, or in other words, with a productivity objective. Efficiency ratios periodically computed for the various factors of production under this method, expressing the actual present productivity, are measured against predetermined productivity standards and draw management's attention to off-standard situations, prompting, thereby, immediate remedial actions if the productivity degree in certain areas declines below a tolerable point.

⁴ Editorial, *Journal of Accountancy*, February 1947, p. 94.

⁵ *The Encyclopedia of Management*, Carl Heyel, Editor, Reinhold Publishing Corp., Capman and Hall Ltd., London.

Accounting's Contribution to Productivity Measurement

Although attempts to develop techniques to contribute to productivity measurement within the framework of accounting are comparatively new, some progress has already been achieved.

The stage for it was set by a parallel development within the accounting profession, namely, the evolution of managerial accounting whose objective it is to provide "methods and concepts necessary for effective planning, for choosing among alternative business actions, and for control through the evaluation and interpretation of performance."⁶

Although still in its infancy, this new branch of accounting has already produced various new and extremely useful techniques.

Just recently another milestone in this re-orientation process was set by incorporating for the first time the human element into the accounting framework through development of Responsibility Accounting. By accumulating, reporting and analyzing accounting data not only according to their nature and function, but also by areas of responsibility, this new performance control mechanism provides management with the necessary informational basis to control all operational functions and key individuals throughout the entire organization with a minimum of effort. By linking responsibility and accountability, it helps to solve even managerial problems which prior had been hidden below the surface.

Despite the fact that most of the new managerial accounting techniques enhance, indirectly, efficiency in performance of productivity of the various operational functions such as production, distribution, and general administration, further techniques were developed specifically designed to measure increases or decreases of the productivity of the firm as a whole and its individual segments.

Productivity Accounting

Although basically productivity is measured by relating the amount of resources used (input) to the volume of products or services produced (output) the major stumbling block in measuring and interpreting productivity and its changes has been the diversity both of output and input.

In order to determine how productivity of a firm could be best measured when multiple resources (input) are always involved and product (output) variety is extremely common, a research study was undertaken during the fifties by the Industrial Research Department

of the Wharton School of Finance and Commerce of the University of Pennsylvania.⁷

After careful deliberations, the researchers decided that the only unit of measure by which the various unlike inputs and outputs could be aggregated into meaningful totals is the country's legal tender, the dollar in case of the United States. By measuring both input and output in dollars, they determined the dollar output obtained per dollar of input. Any increase (or decrease) in productivity, they concluded, would show up as the amount by which output per dollar of input in one period exceeds (or falls short of) that of another period.

Such method of productivity measurement, however, produces only meaningful and comparable results in periods of stable prices. In times of raising or falling price levels inputs and outputs are to be translated to some chosen base scale of values (a base year) to make them comparable. The revaluation of input and output, broken down into major classifications, is accomplished through the use of price indices and the results of such revaluation for at least two years are displayed in a productivity statement. This statement, the culmination of this new productivity measurement technique, presents further data on productivity changes such as output per dollar of input for various years, increases or decreases in productivity from year to year, and finally, the savings achieved through productivity improvements over the base year.

Unfortunately, productivity accounting, as this new measuring technique is called, which produces ratios of output to input, revalued at constant prices, has never achieved broad acceptance in practice, since it was generally assumed that the task of compiling the necessary data would be too onerous.

Other Productivity Yardsticks

As already stated, productivity of a firm and its various segments and functions can be best improved in the long-run by innovation, but at the short-run, within an existing system, improvements in quantity or quality of output can be facilitated only by raising the efficiency with which the resources are utilized.

Top executives today are fully aware that in order to arrive at an optimal over-all productivity level for the firm and there-from relating optimum profits, they must enforce rigidly the highest possible productivity in the usage of all input factors. Experience has taught them that maximum productivity can

⁶ Report on Committee of Managerial Accounting, *Accounting Review*, April 1959.

⁷ Hiram S. Davis, "Productivity Accounting", University of Pennsylvania Press, 1955.

