



TRANSFORMATION PROCESS AND PRODUCTION

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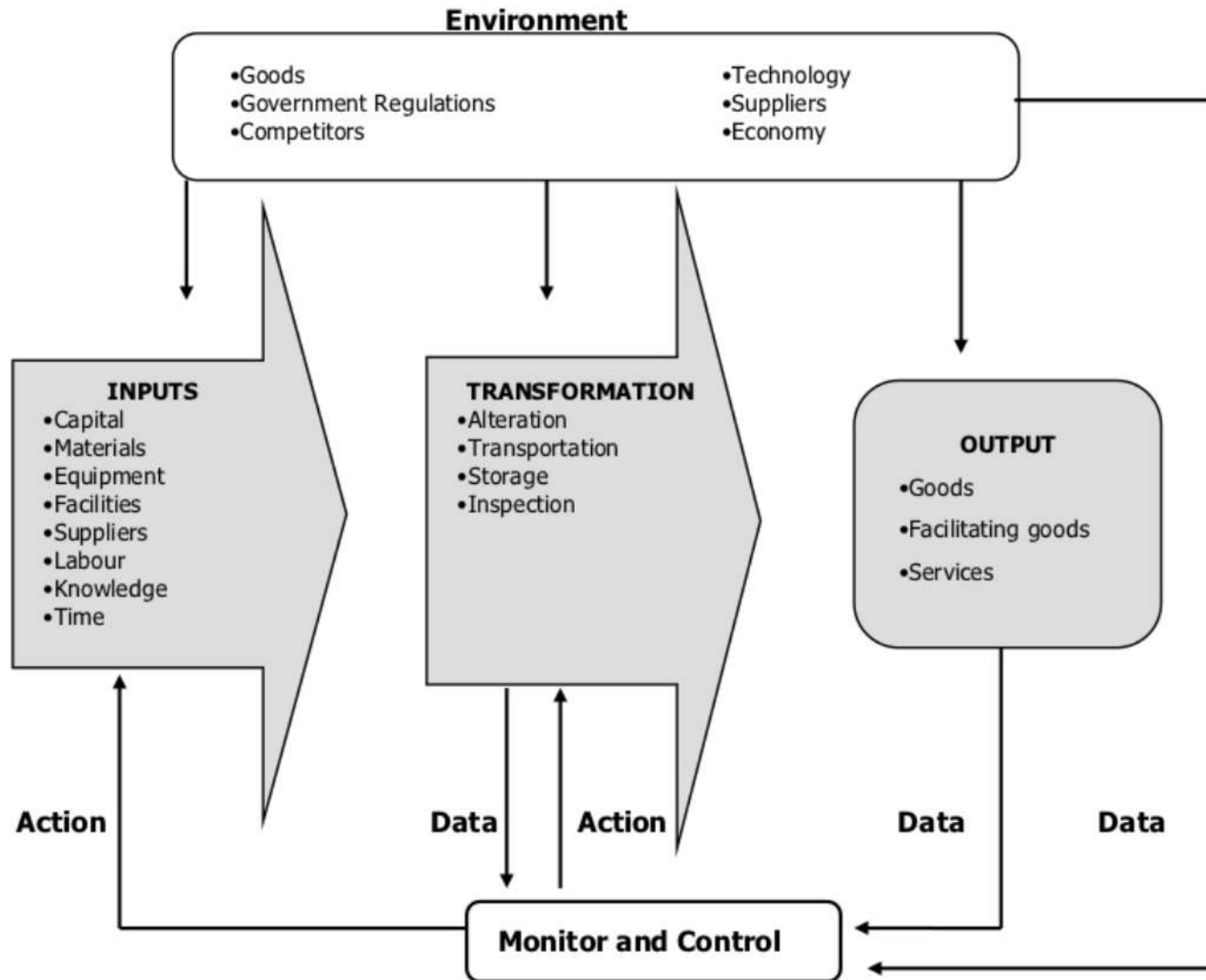
TRANSFORMATION PROCESS

