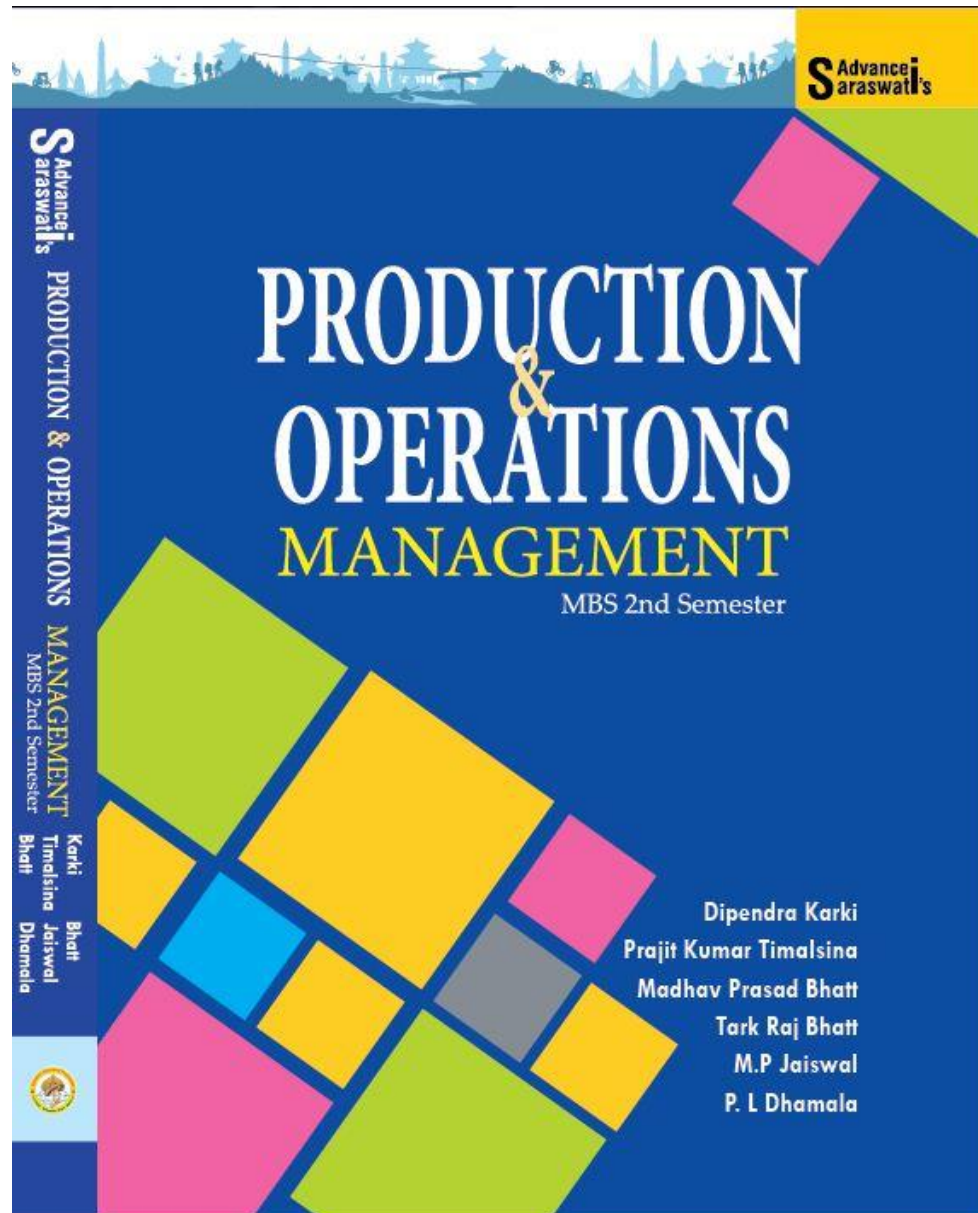


MSC 517: Production and Operations Management



Basic Concepts and Introduction

Chapter 1

The purpose of this chapter is to introduce the basic concepts of production and operations management , its historical development and examine the different methods to determine productivity. This chapter includes:

1.1 Concept, 1.2 Transformation model, 1.3 Manufacturing versus Service operations , 1.4 Historical Development of Operations Management , 1.5 Types of production system, 1.6 Operations strategy, 1.7 Global view of operations, 1.8 Achieving competitive advantage though operations, 1.9 Concept and types of Productivity

Concept:

- **Production & operations management (P/OM) is the work function that oversees making goods and providing services.**
 - eg. Car, radio, Television (Products/goods); Banking, Insurance, Travel booking (Services)
- It is about the transformation of production and operational inputs into outputs that, when distributed, meet the needs of customers.

