

**Supply chain design
and production systems
Lesson 7: Performances**

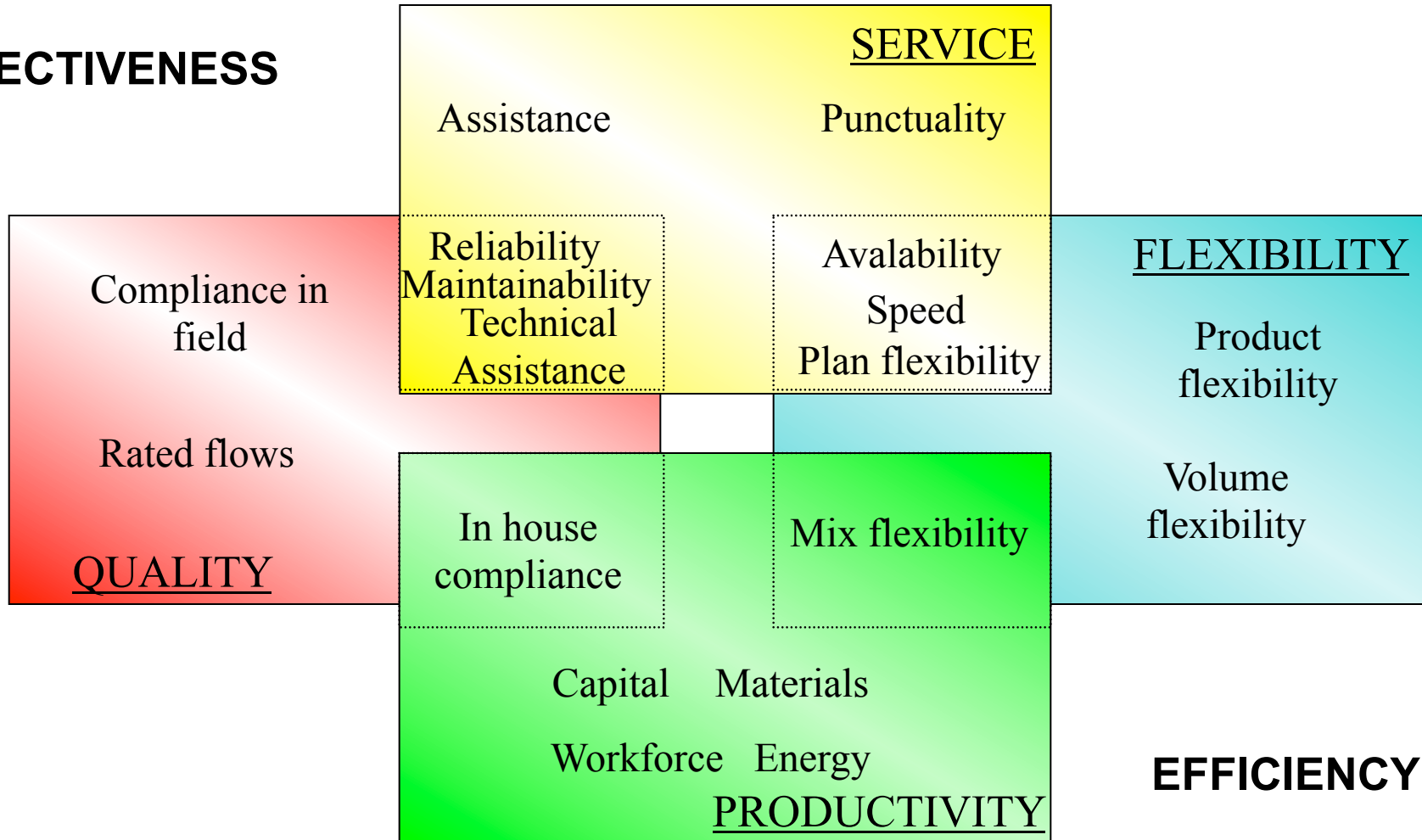
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Agenda

- performances
- internal performances
 - productivity
 - Pareto's law
 - ABC-ABC analysis
- external performances

Performances

EFFECTIVENESS



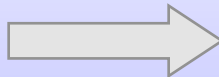
Points of view

External Performances



- Quality
- Service
- Product price
- Innovation
- Lead time

Internal Performances



- Variable cost
- Lead time
- “in house” quality
- inventory level
- Throughput rate
- Flexibility

