

# Productivity and work study 'PRODUCTIVITY'

Productivity is the quantitative relation between what we produce and what we use as a resource to produce them, i.e., arithmetic ratio of amount produced (output) to the amount of resources (input).

Productivity can be expressed as:

Productivity = Output /Input

Productivity refers to the efficiency of the production system.

It is the concept that guides the management of production system.

It is an indicator of how well the factors of production

(Land, Capital, labour and energy) are utilised.

### Productivity 'DEFINITIONS OF PRODUCTIVITY'

1. Productivity is a function of providing more and more of everything to more and more people with less and less consumption of resources.

2. The volume of output attained in a given period of time in relation to the sum of the direct and indirect efforts expended in its production.

3. Productivity is the measure of how well the resources are brought together in an organisation and utilized for accomplishing a set of objectives.

### Productivity 'DEFINITIONS OF PRODUCTION'

Production is defined as a process or procedure to transform a set of input into output having the desired utility and quality.

Production is a value addition process.

Production system is an organized process of conversion of raw materials into useful finished products

### Productivity 'PRODUCTION V/S PRODUCTIVITY'

The concept of production and productivity are totally different.

Production refers to absolute output whereas productivity is a relative term where in the output is always expressed in terms of inputs.

Increase in production may or may not be an indicator of increase in productivity. If the production is increased for the same output, then there is an increase in productivity.

### Productivity HOW PRODUCTIVITY CAN BE INCREASED ?

### **Productivity can be Increased by:**

1. When production is increased without increase in inputs.

2. The same production with decrease in inputs.

3. The rate of increase in output is more compared to rate of increase in input.

### Productivity

Expectations of various groups interested in productivity.

#### MANAGEMENT AND ENTREPRENEURS

High Return on Investment (ROI), Higher market share and corporate image.

MANAGERS: Maximum utilization of resources, lower unit cost, higher quality.

#### WORKERS

Higher wages, safer work environment, increased quality of work life (QWL)

SUPPLIERS: Prompt payment, continuous. order.

CUSTOMERS: Lower cost, quality, reliability, safety and timeliness of delivery.

GOVERNMENT: Economic development, employment generation, more exports.

SHARE HOLDERS: Higher dividends.

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### Productivity BENEFITS FROM PRODUCTIVITY

Productivity integrates the objectives of owners and workers.

Productivity contributes towards increase in production through efficient utilisation of resources and inputs rather than making workers to work hard.

Productivity strives to minimise human hazards and human efforts with a view to utilise them to those areas where they can contribute maximum to the output.

### Productivity DYNAMICS OF PRODUCTIVITY CHANGE

- Productivity improvement results in lower cost per unit by effective utilization of all the resources and reducing wastage.
- Lower cost per unit contributes to increased profit levels so that company can reinvest the surplus in new technology, equipment's and machines.
- This will result in further productivity increase and also there is a greater employment generation due to new investments.

The productivity increase results in higher wages to employees as profit potential of the company increases thereby increasing purchasing power of workers.

### Productivity DYNAMICS OF PRODUCTIVITY CHANGE



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#### Partial productivity Measures

One of the major disadvantage of partial productivity measures is that there is an over emphasis on one input factor to the extent that other inputs are underestimated or even ignored.

This cannot represent the overall productivity of the firm.

### **Input partial productivity measures :**



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Total productivity Measures	$Total Productivity = \frac{Total tangible output}{Total tangible input}$
It is based on all the inputs. This model can be applied to any manufacturing organisation or service company.	Features of Total Productivity Measures Gives both firm level and detailed unit level index.
Total tangible output = Value of finished goods produced + value of partial units produced + dividends from securities + interest + other income	Helps to find out the performance and productivity of the, operational unit.
Total tangible input = Value of (human + material + capital + energy + other inputs) used resources.	Helps to plan, evaluate and control. An important information to strategic
measurable. By: Mudit M. Saxe	na, Mplanners regarding expansion or

y: Mudit M. Saxena, Mplannersaregarding expansion engphasing out decisions.

#### **Total Factor Productivity**

Total Factor Productivity =  $\frac{\text{Net output}}{\text{Labour + capital inputs}}$ 

#### A. TOTAL PRODUCTIVITY MEASURE

- 1. Easy and more accurate representation of the total picture of the company.
- 2. Easily related to total costs.
- 3. Considers all quantifiable outputs and inputs.

#### B. TOTAL PRODUCTIVITY MEASURE

- 1. Difficulty in obtaining the data.
- 2. Requirement of special

#### C. TOTAL FACTOR PRODUCTIVITY MEASURE

- 1. Data from company records is relatively easy to obtain.
- 2. Value added approach.

