

Part A

Productivity and work study

Chapter 1

Productivity concept and definitions

1.1 Introduction

Throughout the history of civilisation, there has been a constant effort to improve the utilisation of resources. A necessary requirement in this respect has been to define appropriate measures of performance for systems. The concept of productivity provides us with one such measure. Operationalised as the ratio of output to input, the productivity measure aims at identifying how efficiently the resources in a system are used in producing the desired output. The measure is applicable for an enterprise, an industry as also the whole economy. The expressions for outputs and inputs, however, vary depending on the system for which productivity is measured. Variations of the traditional definition of output-input ratio have evolved mainly due to the need to highlight the status of the system in part or in full, and to indicate the future directions of improvement for the system.

The objective of this chapter is to put the topic of productivity in perspective. Accordingly, the different definitions and the measurement problems at different levels are presented in the next two sections, and the benefits of higher productivity are discussed in the final section.

1.2 Definitions of productivity

As already noted in the introduction, productivity is defined as:

The ratio of output produced to the input resources utilised in the production.

The input resources in any productive system are one or more among these four: land, material, machines and men. Over and above the overall measure of productivity, where all the inputs are taken together, there is a need to have partial measures relating output to individual input, in order to pin-point the areas of deficiency.

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Two basic variations around the above definition have thus evolved:

Total productivity is the ratio of the aggregate output to aggregate input. Partial productivity is the ratio of the aggregate output to any single input.

The definitions apply for an enterprise, an industry or an economy as a whole.

Partial productivity measures, such as, labour productivity and capital productivity, are to be used together with the total productivity measure in order to make any meaningful interpretation. The aggregate output of a system, for example, may increase because of replacement of old machineries at a certain cost; if the labour input remains unchanged, the labour productivity, defined as output per man-hour, will show an increase, while the capital productivity, expressed as the ratio of output to capital assets employed, will register a decrease. The change in total productivity will depend on the relative proportion of increase in output and the proportion of increase in input costs due to new machineries. It will be erroneous here to act based on the labour productivity figure *per se*. Both types of measures are to be used for proper interpretation of performance and subsequent action.

Within the above broad definitions, different expressions for outputs and inputs have been used by different researchers. The measurement of output at national level poses quite a different problem *vis-a-vis* the measurement at industry or enterprise level. Similarly, depending on whether the objective of measurement of productivity is to highlight the performance of a system over time, or to highlight the relative performance of a system with respect to similar systems, the expressions for outputs and inputs may vary. For example, if we are interested in comparing the labour productivity of two enterprises marketing the same product, with one enterprise engaged in both manufacturing and assembly, and the other doing only the assembly, obviously the measure of output per man-hour will be a wrong one to use. If the expression of output is changed to 'value-added output', whereby we deduct all purchases made by the organisation from the total sales, we get a better picture through the resulting productivity measure.

Thus, depending on what we want to highlight, and the type of system for which productivity measure is sought, different indices are found in use. In the next section, we take up the issue of productivity measurement at different levels. The discussion on value-added concept and other indices are deferred to the second chapter where we will examine productivity at the enterprise level.

1.3 Productivity measurement at national, industrial and enterprise level

The basic objectives behind productivity measurement are:

- 3) to study performance of a system over time;

- b) to attain a relative comparison of different systems for a given level; and
- c) to compare the actual productivity of a system with its planned productivity.

At the macro levels of a nation or an industry, as also at the micro level of an enterprise, the development of productivity measures have been guided by the above objectives.

Though the concept of productivity is a fairly straightforward one, its measurement poses a serious problem. Given the different types of output a system often produces, it is necessary to have a common unit of measurement to arrive at the aggregate output. Similarly, whenever different kinds of input like capital and labour are to be added to arrive at the aggregate input figure, we again need a common unit of measurement for these inputs. Even for the partial productivity measures involving only one kind of input, problem exists in terms of aggregating over different kinds of the same input. For example, labour as an input may have different categories like skilled and unskilled, that need to be aggregated.

The above difficulty in arriving at the aggregate output and input is commonly known as the Aggregation problem. This is a well-researched problem and forms a subject of study in itself. For the purpose of this book, we will be dealing with this topic in brief and in very general terms.