Internal performances



- the productivity performance are usually defined as:

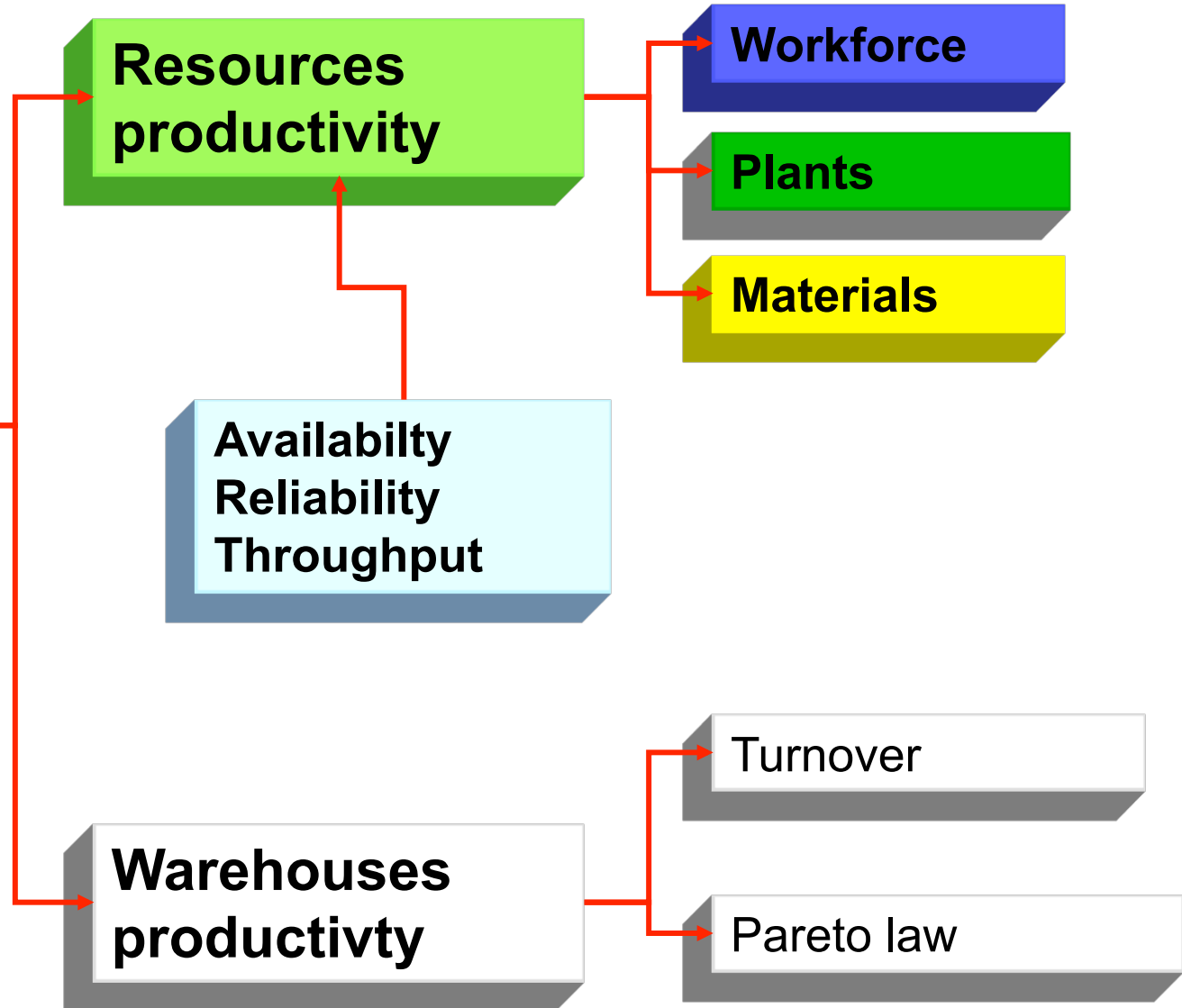
$$\text{Output} / \text{Input}$$

- they can refer to single machines, departments, production systems,...