#### D. TOTAL FACTOR PRODUCTIVITY MEASURE

### 1. No consideration for material and energy input.

2. Difficult to relate value added approach to production efficiency.

#### A. PARTIAL PRODUCTIVITY MEASURE

- 1. Easy to understand and calculate.
- 2. A tool to pinpoint improvement.

### B. PARTIAL PRODUCTIVITY MEASURE

- 1. Misleading if used alone.
- 2. No consideration of overall impact..

### PRODUCTIVITY MEASUREMENT

1. Craig and Harris model: This model points out the inadequacy of partial productivity measure. It is also called as "Service flow model" because physical inputs are converted into rupees that are payments for services provided by inputs. Productivity is viewed as efficiency of conversion process.

Total productivity is expressed as,

$$P = \frac{O}{L+C+R+Q}$$

Where

**P** = Total productivity

- L= Labour input factor
- **C** = **C**apital input factor
- **R** = Raw materials and purchased parts
- Q = Other misc, goods and services.

### PRODUCTIVITY MEASUREMENT MODELS Taylor-Davis model:

Total Factor Productivity (TFP) =  $\frac{S + C + MP - E}{(W + B) + [(KW + KF) Fb*df]}$ 

### Contrary to Craig and Hariss total productivity model, they defined a total factor productivity (TFP) Model

#### Where

- S = Net sales adjusted (Le., deflated to base year)
- C = Inventory change (Raw materials, finished goods and WIP) MP = Manufacturing plant (Unsaleable products like jigs and fixture, SPM)

E = Exclusions (Materials and services purchased from outside + depreciation of buildings + plant + equipment + rentals)

W = Wages and salary

B = Benefits; KW = Working capital ; KF = Fixed capital; Fb = investors contribution (expressed as Sb)

df = price deflator.

In this model, raw material was not considered as input on the basis that raw material is the result of some other labour and effort.

# Productivity and Work study

### PRODUCTIVITY MEASURES (APC model)

APC **model:** American productivity centre (APC) has developed a comprehensive measure which distinguishes among profitability, price recovery and productivity.

It can be utilised to measure productivity changes in labour, materials, energy and capital. It also measures the corresponding effect each one has on profitability.

APC model is based on the premise that profitability is a function of productivity and price recovery.

Productivity relates to quantities of output and quantities of inputs, while price recovery relates to price of output and costs of inputs.

Price recovery can be thought *of* as the degree to which input cost increases are passed on to the customers in the form of higher output price. Relationship between productivity, profitability and price recovery are represented as,

	Profitability	$=\frac{\text{Revenue}}{\text{Cost}}$	
	200 200	Output Quantities × Sales Price	
		Input Quantities × Unit Cost	
		Output Quantities Sales Price	
	l .	Input Quantities Unit Cost	
Profitability = Productiv		= Productivity × Price recovery	

The model compares data from one period (base period) with the data from the current period.

### Productivity and Work study FACTORS AFFECTING PRODUCTIVITY

S.No	Controllable (Internal Factors)	Uncontrollable (External Factors)
1.	Product	Structural Adjustments (economic and social)
2.	Plant and Equipment.	Natural Resources
3.	Technology	Government Policy
4.	Materials	Infrastructure
5.	Human Factors	
6.	'Work Methods	
7.	Management Style	
8.	Financial Factors	
9.	Sociological Factors	

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### Productivity and Work study FACTORS AFFECTING PRODUCTIVITY

**Controllable Factors (Internal Factors)** 

**Product factor:** Product is judged by its usefulness. The cost benefit factor of a product can be enhanced by increasing the benefit at the same cost or by reducing cost for the same benefit.

**Plant and equipment:** The increased availability of the plant through proper maintenance and reduction of idle time increases the productivity.

Productivity can be increased by paying proper attention to utilisation, age, modernisation, cost, investments, etc.

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# Productivity and Work study

FACTORS AFFECTING PRODUCTIVITY

**Technology:** Innovative and latest technology improves productivity to a greater extent. Automation and information technology helps to achieve improvements in material handling, storage, communication system and quality control.

# The various aspects of technological factors to be considered are:

Size and capacity of the plant. Timely supply and quality of inputs. Production planning and control. Repairs and maintenance. Waste reduction. Efficient material handling systems.

### Productivity and Work study FACTORS AFFECTING PRODUCTIVITY

- Material and energy: Efforts to reduce materials and energy consumption brings about considerable improvement in productivity.
  - The factors that are to be considered are:
  - Selection of quality material and right material,
  - Control of wastage and scrap,
  - Effective stock control.
  - Development of sources of supply, Optimum energy utilization and energy savings.

