1.2 Productive system and Process Approach

Operations Management in Corporate Profitability and Competitiveness

LEARNING GOALS after these lessons you will be able to

1. describe operations in terms of inputs, processes, outputs, information flows, suppliers and customers,
2. explain the meaning of nested processes,
3. identify the set of decisions that operations managers make
4. describe operations as a function alongside finance, accounting, marketing and human resources,
5. explain how operations management is fundamental to both manufacturers and service organizations,
6. describe the differences and similarities between manufacturing and service organizations,

LEARNING GOALS after these lessons you will be able to

7. discuss trends in operations management, including service sector growth; productivity changes; global competition; and competition based on quality, time and technology,
8. discuss the need for operations management to develop and maintain both intraorganizational and interorganizational relationships and
9. give examples of how operations can be used as a competitive weapon.

What is a Productive system (Buffa), what is a Process (Krajewski& Ritzman)?

Examples of

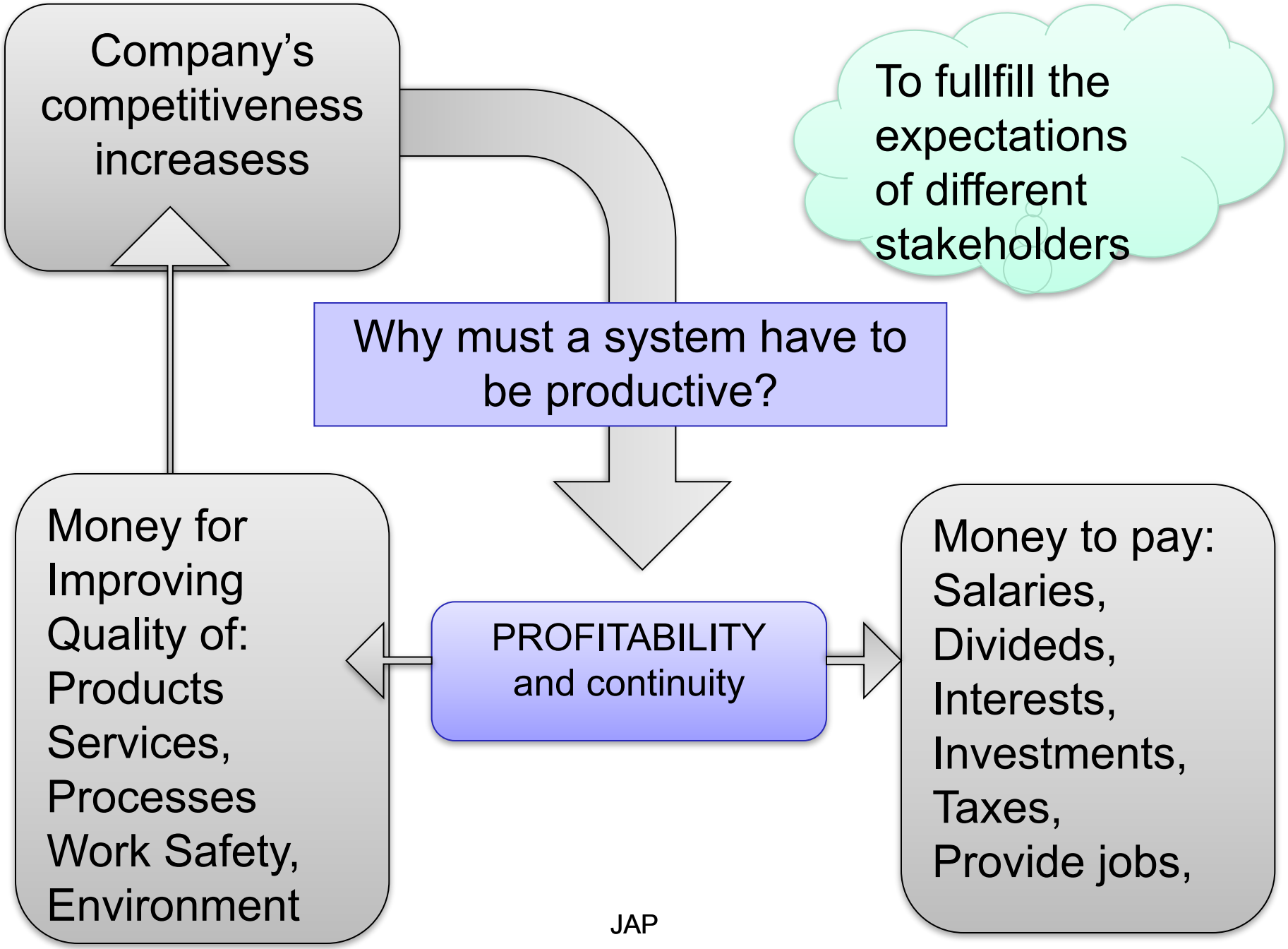
- Productive systems, Processes
- Products versus services
- Services as part of product
- Products as part of service