Transformation process

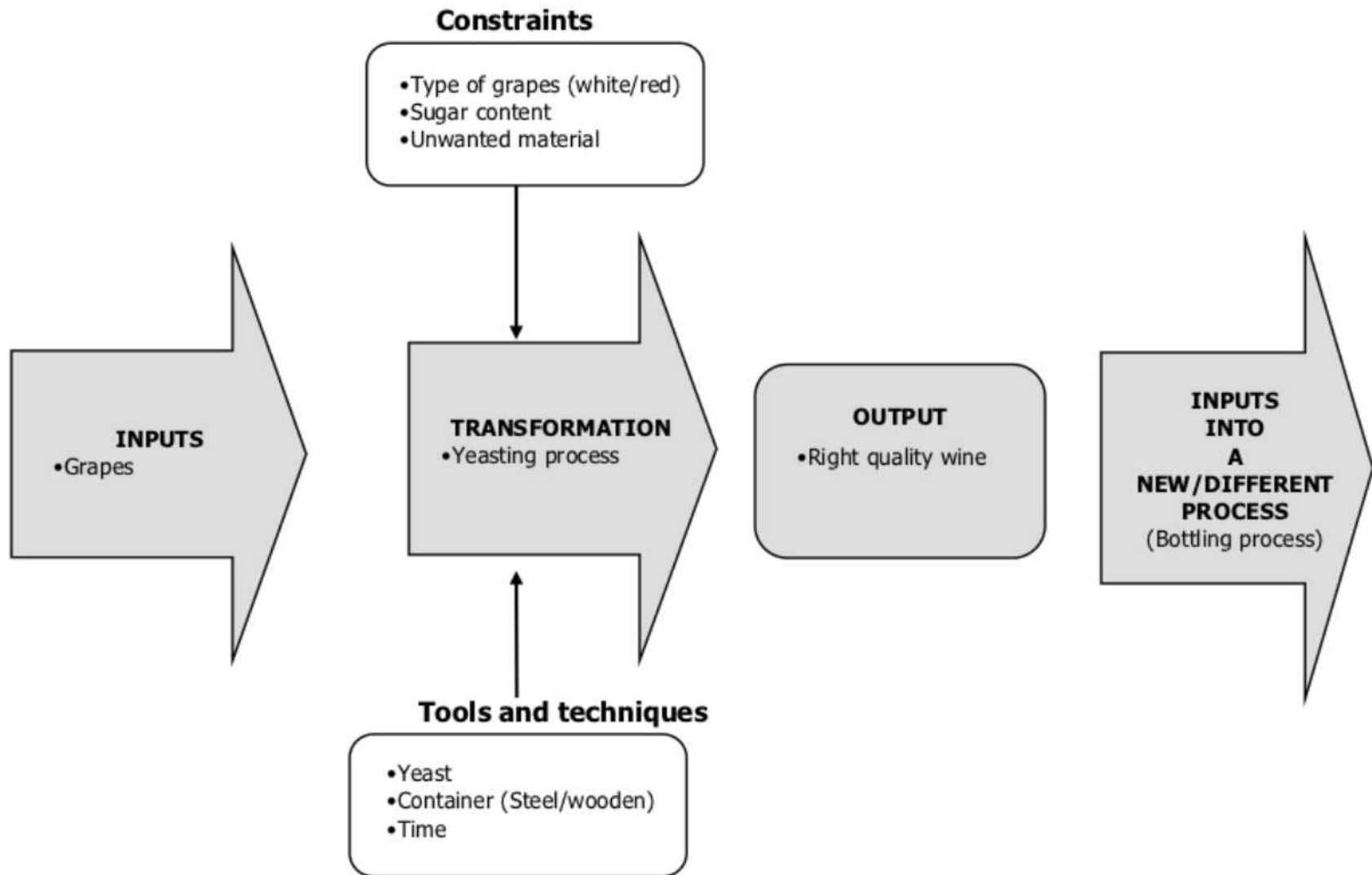
- succession of mutually interconnected activities which aim at reaching the company goals
- all the activities have a **financial** and a **material** dimension



Transformation process



Transformation: wine



Inbound logistics

=stock management

- determining the need for material resources and their procuring
- the aim is to **procure material inputs for the production process in the required quantity, quality, assortment, at the required time and place, while achieving minimum ordering and carrying costs**
- it is a complex process: procurement, transportation, receipt, distribution (of inputs), storage, stock management (stock control...)



Inbound logistics

-what should be procured?

Raw materials / materials – they are a part of the final product

Auxiliaries – paint, lacquer...

Technological materials – lubricants for machines, paper...

Semi-finished products – parts, components...

Traded goods – accessories (e.g. car radio sets...)

Energy – electricity, gas, water...

Inventory – calculators, PCs...

Inbound logistics

-activities:

Planning material needs

Market survey

Search for the best suppliers

Ordering

Transportation

Entry control

Storage – (supply-side, production-side, sales-side)

Expedition

„Just in time“ inventory system

- developed by Toyota (Taichi Ohno)
- perfect coordination of firm with suppliers
- minimum stock and maximum quality
- stock arrives exactly when it is needed
- reduces storage and transportation costs



Just in Case vs. Just in Time

Push vs. Pull



Production Approximation

Anticipated Usage

Large Lots

High Inventories

More Waste

Poor Communication

Production Precision

Actual Consumption

Small Lots

Low Inventories

Less Waste

Better Communication

Production

- basic activity of the company, which leads to **satisfaction of customers' needs**
- transformation of inputs to product
- type of production: tailor-made, serial, mass
- production process: mechanical, chemical, biological
- production program: main, secondary, associated, additional
- it is studied by production management

Second part of the class. 😊

Sales

- activities aimed at **selling goods / services on the market**
- many dimensions: market survey
sales support
after-sales activities
- very big differences among industries



Separate class about marketing.

Human resources

- human resources management
- the goal is to **ensure optimal number of employees with an optimal structure** (profession, qualifications, skills, age...) **at the required time**
- recruitment and selection of employees, qualification growth, remuneration, motivation, social program...



Separate class about HR.

Finance

- the aim is to **provide the company with sufficient financial resources, to make sure it is self-sufficient, has a financial equilibrium position and an optimal capital structure**
- financial relationships with customers, suppliers, government, employees, creditors...
- assets vs. liabilities
- balance sheet, profit and loss statement
- financial resources **by source**:
 - own/internal – capital deposits, profit after tax, depreciation...
 - external – loans, credits, customer prepayments...

Balance sheet

Example Company Balance Sheet December 31, 2017

ASSETS

What the company owns.