The most common way out of the Aggregation problem is to express both the outputs and the inputs in monetary terms. This can be achieved by multiplying the outputs and the inputs by their respective prices. To eliminate the effect of price variations over time, it is customary to inflate or deflate the price figures. However, given a situation, the imputing of prices of different kinds of outputs and inputs raises a host of problems, hence the resultant measure would normally entail a number of assumptions. This is further compounded by the problem of absence of data at macro levels.

Both at the national and the industry level, labour productivity is found to be the most common measure. This may be due to the fact that advances in any country have taken place by the displacement of labour by capital. Thus, the labour productivity measure of output per worker in an economy, is taken as a better indicator of the level of prosperity of the people in the economy compared to any other partial measures, with a higher labour productivity figure being interpreted as an advancement of the economy.

At the national level, the measure of output stems from 'national product', which connotes the market value of the output of 'final' goods and services produced by the nation's economy. The word 'final' is used to connote goods and services which are not resold. Variations of this, like gross national product (GNP) and gross domestic product (GDP), are used as measures of output for an economy. At the industry level, value-added output is a common measure of the numerator of the productivity measure. The input of labour is normally operationalised at the macro level by taking the total number of workers in the system.

The above gives only a broad idea on productivity measurement at the economy and the industry level. For a more detailed discussion on the topic, the reader is referred to the readings at the end of this chapter. For estimates of productivity of the Indian

Economy (1980–1989), one may refer to the study conducted by the National Productivity Council, cited in the references [1].

At the enterprise level, the problems of aggregation and the absence of data are much less pronounced compared to the above. However, the need to come out with meaningful measures, in line with the objectives narrated at the beginning of this section, has compelled many researchers and practitioners to work on the area. Here again, we find the dominance of the labour productivity measure, mainly because of easy availability of data and the relatively easier treatment involved in the approach *vis-a-vis* the other partial measures. However, the type of measure to be used depends on the nature of the enterprise. An enterprise with a high capital investment would naturally be more interested in the capital productivity, whereas, one using very costly raw materials would be concerned about the material productivity. Our major concern in this book being productivity improvement at the enterprise level, we take this up separately in the next section.

1.4 Benefits of higher productivity

From the definition of productivity, it is apparent that a higher total productivity may result, if:

- a) more output is produced with the same or lesser input,
- b) the same output is produced with lesser input, and
- c) more output is produced with more input; the proportional increase in output being more than the increase in input.

In the first case, it is obvious that more goods and services are made available to the community as a whole, and as such, higher productivity contributes to a greater material well-being, hence better standard of living.

In the second case, we find the productivity gain occurring due to the reduction of input. The common fear that higher productivity leads to unemployment has its roots in such a situation. Given the different types of input like labour, capital and material reduction in input may actually be in terms of any one or a combination of these different types. Thus, labour may always be the one that is reduced to achieve the productivity gain in a given situation. The unemployment that is created in such cases may be obviated by using the excess labour for production of other goods and services. If this is achieved, then unemployment is only a temporary phenomenon, and in the long-term society gains in terms of a better standard of living.

Finally, when both the output and the input increase, with the proportional increase in output more than the proportional increase in input, it implies that the productivity gain has occurred by the displacement of one input by another. Historically, productivity gain normally occurs in this fashion. Displacement of labour by capital, resulting in higher capital input and lower labour input, with the overall input increasing and the output increasing in greater proportions, has quite often been the story of advancement of nations. Once again, in such cases, the drive for higher productivity has to be accompanied by corresponding plans to generate employment.

So far in our discussion, higher productivity has been treated synonymous to increase in total productivity. This is true in general. As is obvious from the last paragraph, as also the basic definitions, higher total productivity may be accompanied by a decrease in some of the partial productivity measures. The importance to be given to any particular partial measure depends on the objectives of the nation, the industry or the enterprise for which the total productivity gain will accrue. The effect of the differential treatment to different resources is normally taken care of in the long run by proper planning resulting in higher productivity in all spheres, and hence a better standard of living for all.

Our concern in this book is to look at the problem of raising productivity at the enterprise level. As such, we are interested in examining the ways in which one can increase the productivity of different kinds of resources individually and together. In the present chapter, we have introduced the concept of productivity. We now take up the issues of measuring and raising productivity at the enterprise level.

REFERENCES

1. *Productivity in the Indian Economy: Some Tentative Estimates*, NPC Research Section, *Productivity* 29(4):372.