Internal performances



Efficiency



Internal performances



Paint/machine/productive resource STATES

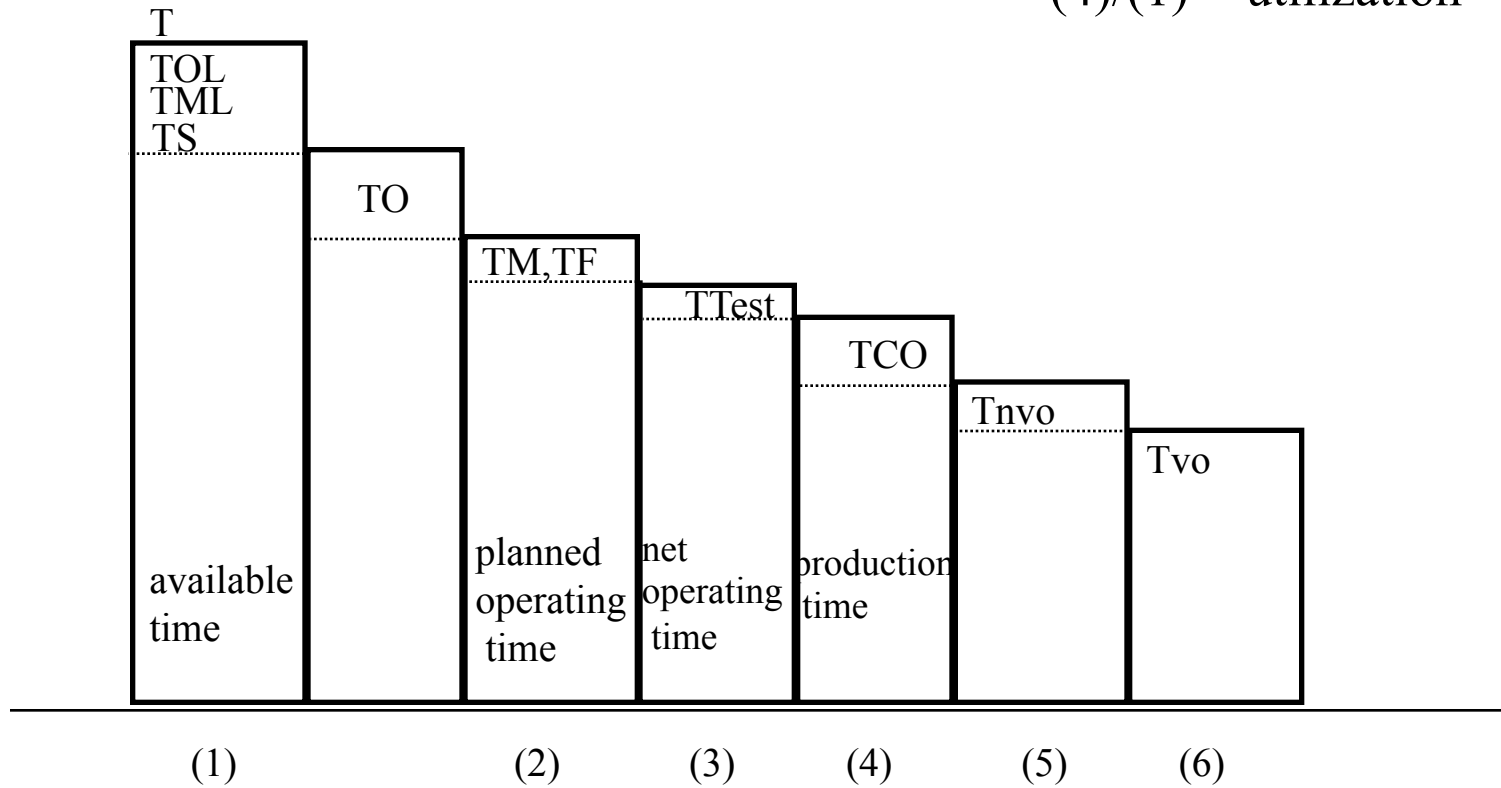
- T open time – available time
- Tvo valuable operating time
- Tnvo not valuable operating time
- TCO changeover time
- Ttest time used for tests
- TF failure stop time
- TM maintenance stop time
- TOL order lack stop time
- TML materials lack stop time
- TS strikes
- TO organizational causes

