Productivity Concept

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Brainstroming

- working harder—unless people are loafing on the job;
- cutting costs—unless this can be done without affecting quality;
- reducing staff and workers unless your market is shrinking;
- extra work for managers—it's part of their job;
- employing specialists—it's a job for everyone.

Production

- Production is the process of converting resources into products or services.
- It is usually measured in terms of output per time period (e.g. boxes per hour, tones per day, bookings per month) or cost per unit of output (e.g. $10 per box, $20 per ton, etc).
- The objective of production operations is to meet the forecasted needs of the market in which they perform at the lowest possible cost.

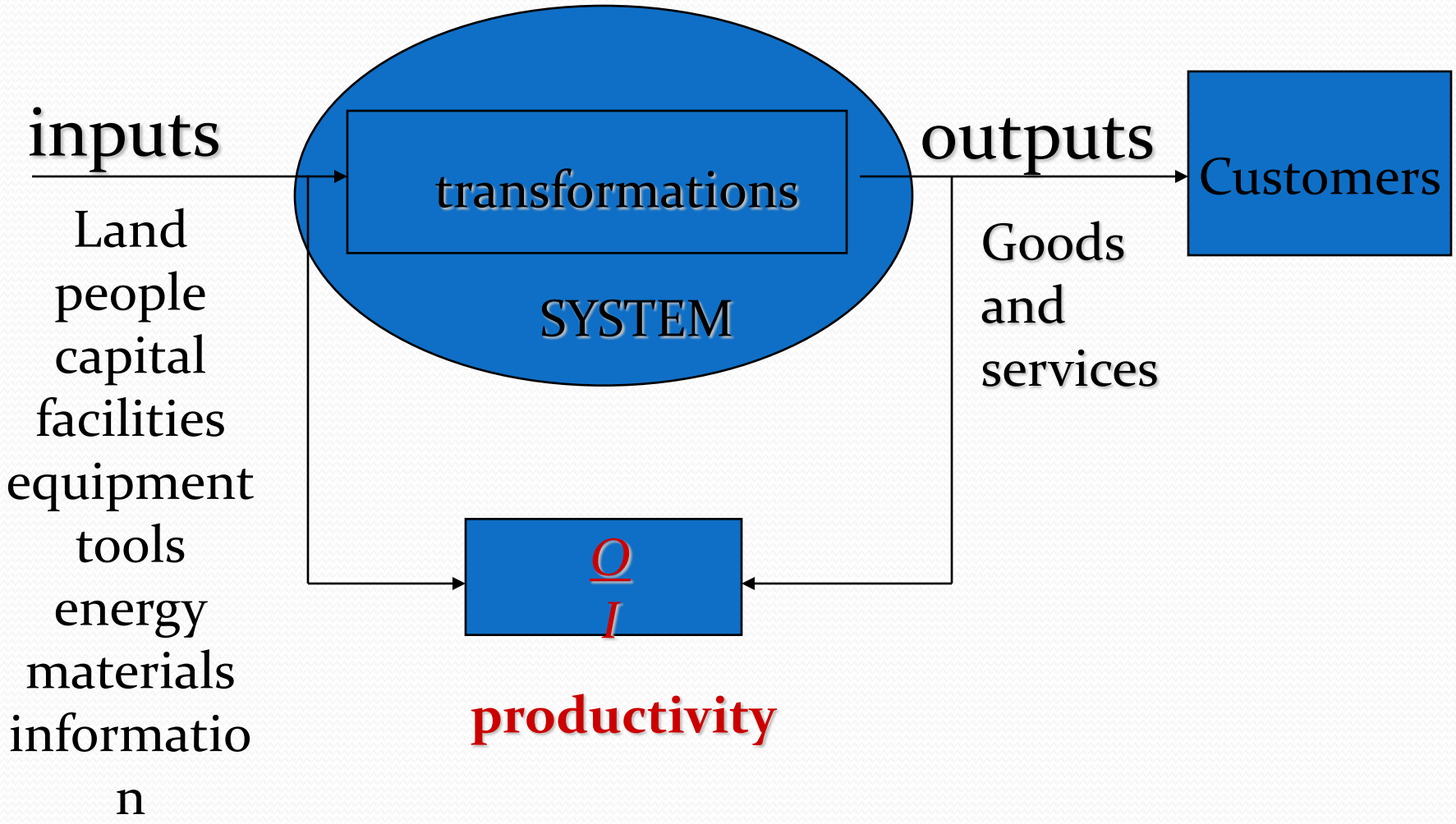
$$\text{Productivity} = \frac{\text{Outputs}}{\text{Inputs}}$$

Productivity is an index that measures output (goods and services) relative to the input (capital, labor, materials, energy, and other resources) used to produce them.