Current assets
Investments
Property, plant, and equipment
Intangible assets
Other assets
Total assets

LIABILITIES & OWNER'S EQUITY

What the company owes.

Current Liabilities
Long-term liabilities
Total liabilities

Owner's equity
Total liabilities & owner's equity

Shareholder's equity.

Loans

1. Short-term loans (<1 year)

Prepayments

Commercial loans

Overdrafts

Factoring

2. Medium-term loans (1-4 years)

Bank loans

Leasing

Forfaiting

Bonds

3. Long-term loans (>5 years)

Bank loans

Bonds

Lombard loan?

Revolving loan?

Financial analysis of a firm

1. **Collecting** accounting and other documents
 - balance sheet, profit and loss statement, cash flow statement, account statements...
2. **Calculating** financial indicators
 - liquidity, profitability, solvency, stability
3. **Comparing** indicators with other values
 - planned values, past-period values, values of other companies in the same industry...
4. **Evaluation** and proposing measures

The most important are: **cash flow**
economic result (profit or loss)

Investment

- in general, it is the act of committing money or capital to an endeavor (a business, project, etc.), with the expectation of obtaining an additional income or profit
- activities focusing on **renewal and purchase of new assets (equipment, property, intangible assets)...**

a) Tangible investment

- in entrepreneurship, real estate, art collections, precious metals...
- lowers the liquidity

b) Intangible investment

- research, software, licences, know-how

c) Financial investment

- securities (≤ 1 year) – bills of exchange, checks – financial market
- securities (> 1 year) – stocks, bonds – capital market

Research and development

- using own or external scientific and technical knowledge in an effort **to improve manufactured products and services provided, and increase productivity of the processes**
- e.g. in Slovakia a part of R&D costs (25 %) can be deducted from income tax payable

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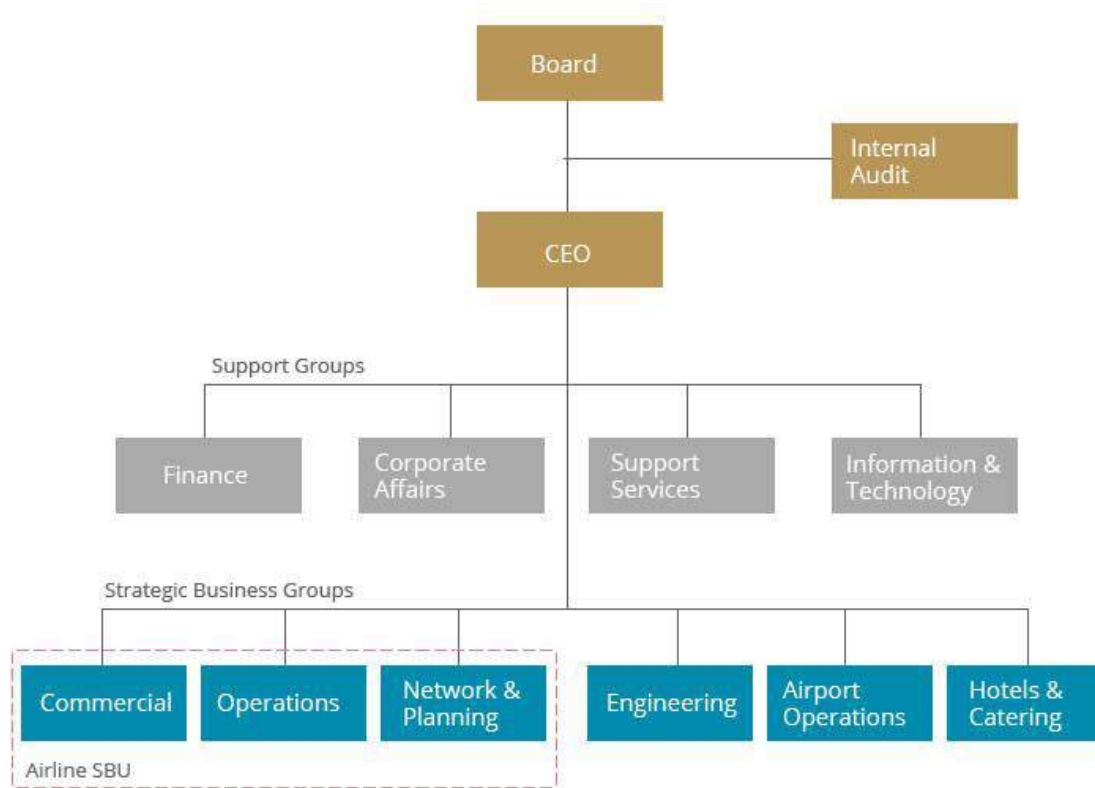
DIČ

Príloha k § 30c zákona - Odpočet výdavkov (nákladov) na výskum a vývoj a údaje o projektoch výskumu a vývoja podľa § 30c zákona

| Projekt číslo / počet projektov | Dátum začiatku realizácie projektu | Zdaňovacie obdobie | Výška vykázaného nároku na odpočet výdavkov (nákladov) na výskum a vývoj v zdaňovacom období | časť odpočítavaná v príslušnom zdaňovacom období |
|---------------------------------|------------------------------------|--------------------|--|--|
| | | 1 | 2 | 3 |
| 1 | 2 0 | 2 0 | | |
| 2 | 2 0 | 2 0 | | |