Internal performances



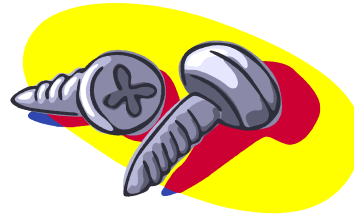
$(3)/(2) = \text{availability}$

$(4)/(1) = \text{utilization}$



Internal performances

$$\text{Productivity} = \frac{\text{output (value, volume,...)}}{\text{input (value, volume,...)}}$$



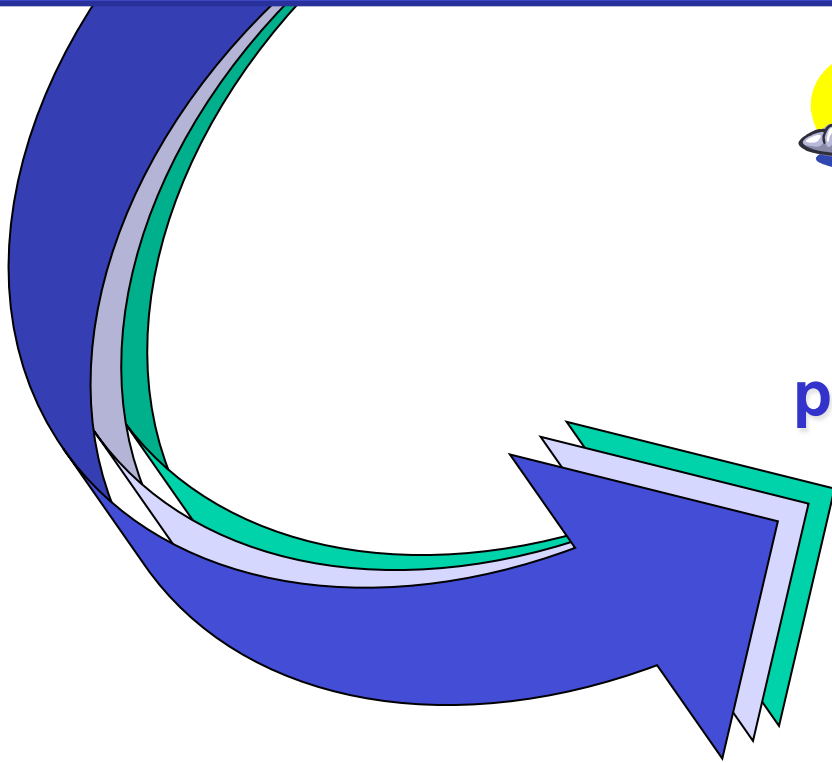
**Materials
productivity**



**Machines
productivity**



**Workforce
productivity**



Productivity performances

Workforce

$$\text{Productivity} = \frac{\text{produced volumes}}{\text{paid hours}}$$

$$\text{Utilization} = \frac{\text{actual worked hours}}{\text{paid hours}}$$

$$\text{Efficiency} = \frac{\text{standard time to produce the produced volume}}{\text{actual worked hours}}$$