Productivity

- Productivity is simply a measure of the ratio between the output of a process and the input of resources needed for it. It is usually expressed as output divided by input.
- Output can be expressed in terms of units or volume (e.g. tones, litres, boxes, etc) and these units have usually been already determined for production planning purposes. In cases where outputs cannot be individually defined a monetary total can be used (e.g. $s of production, $s of sales, etc).
- Inputs are usually separated into Manpower, Machinery and Materials. In cases where inputs cannot be segregated a monetary value can be substituted (e.g. £s of material).

Systems Concept



Why Productivity Matters

- High productivity is linked to higher standards of living
  - As an economy replaces manufacturing jobs with lower productivity service jobs, it is more difficult to maintain high standards of living
- Higher productivity relative to the competition leads to competitive advantage in the marketplace
  - Pricing and profit effects
- For an industry, high relative productivity makes it less likely it will be supplanted by foreign industry

Measures of Productivity

Partial measures

$$\frac{\text{Output}}{\text{Labor}} \quad \frac{\text{Output}}{\text{Machine}} \quad \frac{\text{Output}}{\text{Capital}} \quad \frac{\text{Output}}{\text{Energy}}$$

Multifactor measures

$$\frac{\text{Output}}{\text{Labor + Machine}} \qquad \frac{\text{Output}}{\text{Labor + Capital + Energy}}$$

Total measure

$$\frac{\text{Goods or Services Produced}}{\text{All inputs used to produce them}}$$

Examples of Partial Productivity Measures

Labor Productivity	Units of output per labor hour Units of output per shift Value-added per labor hour
Machine Productivity	Units of output per machine hour machine hour
Capital Productivity	Units of output per dollar input Dollar value of output per dollar input
Energy Productivity	Units of output per kilowatt-hour Dollar value of output per kilowatt-hour

Example 1

7040 Units Produced

Sold for $1.10/unit

Cost of labor : $1,000

Cost of materials: $520

Cost of overhead: $2000

Which productivity measures can be calculated?

What is the multifactor productivity?

Solution 1

$$MFP = \frac{\text{Output}}{\text{Labor} + \text{Materials} + \text{Overhead}}$$

$$MFP = \frac{(7040 \text{ units})*(\$1.10)}{\$1000 + \$520 + \$2000}$$

$$MFP = 2.20$$

Example 2

5,500 Units Produced

Sold for $35/unit

500 labor hours are used

Cost of labor: $25/hr

Cost of raw material: $5,000

Cost of overhead: 2 x labor cost

What is the labor productivity?

What is the multifactor productivity?

Solution 2: Labor Productivity

- 5,500 units/500 hours = 11 units/hour

Or we can arrive at a unitless figure:

- (5,500 units*$35/unit)/(500 hours * $25/hr) =15.4

Solution 2: Multifactor Productivity

$$MFP = \frac{\text{Output}}{\text{Labor + Materials + Overhead}}$$

$$MFP = \frac{(5{,}500 \text{ units})*(\$35)}{(500\text{hrs.})*\$25/\text{hr.} + (\$5000) + 2*(500\text{hrs.})*\$25/\text{h}}$$

$$MFP = 4.52$$

Example 3

- You have just determined that your service employees have used a total of 2400 hours of labor this week to process 560 insurance forms. Last week the same crew used only 2000 hours of labor to process 480 forms.
- Which productivity measure should be used?
  - Answer: Could be classified as a Partial Measure.
- Is productivity increasing or decreasing?
  - Answer: Last week's productivity = 480/2000 = 0.24, and this week's productivity is = 560/2400 = 0.23. So, productivity has decreased slightly.