Administration

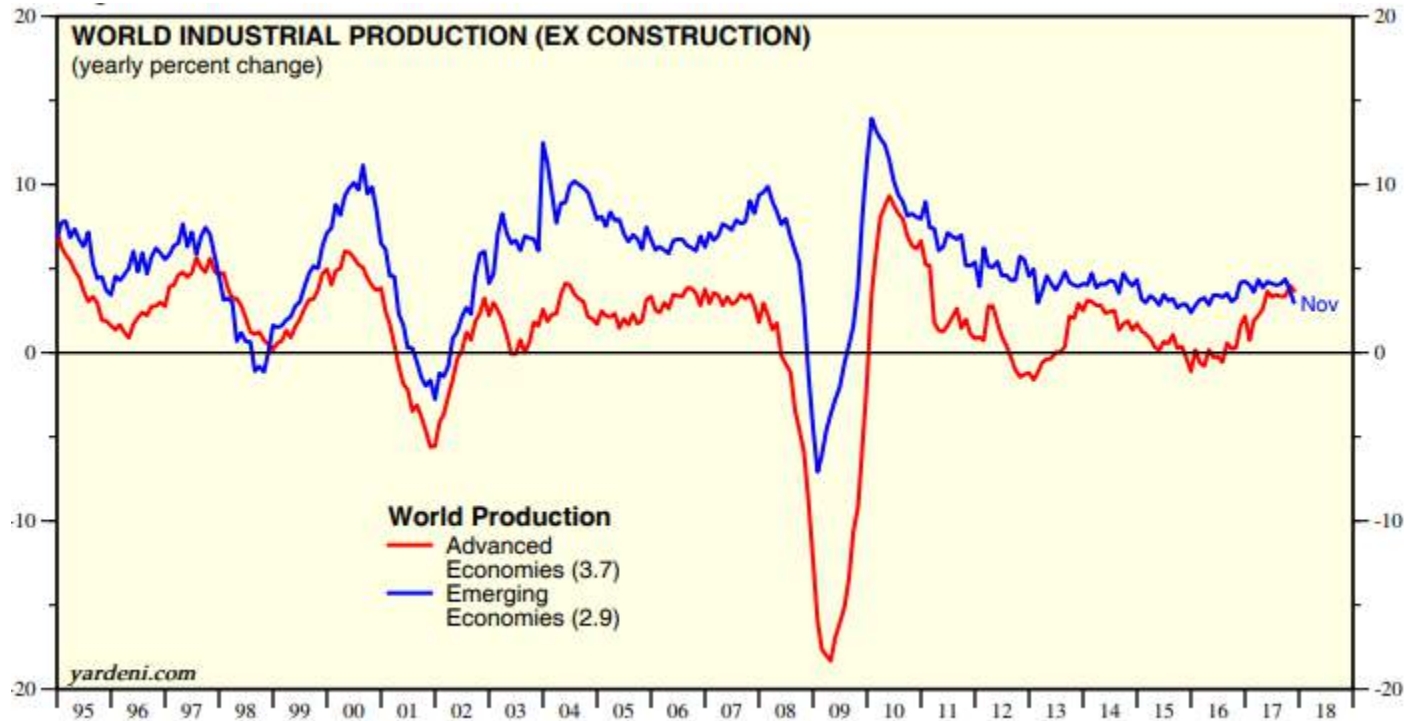
- various **supporting activities**
- accounting, finance, legal department, general management...
- often centralized to support the whole enterprise



2.

PRODUCTION

Production in the world



Source: Netherlands Bureau for Economic Policy Analysis.

Annual world output approx.: 75 mil. cars, 1 700 aircraft, income of chemical industry over 5 tril. USD, 800 mil. tons of wheat, 1 bil. tons of corn...

Goods vs. services

-main differences:

- INTANGIBILITY
- HETEROGENEITY
- SIMULTANEOUS PRODUCTION AND CONSUMPTION
- PERISHABILITY

| Criteria | Product (product manufacturer) | Service (service provider) |
|----------------------|---|---|
| Durability | A physical, durable product | Intangible, perishable product |
| Inventory | Output can be inventoried | Output cannot be inventoried |
| Customer involvement | Low contact with customers | High contact with clients |
| Operation facility | Large production facility | Small service facility |
| Resource intensity | Capital intensive | Labour intensive |
| Quality | The quality of the product is easily measured | The quality of the service is not easily measured |
| Re-usability | The product can be resold | The service cannot be resold |
| Patents | A product can be patented | A service can only be patented with difficulty |

Production process

- final result of the production process are tangible goods and intangible services
 - we will focus on **goods**
 - the production process starts with the input of materials (and other inputs) into production and ends with the completion of the product
 - it is a combination of technological, human and natural process
- Technological:** transformation using machines and tools.
- Human:** transformation using human labor.
- Natural:** transformation using natural processes.
- => more often than not it is a combination of them

Production program

-what the company produces, the whole assortment:

Main product: corresponds to the main specialization of the production unit

Secondary product: products which are parts or accessories of the main products

Associated product: allows for greater use of equipment or of waste material

Additional product: product belonging to a completely different class of products

Technological processes

-by the type of process used in production we distinguish between:

Mechanical production: the properties of the materials used do not change – what changes is appearance, shape, and so on.

