
6
Operations
PRISMACOLOR
Plastic Eraser
Gomme en plastique
inch
MADE IN CHINA

At a glance

Lesson 6 focuses on *Operations Management*. Firstly, we explore this concept that refers to the **Production Function** of the firm, through revising the main decisions that a company makes in this regard.

Subsequently, we introduce the **production cost analysis**, where some key concepts are defined.

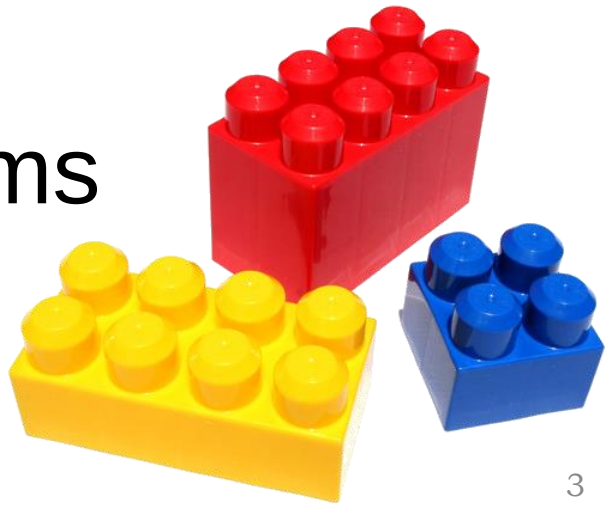
Lastly, we analyze the main **production systems** that are used in practice. From the classical alternatives, we move on towards new successful approaches.

Lesson 6. Operations

6.1. The Production Function

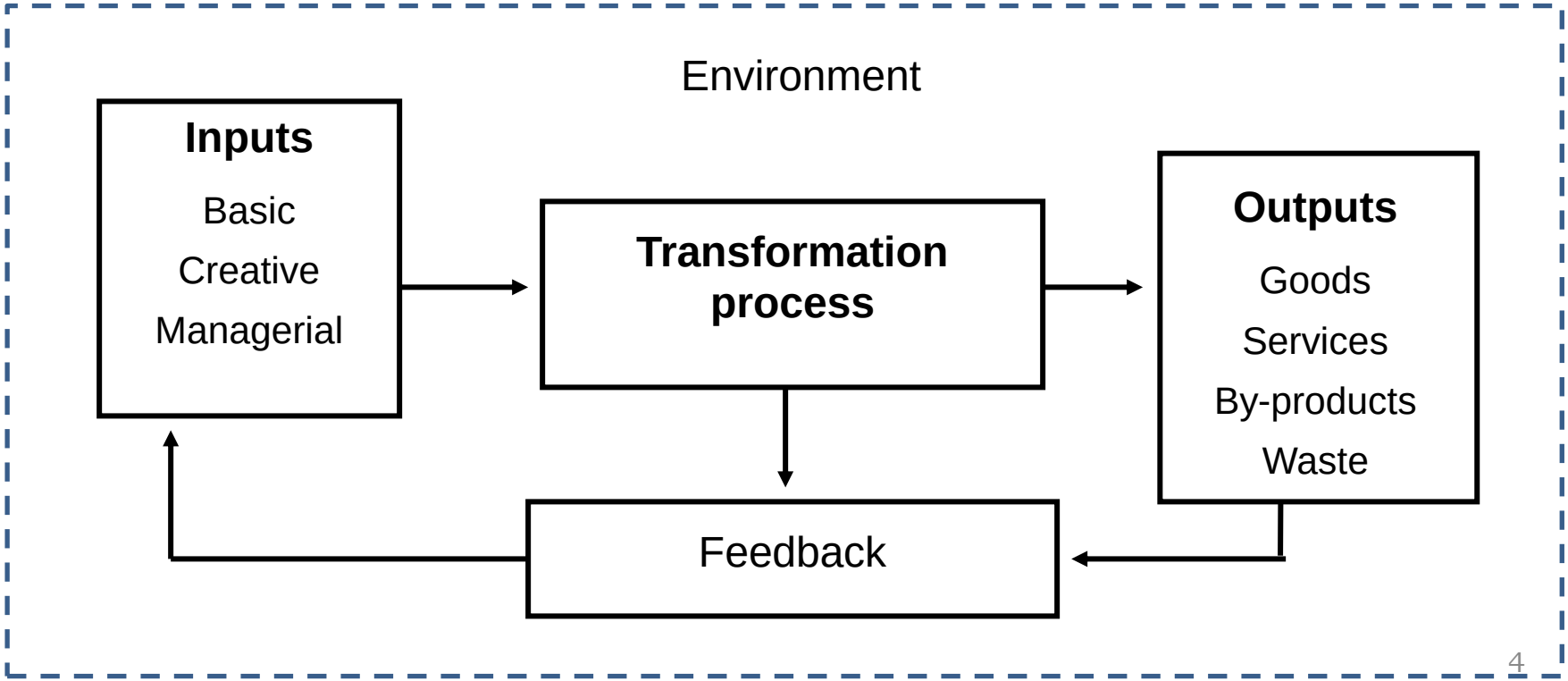
6.2. Cost Analysis

6.3. Production Systems



A. Operations Management: Definition

- Operations Management is concerned with managing all the *processes* involved in *creating value* by *producing goods and services* and *distributing them to customers*.

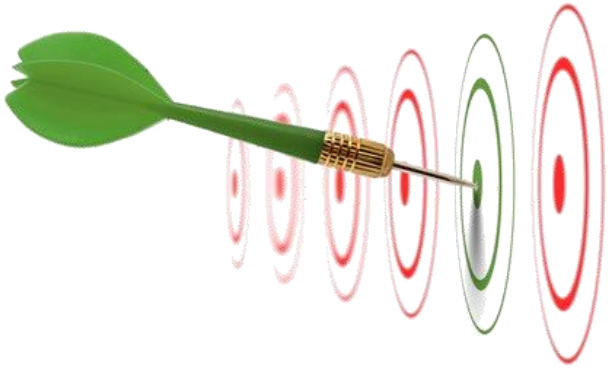


Some examples

Type of Business	Inputs	Processes	Outputs
Hospital	Doctors, nurses, operating rooms, ambulances, equipment, patients…	Medical procedures, therapy, professional care of patients, service delivery…	Health services, waste…
Bakery	Flour, sugar, equipment (ovens), energy, bakers…	Food preparation according to recipes, machine setup, mix, mould, bake, pack…	Cakes, pies, bread, waste…
Coal-burning electric generating plant	Coal, boiler, turbine, transmission lines, water, employees…	Conversion of the chemical energy stored in coal into thermal energy, mechanical energy and, finally, electrical energy…	Electricity, CO_2…

B. Operations Management: Goals

- EFFICIENCY – The firm must produce the right goods / services in the right quantities, all the while keeping the appropriate quality and cost.
- TIME – The products must be distributed to the right customers at the right time.
- FLEXIBILITY – The production system must be able to adjust itself to produce new products, or change from one product to another, or change the volume of production.
- QUALITY - the products must conform to the technical specifications and/or they must meet customer expectations.