Productivity Growth

$$\text{Productivity Growth} = \frac{\text{Current productivity} - \text{Previous productivity}}{\text{Previous productivity}} \times 100\%$$

Productivity Growth is a key factor in a contry's rate of inflation and the standard of living of its people

Example 4

Labor productivity on the ABC assembly line was 25 units per hour in 2006. In 2007, labor productivity was 23 units per hour. What was the productivity growth from 2006 to 2007?

$$\text{Productivity Growth} = \frac{23-25}{25} \times 100\% = -8\%$$

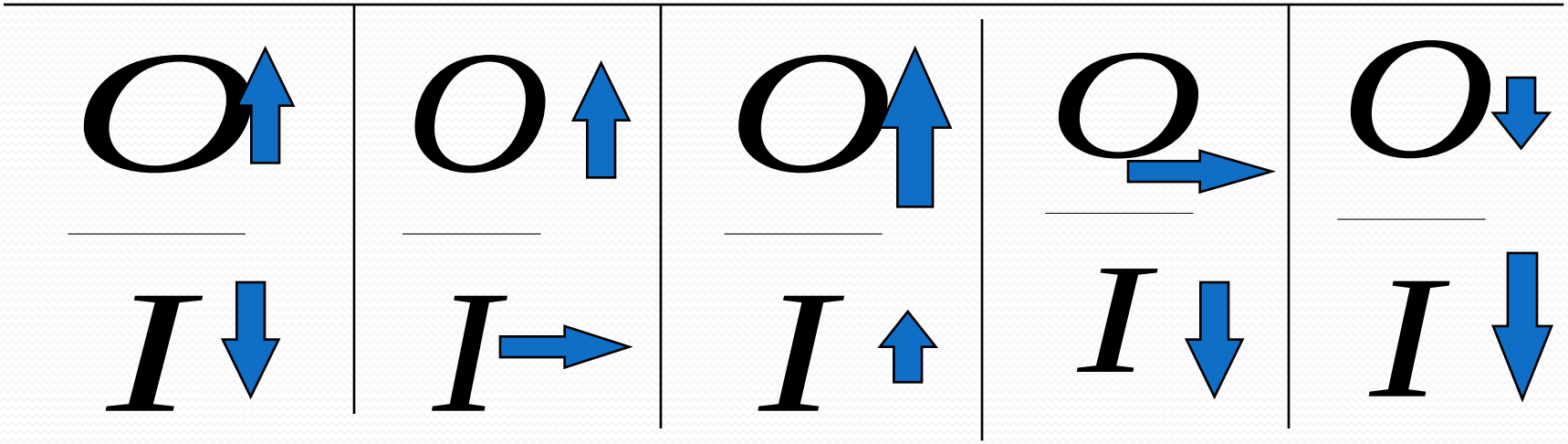
Measurement Problems

- **Quality differences *may distort productivity measurements***
- **External elements may cause an increase or decrease in productivity**
- **Precise units of measure may be lacking**
- **Technological differences may lead to misleading results.**

Productivity Improvement

Productivity Improvement (PI) is the result of managing and intervening in transformation or work processes.

PI will occur if:



Productivity improves when firms:

- Become more efficient
- Downsize
- Expand
- Retrench
- Achieve breakthroughs

Ways to Increase Productivity

- Increase output by using the same or a lesser amount of (input) resource.
- Reduce amount of (input) resource used while keeping output constant or increasing it.
- Use more resource as long as output increases at a greater rate.
- Decrease output as long as resource use decreases at a greater rate.
- Production is concerned with the activity of producing goods and services.
- Productivity is concerned with the efficiency and effectiveness with which these goods and services are produced.

Ways to Increase Productivity

- The cost of any product or service is the sum of the costs of the resources used in producing it.
- The more productive each of those resources can be made the lower the final cost of the product.
- In a free market the lower the cost of a product, the greater the demand it generates and the more profitable the enterprise, with ultimately a beneficial effect on the living standards of everyone.
- Increase input but get a greater increase in output.
- Maintain input but increase output.
- Decrease input with a smaller decrease in output.
- Decrease input but maintain output.
- Decrease input but increase output.

Key Steps for Improving Productivity

- Develop productivity measures for all operations
- Determine critical (bottleneck) operations
- Develop methods for productivity improvements
- Establish reasonable goals
- Get management support (make it clear that management supports and encourages productivity improvements.)
- Measure and publicize improvements
- Invest on labor force by training and education

(Don't confuse productivity with efficiency)

Efficiency and Effectiveness for productivity improvement.

- Efficiency is a necessary but not a satisfactory condition for productivity. In fact, both effectiveness and efficiency are necessary in order to be productive.
- Efficiency is the ratio of actual output generated to the expected (or standard) output prescribed.
- Effectiveness, on the other hand, is the degree to which the relevant goals or objectives are achieved.
- Effectiveness involves first determining the relevant (right) goals or objectives and then achieving them.
  - If, for example, nine out of ten relevant goals are achieved, the effectiveness is 90%. One can be very efficient and still not be productive.

THANK YOU FOR YOUR ATTENTION