Chemical production: the properties of the materials used change due to chemical processes.

Biological (biochemical) production: the properties of the materials used change due to natural processes.
E.g. food industry.

Types of production

-the main difference is number of products and the width of assortment

Tailor-made

- Various types of products in small quantities
- Irregular or no repetition
- High qualification of workforce, great versatility of production facilities
- Often higher product prices, high storage costs
- Lower labor productivity

Serial

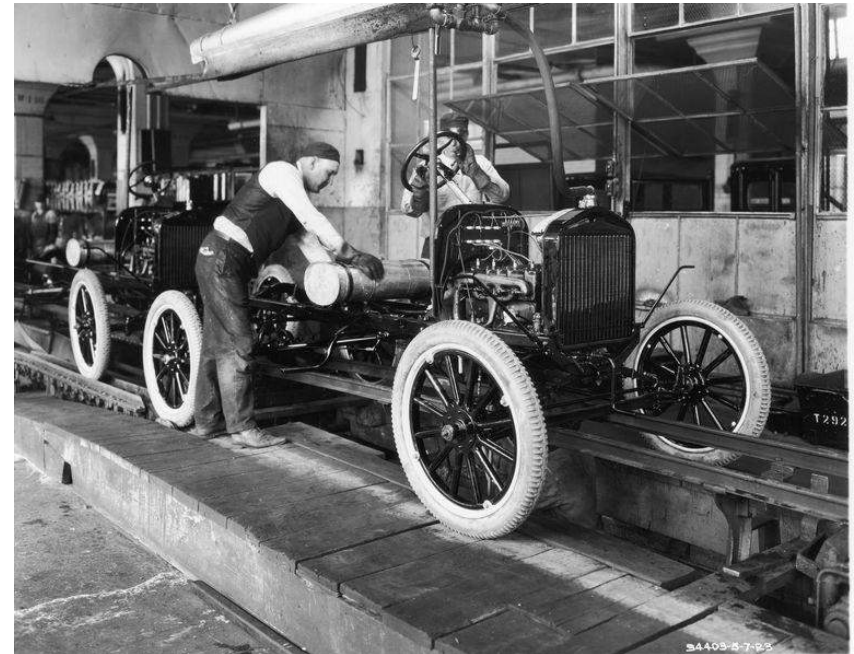
- Certain quantities of products of the same kind (series)
- The series are repeated regularly
- Universal and specialized equipment and specialized workforce (less qualified)

Mass

- Few products in large quantities
- Long production of the same products
- Single-purpose equipment, highly specialized
- The most effective type of production
- Highest labor productivity

Types of production

- continuous and discontinuous production
- cyclical and non-cyclical production
- simple and complex production



- manufactures (18th century)
- assembly line (1913 – Ford)
- CNC automation (1950s)
- mass introduction of robots in production (1970s)

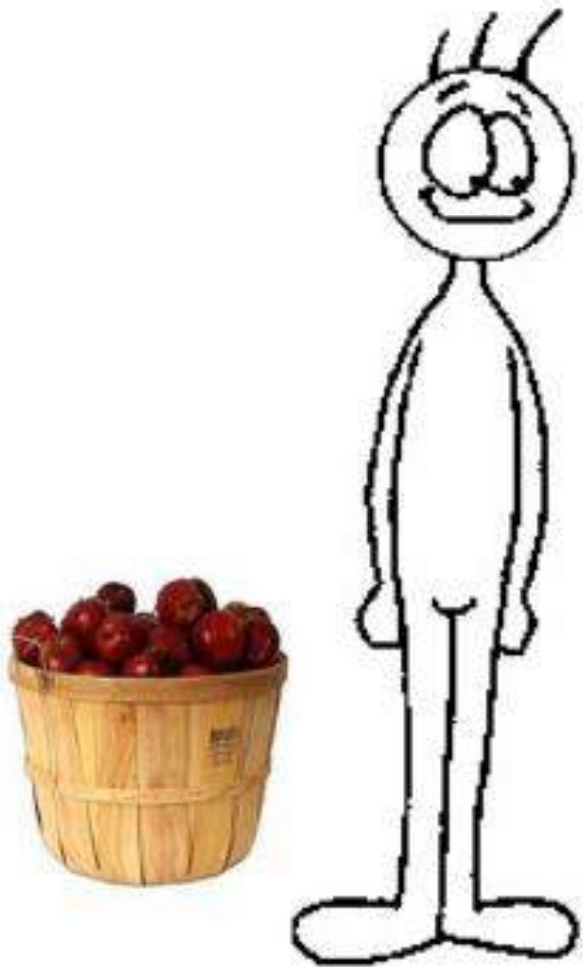
Division of labor

-Smith's example with production of pins: (abridged)