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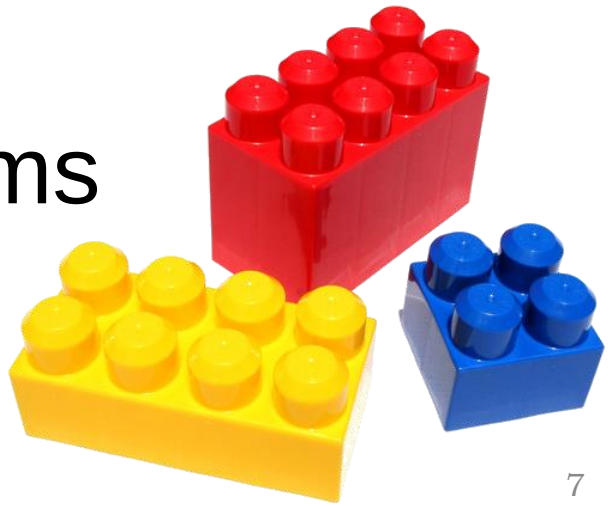


A. Types of cost

- **Fixed Costs** ➔ **Independent** of **production volume**

Leases
Salaries
Advertisement expenses
Loan interests

- **Variable Costs** ➔ Those that **vary** with the **production volume**

Raw materials, energy
Packages
Vendor comissions

B. Cost function

Total fixed cost: $TFC[€]$

Variable cost (per unit): $vc[€/u]$

Total variable cost: $TVC[€]$

Products sold: $q[u]$

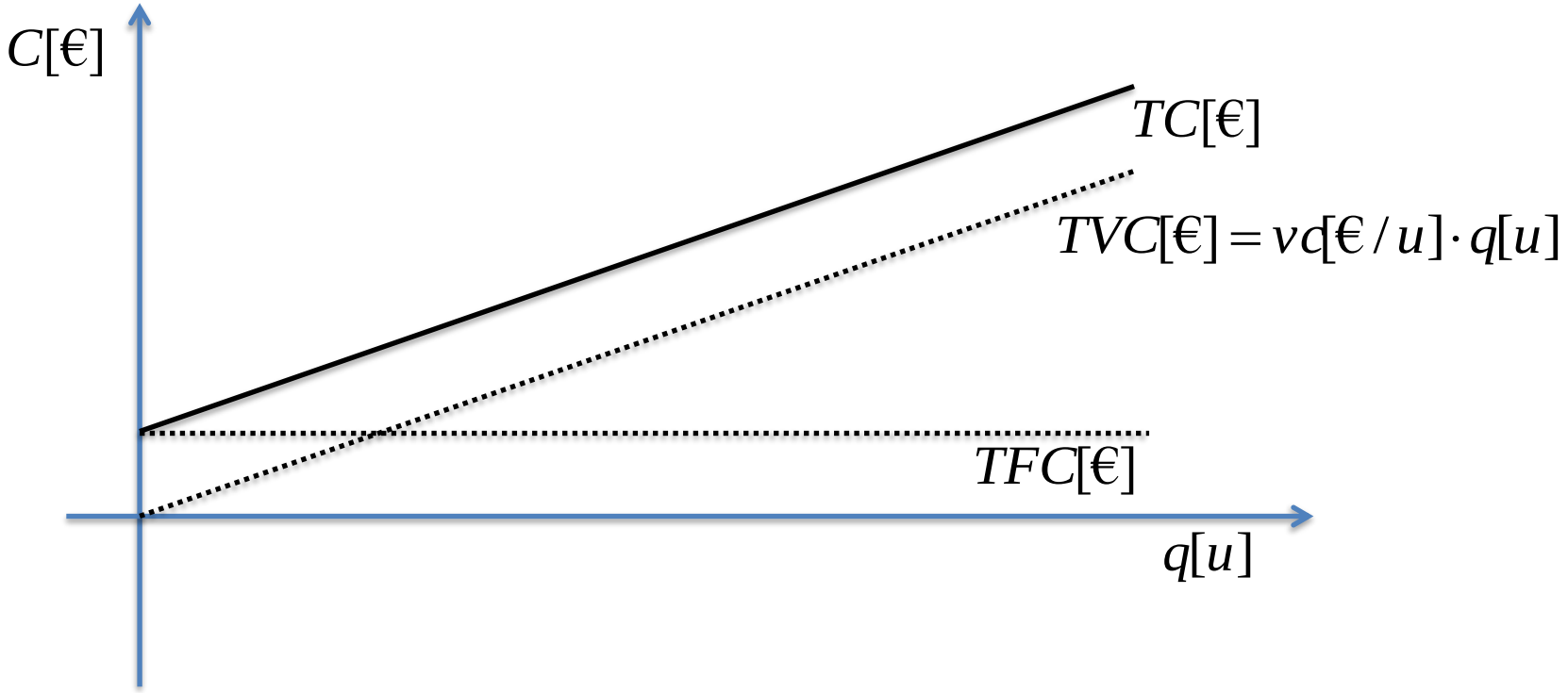
TOTAL PRODUCTION COST (per period)

It is the sum of total fixed cost and total variable cost.

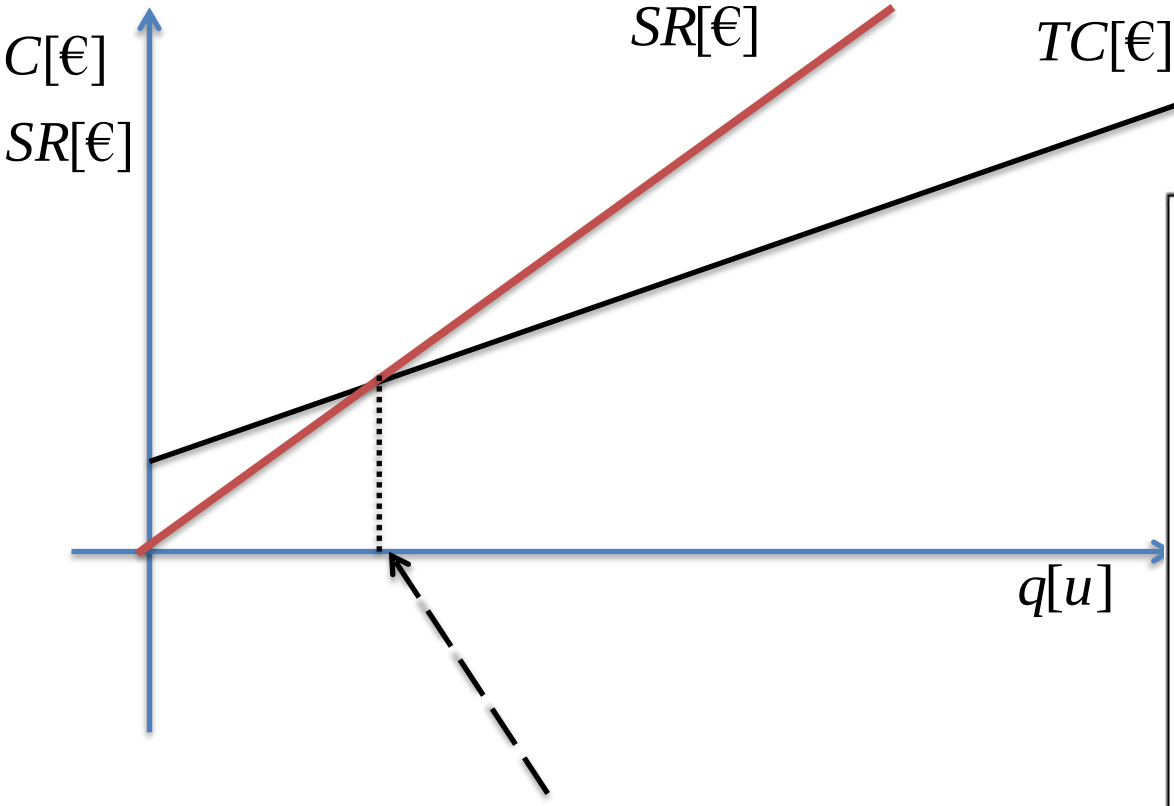
$$TC[€] = TFC[€] + TVC[€] = TFC[€] + vc[€/u] \cdot q[u]$$

B. Cost function

$$TC[€] = TFC[€] + TVC[€] = TFC[€] + vc[€/u] \cdot q[u]$$



C. Break-even point



Break-even point shows the lowest amount of sales necessary to prevent losses.