Productivity performances

Machines

$$\text{Productivity} = \frac{\text{produced volumes}}{\text{capacity}}$$

T_{vo} and T_{nvo} = actual values
 TCO = calculated standard value

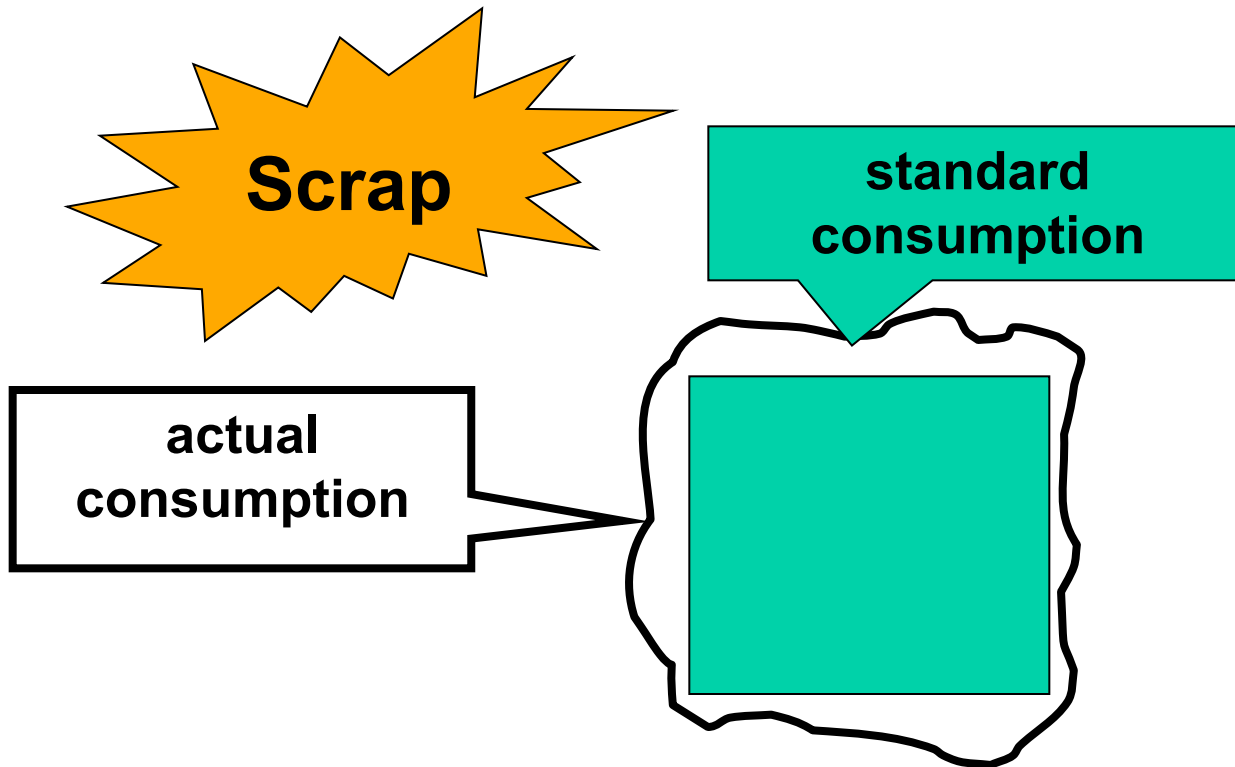
$$\text{Utilization} = \frac{\text{production time}}{\text{available time}} = \frac{T_{vo} + T_{nvo} + TCO}{\text{available time}}$$

$$\text{Efficiency} = \frac{\text{standard time to produce the produced volume}}{\text{production time}}$$

Productivity performances

Materials

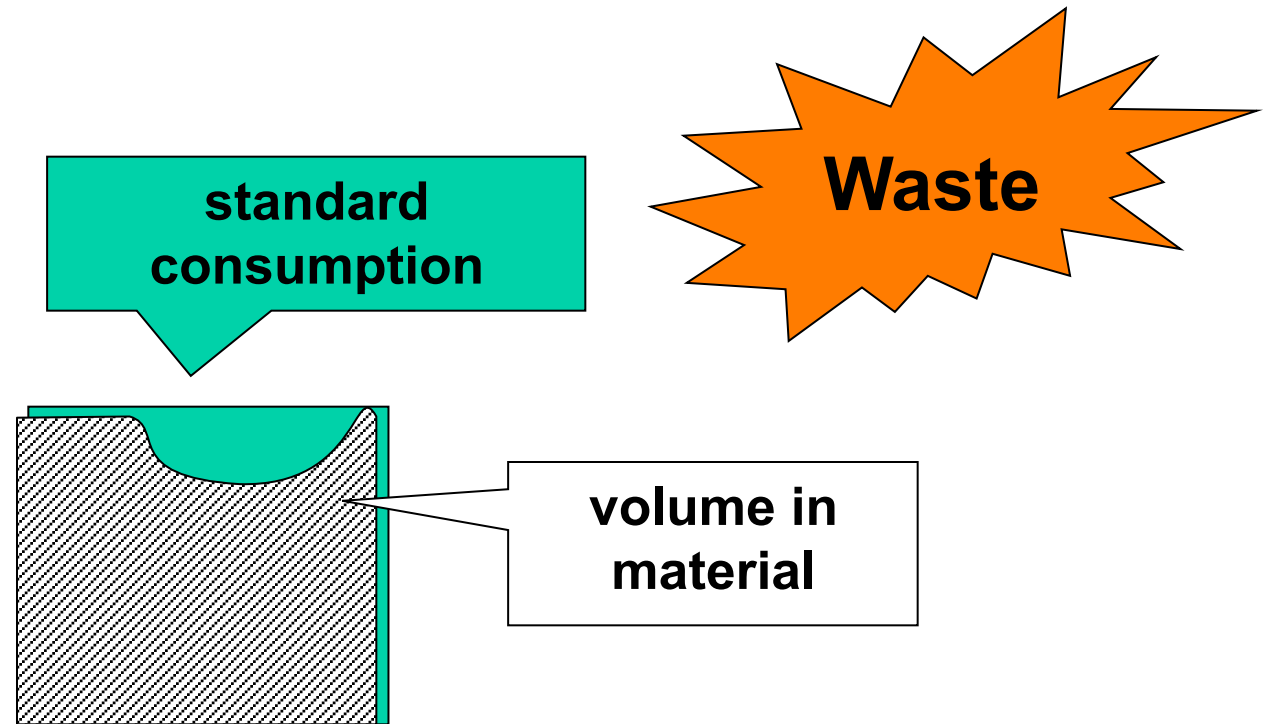
$$\text{materials productivity} = \frac{\text{standard consumption}}{\text{actual consumption}}$$