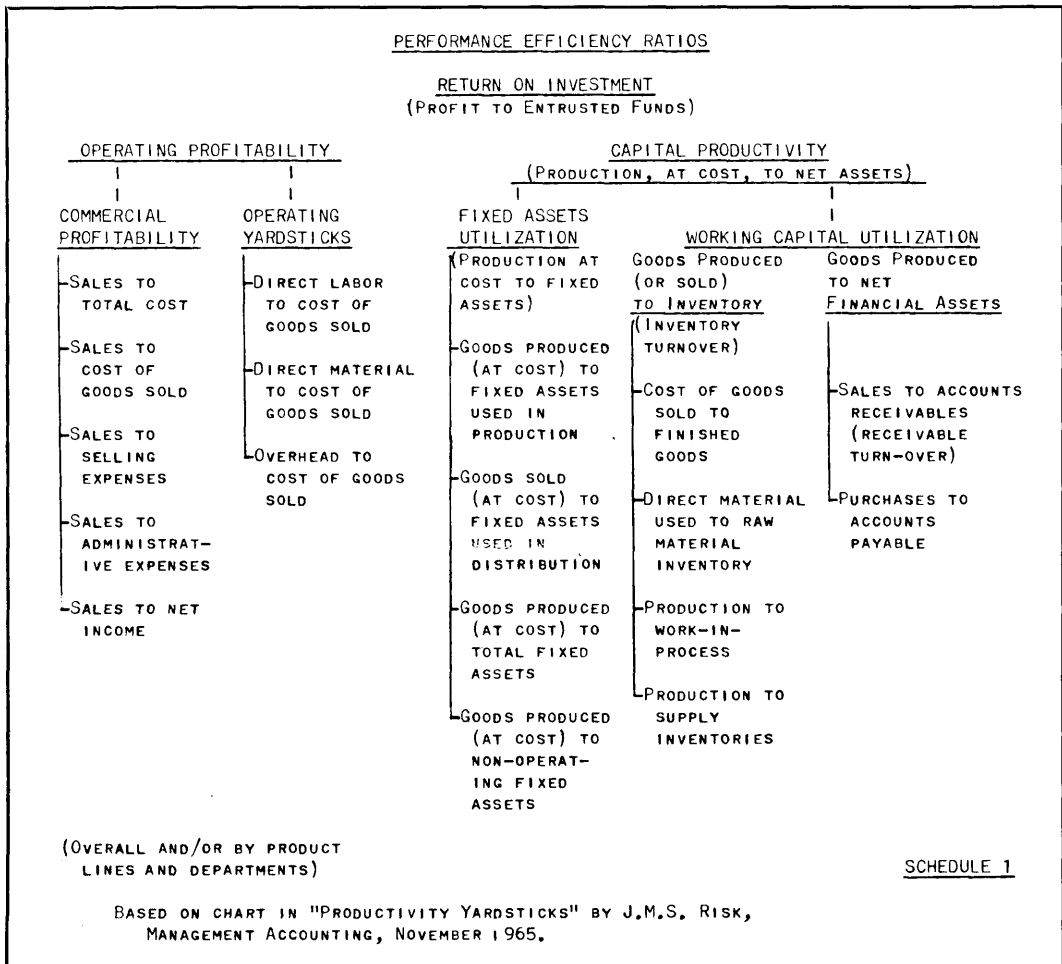
only be achieved if there exists a healthy relationship between the volume of business and amounts tied up in property, plant and equipment, in inventories, receivables and in working capital. They are aware that the existing operating potential or operating capacity has to be used fully, if the inflexible capacity cost incurred through its maintenance are not to be absorbed by a smaller output volume, with the result of higher per unit cost and a drainage of profits.

Productivity Ratios

In order to supply management with suitable tools to control and improve productivity in the use of the various input factors, a variety of productivity yardsticks in form of performance and productivity ratios have been developed by accountants and they are constantly refined (see Schedule I). Such ratios periodically computed for the various input factors tell how many dollars of sales were produced from each, how fast certain assets moved through the business and how productive the various operational functions (production, dis-

tribution, and administration) were carried out. When compared against predetermined productivity standards or with productivity ratios of competitors and industry averages, they draw management's attention quickly to any off-standard situation.