"We're **lacking funds**. As soon as we reach the break-even point, we'll buy a lemon."

C. Break-even point

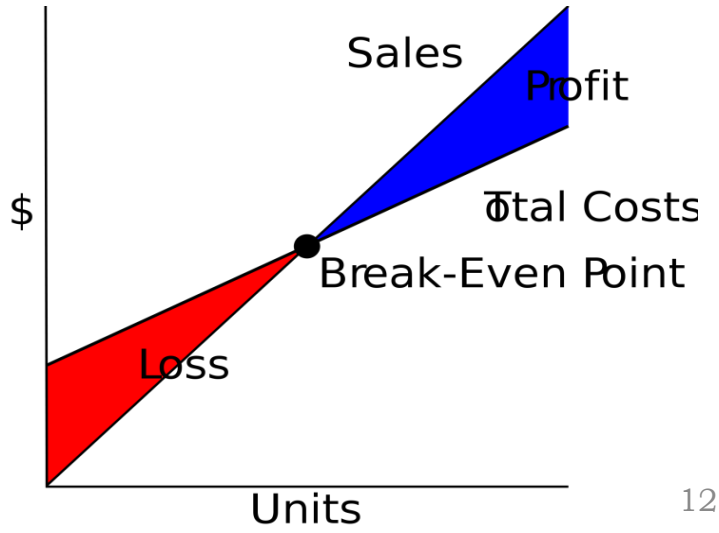
BREAK-EVEN POINT

Products sold so that expenses and revenue are equal. If the company sells more products, it will enter the profit zone.

$$BEP = q[u] \mid BAIT[€] = 0 \Rightarrow BEP = q[u] = \frac{TFC[€]}{(p - vc)[€/u]}$$

As it represents the minimum production needed to generate positive return…

The higher BEP, the larger operational risk.



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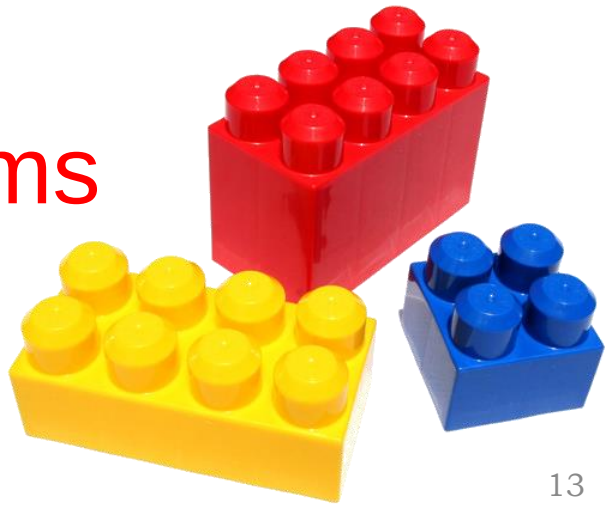
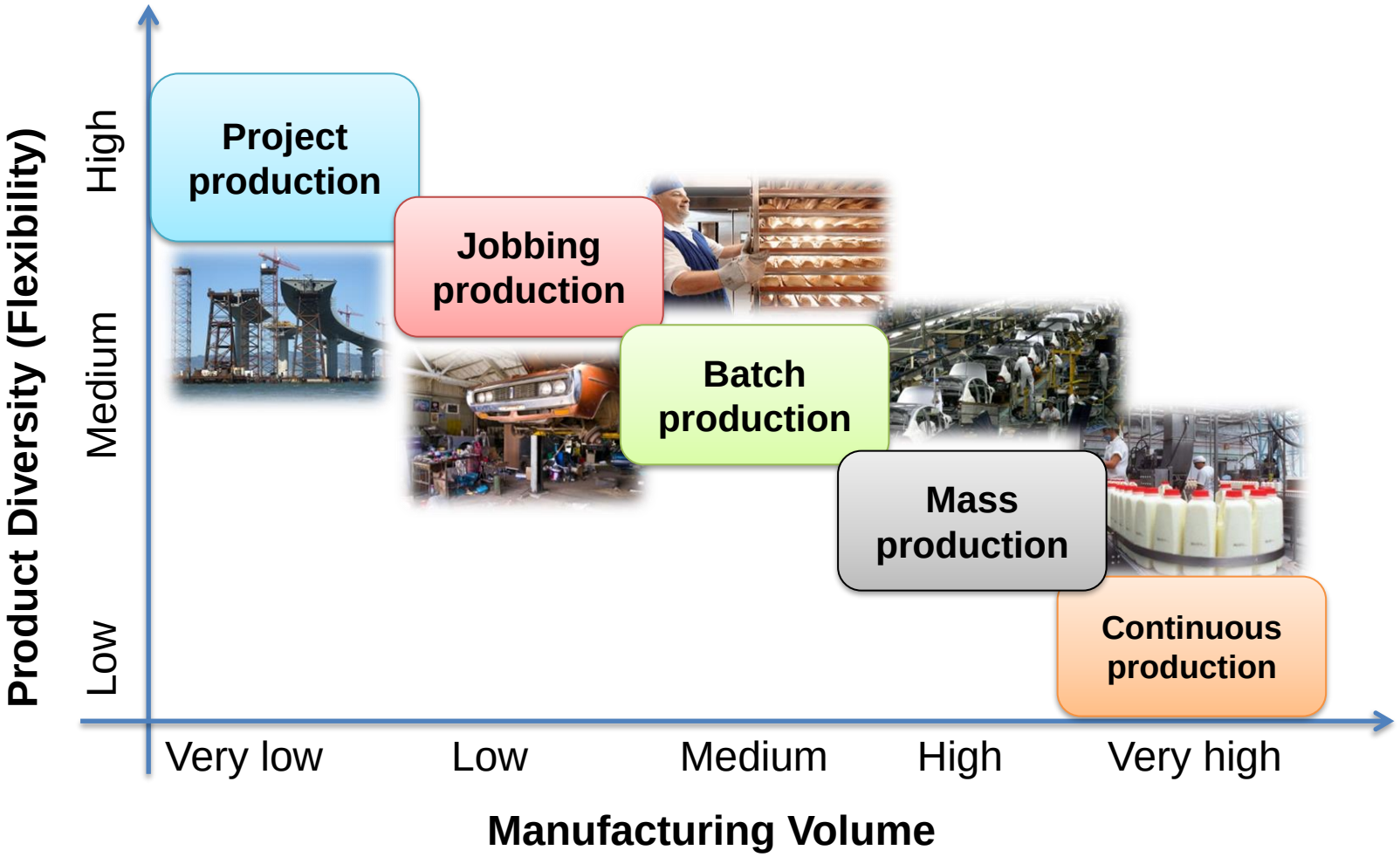
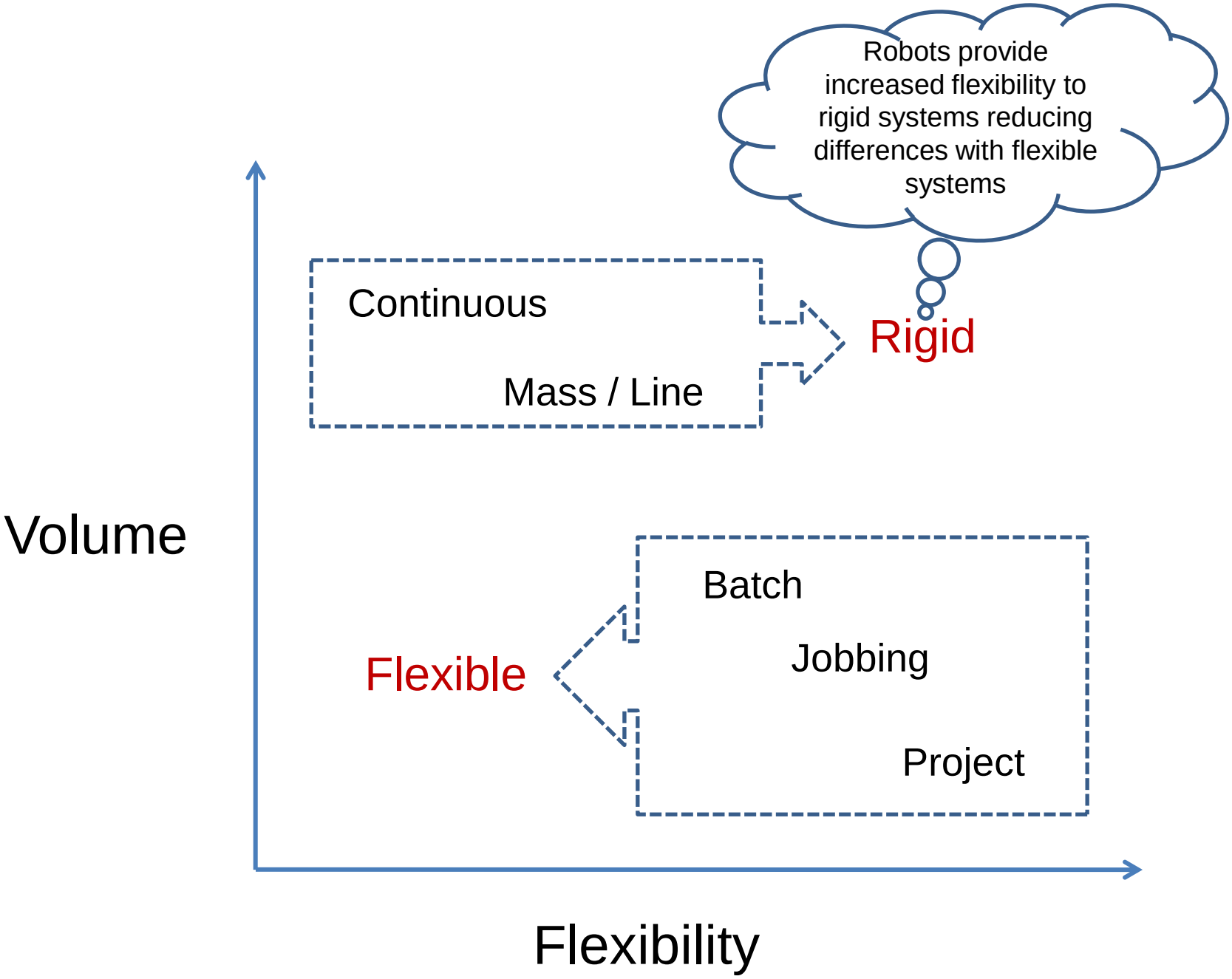