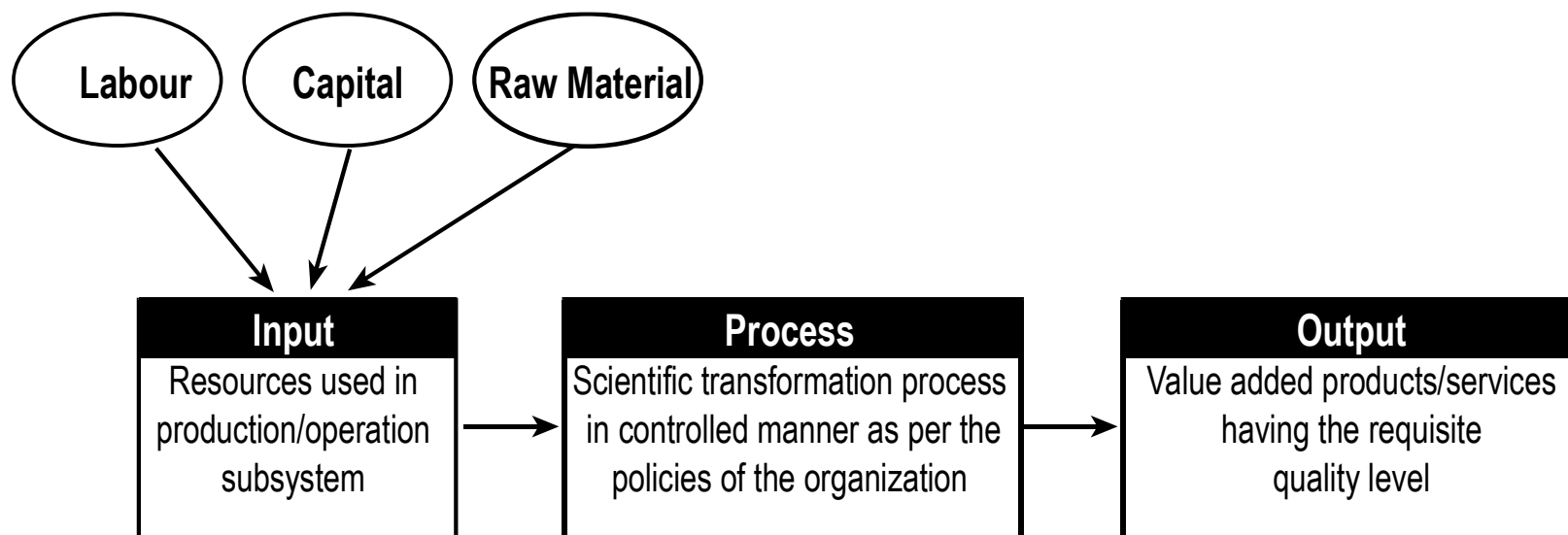
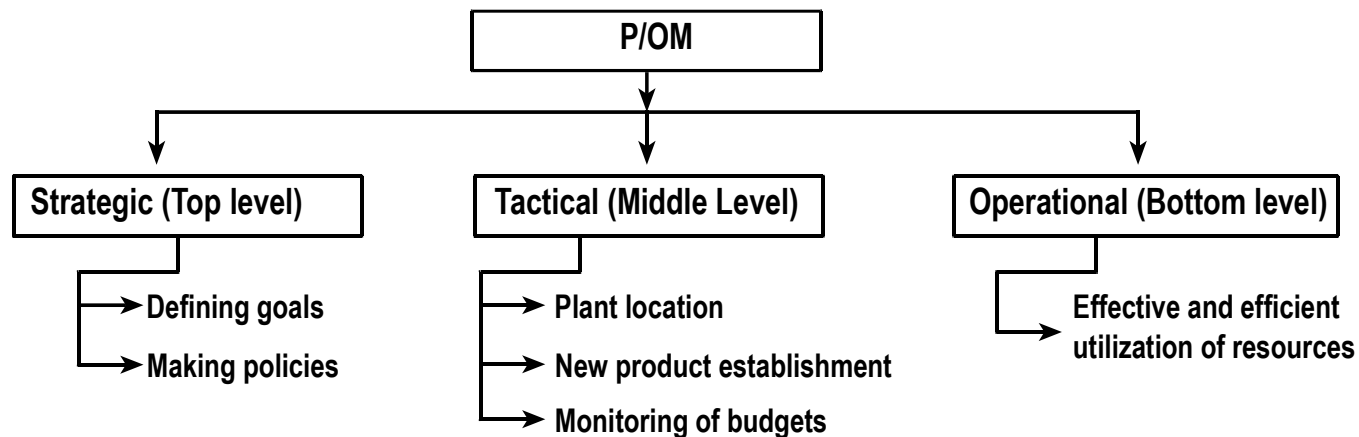


Fig. 1.1: The P/OM function involves the conversion of inputs into outputs

Concepts:

In the process of managing various subsystems of the organization, P/OM considers 3 levels of management decisions; Strategic, tactical and operational.



P/OM is concerned with the management of conversion process to produce desired output.

- It is the foundation of whole organization
- Manufacturing organization: manufactures tangible products
- Service organization: produces intangible products
- In absence of it, no organizational objectives can be achieved.

Definitions:

“Production management deals with decision making relating to production process so that the resulting goods and services are produced in accordance with the quantitative specification and demand schedule with minimum cost.”

- Buffa

“Production management is the process of effective planning and regulating the operations of the section of an enterprise, which is responsible for the actual transformation of materials into finished goods.”

E L. Brech

“The operations manager’s job is to manage the process of converting inputs into desired outputs.”

- Adam Jr. & Ebert

“Operations management may be defined as the design, operation, and improvement operations of the production systems that create the firm’s primary products or services.”

- Chase, Aquilano & Jacobs

Concepts:

Edwood Buffa "a process by which goods and services are created". It is the science of completing a given job:

- with specified quality and quantity
- With predetermined cost and at the right time
- Irrespective of the manufacturing or service sector.

