INDUSTRIAL PRODUCTIVITY AND IT'S MEASUREMENT

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Abstract:

Productivity is defined as the efficiency of a Production System. It is the ratio between the output volume and the volume of inputs in production. It is an average measure of the efficiency of production. Efficiency of production means its capability to create income which is measured by the formula real output value minus real input value. Increasing National Productivity can raise living standards because more real income improves people ability to purchase goods and services, enhance housing and educational facilities and contribute to social and environmental programs. Productivity Growth also helps businesses to be more profitable.

I. Introduction

In simple terms, Productivity refers to the physical relation between the quantities produced (Output) and the quantity of resources used in the course of production (Input).

$$\text{Productivity (P)} = \frac{\text{Output (O)}}{\text{Input (I)}}$$

Where Output (O) implies production while Input (I) means land, labour, capital, management etc.

There are three perspectives which have dominated the field of Productivity namely Economics, Industrial Engineering and Administration. These perspectives have complicated a search for any precise defination of the concept 'Productivity'.

II. Significance of High Industrial Productivity

Productivity is considered as a key source of economic growth and competitiveness. Productivity Growth constitutes an important element for modelling the productive capacity of economies. Productivity is one of the main concerns of business management and engineering. Practically all companies have established procedures for collecting, analyzing and reporting the necessary data regarding Productivity. Typically the accounting department has overall responsibility for collecting and organizing and storing the data, but some data normally originate in the various departments.

Productivity is not everything, but in the long run it is almost everything. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker. Despite the proliferation of computers, productivity growth was relatively slow from the 1970s through the early 1990s. Although several possible causes for the slowdown have been proposed there is no consensus. The matter is subject to a continuing debate that has grown beyond questioning whether just computers can significantly increase productivity to whether the potential to increase Productivity is becoming exhausted.

Productivity is created in the real process, productivity gains are distributed in the income distribution process and these two processes constitute the production process. The production process and its sub process, the real process and income distribution process occur simultaneously, and only the production process is identifiable and measurable by the traditional accounting practices. The real

process and income distribution process can be identified and measured by extra calculation, and this is why they need to be analyzed separately in order to understand the logic of production performance.

Various benefits derived from higher Industrial Productivity are as follows:

1. It helps to cut down cost per unit and thereby improve the profits.
2. Gains from Productivity can be transferred to the consumers in from of lower priced products or better quality products.
3. These gains can also be shared with workers or employees by paying them at high rate.
4. A more productive entrepreneur can have better chances to exploit export opportunities.
5. It would generate more employment opportunities.

III. Factors Influencing Industrial Productivity

Following factors influence the Industrial Productivity:

(a) Human factors: Human Nature and Human Behavior are the most significant determinants of Productivity. Human factors include:

i. Ability to work
ii. Willingness to work

(b) Technological factors: Technological factors exert significant influence on the level of Productivity. These include the following:

i. Size and Capacity of Plant
ii. Product Design and Standardization
iii. Timely supply of Materials and Fuels
iv. Repairs and Maintenance
v. Production Planning and Control
vi. Plant Layout and Location
vii. Material Handling System
viii. Inspection and Quality Control
ix. Inventory Control

(c) Managerial factors: The competence and attitudes of managers have considerable effect on Productivity as despite latest technologies and trained manpower, an organization may have Low Productivity.

(d) Natural factors: Natural Factors such as physical, geographical and climate conditions exert considerable influence on Productivity, particularly in extreme climates tends to be comparatively low. Natural resources like water, fuel and minerals influence Productivity.

(e) Sociological factors: Social customs, traditions and institutions influence attitudes towards work and job. For instance, bias on the basis of caste, religion etc. inhibited the growth of modern industries in some countries. Close ties with land and native place hampered stability and discipline among industrial labor.

(f) Socio- Economic factors: Law and Order, stability of government, harmony between states etc. are essential for high Productivity in industries taxation policies of the government influence willingness to work, capital formation, modernization and expansion of plants.

Tariff policies influence competition. Elimination of sick and inefficient units also helps to improve Productivity. Sizes of the market, banking and credit facilities, transport and communication systems etc. are some other important factors which influence Industrial Productivity.

IV. Various Reasons for low Industrial Productivity:

The following are the reasons for low Industrial Productivity:

- Ineffective use of resources
- Non-productive /unnecessary activities
- Low labour Productivity
- Worker disputes
- Poor information flow
- Excessive reworks
- Wastage of materials
- Frequent machine breakdowns/stoppages
- Excessive inventory

Generally, we found three primary causes mainly in industries; ineffective use of resources, non-productive /unnecessary activities and poor information flow as important factors for low Industrial Productivity. The majority was in strong disagreement with primary cause worker disputes as a reason for low Industrial Productivity.