A. TRADITIONAL PRODUCTION SYSTEMS




Robots provide increased flexibility to rigid systems reducing differences with flexible systems
Continuous
Mass / Line
Rigid
Volume
Batch
Jobbing
Project
Flexible
Flexibility

FLEXIBLE PRODUCTION

- It can manufacture small production volumes and favors the innovation of products and the adaptation of production to market changes.
- Manufacturing system with flexible equipment, versatile machinery and predominance of manual and non-standardized tasks.
- Highly skilled workforce, with a global vision of the product and the company. The aim is to innovate or improve quality and therefore, cooperation and information exchange is promoted through teamwork and the internal rotation of workers.
- High unit costs, but this system is more efficient for low production volumes.
- Especially indicated for manufacturing new products to adapt the design and volume over time.

RIGID PRODUCTION

- It can produce a large amount of a standardized product.
- Highly mechanized and capital intensive manufacturing system, highly specialized machinery. Standardized processes.
- Low skilled labor (mass), specialized horizontally and vertically. In continuous production, on the contrary, the workforce is highly qualified.
- Focus on efficiency or reduction of manufacturing costs. The average cost is low due to economies of scale and experience. (A high market share is required).
- Rigidity in quantities, inventories are required and the product must have a "stable" value.
- Based on **modularity and assembly lines**.

