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Productivity: Measurement Formulas For the Indirect Workforce

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I. INTRODUCTION

The indirect workforce is a concept coined by the IBM Corporation to denote workers who do not produce a tangible product. As a result of technological advancements and the flourishing of service industries, this workforce has been growing rapidly in number. In the past two decades alone, the number of white collar workers in the labor force has grown by eight percentage points while the number of blue collar workers has declined by seven percentage points (Gregarman, 1981, p. 9). It is predicted that by 1990, 90% of all employed Americans will be working on either white collar jobs or in service sector occupations (Rowe, 1981, p. 42).

Along with the growth of the indirect workforce, there has arisen a widespread concern about productivity. From a macro perspective, there arises the question of the effects which the growth of the indirect workforce has had on industry or nationwide productivity levels. From a micro perspective, it is often useful to assess the productivity of the indirect workforce within the individual firm. The U.S. Bureau of Labor Statistics has developed productivity measures for the service industries. However, since the compiled statistics are highly aggregated, they are of little use to managers.

To explain further, manufacturing and service firms alike employ little physical capital for their indirect workers. The major portion of investment is spent obtaining and training employees. Thus, the main concern of firms employing such workers is the efficient utilization of their workforce and the motivation of employees to achieve their maximum productivity levels. Productivity measures of the indirect workforce may be extremely helpful in pinpointing “trouble spots” within a firm. Motivational goals may be established, and company policies may be formed emphasizing these “trouble spots.” Also, a manager’s performance may
be improved as a result of greater awareness of the economic importance of his/her subordinates. Finally, the greater availability of productivity data may help in investment decisions when a choice must be made between human resources and physical capital because of limited finances.

Many techniques have been developed to measure the productivity of the indirect workforce for a given firm. Some corporations (e.g., IBM) have developed new concepts, while others (such as Westinghouse) have based their measurement systems on previously existing theories. It is the purpose of this paper to discuss some of the more successful of these techniques in use today. Since each firm has different needs which must be fulfilled by its information systems, no one formula can be ascertained to be the most appropriate. However, by observing the characteristics and uses of already developed measures, one can obtain a relevant productivity formula for any firm. In light of the above, this paper will therefore also analyze the attributes and the usefulness of existing productivity measures of the indirect workforce. In particular, special focus will be directed to the usefulness of human resource accounting.

II. VARIOUS PRODUCTIVITY MEASURES

There are many productivity measures for the indirect workforce in use today. All can be considered successful when viewed in the context of the organizations in which they were developed. However, if this success is to continue when a measurement formula is applied in a new situation, both the mechanics and limitations of the formulas must be clearly understood. Thus, this section of the article will briefly explain several of the measurement techniques in use today along with their limitations.

A. The BLS Productivity Measure for Service Industries

Productivity measurements relate inputs to final outputs in an attempt to measure how efficiently resources are being employed. A ratio commonly used by the U.S. Bureau of Labor Statistics (BLS) is the following:

\[
\text{Productivity Measure} = \frac{\text{output of goods and services}}{\text{input(s) necessary to achieve final output}}
\]

This formula cannot easily be used in calculating the productivity of the indirect workforce. First of all, it is difficult to quantify the output of goods and services of these workers. Not only is the output intangible, but the nature and quality of the different services performed make it difficult to estimate accurately their overall quantity. Secondly, there is only one major input to the output of the indirect workforce—the workers themselves. Since labor needs differ for different services performed, a comparable denominator figure cannot be obtained without the use of equalizing adjustments.
The Bureau of Labor Statistics has attempted to alter the data on service industry output to fit its productivity formula. The numerator of this formula is determined by adding the constant dollar market value of services performed by a firm or industry. If all services performed are alike (an unusual situation) no problem exists. However, when different services are performed, each service is weighted by the labor hours necessary for performance. These weighted measurements are then summed. The specification of the mathematical weights is largely based on human judgment. This subjectivity may lead to an overstatement or understatement of output since inaccurate weights may be applied. As a motivational factor, this measurement may lead to a low quality output since no reference to quality of services performed is made.

The denominator of the formula is measured in labor hours. The proportion of hours paid is used to estimate actual hours worked. The problem with this calculation procedure is that no distinction is made between hours of various employees. To assume all labor hours are equivalent is incorrect since the nature of the different services performed may influence the hourly output and the intensity of the workforce.

Because of the above, the published BLS statistics for service industries are generally considered to be of little use to management. The aggregate industry measurements are too broad for intracompany use. What is more, achievement goals and standards cannot easily be developed from these measures. Also, due to assumptions made in the calculations, divisional productivity within a firm cannot be compared. Subjective weighting of a division's activities may not lead to equivalent measures. For example, applying mathematical adjustments to the services provided by an engineer and a receptionist may not lead to accurate comparisons of output.