Productivity performances

Materials

$$\eta = \frac{\text{volume in material}}{\text{standard consumption}}$$



Productivity performances



Materials

$$\text{Materials productivity} \times \eta = \frac{\text{produced volume}}{\text{actual consumption}}$$

Warehouse Productivity

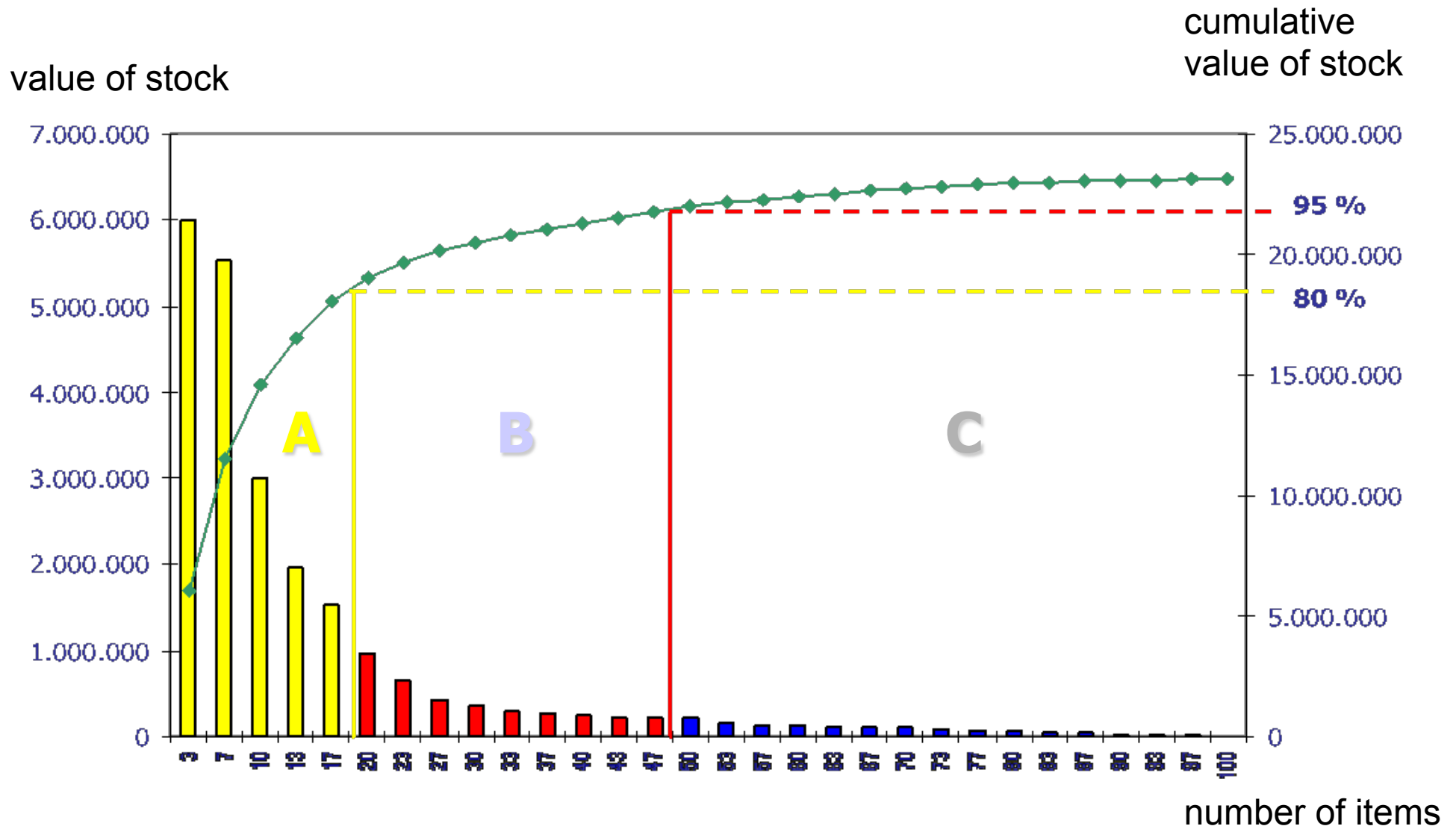


Turnover Index = $\frac{\Sigma \text{ Consumption in a period}}{\text{Average stock}}$

Coverage = $\frac{\text{days in period}}{\text{Turnover Index}}$



Pareto's law



ABC – ABC analysis

Example

		Stock			
		A	B	C	
Sales	A	8%	3%	1%	12%
	B	8%	7%	3%	18%
	C	6%	18%	46%	66%
		22%	28%	50%	100%

ABC – ABC analysis

- high opportunity and high risk
- limited number of items: possibility to perform analyses
- specific states of the system:
 - constant stock, frequent replenishment of small quantities: **reduce safety stock**
 - constant stock, sporadic replenishment of big quantities: **change the replenishment policy**
 - cyclical stock, frequent replenishment of small quantities: **deseasonalizing the replenishment**
 - cyclical stock, sporadic replenishment of big quantities: **deseasonalizing the replenishment and change the replenishment policy**

gray	blue	gray
gray	blue	light blue
gray	blue	light blue

ABC – ABC analysis



- limited number of items;
“zeroing objective”
- specific states of the system:
 - obsolete items: **don’t produce/purchase, just “consume”** them by promotion, offering to different channels/markets;
 - new products/spare parts : **monitoring**

gray	blue	gray
gray	blue	light blue
gray	blue	light blue

ABC – ABC analysis

light gray	medium blue	light gray
light gray	medium blue	light blue
light gray	medium blue	light blue

- limited number of items; “increasing objective”
- limited stock?
carefully monitoring the stockouts
- specific states of the system:
 - items produced/purchased **by order**
 - items managed **Just In Time**

ABC – ABC analysis



light gray	medium blue	light gray
light gray	medium blue	light blue
light gray	medium blue	light blue

- high number of items
- “not interesting” items
- onerous management: stock data update, occupation of space
- specific states of the system:
 - low interest items: verify the possibility to **lower the stock**
 - the sales are low because the items are not available: **improving the stock management and monitoring the stockouts**

External performances



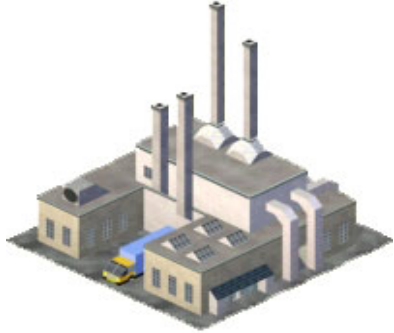
- How to achieve competitive advantage
- Which are the Operations strategies to achieve competitive advantage?
- How to measure the performances perceived by the market?

External performances



- The perceived Quality deals with customer satisfaction
- The Service level points the quantitative realization of the promise of supply
- The product price deals with the economical dimension
- Innovation deals with the ability to propose new products

.... of course, in relation to competitors!



Service



Make to Stock systems

availability

stock-out persistence

delivery accuracy and completeness

**Make to order/
assembly to order systems**

readiness

punctuality

Indexes:

– Physical:

- stock-out quantity (not delivered) / ordered quantity;
- num. of delivered orders / num. of orders;
- num. of not delivered orders / num. of orders;
- num. of delivered order lines / num. of order lines;
- num. of delivered items / num. of ordered items;

– Economical:

- Loss of earn;
- Penalties.

Stock out persistence



- Physical:
 - number of stock out periods / number of periods
- assess the actual stock outs and potential stock out

Punctuality and readiness