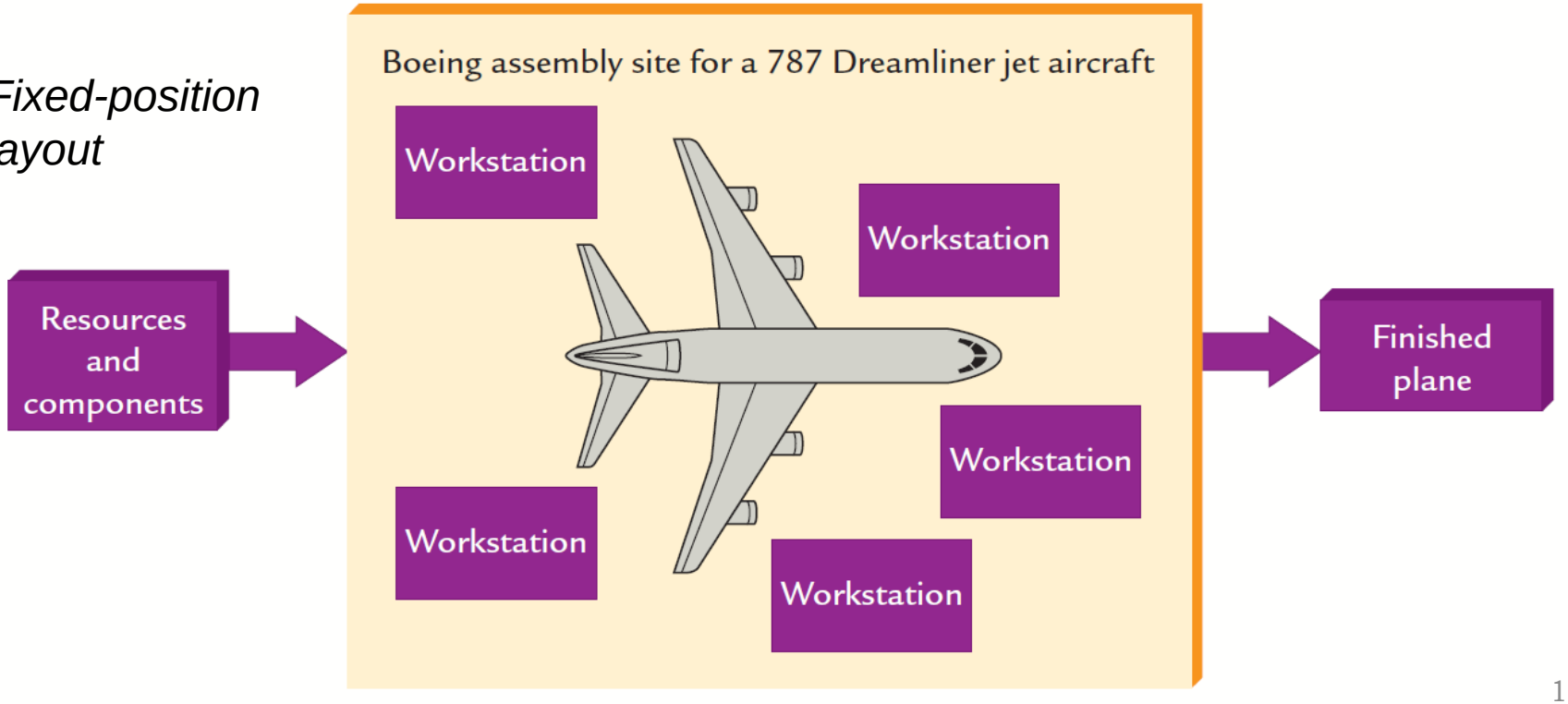
1. PROJECT

- Examples: civil engineering, shipbuilding, services (decoration)
- Product: unique for each client
- Unit cost: high (no economies of scale)
- Labor: highly skilled (adaptable to different tasks)
- Machinery and equipment: versatile, general use
- Plant layout: fixed-position (the product does not move during transformation. Workers and equipment move near the product for performing operations)

A. TRADITIONAL PRODUCTION SYSTEMS

Project production

Fixed-position layout



2&3. JOBBING AND BATCH PRODUCTION

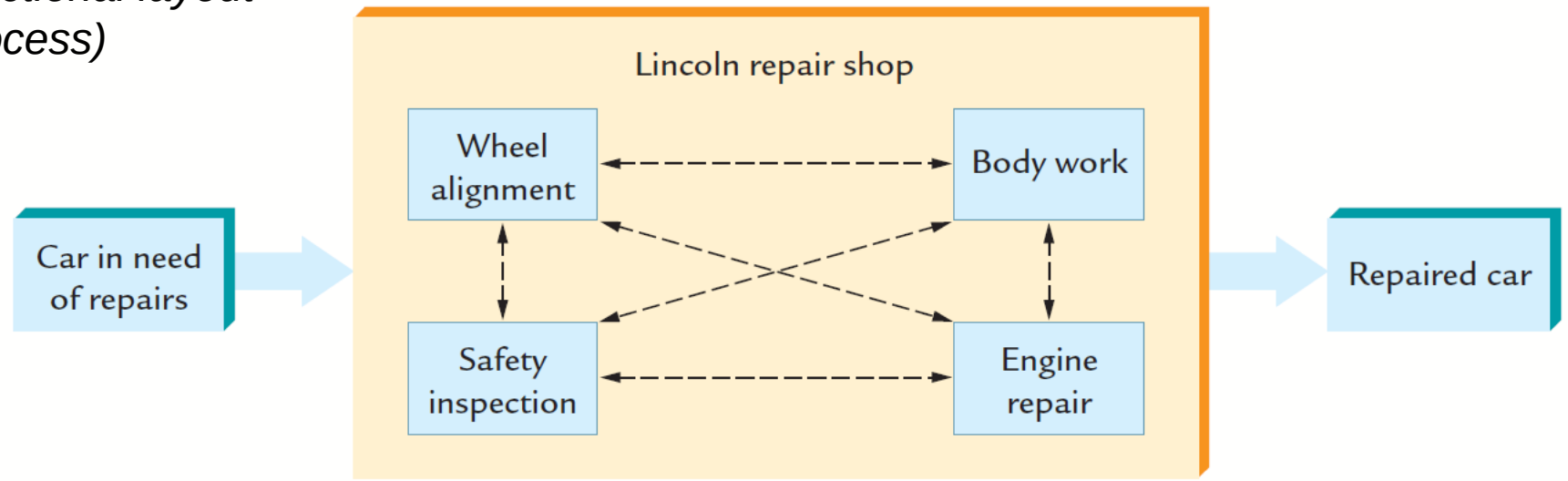
- Examples: repair shops (j), bakery (b), pottery (j/b), clothing (b), wedding dressmaker (j)
- Product: low amount, high variety
- Unit cost: high
- Labor: highly skilled
- Machinery and equipment: versatile, general use (flexibility)
- Plant layout: process/ functional (resources which have similar function are grouped together and the product visits the area where the operation is to be performed, even more than once)

A. TRADITIONAL PRODUCTION SYSTEMS

Jobbing production

Batch production

Functional layout (process)