To be of use to management, productivity measures must have several characteristics. Without these attributes, the resulting calculations will be subjective and biased. According to Hurst (1980, p. 44), accurate measures must be:

1. **controllable** by those being measured. Factors that cannot be influenced by the organization (e.g., inflation) should not be included.
2. **congruent** with organizational goals. With this attribute incorporated into productivity measures, managers may be more aware of where their division fits into the overall organizational plan.
3. **easily interpreted** and clear to all who use them.
4. **reproducible** in number if the same inputs and outputs are repeatedly entered into the formula.
5. **accurate and objective.** Subjectivity and bias lead to unfair comparisons.
6. **understandable** to the employee being measured and to his superiors as well.
7. **choosable.** Whenever possible, those being measured should be able to choose the factors being analyzed.
Not all of the above attributes may be present in a given formula. One characteristic might be able to be included only by reducing or eliminating another. Therefore, a firm must determine which attributes are most important in measuring and maximizing employee productivity.

In the section to follow, we will discuss various industrial engineering techniques and the degree to which they possess each of the above attributes. In formulating these techniques, management determines which measurement characteristics are most useful in decision making. These characteristics are then emphasized in the formulation or selection of a productivity measure.

B. Industrial Engineering Techniques
Many firms are struggling with the difficulties of productivity measures for the indirect workforce. Much research has been done on the topic, and the resultant measures are numerous and useful. However, most are limited in the scope of uses within a firm. Most of the newly developed techniques have an industrial engineering base and focus on employee responsibility and measurement comparisons.

The most successful industrial engineering technique is used in measuring the productivity of the indirect workforce of IBM Corporation. The major purpose of their “Common Staffing System” (CSS) is to indicate performance trends. With their indirect workforce scattered in plants located throughout the world, the technique is extremely helpful to management in making branch comparisons and in setting branch goals.

There are five steps to CSS (Charon and Schlumpf, 1981). First, “white collar” functions are determined. These major functions are then subdivided into supportive responsibilities until individual activities are clarified. For example, if engineering is classified as a major function, industrial engineering would be a supportive subdivision. The individual activities would include time and motion studies, plant layout and process flow. Based on these activities, workers are subdivided into groups according to responsibility. Management then determines which activities will be used in comparative staffing measurement.

The second step in the process is to establish indicators for the various activities. The workload in any one activity is directly related to indicators. For example, the number of secretarial services performed within a firm is directly related to the population within a given plant. Plant floor space will directly indicate the amount of facilities maintenance which is necessary. Some other examples are as follows (Gregarman, 1981, p. 44):
Activity | Indicator
---|---
Production buying | Purchase dollars
Vendor billing | Number of invoices
Production scheduling | Shipping dollars
Facilities maintenance | Plant floor space
Secretarial services | Plant population

Obviously, data collection is necessary in any measurement. This is the third step of CSS. Each plant or IBM branch submits information on the number of persons involved in each activity. If an employee performs more than one activity, an appropriate allocation of time spent in each activity is made. For example, one-half time may be allocated to each of two activities performed by a single employee.

In the analysis of the data (the fourth step of CSS), various ratios are calculated. A productivity ratio is computed for each activity within an IBM plant as follows:

\[
\text{Productivity Ratio} = \frac{\text{Number of employees involved in an activity}}{\text{Indicator measurement}} = \frac{\text{(e.g., the number of secretaries)}}{\text{Indicator measurement (e.g., plant population)}}
\]

Since the number of employees involved in an activity is a sampling of the total plant population, regression analysis can be used in finding the “best fit” line for productivity ratios of the total company. The plant population is the independent variable upon which the number of employees in a specific activity depends. The values on the regression line are referred to as “trend activity values.” Since linearity is assumed, the expected (or average) number of people involved in an activity may be estimated if plant population is known. An individual plant can then compare itself to this average in each activity by computing the norm index:

\[
\text{Norm Index} = \frac{\text{actual activity of a plant}}{\text{trend activity value}}
\]

Finally, the productivity index is calculated to measure productivity changes over various periods of time:

\[
\text{Productivity Index} = \frac{\text{productivity ratio, period 1}}{\text{productivity ratio, period 2}}
\]

The fifth and final step of CSS is the interpretation of the results. Productivity trends are established and branch comparisons made. This historical data may
be useful in future resource planning and in citing branch areas with low productivity levels.