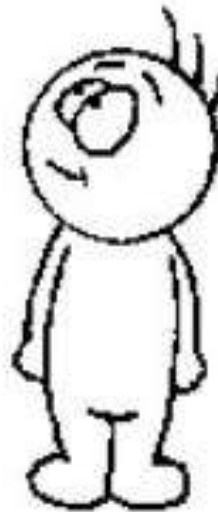
*„... a workman not educated to this business [...] could scarce, perhaps, with his utmost industry, make **one pin in a day**, and certainly could not make twenty. But in the way in which this business is now carried on, not only the whole work is a peculiar trade, but it is divided into a number of branches, of which the greater part are likewise peculiar trades. One man draws out the wire, another straightens it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving, the head; to make the head requires two or three distinct operations; to put it on is a peculiar business, to whiten the pins is another; it is even a trade by itself to put them into the paper; and the important business of making a pin is, in this manner, divided into about eighteen distinct operations, which, in some manufactories, are all performed by distinct hands, though in others the same man will sometimes perform two or three of them. I have seen a small manufactory of this kind where ten men only were employed, and where some of them consequently performed two or three distinct operations. But though they were very poor, and therefore but indifferently accommodated with the necessary machinery, they could, when they exerted themselves, make among them about twelve pounds of pins in a day. There are in a pound upwards of four thousand pins of a middling size. Those ten persons, therefore, could make among them upwards of forty-eight thousand pins in a day. Each person, therefore, making a tenth part of forty-eight thousand pins, might be considered as making **four thousand eight hundred pins** in a day.”*

Wealth of Nations, 1776

Division of labor



Tall dude should specialise in apple picking



Short dude should specialise in strawberry picking



Modern times and ec. devel.

- new inventions
- new discoveries = new opportunities for trade
intensification in international relations
- new sources of precious metals
- relatively rapid population growth
- renaissance in culture and philosophy
- emerging class of “traders”
- rise of nation-states and colonial system



MERCANTILISM
= political economy of state building

Discoveries

| | |
|-----------------------------------|-------------------------------|
| 1488 – Bartolomeu Dias (POR) | Cape of Good Hope |
| 1492 – Christ. Columbus (SPA) | America (the Bahamas) |
| 1498 – Vasco da Gama (POR) | Maritime route to India |
| 1500 – Pedro Álvares Cabral (POR) | Brasil |
| 1513 – Vasco N. de Balboa (SPA) | Crossed the Isthmus of Panama |
| 1522 – Fern. de Magallanes (SPA) | Sailed around the world |
| 1606 – Willem Janszoon (HOL) | Australia |
| 1642 – Abel Tasman (HOL) | Tasmania, New Zealand |
| 1778 – James Cook (ANG) | Hawaii |

Industrial revolutions

First

- 18th century in England
- use of steam in production (trains, printing, factories)

Second

- turn of 19th / 20th century
- use of oil and electricity in production
- telephone, radio, television, later assembly line

Third

- 1970s – 2008 (?) in USA and the West
- use of new energies and ICT in production

Fourth

- today
- digital revolution, biotechnologies, nanotechnologies, 3D printing

Stages of production process

- 1. Pre-production stage** – preparation, processing of inputs
-preparation of semi-finished products, parts, etc.
for the next stage
- 2. Production stage** – manufacturing of the product itself or of the components it consists of
- 3. Finishing stage** – final processes: dyeing, painting, impregnation...
-assembly of the final product from the components manufactured in the previous stage

Production cycle

-the time elapsed in production since the first operation begins until the last operation is completed

-it consists of several components:

Time of technological operations (t_T): -time needed to perform the technological operations in production

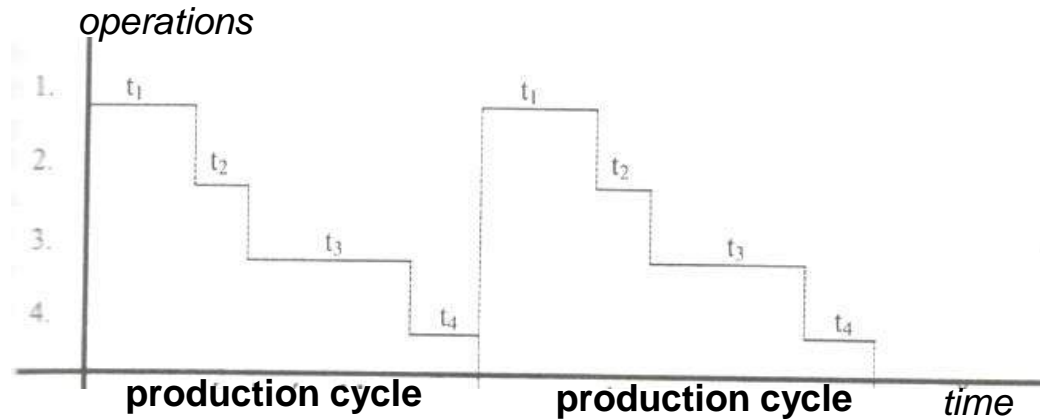
Time of non-technological operations (t_N): -transportation, packaging, measuring, weighing, repairing, controlling, waste handling...