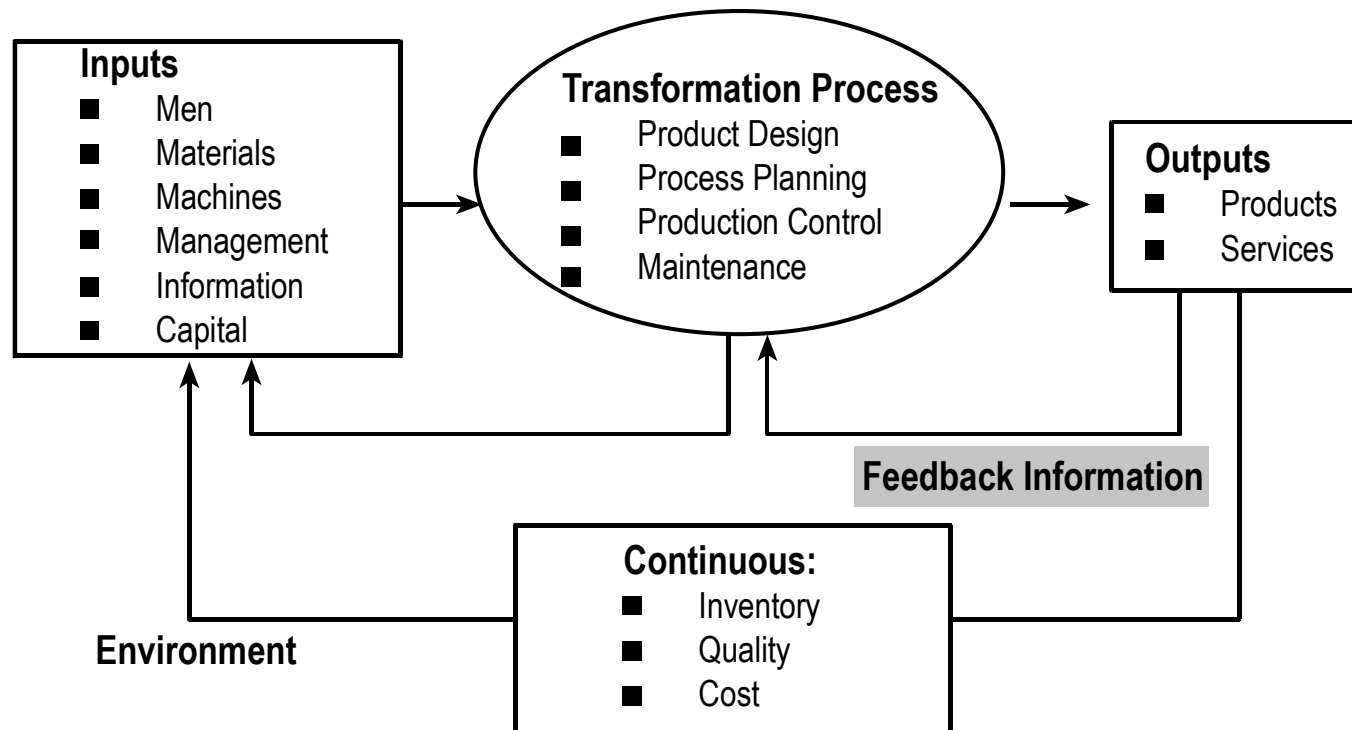


Fig. Schematic diagram of POM system

What is the difference between Production and Operations Management?

- POM is an umbrella term which surrounds a spectrum of ideas within the managerial circles.
- Both the processes are more similar than different.
- When the manufacturing product process is a prime interest, then it is called production management.
- Whereas administration of the services while manufacturing the product is called operation management.

1.2 Transformation Model

- A model is a representation of reality and a simplified version of something that captures the essential features of an object/system/process. For example, a child's toy car is a model of a real car.
- Three types:

I. *Physical model*: Looks like their real life counterparts.

Replica of a physical object with a change of scale.

(Ex. solar system, Atomic model)

II. *Schematic model*: are more abstract than their physical counterparts; that is, they have less resemblance to the physical reality. They may be 2-D models , Symbolic chart, Maps of locations etc.

III. *Mathematical model*: are the most abstract: they do not look at them like their real-life counterparts. Examples include numbers, formulas, and symbols.

1.3 Manufacturing Vs Service Operations

Dimension	Manufacturing (Product)	Service Operations
1. Nature of output	Tangible, durable products.	Intangible, perishable products.
2. Inventories	Output can be inventoried.	Output can't be inventoried.
3. Consumption of output	Consumption/use takes more time.	Immediate consumption.
4. Degree of Customer contact	Low customer's involvement.	High customer's involvement.
5. Response time	Long response time.	Short response time.
6. Availability	Available at regional, national and international market.	Local market.
7. Facilities	Require large facilities.	Require small facilities.
8. Capital/Labour Priority	Capital intensive.	Labour intensive.
9. Measurement of quality	Quality easily measured.	Quality not easily measured.
10. Demand variation	Demand variable on weekly, monthly, seasonally.	Demand variable on hourly, daily, weekly basis.

Service or Good?

- “If you drop it on your foot, it won’t hurt you.”
(Good or service?)
- “Services never include goods and goods never include services.” (True or false?)