Although CSS is very successful in fulfilling the needs of IBM Corporation, it would probably not be beneficial to smaller firms because such firms would need to compare divisions performing unlike services. However, a large corporation with various geographical subsidiaries and branches may well find it useful to institute a system such as CSS.

2. Nominal Group Technique
The nominal group technique is a brainstorming process used in problem solving. By involving the employees in decision making, this technique allows for a large generation of possible solutions. It allows workers to participate in the management of the firm and makes management more aware of problem areas and employee ideas. Many corporations have begun to use this technique as a means of developing productivity measures.

There are five steps to the nominal group technique (NGT) (Gregarman, 1981, p. 28). First, the problem must be presented to the employees. For problems involving productivity, workers would be asked what they think would be appropriate measures for their respective departments. A silent generation of ideas follows. Employees prepare their lists individually in order to avoid peer pressure. The third step of the NGT is to have the participants rank their ideas. Next, all ideas are discussed and clarified orally with the entire group. As a final step, an overall ranking is determined with votes being taken when necessary.

NGT is especially useful in creating productivity measures of the indirect workforce. The intangible output of the employees is reduced to measurable terms determined by the employees themselves. This participative style may lead to a more cohesive and co-operative workforce. A number of productivity measures can be developed for each department. Therefore, much information regarding problem areas will be available to managers, sometimes making the formation of department goals and motivational techniques easier. Managers might also have information as to what areas of the work environment are of most importance to the employees. These areas may then be emphasized in management decisions and styles.

Westinghouse is one example of a corporation which has realized the advantages of using NGT to develop productivity measures. However, it has expanded the brainstorming process to include a measure of overall divisional productivity. This has been done by calculating composite indexes based on the individual productivity ratios (Rowe, 1981, p. 42). The ratios are weighted and mathematically adjusted to provide measures that may be compared. Thus, productivity measures may be used at two different levels within the firm. Within divisions, feedback may be received from the various productivity measures developed through NGT. Further, interdivisional comparisons may also be made by using the weighted ratios.
Care must be taken in mathematically adjusting the ratios for interdivisional comparisons. The subjectivity inherent in choosing the weights may lead to inaccurate calculations and, hence, inaccurate comparisons. Also, mathematical adjustments may make the productivity formulas too complicated for easy interpretation.

C. Human Resource Accounting
Existing productivity measures used internally can easily be altered for more accurate use with the indirect workforce. The necessary adjustments are found in human resource accounting (HRA) theory. According to HRA, the costs incurred in hiring and training an employee are capitalized as an asset of the employer. These costs are then expensed over the working life of the employee.

Many theories have been formulated as to exactly which costs should be capitalized. According to Benston, the costs to be capitalized may include:

a. recruiting and outlay costs. Outlay costs for the successful and unsuccessful candidates are allocated to the hired employee. These costs include search fees and travel expenses.
b. acquisition costs. These include such costs as placement fees and moving expenses incurred by the employer.
c. formal training and familiarization costs. These are incurred in teaching the employee his job tasks and responsibilities.
d. informal training costs. Costs arising in teaching a person to adapt old skills to new tasks may be capitalized.
e. familiarization costs. These are associated with an employee’s learning a company’s goals and policies.
f. investment building and experience costs. The expense of on-the-job training may be capitalized.
g. development costs. These are costs which increase the capabilities of existing workers.

Any costs which are capitalized are subsequently amortized over the working life of the employee or over the length of time benefits will be received. If an employee leaves the firm earlier than expected, his asset account must be written down to zero. A loss is incurred by the firm and the department in which the employee worked.

A major criticism of HRA is the classification of the labor force as an asset. An asset is anything which provides future benefits to a firm. The workforce provides future benefits simply by the nature of its employment. Also, an asset is purchasable. In business acquisitions, payment is often made for intangible assets such as a high quality labor force (Materne and Vangermeersch, 1973, p. 27). Finally, much economic analysis of the labor market is based on human capital theory, which views a worker’s skills as a capital asset (Ehrenberg and Smith, 1982). Thus, human resource investments meet the criteria for asset classification.
If human resource accounting is integrated into productivity measures, attitudinal changes may occur in management. The economic importance of the employees becomes clearly evident, and training and development costs may be considered in a different light, since the importance of these investments in increasing employee productivity will be more obvious. Also, this approach treats expenditures as capital investments, which may be depreciated over time instead of in the period they are incurred. The impact of an employee's decision to leave the firm will be greater since the costs will be seen in dollar terms. Finally, intercompany profitability comparisons may become more realistic since human resource investments are major inputs in service industries and in white collar jobs.