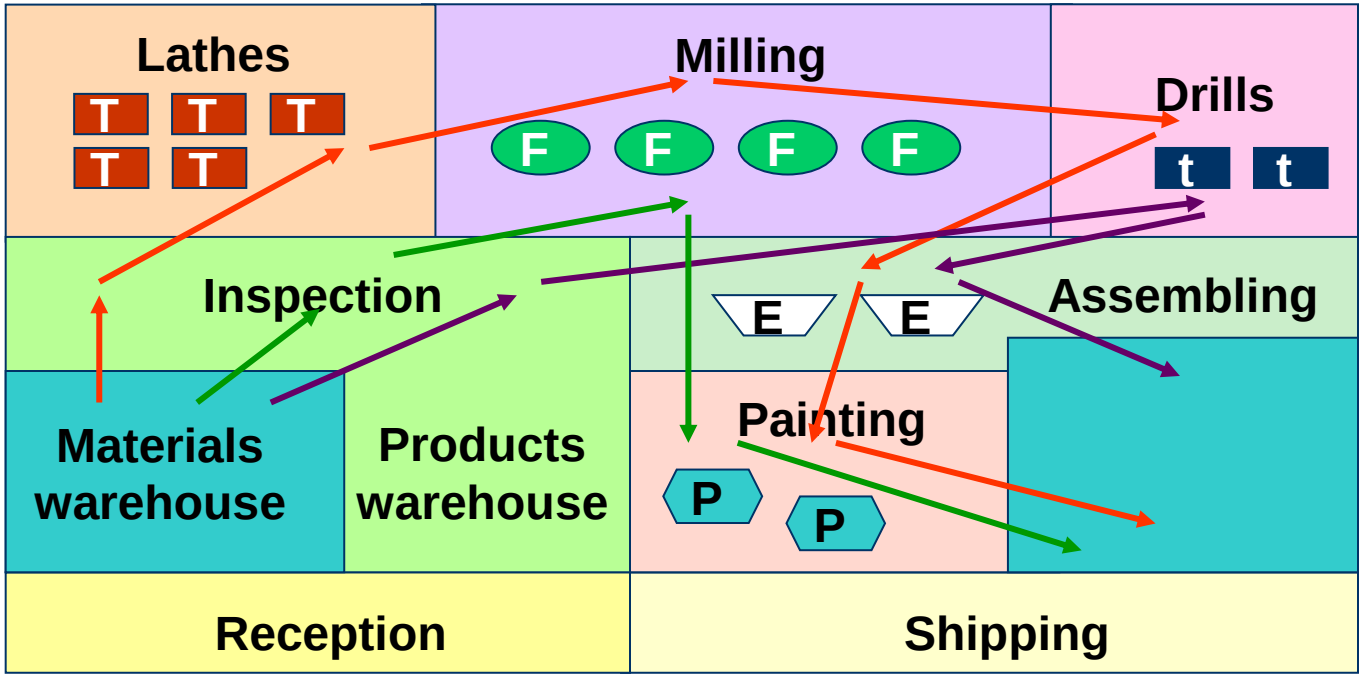


A. TRADITIONAL PRODUCTION SYSTEMS

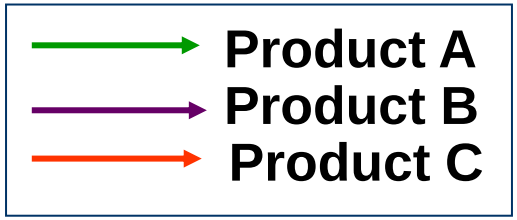
Jobbing production

Batch production

Functional layout (process)



Examples: repair shops (jobbing), bakery (batch), pottery (jobbing/batching), wedding dressmaker (jobbing)



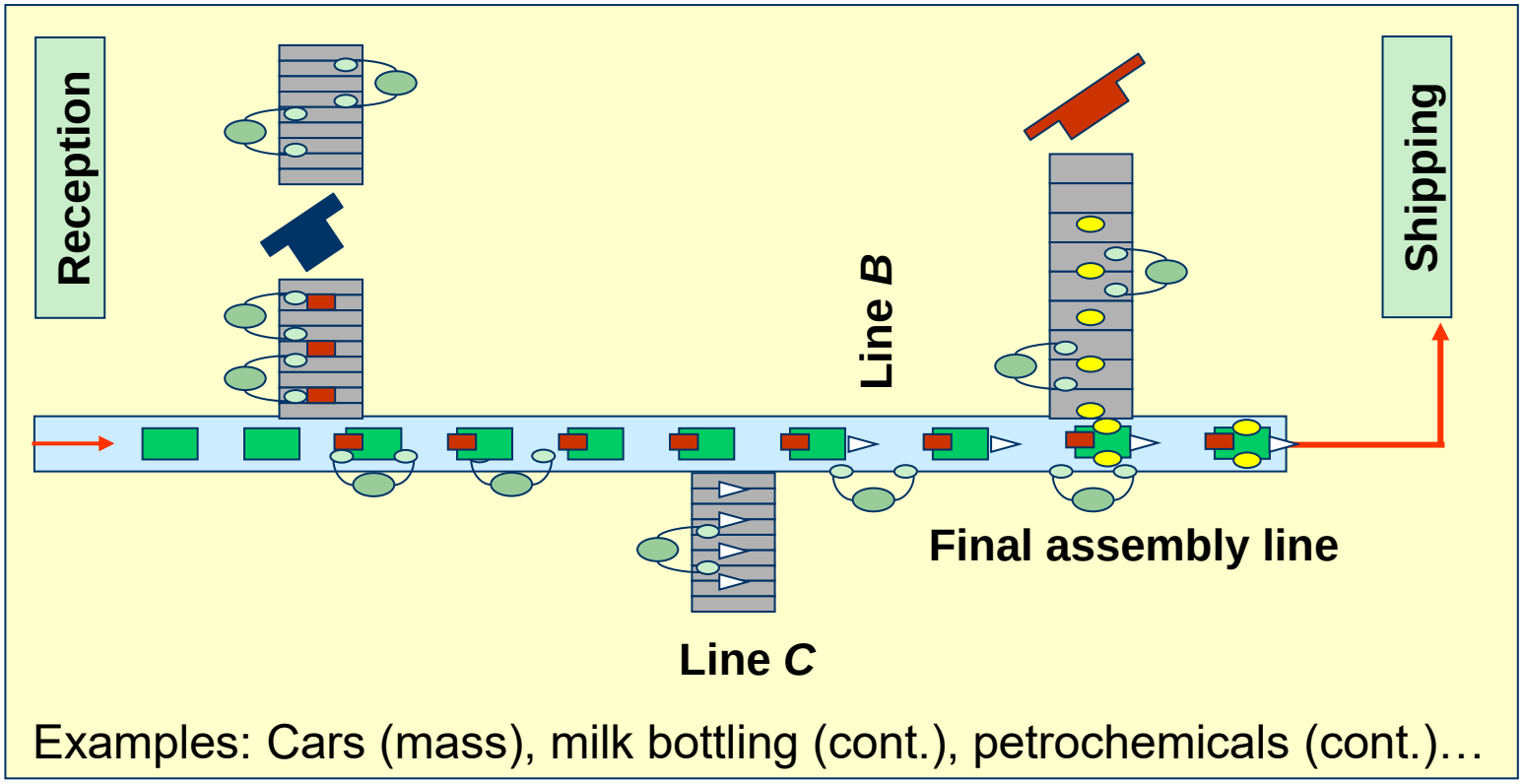
4&5. MASS AND CONTINUOUS PRODUCTION

- Examples: industrial manufacturing... Food cans (m), milk bottling (c), petrochemicals (c)
- Product: standardized, low variety
- Unit cost: low
- Labor: low skilled **very skilled but scarce (continuous production)**
- Machinery and equipment: specialized
- Plant layout: product (the product flows in order from one processing station to the next)
- Mechanized materials handling, automation, robots…

A. TRADITIONAL PRODUCTION SYSTEMS

Mass production

Continuous production



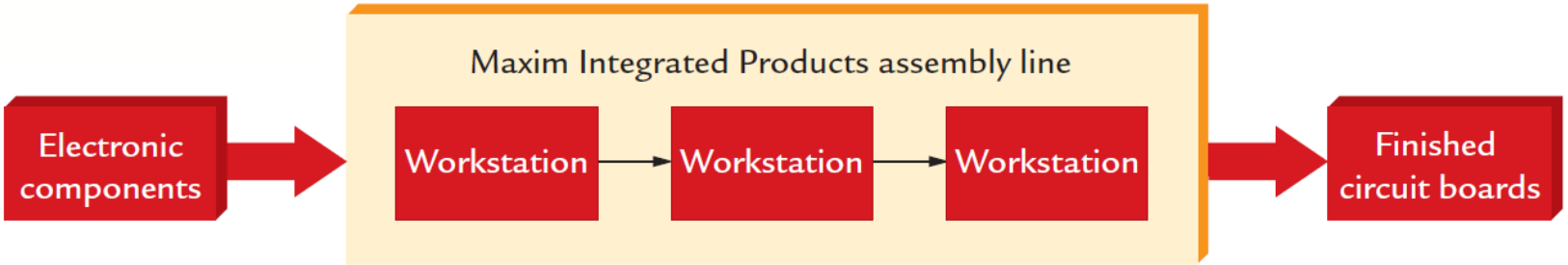
Examples: Cars (mass), milk bottling (cont.), petrochemicals (cont.)…

A. TRADITIONAL PRODUCTION SYSTEMS

Mass production

Continuous production

Product layout (assembly line) is used when all products undergo the same operations in the same sequence.