V. Productivity Measures

In order to measure Productivity of a nation or an industry, it is necessary to operationalize the same concept of Productivity as in a production unit or a company, yet, the object of modeling is substantially wider and the information more aggregate. The calculation of Productivity of a nation or an industry is based o the time series of the SNA, System of National Accounts. National Accounting is a system based on the recommendations of the United Nation to measure total production and total income of a nation and how they are used.

Productivity Measurement is one of the important functions of Industrial Engineering Departments in companies. In fact, Productivity Measurement is the quantification of both the output and input resources of a productive system. The intent is to come up with a quantified monitoring index. The goal of Productivity Measurement is Productivity improvement, which involves a combination of increased effectiveness and a better use of available resources. It facilitates planning and controlling Productivity levels in the companies. The objectives of Productivity Measurement include technology, efficiency, real cost savings, benchmarking production processes, living standards.

Technology: A frequently stated objective of measuring Productivity Growth is to trace technical change. Technology has been described as “the currently known ways of converting resources into outputs desired by the economy”.

Efficiency: The quest for identifying changes in efficiency is conceptually different from identifying technical change. Full efficiency in an engineering sense means that a production process has achieved the maximum amount of output that is physically achievable with current technology and a fixed amount of inputs.

Real cost savings: A pragmatic way to describe the essence of measured Productivity change. Although it is conceptually possible to isolate different types of efficiency changes, technical change and economics of scale, this remains a difficult task in practice.

Benchmarking production processes: In the field of business economics, comparisons of Productivity measures for specific production processes can help to identify inefficiencies.

Living standards: Measurement of Productivity is a key element towards assessing standards of living. A simple example is per capita income, probably the most common measure of living standards.

VI. Measurement Models for Productivity

Different models for Productivity Measurement are as follows:

1. Kendrick Creamer Model:

Kendrick and Creamer (1965) introduced Productivity Indexes at the company level in their book, "Measuring Company Productivity". They proposed two types indices:

(a) Total Productivity: Total Productivity Index for given period= (measured period output in base period price)/ (measured period input in base period price)

Total Factor Productivity Index = **Net Output / Total Factor Input**

Net Output - Intermediate goods and services

Total Factor Input - Man hour input and total capital

(b) Partial Productivity: Partial Productivity of labour, capital or material Productivity Index can be calculated as:

Partial Productivity = (output in base period price) / (any one input in base period price)

2. Craig – Harris Model:

Craig and Harris defined Total Productivity measure as:

$$P_t = Q_t / (L+C+R+Q)$$

Where

P_t - Total Productivity;
Q_t - Total Output;
L - Labour Input Factor;
R - Raw Material Input Factor
Q - Other miscellaneous goods and services input factor

The output is defined as the summation of all units produced times their selling price, plus dividends from securities and interest from bonds and other such sources – all adjusted to base-period values.

3. American Productivity Centre Model:

American Production Centre has measured that expresses profitability as a product of Productivity and price factor. The way it is done is:

Profitability= Sales/Cost

= (Output Quantity)*(Price)/ (Input Quantity)*(Unit Cost)

= (Productivity)* (Price Recovery Factor)

Where Productivity= Output Quantity / Input Quantity

4. Sumanth's Total Productivity Model:

Total productivity (TPM) = Total Tangible Output / Total Tangible Input

Where:

Total Tangible Output = Value of finished units produced + value of partial units produced + dividends from securities + interest from bonds + other income

Total Tangible Input = Value of (human + material + capital +energy+ other expenses) inputs used.

Sumanth's provided a structure for finding Productivity at product level and summing product level productivities to total firm level Productivity. The model also has the structure for finding partial productivities at the product level and aggregating them to product level productivities.

VII. Conclusions

Productivity is simply the efficiency of a Production System. It is expressed as the ratio of outputs to inputs in production. Increasing National Productivity can raise living standards because more real income improves people ability to purchase goods and services, so thereby improving housing, education and contributing more towards social, environmental and industrial growth programs. Productivity is considered to be a key source of economic growth and competitiveness. There are various factors affecting Productivity, viz. human, technical, managerial, natural, sociological, political and economic factors etc. The prime reasons for low Industrial Productivity are poor utilization of resources, worker's disputes, excessive inventory and rework and frequent machine breakdown etc.

Productivity Measurement is the quantification of both the output products and input resources of a Production System. The main objectives of Productivity Measurement include technology, efficiency, real cost savings, benchmarking production processes, living standards. Normally, some models such as Kendrick-Creamer, Craig Harris, American Productivity Centre and Sumanth Total Productivity Models are being used for the measurement of Industrial Productivity. At last, in today's highly competitive global environment, Indian Industries especially in region of Uttrakhand will have to select such advanced technology which may generate cost efficient and good quality optimal outputs to ensure high Industrial Productivity.

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