Two commonly used performance formulas based on HRA principles can be adjusted and used as productivity measures of the indirect workforce. Both return on investment (ROI) and residual income (RI) measure the relationship between profit and capital investment. In regard to the indirect workforce, the majority of investment is in human resource capital. By relating human capital costs (as formulated according to HRA) to profitability, relevant productivity measures for indirect workers can be obtained.

Both ROI and RI procedures are often used in making intracompany profitability comparisons. Inherent in these comparisons is the need to allocate a firm's net income among its divisions. Such a distribution has been done in the past in manufacturing firms. However, in service industries a problem arises. Fewer tangible allocation bases are available. Therefore, if ROI and RI techniques are to be used in these industries for divisional comparison, an income distribution system must be developed. The need for this distribution system can easily be seen by analyzing the mechanics of these formulas.

1. Return on Investment
One of the most frequently used techniques of measuring profitability is return on investment (ROI). Its fundamental basis is cost-benefit analysis. The cost of operating a firm or division may be measured by its capital investments. The benefits received are the returns on these investments or profits.

ROI is generally defined as follows (Horngren, 1977, p. 710):

$$\text{ROI} = \frac{\text{net income}}{\text{invested capital}}$$

By inserting the capitalized costs of the indirect workforce into the denominator of this formula, productivity measures for the indirect workforce can be calculated. As is characteristic of productivity measures, input (the capitalized human resource costs) is related to the output. The output, net income, is an indirect end product generated by the employees.
Upjohn uses HRA, ROI and a variation of value added in measuring employee productivity. Value added is generally defined as sales minus the costs of goods and services used (Dahl, 1979, p. 44). Upjohn breaks this down further:

\[
\text{Value Added} = \text{employee costs} + \frac{\text{tangible capital costs}}{\text{pretax earnings}}
\]

Various ROI ratios are calculated by showing each component cost as a percentage of total value added. By plotting the results over time, productivity trends can be developed.

2. Residual Income

The residual income technique (RI) presents an absolute figure obtained by subtracting an interest charge on capital investments from a firm’s net income. A manager’s goal is to maximize this dollar figure.

The formula for RI is (Horngren, 1977, p. 712):

\[
\text{Residual Income} = \frac{\text{Net Income}}{\text{the imputed interest charge on investment}} \times \frac{\text{invested capital}}{\text{capital}}
\]

If human resource accounting is used by a firm, the invested capital can be defined as budgeted human resource expenses (Sinclair, 1978). Thus, feedback on human resource investment is received by managers.

Human resource accounting principles use a dollar figure to record human capital, a major input in service industries and white collar jobs. The human factor can more easily be incorporated into performance measures when stated in absolute terms. Thus, its impact on profitability may be easily assessed.

ROI and RI are merely two examples of currently used performance measures. By relating overall net income of a firm to its human capital, management may receive feedback as to the success of its hiring, training and development practices. As stated earlier, if an income distribution system exists within a firm, adjusted ROI and RI figures may be used for divisional comparisons.

The various productivity measures discussed above have all been successful when considered in the context of the entity in which they were developed. Each measurement formula has been specially developed for its respective firm by incorporating certain attributes and characteristics chosen by management. In placing one of these productivity measures into a new situation, one should match the attributes of the firm with those of the formula. Thus, a productivity measure will be chosen that meets the needs and resources of the entity.
III. DEVELOPING PRODUCTIVITY MEASURES

As service industries and white collar employment continue to grow, the necessity for accurate productivity measures for these workers increases. By assessment of the nature and needs of a firm, the most relevant productivity measures may be developed for that firm.

The size of a firm affects the complexity of a productivity measure. A very small firm may simply compute a single productivity measure, such as a ROI ratio, for the entire firm. This may be sufficient for its needs. Since employees will be few, corporate goals are not far removed from divisional goals and are still useful in motivating employees. However, in a large multi-branch firm (such as IBM), a more complex measurement system must be developed. This may facilitate the formation of divisional goals that may motivate all employees.

The inherent nature of the work performed in a firm may influence the development of productivity measures. For example, if group work is performed within a firm, managers may employ a participative technique, such as NGT, in assessing productivity. This may also have the effect of improving cohesiveness through employee participation. A firm with less worker interaction, on the other hand, may motivate workers by using a technique which encourages employee performance. Different measurement attributes may be incorporated into productivity formulas. Each firm must determine which attributes are necessary to fit its needs.

Finally, the cost factor must be considered. A system such as NGT may be expensive since mediators may have to be hired, and employee work time is lost during the brainstorming process. The use of a technique such as CSS further involves the expenses of data collection and comparison, whereas the adjustment and use of existing measures may result in lower incremental costs. Therefore, a firm should develop productivity measures based on what it can afford.

In short, a firm should be encouraged to develop productivity measures for its indirect workers based on its needs and available resources. Consideration should be given to all aspects of a firm, and characteristics of the various measurement systems should be carefully analyzed before a particular technique is finally chosen.

IV. USES OF PRODUCTIVITY MEASURES FOR THE INDIRECT WORKFORCE

Productivity measures for the indirect workforce may be put to the same uses as those for blue collar workers. They may be used for economic analysis, forecasts and budgeting, performance appraisals and trend analysis.

Productivity measures may also be used to ascertain the level of managerial effectiveness. Managerial decisions, techniques and styles may affect worker productivity by creating a productive work environment. This is extremely important in service industries and white collar jobs since labor is the dominant input...
in these areas. Managers also need feedback on their actions which influence employees. Through measuring the productivity of indirect workers, the effectiveness of managers may be indirectly reviewed. Productivity trends may be extremely helpful as changes in managerial decisions may be compared with changing productivity levels.

Utilization of the labor force is an important concern when employing indirect workers. In order to receive a high return on their investment in human capital, managers must motivate workers to their maximum potential. By using a formula to measure the productivity of these workers, managers may indirectly assess their ability to control costs and motivate employees. Human resource accounting is useful in this area as it clarifies the dollar amount invested in a firm's employees. A useful comparison of input to output can be made using this amount.

Coupled with the concern of worker utilization is the need for qualified workers. Managers should look at the hiring process as an investment decision. Cost-benefit analysis may be employed so that the most productive workers are hired. Productivity measures may clarify this decision. For example, measurements using human resource accounting both clarify the costs incurred for existing workers and provide a basis for the estimation of costs of new workers. Productivity information about existing employees may help to assess the skills and qualifications which a productive worker should possess. These characteristics can then be incorporated into the hiring process.

Productivity measures can furthermore be extremely useful in budgeting costs and output, as well as in forecasting labor requirements. All productivity measures are useful in this regard inasmuch as they are a means by which inputs or costs may be compared to the resultant output. However, the productivity measure used may be influenced by the level within a firm for which budgets or forecasts are being prepared. For example, a firm budgeting for the divisional level may employ adjusted ROI or RI techniques while intradivisional forecasting may require a simpler technique (such as NGT) to analyze the different aspects within a division. A system such as CSS might then be used on large scale budgets, such as those for branches or for individual plants.

The financial resources of a firm affect both the capital investment in a firm and the expenses which a firm incurs. In a manufacturing firm employing both white collar and blue collar workers, a tradeoff might be made between investment in physical capital and investment in human resources. This is especially true when finances are limited. By having relevant measurements available for both direct and indirect workers, managers may better assess which investments will have the greatest influence upon productivity. For such comparisons to be made, similar measurement systems should be employed for both types of workers. Since ROI is already a popular technique used for blue collar workers, adjusting this measurement for indirect workers (with income allocation) may be feasible.

In summary, productivity measures for the indirect workforce may be extremely useful in creating a productive and profitable firm. Different measurement systems are useful for different decision making processes. Therefore, the
uses of such measures should be assessed before developing a productivity measurement system.

In comparison to American firms, Japanese companies rely to a great extent upon evaluations of performance (Ouchi, 1982). Relying upon these evaluations, Japanese management is able to motivate their employees to maximum productivity levels. The productive environment is created through human interaction, through formation of publicly acceptable goals, and through trust between management and other workers. American firms may be able to increase productivity, especially that of their indirect workers, by developing relevant output measurements and by better managing their human resources in the same manner as in Japan.

V. CONCLUSIONS

The major goal of most firms is to maximize profits. Two factors which greatly influence the extent to which this goal is reached are management decisions and employee productivity. These factors are inseparable inasmuch as each influences the other.

Management decisions have a direct effect on sales and profits through income from external investments, marketing techniques, the purchase of plant and equipment, etc. They also have an indirect effect on employee productivity through the work environment. Leadership styles and managerial decisions may create a more productive atmosphere in the work place. As a result, employee productivity may be influenced.

Productivity measures are essential to profit maximization. These measures are the link or feedback mechanism informing management of the success of their decisions. The importance of productivity measures increases further when indirect workers are employed since hiring these workers is a major internal investment made by these firms.

Thus, the importance of productivity measures is increasing with the growth of the indirect workforce. If useful measures can be formulated, managers may be able to handle this workforce more efficiently and thus increase the profitability of their respective firms.

REFERENCES