When computing productivity ratios, accountants generally start with the return-on-total investment ratio, since it is considered the best available single measure of performance, because it blends together all the ingredients of management's responsibility and measure how well the permanent funds entrusted to the business were used. For appraising managerial performance for the firm as a whole, assets rather than equities are used as the base upon which the rate of return is calculated. When measuring the performance of divisions, products, and other segments of a business, the necessity for determining capital or assets employed and income for individual segments without resort to arbitrary and questionable allocations, sets practical limits to the applicability of this tool.



These ratios are then supplemented by various conventional commercial and operating profitability ratios, relating the various types of cost to sales and cost of goods sold.

For actual productivity measurement, however, they all are only of limited value, since they are based on profits and sales which both are affected also by factors other than productivity. To obtain realistic results for productivity measurement, ratios are required which exclude the profit element. Such exclusion was accomplished by relating the production (at cost) to the total funds invested (net assets). Such ratios, commonly called capital productivity ratios, do not depend on the existence of a selling price nor an end product, and can readily be applied also on a departmental basis or by functions as long as both output and input are measurable in homogeneous units.

To test further whether fixed assets and working capital bear a reasonable relationship to goods produced and sold, fixed assets and working capital ratios have been developed and are in general use. They are commonly known as the "Fixed Assets Utilization Ratios" because they tell how many dollars of production (at cost) were produced from each dollar invested in property, plant, and equipment and tied up in working capital. Fixed asset utilization ratios are also computed for the various types of fixed assets such as operating and non-operating fixed assets, etc., to judge individually their utilization degrees.

Since usually a material amount of working capital is tied up in inventories, inventory turn-over ratios are in general use to keep a close check on the velocity with which the various types of inventories move through the business. Any slow-down in turn-over presents a significant danger signal and may indicate excess inventory build-up and/or obsolete items.

Efficient use of resources also requires a close check on accounts receivables, to ascertain that they do not get out of line and tie up an excessive amount of valuable working capital. Such check is accomplished by closely watching their turn-over through periodically computed ratios. Frequently, the turn-over is also converted to days to permit comparison with the credit terms offered by the company.

When computing capital productivity ratios by specific functions such as distribution or general administration, additional difficulties are encountered since frequently a more meaningful unit for output (or the services rendered) must be selected to obtain useful results.

Productivity of individual employees is commonly measured by man-power out-put ratios.

Although few firms prepare periodically all

the before mentioned ratios, most use today the ones most vital to productivity control of their specific operations.

Multi-Purpose Measurement Tools

Besides the tools discussed before, a number of multi-purpose tools are now available, which although not constructed specifically for productivity measurement, enhance indirectly productivity of all operational functions by controlling cost and planning output and profits.

The most powerful of these multi-purpose tools is the budget. Many firms now already employ an elaborate budget system which provides a disciplined approach to the solution of their various managerial and operating problems and sets desirable profit and performance goals. Besides, such a budgetary system develops throughout the organization an atmosphere of profit-mindedness and encourages an attitude of cost-consciousness, maximum asset utilization and high standards of performance. By stimulating competition, it provides a sense of urgency and serves as an incentive to perform even more effectively than planned.

In addition to setting standards of performance, a budget is also an indispensable aid in directing capital and effort into the most profitable channels and ensues proper balance of funds to be expended for facilities, inventories, and amounts to be directed to the promotion of sales, research, etc.

If such budgets are further constructed by responsibility centers and each center is only charged with those revenue and cost items over which the individual accountable for its activities has at least some degree of control, management has in its hands a powerful performance control mechanism with which it can control, with a minimum of effort, the degree of performance of departments, functions and key employees.