1.4 Historical Development of Operations Management

i. Manufacturing Management

- Early era of recognizing benefit of work specializing in manufacturing system (Adam Smith- F.W. Taylor).

ii. Production Management

- It was the era between 1930 and 1950.

iii. Operations Management

- Started since 1970 and service product is also considered with physical product.

History of Operations

- Cottage System <1700
- Industrial Revolution 1700 - 1800
- Civil War 1850s
- Scientific Management 1890s
- Moving Assembly Line 1910s
- Hawthorne Studies 1930s
- Operations Research 1940s
- Global Competition 1970s
- Service Revolution 1980s
- Mass Customization 1990s

TIME



1.4 Historical Development of Operations Management Contd...

<i>Date</i>	<i>Contribution</i>	<i>Contributor</i>
1776	Specialization of labour in manufacturing	Adam Smith
1799	Interchangeable parts, cost accounting	Eli Whitney and others
1832	Division of labour by skill; assignment of jobs by skill; basics of time study	Charles Babbage
1900	Scientific management time study and work study developed; dividing planning and doing of work	Frederick W. Taylor
1900	Motion of study of jobs	Frank B. Gilbreth
1901	Scheduling techniques for employees, machines jobs in manufacturing	Henry L. Gantt
1915	Economic lot sizes for inventory control	F.W. Harris
1927	Human relations; the Hawthorne studies	Elton Mayo
1931	Statistical inference applied to product quality: quality control charts	W.A. Shewart
1935	Statistical sampling applied to quality control: inspection sampling plans	H.F. Dodge & H.G. Roming

Source: Adam & Ronald, from 5th ed. Prentice Hall of India

1.4 Historical Development of Operations Management Contd..

<i>Date</i>	<i>Contribution</i>	<i>Contributor</i>
1940	Operations research applications in World War II	P.M. Blacker and others.
1946	Digital computer	John Mauchly & J.P. Eckert
1947	Linear programming	G.B. Dantzig, Williams & others
1950	Mathematical programming, on-linear and stochastic processes	A. Charnes, W.W. Cooper & others
1951	Commercial digital computer: large-scale computations available.	Sperry Univac
1960	Organizational behaviour: continued study of people at work	L. Cummings, L. Porter
1970	Integrating operations into overall strategy and policy, Computer applications to manufacturing, Scheduling and control, Material requirement planning (MRP)	W. Skinner J. Orlicky and G. Wright
1980	Quality and productivity applications from Japan: robotics, CAD-CAM	W.E. Deming and J. Juran.
1990s	Total Quality Management (TQM), Business Process Re-engineering, Electronic enterprise, Supply chain management	W. Skinner, Japanese manufacturers
2000s	E-commerce	Numerous

- POM incorporates tasks that are interdependent, but which can be grouped under five main headings: (5 Ps)

1: PRODUCT

- Ensure that a business sells products that **meet customer needs and wants**.
- Ensure to make the required products in accordance with the plan.
- Focuses on:
 - Performance
 - Aesthetics
 - Quality
 - Reliability
 - Quantity
 - Production costs
 - Delivery dates

2: PLANT

- **Requirement** of PLANT: fixed assets of the business. consider areas such as:
 - Future demand (volume, timing)
 - Design and layout of factory, equipment, offices
 - Productivity and reliability of equipment
 - Need for (and costs of) maintenance
 - Health and safety (particularly the operation of equipment)
 - Environmental issues (e.g. creation of waste products)

3: PROCESSES

- There are many different **ways of producing a product**.
- Basically, consider the following factors to choose one:
 - Available capacity
 - Available skills
 - Type of production
 - Layout of plant and equipment
 - Safety
 - Production costs
 - Maintenance requirements

4: PROGRAMMES

- The production PROGRAMME **concerns the dates and times** of the products that are to be produced and supplied to customers. The decisions on programming will be influenced by factors such as:
 - Purchasing patterns
 - Cash flow
 - Need for / availability of storage
 - Transportation

5: PEOPLE

- Production **depends on PEOPLE**, whose skills, experience and motivation vary. It will consider the following areas:
 - Wages and salaries
 - Safety and training
 - Work conditions
 - Leadership and motivation
 - Unionization
 - Communication

Functions of POM

- As a part of management, it has following functions:
 - Planning:
 - Organizing:
 - Controlling:
 - Behavior:
 - Models

CONT...

PLANNING

- **Course of action that guides future decision- making.**
- The operation manager defines the objectives for its subsystem of the organization, and the policies, and procedures for achieving the objectives.

ORGANIZING

- Activities that establishes a **structure of tasks and authority** is called organizing.
- POM establish a structure of roles and the flow of information within the POM subsystem. It determines the activities required to achieve the goals and assign authority and responsibility for carrying them out.

CONT...

CONTROLLING

- Activities that **assure the actual performance** in accordance with planned performance is called Controlling.
- To ensure that the plans for the POM subsystems are accomplished, the PO manager must exercise control by measuring actual outputs and comparing them to planned operations management.

