

# ***Definition of Productivity***

---



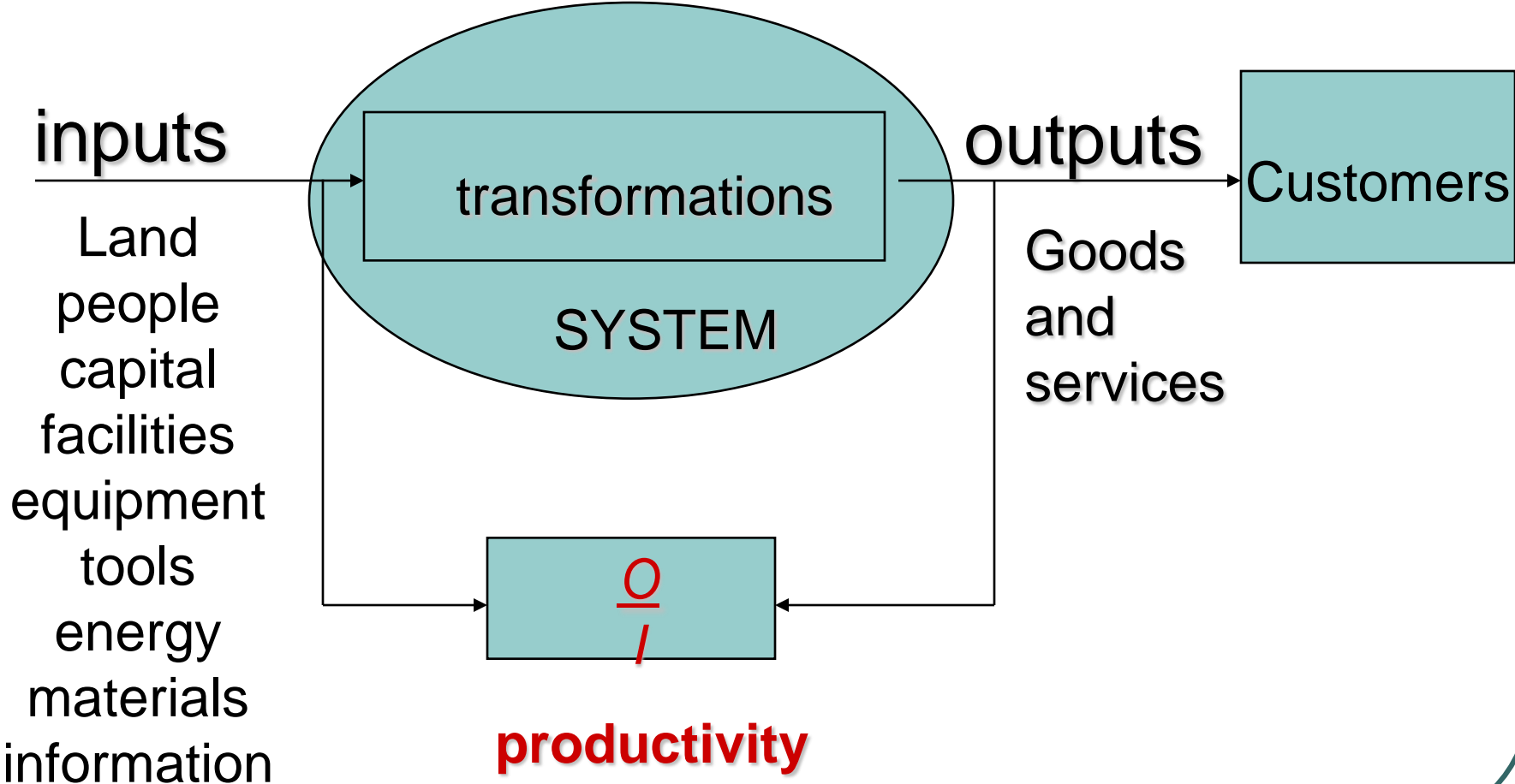
# Productivity: Definition

---

**Productivity** is the relationship between the **outputs** generated from a system and the **inputs** that are used to create those outputs. Mathematically