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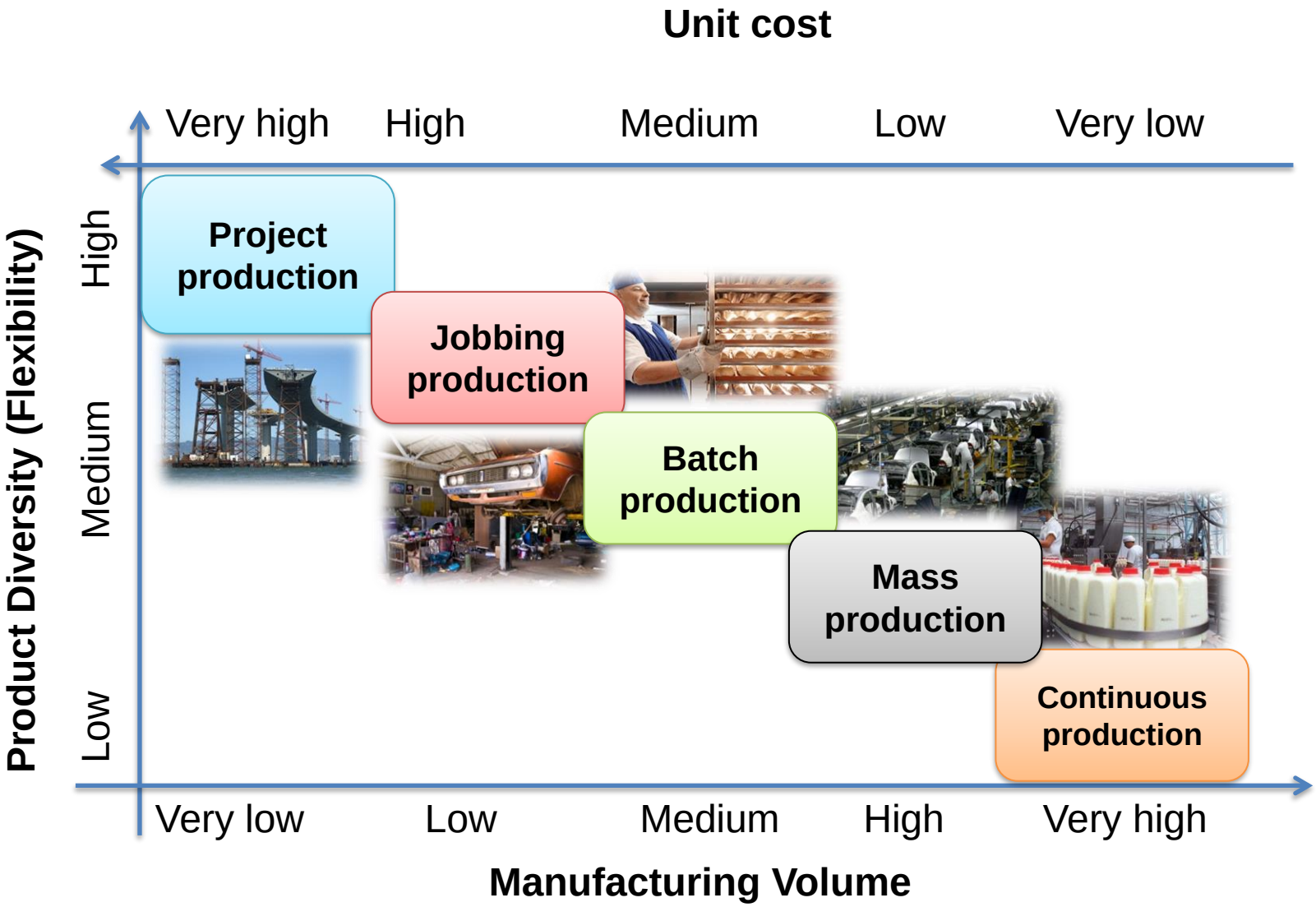


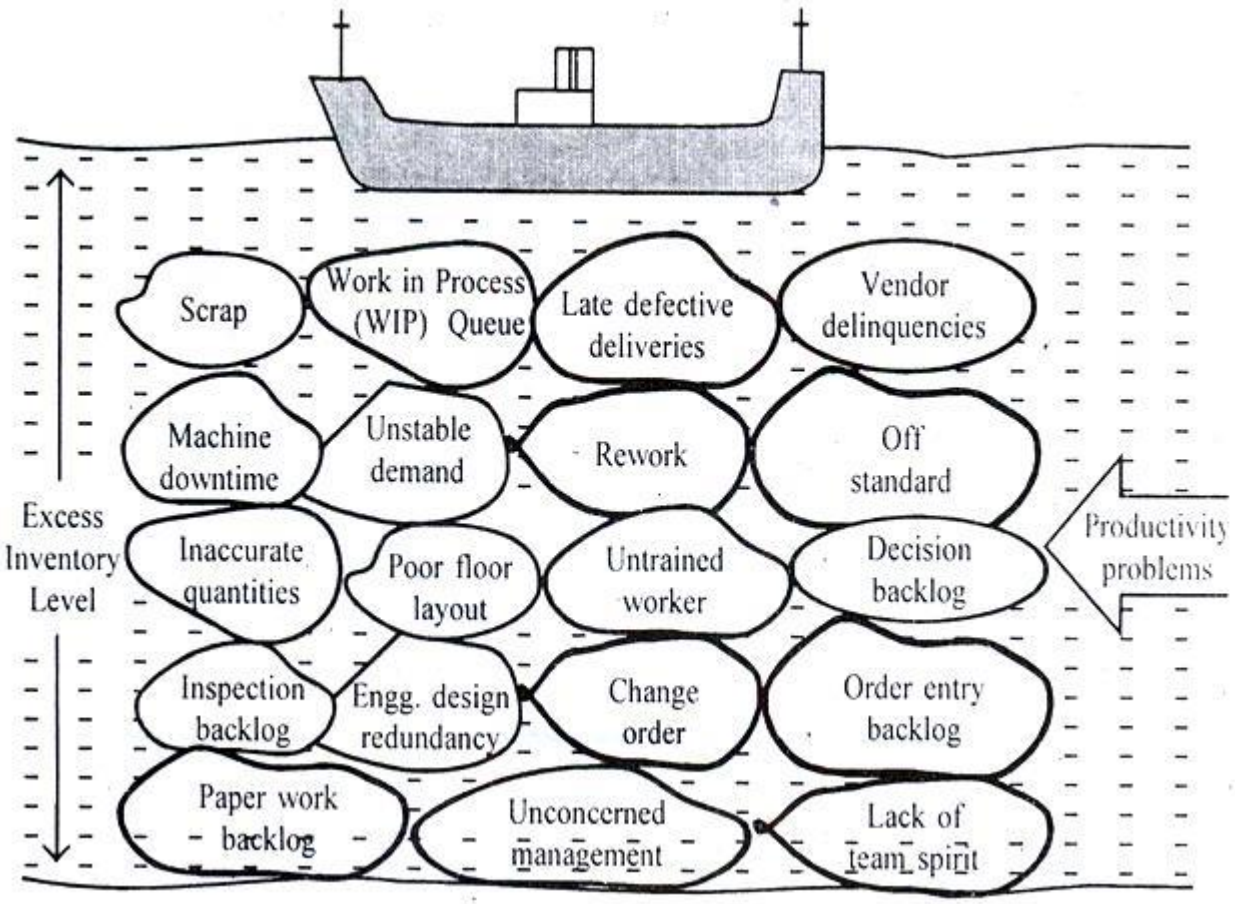
B. MODERN APPROACHES TO PRODUCTION

Problems of the traditional approach to production.