BEHAVIOUR

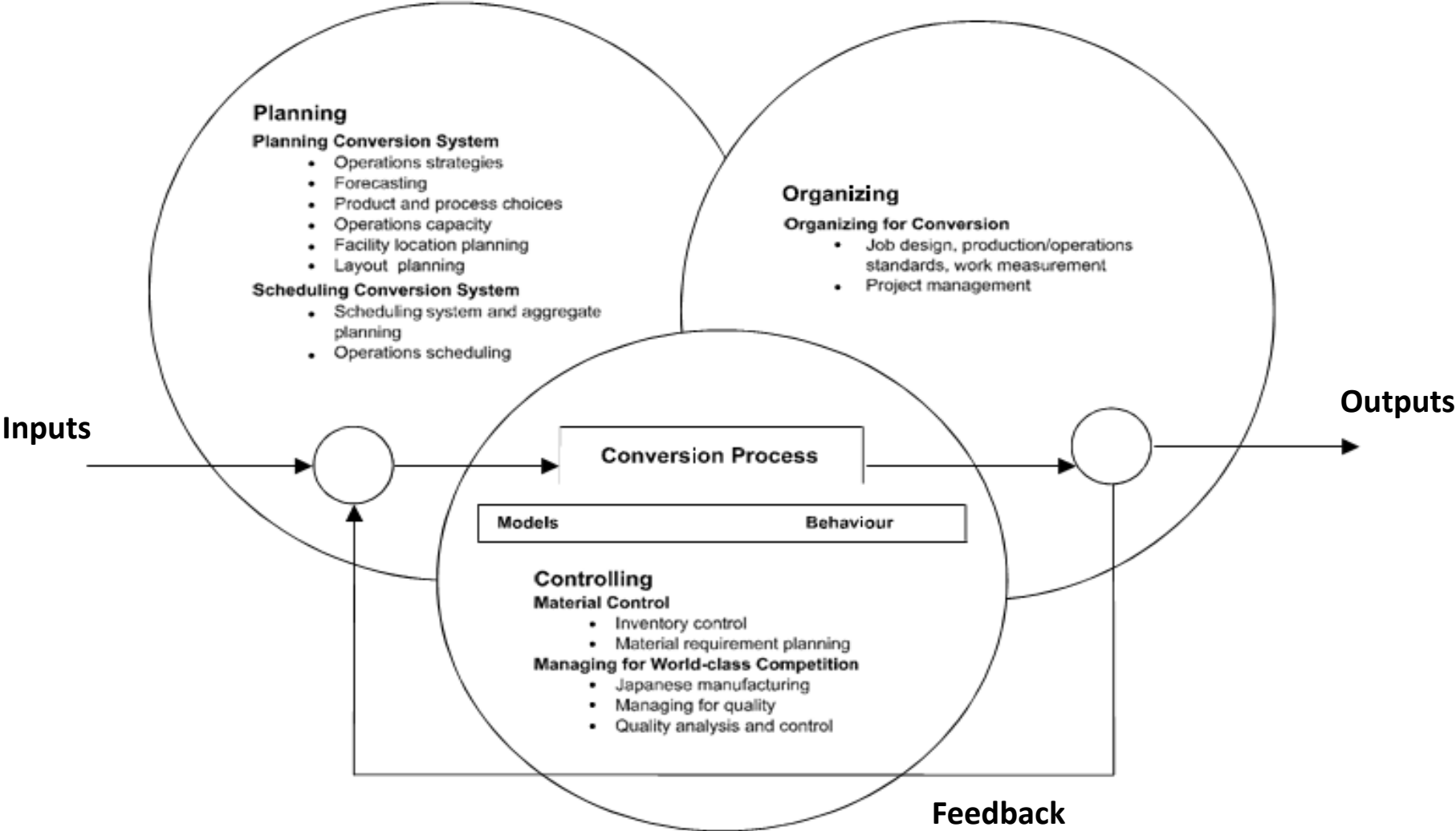
- **Human aspect** on the job is called behaviour.
- PO managers are concerned with how their efforts to plan, organize, and control affect human behaviour. They also want to know how the behaviour of subordinates can affect management's planning, organizing, and controlling actions.

CONT...

MODELS

- The **techniques** which are used for problem solving is called Models.
- As a process of plan, organize, and control the conversion process, PO manager encounter many problems and must make many Decisions.

Fig. General models for Operations Management



Source: Adam Jr. & Ebert: Production and operations management

Types of Production System

Two types:

Intermittent Production System

Continuous Production System

Intermittent Production System

- Produced to **fulfill the orders of the customers** rather than for stock
- Production facilities are **flexible** enough to produce wide varieties of products
- No continuous flow of production
- Complex production planning and controlling
- Widely used in hospitals, machine shops, restaurants, furniture, and offset printing press etc.

Intermittent Production...

Characteristics:

Production in small quantity

Unbalanced work load

High skilled manpower

Frequent change in planning, scheduling, and routine

Highly flexible

High unit cost

Further classified into two types:

Job shop production system : *Manufacturing of **one or few** quantity of products designed and produced as per the specification of customers within prefixed time and cost. (eg. stitching a cloth for individuals)*

Batch production system: *Manufacturing in which the job passes through the functional departments in **lots or batches** and each lot may have a different routing. (eg. preparing uniform for school or offices)*

Types of Production System...

Continuous Production System

- Used for producing **highly demanded products**
- Produces **goods for stock** not for order
- Standardized planning, scheduling and controlling activities
- eg. production of biscuits, noodles, coke etc..

Further classified into two types of continuous production system:

Mass production system : *Manufacture of **discrete** parts or assemblies using a **continuous process**.* (eg. producing in discrete lots; biscuits of salty and then sweet variety)

Continuous/process production system: ***sequence** of production operations from the first operations to the finished product.* (eg. manufacturing cement, beers, coke etc.)

Types of Production System...

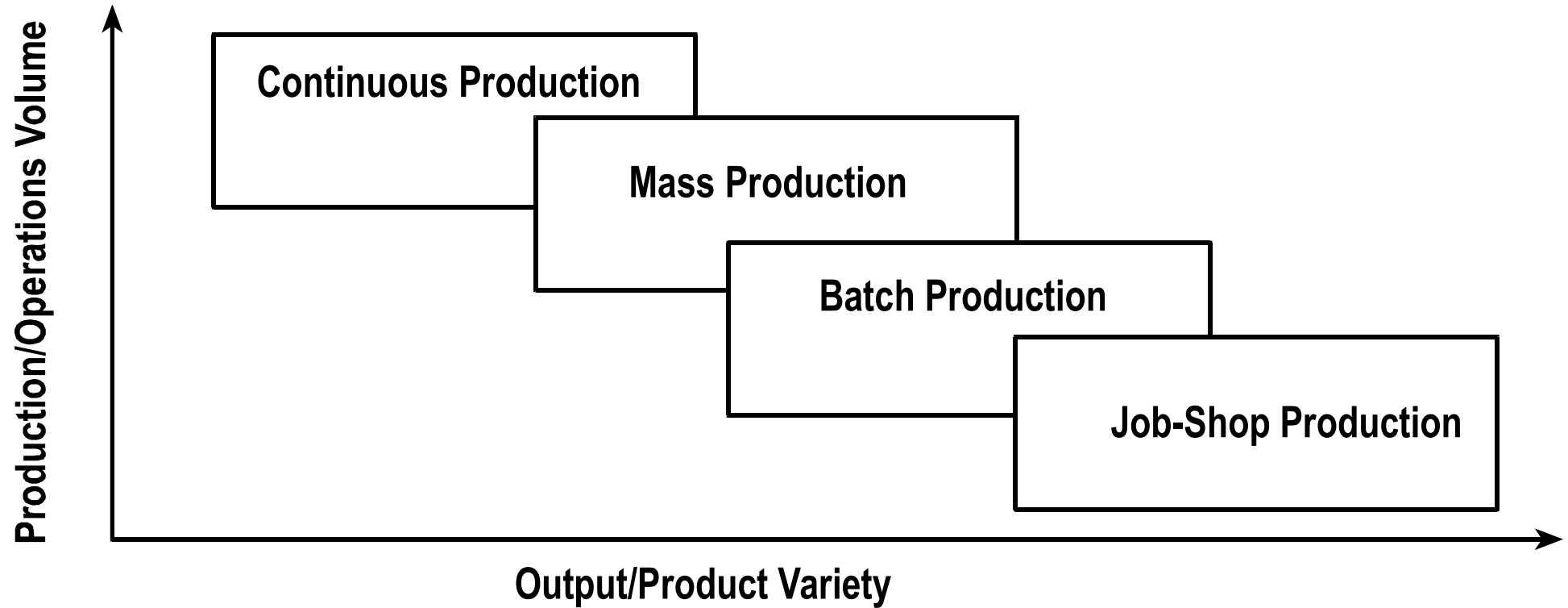


Fig. Classification of production systems

1.6 Operations Strategy

The strategy of the organization is based on following issues of market

where it is now and where it will be in future

what are the existing market and potential markets

(Primary goals)

The organizational goal achievement is the basic of any system.

The strategic goals are:

Quality (product performance)

Cost efficiency (low product price)

Dependability (reliability, timely delivery)

Flexibility (responding to the change in product and output volume)

(Secondary goals)

Priorities:

- Efficiency & Economy of conversion process
- Setting the organizational goals/objectives/policies & Plan
- Best utilization of resources
- Effective control
- Customer satisfaction

Operation Strategy

Strategy Process

Customer Needs



Corporate Strategy



Operations Strategy



Decisions on Processes
and Infrastructure

Example

More Product



Increase Org. Size



Increase Production Capacity



Build New Factory

Execution!!

- **Strategy is execution. (Louis Gerstner)**
- **Unless you translate big thoughts into concrete steps for action, they're pointless. (Larry Bossidy)**
- **In the business world, having a good objective means nothing if you implement it badly. (Fareed Zakaria)**

1.7 Global View of Operations

Globalization: *process in which geographic distance becomes a factor of diminishing importance in the establishment and maintenance of cross border economic, political and socio-cultural relations.*

Four developments, which have spurred the trend toward globalization :

1. Improved transportation and communication technologies;
2. Opened financial systems;
3. Increased demand for imports; and
4. Reduced import quotas and other trade barriers.

Managing global operations would focus on:

- To acquire and properly utilize the concepts related to global operations, supply chain, logistics, etc.
- To associate on global historical events, key drivers in global operations, from different perspectives.
- To associate success and failure cases of global operations to political, social, economical and technological environments.
- To predict trends in global operations.
- To develop an understanding of the world vision regardless of their country of origin, perspectives of people from different races, preferences, religion, politic affiliation, place of origin, etc.