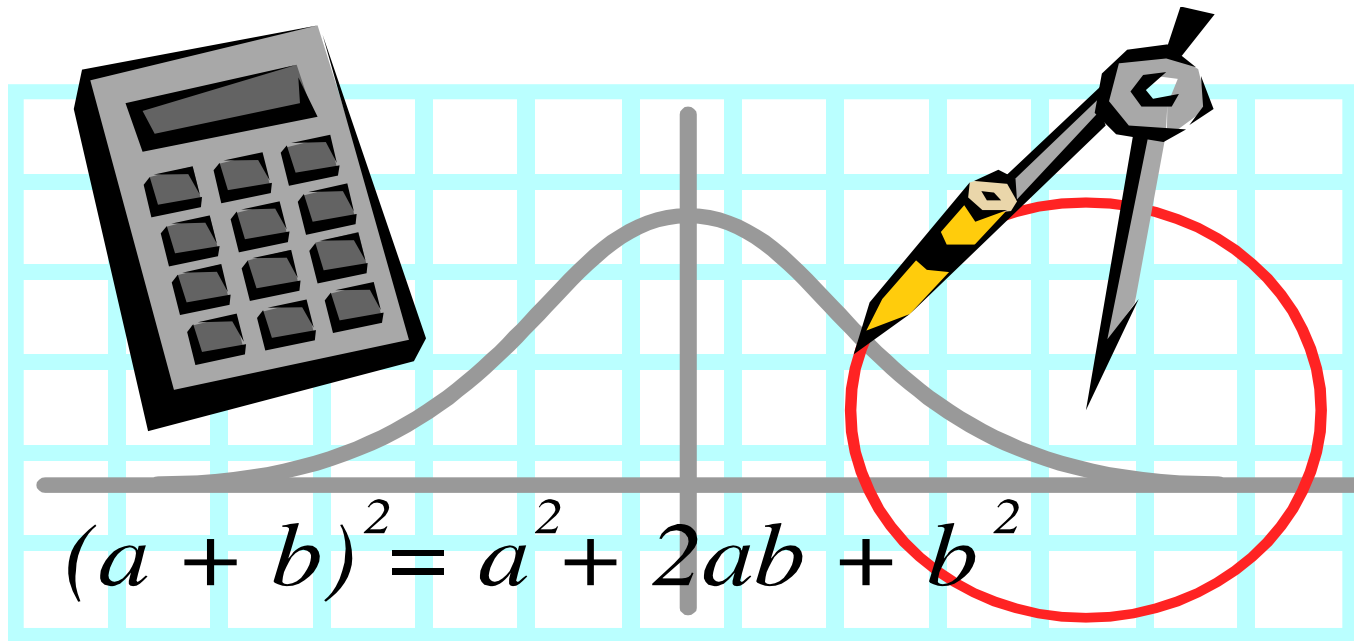
$$P = \frac{O}{I}$$

# Systems Concept



# Mathematically, How Can We Increase Productivity?

---



# Productivity Improvement

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

PI will occur if:

$\frac{O \uparrow}{I \downarrow}$	$\frac{O \uparrow}{I \rightarrow}$	$\frac{O \uparrow}{I \uparrow}$	$\frac{O \rightarrow}{I \downarrow}$	$\frac{O \downarrow}{I \downarrow}$
-----------------------------------	------------------------------------	---------------------------------	--------------------------------------	-------------------------------------

# Measuring Productivity

---

- **Static:**  $P=O/I$  in a given period of time (t).  
Useful for benchmarking purposes.
- **Dynamic:**  $p(1)=O(1)/I(1)$ ;  $p(2)=O(2)/I(2)$ ;  
then  $p(2)/p(1)$  yields a dimensionless index  
that reflects change in productivity between  
periods.  $((p(2)-p(1))/p(1))*100$  yields the  
percentage change between periods.

# Measuring Productivity (Continued)

---

- **Partial-Factor:** Uses a single “I” factor; e.g., output/labor-hour, sales/employee
- **Multi-Factor:** Uses more than one “I” factor; e.g. output/direct costs (labor, materials, and overhead).
- **Total-Factor:** Uses **all** “I” factors.  
(Note: Total-Factor captures “trade-offs” between input factors.)

# Measurement Problems

---

- Multiple products/services (aggregation-O)
- Varied categories, types, and levels of input resources (aggregation-I)
- Price/cost changes of outputs & inputs
- Redesigned products, services, processes
- “Hard-to-measure” factors (e.g., quality)



# Application of Productivity Measures

---

- Individual level
- Group level
- Department level
- Corporate level
- National level
- Global level

# Global-Level Productivity

---

- Why are global-level productivity measures important?
- How do we compare productivity among nations?
- How can a nation increase productivity in a global economy?

# Importance of Global-Level Productivity Measures

---

- Measure and compare competitiveness among nations.
- Contribute to the development of a nation's economic, social, and political policies.
- Develop global cooperation among nations.
- Help business organizations make investment decisions.

# Global-Level Productivity Measures

---

- Organisation for Economic Co-operation and Development (OECD) – <http://www.oecd.org/home/>
- **GDP per capita** (labor productivity \* fraction of people who work) is widely regarded as the best measure.
- A common currency is used to measure the GDP.

# **Factors Affecting Productivity Improvement at Global Level**

---

- Education
- Technology
- Macroeconomic policies
- Social and culture environments
- Foreign aids
- Foreign investments
- Industry policies & competition

# Why is National Productivity Important?

---



# Competing on Productivity

---

- At the national level, growing productivity
  - leads to a higher standard of living
  - holds inflation in check
  - enhances international competitiveness.
- The annual GDP growth is partially due to
  - growth in productivity
  - growth in inflation

# National Productivity Measures (<http://www.bls.gov/>)

---

- Comparisons within a segment of economy over time
- Comparisons of specific productivity measures
- International comparisons



# Labor Productivity - Percent Change from Previous Year

---

	2001	2002	2003	1994 - 2003
Business Sector	2.2	4.9	4.5	2.6
Non-Farm Sector	2.1	5.0	4.4	2.6
Manufacturing	2.2	7.2	5.1	4.2

# Other Measures Affecting Productivity

---

- Efficiency
- Effectiveness
- Quality
- Quality of Work Life
- Innovation

# Efficiency

---

- Measures the **resources** expected to be consumed to the resources actually consumed.
- Hence, it focuses on the **input** side of the system. (To what degree did the system utilize the “right” things.)

# Effectiveness

---

- Measures what the system sets out to accomplish (objective) with what was actually accomplished; **plan vs. actual**
- Hence, effectiveness is an **output** measure.  
(Is the output “right” - right quality, right quantity, on time, etc.)

# Quality

---

- Degree to which the outputs (products and services) from the system conform to requirements or meet customer expectations.
- The focus is on quality attributes (e.g., conformance, performance, convenience, responsiveness, perceived quality.)

# Quality of Work Life (QWL)

---

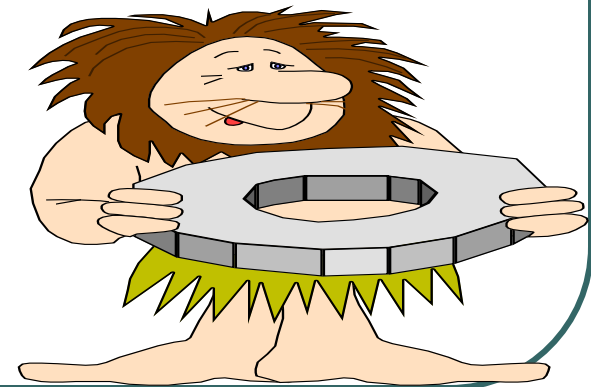
- Measures the way that employees in a system respond to the sociotechnical aspects of that system.



# Innovation

---

- Measures the applied **creativity** of the system.
- Relates to the design and development of **improved** products, services, and processes.



# How Do Those Other Measures Affect Productivity?

---