Wait time and lost time (t_W): -necessary breaks
-unwanted losses of time

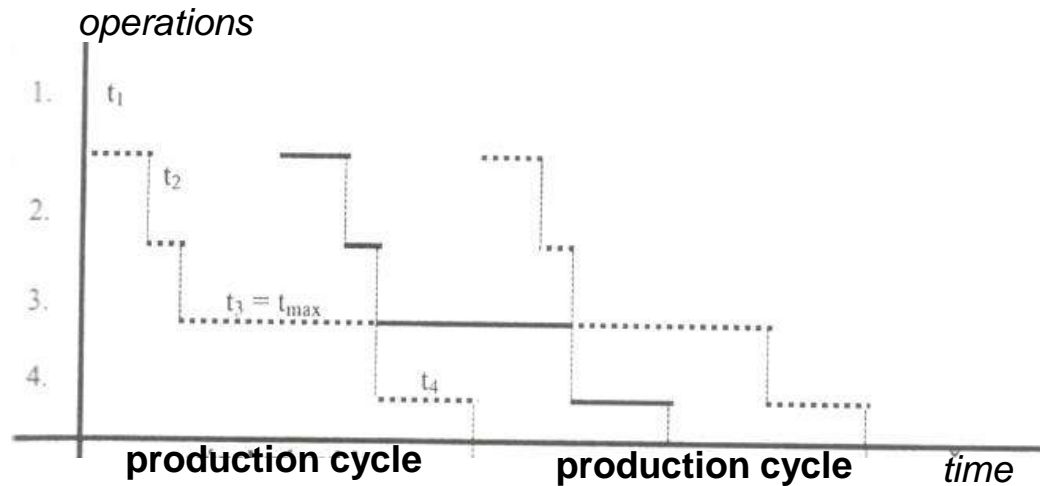
$$t = t_T + t_N + t_W$$

Production cycle

-gradual



-parallel



Production cycle

- factors affecting the length of production cycle:
 - length of technological operations
 - size of batches
 - transfer of batches between departments
 - location of workplaces
 - speed of handling (conveyor belts, etc.)
 - length of production path
 - technical factors
 - qualification of workers
 - time of control operations
 - time of interruptions
 - level of production management
 - ...



Labor productivity

- a significant indicator of company success
- can be calculated directly for each firm:

$$P_p = \frac{Q}{p}$$

in € per employee
in pcs. per employee
in kg per employee
...

$$P_p = \frac{Q}{t}$$

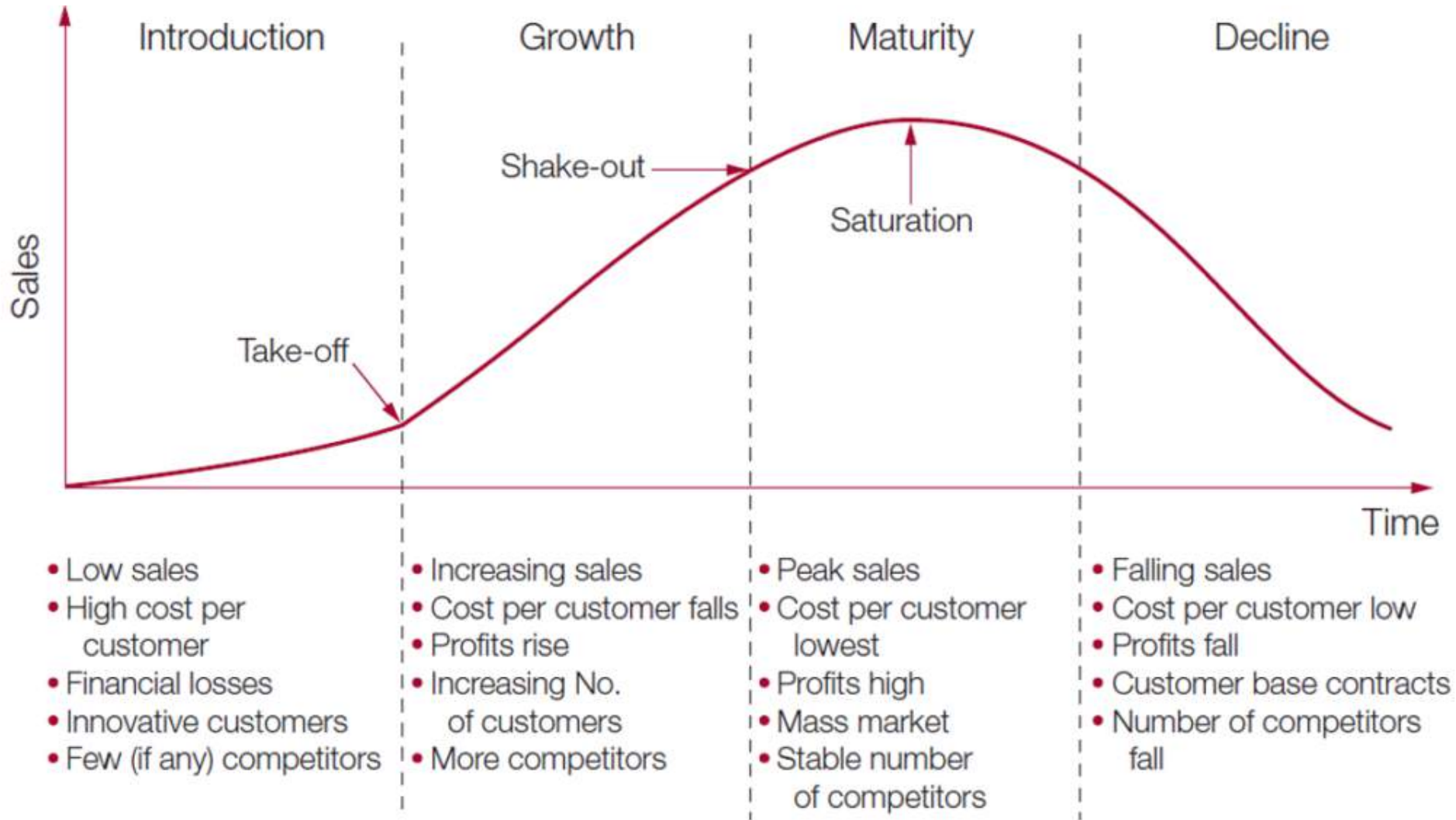
- how to increase labor productivity?