- It presents the dilemma flexibility *versus* efficiency.

- It studies the issue from a reductionist perspective.

- It uses mechanisms to adapt to inefficiencies, not to reduce them.



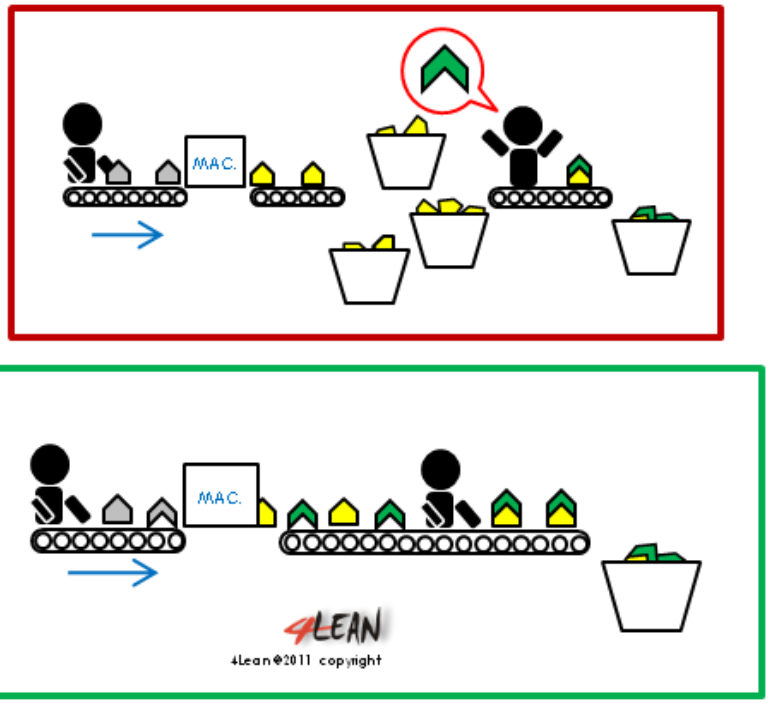
6. LEAN MANUFACTURING

- Examples: automobile manufacturing, windmill manufacturing…
- Product: high variety, large amounts, small batches
- Unit cost: low
- Labor: skilled multifunctional workers
- Machinery and equipment: general purpose, flexible
- Plant layout: U-shaped or cellular layout (the sam worker or group of workers can perform several different operations on the product)
- Suppliers: long term relationships (supplies must come just in time whenever needed; no stocks; reduce waste; pull system)
- Continuous improvement and Total Quality Management (TQM)

B. MODERN APPROACHES TO PRODUCTION

Toyota Production System (TPS) – **Lean Manufacturing**

"Making only what is needed, only when it is needed, and only in the amount that is needed“



B. MODERN APPROACHES TO PRODUCTION

Toyota Production System (TPS) – **Lean Manufacturing**

STRATEGIC GOALS

TPS focuses on improving efficiency, quality, time and flexibility at the same time.

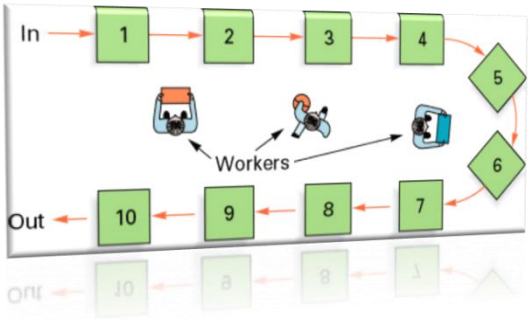
TACTICAL GOALS

Eliminating:

MUDA

MURA

MURI



B. MODERN APPROACHES TO PRODUCTION

Toyota Production System (TPS) – **Lean Manufacturing**

1. *Muda* of processing

2. *Muda* of inventory

3. *Muda* of overproduction

4. *Muda* of waiting

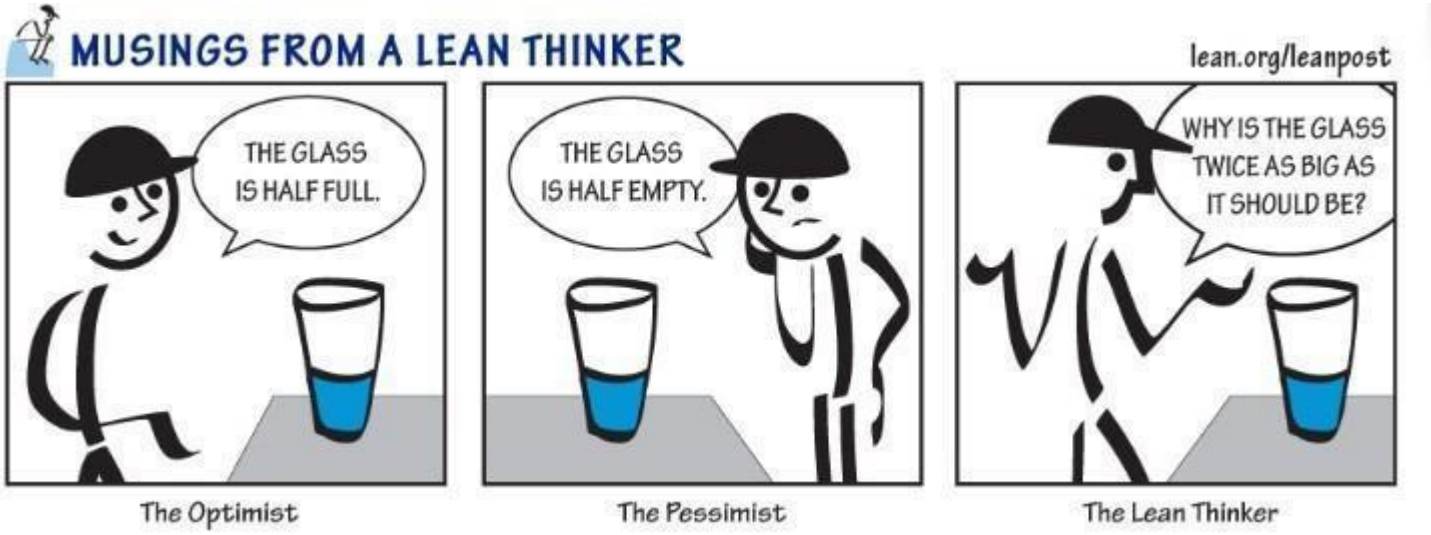
5. *Muda* of repair/rejects

6. *Muda* of transport

WASTE

B. MODERN APPROACHES TO PRODUCTION

Toyota Production System (TPS) – **Lean Manufacturing**



Key concepts

Operations Management – Concept
Operations Management – Goals: Efficiency, quality, time, and flexibility.

Types of cost: Fixed and Variable
Cost and EBIT functions.
Break-even point (BEP).

Traditional production systems: product diversity vs. manufacturing volume.
Traditional production systems: project, jobbing, batch, mass and continuous production.
Layout: fixed-position, functional (process) and product (assembly line).