1.8 Achieving Competitive Advantage through Operations

Two ways:

i. Activities Relating to Production System Designing:

ii. Activities Relating to Analysis and Control of Production:

As illustrated , figure below shows the activities in which operations management seek to achieve competitive advantages:

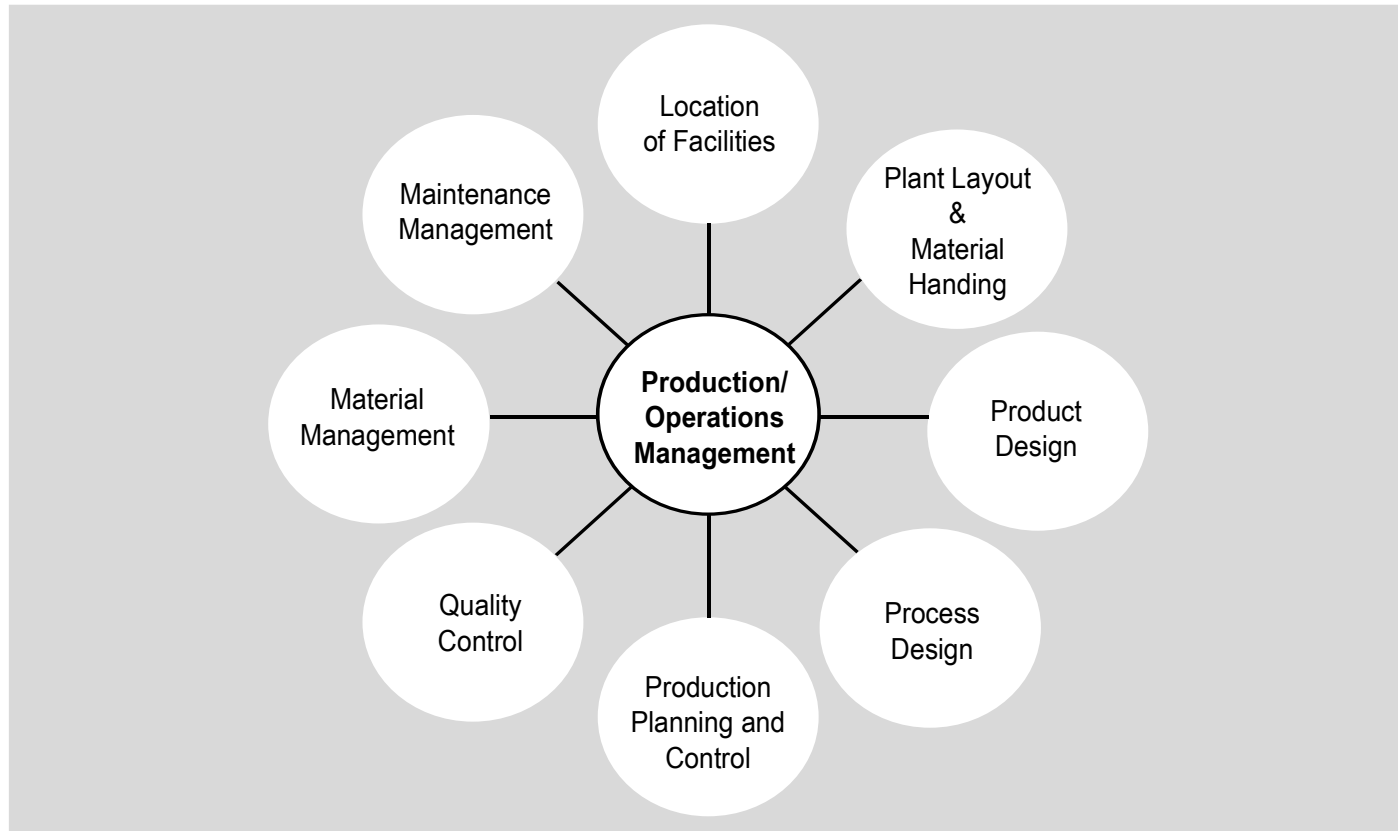


Fig. Scope of production and operations management

Benefits Derived from Efficient P/OM

- **The efficient Production & Operations Management will give benefits to the various sections of the society. They are:**
 - i. Consumers**
 - ii. Investors**
 - iii. Employees**
 - iv. Suppliers**
 - v. Community**
 - vi. Nation**

1.9 Concept and Types of Productivity

- **Productivity is the quantitative relationship between what we produce and what we use as a resource to produce them.**
- It is the ratio of aggregate output to the aggregate input.

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

- Productivity refers to the efficiency of the production system.
- For survival of any organization, this productivity ratio must be at least 1.

Example: Let ABC Company produces 6,000 units of outputs with the help of 2000 units of inputs. Then its productivity will be:

$$\text{Productivity} = \frac{\text{Outputs}}{\text{Inputs}} = \frac{6000 \text{ units}}{2000 \text{ units}} = 3:1$$

It means ABC Co. can produce 3 units of outputs from 1 unit of input.

Production and Productivity

Production	Productivity
<ul style="list-style-type: none">▪ It deals only conversion process▪ Process▪ It can be expressed in unit▪ It satisfies the human need▪ It is something that can be touched & felt▪ It is the measure of produced goods	<ul style="list-style-type: none">▪ It is the ratio of output by input▪ Measure▪ It does not have any unit▪ It is the management technique to improve the effectiveness & efficiency▪ It is the attitude of mankind▪ It is the measure of efficiency

Productivity is positive attitude

- Efficiency + Effectiveness

Types of Productivity

i. Partial factor productivity

output/(Single input)

- Labor productivity
- Capital productivity
- Material productivity
- Energy productivity

ii. Multi-factor Productivity

output/(multiple inputs)

iii. Total Productivity

output/(total inputs)

Example 1.