- increase the degree of mechanization
- reduce downtime, accidents, sick leaves
- improve the organization of work
- change the assortment
- increase qualifications of employees
- reduce employee turnover

Production program

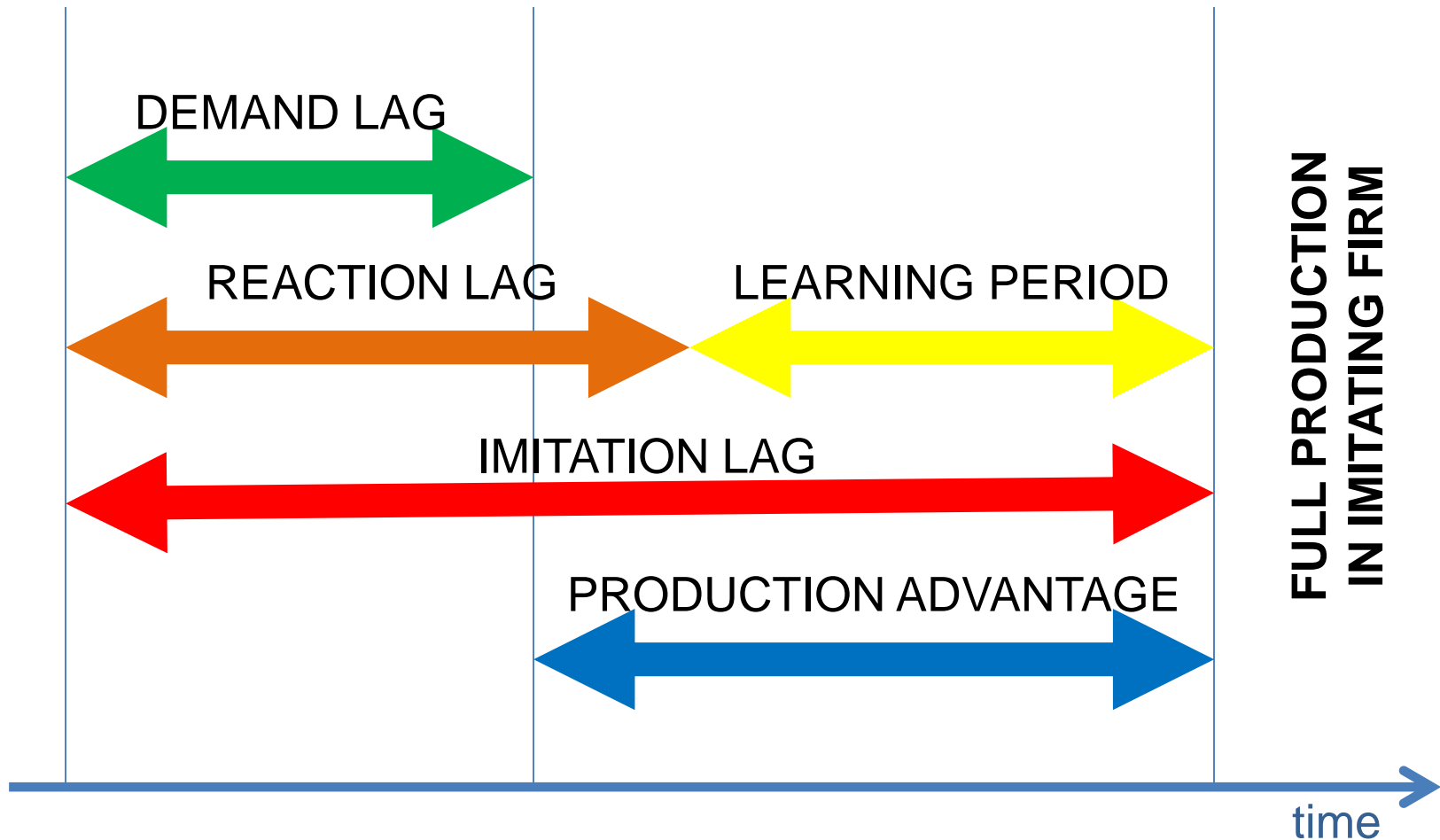
- a good production program has to:
 - ensure the firm reaches profits in the long-term
 - efficiently use the firm's assets
 - enable the firm to reach a high market share
- i.e. it must take into account:
 - situation on the market (supply, demand, price...)
 - company resources
 - > **production capacity**
- what influences production capacity?
 - technological background, equipment
 - machine-hour capacity
 - number of time periods (Shifts? Holidays? Weekends?)
 - composition of the production plan
 - bottlenecks

Product life cycle



Source: www.marketing-insider.eu

Imitation lag



Source: www.wright.edu

Imitation lag

-the imitation gap cycle:

