



MEASUREMENT OF PRODUCTIVITY: VARIOUS MODELS

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ABSTRACT

In the modern era of globalization and liberalization where, battle of products, through mass media, is exciting the endless desires, the word "Productivity" has become synonymous for progress. Productivity refers to the physical relationship between the quantity produced (output) and the quantity of resources used in the course of production (input).

Productivity measurement includes partial or factorial productivity and overall productivity. Measurement of productivity is a very difficult task because it depends on so many factors. It can be measured separately for each factor of production such as men, machines, materials etc. Productivity measurement is helpful in goal setting, cost reduction, resource allocation, motivation for improvement, forecasting output and national income etc. This paper attempts to explain various models of productivity measurement.

KEY WORDS: Productivity, Input, Output, Financial Ratio.

INTRODUCTION

An increase in productivity means an increase in output that is proportionately greater than an increase in inputs. Measurement of productivity is a very difficult task because it depends on so many factors. If a concern is engaged in the production of a single product, output can be measured in physical terms, e.g. , number of units produced, volume, weight etc. But it becomes very difficult when a variety of goods is being manufactured. The problem becomes more complicated when an industry produced some by-products. When the value of money does not remain stable due to price fluctuation, monetary measurement do not measure correctly changes in quantity. Thus, productivity measured in terms of monetary value may not reveal the correct position. Input factors are many and varied. Therefore, measurement of inputs poses similar problems. Some of them e.g. , managerial skill, may not be measureable at all. They have

to be converted into money terms. Productivity measurement is even more difficult in service enterprises. Generally, the productivity of one factor may be affected by the productivity of another factor. For example, productivity of labour may adversely be affected by poor quality of management, defective tools and machinery, bad quality of materials. In spite of all these difficulties, it is desirable to measure productivity so that action may be taken for correction and improvement may take place. "Productivity measurement and analysis are also helpful in locating the shortages of a particular factor, which might have caused a decrease in productivity."

The basic objective of analysis of productivity is to find out some ideas in relation to improve the efficiency and these ideas may be applied in the field of resources utilization.

Beri, (1962) observes : “They are also used in determining the distribution of the product of industry and thereby in some sense they are relevant for collective wage-bargaining. At industry level also, such measurement are very helpful. Comparisons of productivity change within an industry over a period of time as also between two or more industries can indicate various interesting facts, regarding technical, economical and managerial aspects in the industry.”

Davis, (1951) Stresses importance of productivity analysis and says “There is growing recognition that productivity measures per se, however computed, provide little guidance for either public or private economic policy and that such measures only take on significance when the factors associated with the changes or differences shown have been analyzed.” Productivity measurement, in itself, is not an end. It should be useful to meet management needs.

Productivity measures are useful in the following management areas :

- i. Goal setting;
- ii. Estimating Resources requirements;
- iii. Organizational improvement;
- iv. Operation Control;
- v. Resource reallocation;
- vi. Responsibility Accounting; and
- vii. Motivation for improvement.

Liaw & Chen (2001) defines productivity in the following words, productivity is often used to evaluate the aggregate performance of a business unit, generally defined as the ratio of outputs to inputs. However, for different applications and research domains there are different definitions of productivity. This definition supports the established fact discussed in previous pages that productivity has different meanings in different situations.

Baig,(2002) has defined productivity in the following words, doing things right at the least possible cost in least possible time with the highest possible quality and to the maximum level of satisfaction of the customers and employees.

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Paul Krugman, (1994) There are different measures of productivity and the choice between them depends either on the purpose of the productivity measurement and/or data availability. One of the most widely used measures of productivity is Gross Domestic Product (GDP) per hour worked.

Sardana and Vrat,(1984) presents the following major categories of models and their approaches;

1. Production Function Models :-

Production function model is of this approach that the production is the main function of an organization. Therefore, it derives the measurement of productivity from the production function. Models based on production function consider only labour and capital as input while other inputs variables are also present, in practice.

2. Economic utility Models:-

Productivity measurement models under this approach recommended use of multi ratios, each ratio reflecting on a particular economic activity or utility function. The conventional ratio concept of output to input is not followed under this model. It may be more useful in measuring productivity at macro level instead of micro level.

Model of this approach is as follows:-

$$O = A+M+Y+K \quad (1)$$

Where :-

“O” Stands for gross output during the period.

“A” Stands for depreciation and replacement of stocks.

“M” Stands for current intermediate inputs.

“Y” Stands for national income.

“K” Stands for capital.

$$I = K+A+M \quad (2)$$

Here

“I” represents aggregate input of the factor cost for productivity “O” National income is the excess of “O” over I. Analysis of National income is as follows:

$$Y=W+P+D \quad (3)$$

Where :-

“Y” Stands for National Income

“W” Stands for Aggregate wages

“P” Stands for Profits

“D” Stands for Differential rents

Hence, Y/A is the ratio of national income or net output to capital utilized and Y/L is the net output per worker in terms of rupee when L stands for working population of an economy. Y/L is used to measure overall productivity.

3. Measurement Through Financial Ratio:-

Although the financial ratios are generally useful to the measurement of financial performance of a concern, they seldom represent the measurement of productivity. Productivity depends to a great extent on the stability,

solvency and activity of a concern. Therefore, areas such as liquidity, stability, profitability, coverage, stock and creditors turnover can be studied for productivity measurement of a concern. If ratios regarding the above factors are more favorable, it will indicate the concern is more productive. For this purpose, acid test ratio, debtors turnover, creditors turnover, stock turnover. Assets turnover and return on capital employed may be considered s important ratios in this connection.

4. Surrogate Models:-

It is based on partial productivity approach. The model selects "Such measures which can be considered valid in place of measures which are either difficult to define or are unavoidable because of problems inherent in data collection etc." These models do not consider many factors which affect the productivity, so, these are used for small set-up in a highly restrictive way. Key activities' closely linked with the total productivity are suggested under this model. With the help of payroll records, productivity under this approach can be measured as:

"Productivity Index = Actual Pay/ Standard Pay

Here

"Actual Pay" means the pay, paid to the worker

"Standard Pay" Hours worked * Standard rate of pay.

5. Systems Approach Based Models:-

Mason,(1984) is the main supporter of system approach based models. He says that "the exercise of productivity measurement is basically reduced to measuring the entire output a system has generated in relation to the input resources consumed during the production process." He has presented the productivity measurement concept in details with each of the four types of environment which are based on conventional methodologies and output and input are considered in the traditional manner.

6. Production Based Models:-

Production based models may be categorized in two following classes :-

- i. Models based on output as value of production;
- ii. Models based on output as value addition.

These models are being discussed here :-

(i) Models based on output as value of production :-

Kendrick and Creamer,(1965) are considered to be propounded of this approach. They are of this view that there are three types of productivity indices to measure and analyze productivity of a company.

- a) Partial Productivity Index i.e. Output/ One factor of input

- b) Total Productivity index i.e. Total Output/ All Input.

- c) Total factor productivity index i.e. Net Output/ Total factor input.

Here,

Net Output = Output - Intermediate goods and services

Total Factor Input = Manpower input + Capital input

(ii) Models based on output as value addition :-

Cox,(1983) Value added is "The increase in market value brought about an alteration in the form, location or availability of a product or services excluding the cost of brought in materials or service."

The above models place too much emphasis on labour and have limitations. In words of Davis,(1951)"The practice of using output per unit of labour time expended to answer all questions about productivity performance has led to confusion." Measure of valued added per manhour also becomes a misnomer of productivity as value addition is generally the total cost of products minus the cost of purchases. Owing to this, high wages would automatically increase the value of products appearing as numerator and hence, increase productivity."

7. Productivity Accounting Model (PAM) :-

According to Sardana and Vrat,(1984) "The model should be such that it may help management in analyzing areas of improvement, take into account all possible outputs and inputs used, keep out external factors such as price rise etc., from the calculation of productivity of the organization and the data should be available for the measurement of productivity." All the conditions mentioned about are not satisfied in all the models discussed above due to their inherent limitations but productivity accounting model is only the model under which all the above mentioned conditions are satisfied. The present study is based on Productivity Accounting Model (PAM) because this model is based on accounting data and present study is also being conducted in the field of accounting. The Model is based on common price accounting and takes into account all outputs and all inputs. Davis, advocate of this model says in the justification of using the term accounting that "Even if the method presented here deals with productivity , is it accounting? If accounting is only book-keeping, then perhaps there is an unwarranted borrowing of the term. But accounting seems to have long outgrown the systematic recording of transactions."

In words of Grewal,(1993) "A skilful accountant will prepare accounts in such a way as to show up all the deficiencies and good points of the firm concerned. Thus, he will help management to know not only how strong or weak the firm is financially but also to take action to remove shortcomings and inefficiencies-now a special branch of Accountancy has emerged, known as Management Accounting. Even Economists have found a use of accounting techniques. There is such a thing as National Income Accounting. Accounting is now developing into an almost exact science of measurement." Gupta and Radhaswami,(1995) quote definition given by American Accounting Association and define accounting as "The process of identifying, measuring and communicating economic information to permit informed judgments and decisions by the users of information." Porwal,(1996) observes : "Accounting is now regarded as a service activity, a descriptive/analytical discipline and an information system." Sharma point out that "It may be alleged that productivity measurement is a subject of economics, therefore, it is out of the sphere and scope of accounting. This plea has been successfully refuted by several advocates of accounting." He quotes Boulding,(1969) and writes "Economics and Accounting are two disciplines which draw their raw material from much the same mines. From these raw materials, however, they seem to fashion different products. They both study the operations of firm, they both are concerned with such concepts as income, expenditure, profits, capital, value and prices."

Thus, "Productivity accounting is a technique of measuring and analyzing productivity by the relation of total output to total input after both have been revalued to some appropriate scale of constant prices and it is grounded on basic accounts of a firm." Productivity analysis not contributes for the firm but also contributes in the development of the country by directing for better utilization of resources.

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