Productivity Measurement by Functions

As demonstrated, accounting has so far produced quite a number of tools capable of measuring, either directly or indirectly, productivity of an enterprise as a whole as well as its segments.

Which of these are also applicable in measuring the productivity of specific functions such as the administrative and commercial function?

Theoretically, productivity can be measured for any segment of an organization. However, mechanical difficulties in data compilation frequently set practical limits to the applicability of certain tools.

From the various ratios discussed before, ratios of commercial profitability (which relate

(continued on page 16)

dents were not included. The Court concluded that, because of the relatively minor benefits accruing to the one nonstockholder beneficiary, the plan was not for the benefit of employees.

In *Sanders and Son, Inc. et al*, TC Memo. 1967-146 the plan covered all full-time officers, but in the case under review such officers were also stockholders. In determining deductibility of the payments under Section 162(a) they were considered in conjunction with compensation; and, in the case of one of the covered employees, the total compensation, including medical reimbursement, was deemed excessive in consideration of services rendered.

Present case law should not discourage the use of medical reimbursement plans in closely held corporations. In view of the favorable tax treatment accorded both the corporation and covered employees, however, the adoption of any plan should encompass a sufficient number of nonstockholders, on an equivalent basis with shareholders, to enable the plan to be characterized as for the benefit of employees. In all cases the reimbursement, plus compensation, should not exceed what would be deemed to be reasonable compensation. To overcome the difficulty present in a year where illness in the family results in large medical expenses, the plan for reimbursement should place a ceiling on the amount payable by the corporation which, together with regular compensation, will not be deemed excessive.

ACCOUNTING AS A MEANS OF MEASURING PRODUCTIVITY

(continued from page 10)

the functional expenses to sales and are an automatic by-product of any income statement and capital productivity ratios) which relate the production (at cost) to the total funds employed, have proven quite practical. Allocation problems, however, are frequently encountered in determining capital or assets employed by function.

To increase the meaningfulness of capital productivity ratios when measuring productivity of subfunctions such as accounting, billing, purchasing, etc., the measurement base is best changed from the organizational output to units of output or services rendered by the specific function, such as equivalent work hours required for work to be done, units sold, or purchase orders processed.

To measure directly the productivity of individual employees carrying out specific functions, the use of work measurement techniques, as applied to production, have proven quite successful.

The most powerful tool, however, when at-

tempting to measure productivity by functions, is a budget constructed on the basis of responsibility centers and compared regularly with actual performance data as supplied by responsibility accounting. If such comparisons are periodically presented in the form of current performance reports, management of the various levels is informed not only as to what happened by accounts, but also what happened according to functional responsibilities of individuals.

By measuring the variances between actual and budgeted performance, such functional performance reports disclose inefficiencies in productivity and pinpoint trouble areas. If actual operations in each functional responsibility center follow budgetary plans, presumably there are no troubles and operations can be allowed to continue unchanged.

If the performance reports disclose significant favorable or nonfavorable variances, the specific area of operations must be investigated to discover the underlying causes. In case of variances indicating declining productivity which will have an adverse effect upon profits, immediate remedial actions have to be taken once the causes are detected. In case of variances with favorable effect upon profits, management should discover the causes to promote continuation of the situation.

Conclusion

As demonstrated, the managerial segment of the accounting profession has developed during the past decades a number of valuable tools capable of measuring and improving productivity of a firm as a whole and its segments. Some of them are specifically designed to measure increases or decreases of productivity, others enhance, indirectly, efficiency in the performance of all operational functions and in the use of all input factors by attempts to maximize profits and to minimize costs.

They all qualify as other milestones in the present revolutionary reorientation process of our discipline, which is characterized by attempts to create tools not only capable of periodic reporting of the operating and financial condition, but also able to provide management of all levels with the information necessary for meaningful planning, decision making, and measurement of productivity in performance.

DP—Data Processing—also stands for Data Pollution, “Contamination of information that contributes to erroneous management decisions.” Definition supplied by Jean Paul Pittenger, manager, Peat, Marwick, Mitchell & Co., Cleveland.