10,000 Units Produced

Sold for Rs.10/unit

500 labor hours

Labor rate: Rs. 9/hr

Cost of raw material: Rs. 5,000

Cost of purchased material: Rs.25,000

*What is the
labor productivity?*

Example--Labor Productivity

10,000 units/500hrs = 20 units/hour ...

... or we can arrive at a unitless figure

$(10,000 \text{ unit} * \$10/\text{unit}) / (500\text{hrs} * \$9/\text{hr}) = 22.22$

Example 2. Productivity measures

A furniture manufacturing company has provided the following data. Compare the labour, raw materials and supplies and total productivity of 2016 and 2017.

Inputs and Outputs		2016 (Rs.)	2017 (Rs.)
<i>Inputs:</i>	Labour	10,000	15,000
	Raw materials and Supplies	8,000	12,500
	Capital equipment depreciation	700	1,200
	Energy	2,200	4,800
<i>Output:</i>	Sales value of production	22,000	35,000

Solution:

Productivity measures	2016	2017
Labour Productivity	2.2	2.3
Raw materials and Productivity	2.75	2.80
Capital Productivity	31.43	29.17
Energy Productivity	10	7.29
Total Productivity	1.05	1.04

Here, Partial productivities related to raw materials and energy as well as total productivity are lower in 2017 with respect to 2016, though labour and capital productivities are increased in 2017.

Example 3: Productivity Measurement

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.

Is productivity increasing or decreasing?

Factors affecting Productivity:

Factors affecting productivity can be classified broadly into two categories:

(A) controllable (or internal) factors and

(B) un-controllable (or external) factors.

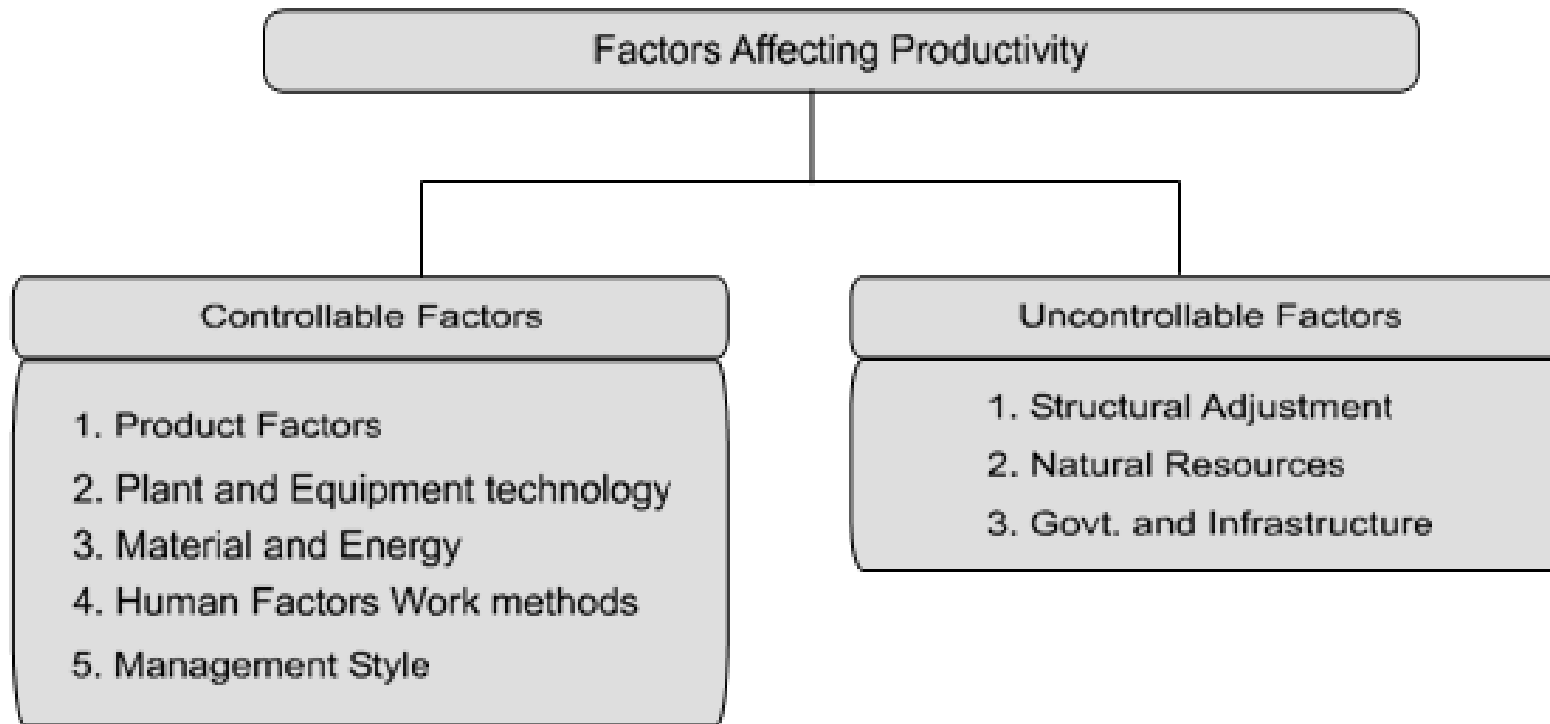


Fig. Factors affecting productivity