### Productivity and Work study FACTORS AFFECTING PRODUCTIVITY

**Human factors:** Productivity is basically dependent upon human competence and skill. Ability to work effectively is governed by various factors such as education, training, experience aptitude, etc., of the employees. Motivation of employees will influence productivity.

Work methods: Improving the ways in which the work is done (methods) improves productivity. Work study and industrial engineering techniques and training are the areas which improve the work methods which in term enhances the productivity.

Management style: This influence the organisational design, communication in organisation, policy and procedures. A flexible and dynamic management style is a better approach to achieve higher productivity.

### Productivity and Work

### Study FACTORS AFFECTING PRODUCTIVITY

#### **External Factors**

Structural adjustment includes both economic and social changes. Economic changes that influence significantly are: Shift in employment from agriculture to manufacturing industry,

Import of technology,

Industrial competitiveness.

Social changes such as women's participation in the labour force, education, cultural, values, attitudes are some of the factors that play a significant role in the improvement of productivity.

**Natural resources:** Manpower, land and raw materials are vital to the productivity improvement.

**Government policies and infrastructure:** Government policies and programmes are significant to productivity practices of government agencies, transport and. communication power, fiscal policies (interest rates, taxes) influence productivity to the greater extent.

### Productivity and Work study

**PRODUCTIVITY IMPROVEMENT TECHNIQUES** 



# Productivity and Work study

**PRODUCTIVITY IMPROVEMENT TECHNIQUES** 

### **Technology Based**

- 1. Computer Aided Design (CAD), Computer Aided Manufacturing (CAM), and Computer Integrated Manufacturing System(CIMS):
  - CAD refers to design of products, processes or systems with the help of computers. The impact of CAD on human productivity is significant for the advantages of CAD are:
    - Speed of evaluation of alternative designs
    - Minimization of risk of functioning
    - Error reduction.

CAM is very much useful to design and control the manufacturing system. It helps to achieve the effectiveness in production system by Line Balancing.

(CRP) Manufacturing Resource Planning (MRP II) and Materials Requirement Planning (MRP), Automated inspection.

Computer integrated manufacturing (CIM) is characterized by automatic line balancing, machine

loading/scheduling and sequencing, automatic inventory control and inspection.

### Productivity and Work

# study

### PRODUCTIVITY IMPROVEMENT TECHNIQUES Employee Based Product Based

Financial and non-financial incentives at individual and group level.

Employee promotion.

Job design, job enlargement, job enrichment and job rotation.

Worker participation in decision-making.

Quality circles (QC), Small Group Activities (SGA).

Personal Development.

#### **Material Based**

1. Material planning and control.

2. Purchasing, logistics.

3. Material storage and retrieval.

4. Source selection and procurement of quality material.

5. Waste elimination.

6. Material recycling and reuse.

#### **Process Based**

1. Methods engineering and work simplification.

2. Job design, job evaluation, job safety.

3. Human factors engineering By: Mudit M. Saxena, M. Tech. (Industrial

Value analysis and value engineering. Product diversification. Standardization and simplification. Reliability engineering. Product mix and promotion.

### Management Based

- 1. Management style.
- 2; Communication in the organisation.
- 3. Work culture.
- 4. Motivation.
- 5. Promoting group activity.

## Productivity and Work study PRODUCTIVITY IMPROVEMENT TECHNIQUES

### LEVELS OF PRODUCTIVITY MEASUREMENTS

- 1. International Level
- 2. National Level
- 3. Industry (Sector) Level
- 4. Company Level
- 5. Individual Resource Level

Development of indexes to compare the growth and competitive position of competing countries.

Developing economic indicators to enable the country to plan its resources on a rational basis.

Developing measures to compare each others performance to plan its manpower requirements, to compare performance of companies which comprise the industry in a sector.

Measures to enable them compare themselves in terms of performance experience. To measure trends of productivity improvements to plan effectively company resources.

To develop measures to compare performance of each resource amongst one another. To plan the future requirement of these resources.

# Assignment

- Q 1. What is productivity and what is its relation with production ? How productivity can be increased?
- Q 2. Explain partial productivity measures and total productivity measures and what are the advantages and limitations of both.
- Q 3. Explain the factors which affect productivity,
- Q 4. Explain APC model of productivity.
- Q 5. What are the expectations of various groups interested in productivity.
- Q 6. Explain various tools and techniques to improve productivity.