EXAMPLES OF PRODUCTIVE SYSTEMS:

Electronics assembly
Airplane manufacturing
Steel production
Automobile assembly
Oil refining

Fast food outlet
Hospital
Air transportation
Car seller
EDP -support

Why must a system has to be productive?


Company's competitiveness increasess
To fullfill the expectations of different stakeholders
Why must a system have to be productive?
Money for Improving Quality of: Products Services, Processes Work Safety, Environment
PROFITABILITY and continuity
Money to pay: Salaries, Divideds, Interests, Investments, Taxes, Provide jobs,

What is a Productive system ?

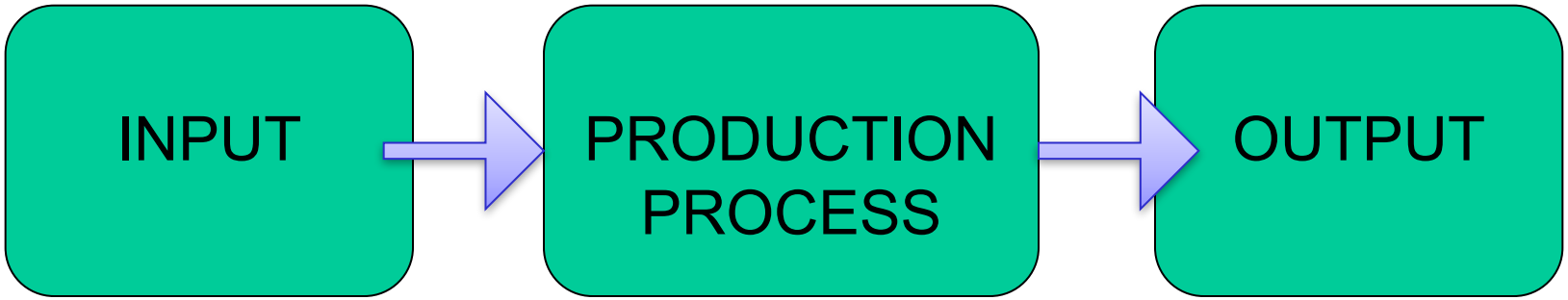
(Buffa means here production system)

- We define productive systems as the means by which we transform resource inputs to create useful goods and cervices as outputs.
- Productive systems resource inputs (and examples of output-input ratio)
  - Labor (man hour – mobile phone / man hour)
  - Materials (kg, m, … - phone (pc) / plastic (kg))
  - Investments: machines, facilities, information, storage, know how, education
  - Energy (Joule, KWh - Finished Products / KWh
  - Overall

PRODUCTIVITY (is the value of outputs (goods, services) produced and divided by the values of input resources) IS THE RATIO OF OUTPUT TO INPUT, OR

$$\text{PRODUCTIVITY} = \frac{\text{OUTPUT}}{\text{INPUT}}$$

Not concerned by money (but sometimes yes)



example 1 / productivity

Calculate the productivity for the following operations:

a) Three employees process 600 insurance policies in a week. They work 8 hours per day, 5 days a week.

b) A team of workers make 400 units of a product, which is valued by its standard cost of 10 € each (before profit). The accounting department report that for this job the actual costs are 400 € for labor, 1000 € for material and 300 € overhead.

Labor productivity = Processes policies / Employee hours

$$\frac{600 \text{ policies / week}}{3 \text{ employees} * 40 \text{ hours /employee}} = 5 \frac{\text{policies}}{\text{hour}}$$

Multifactor productivity = Quantity of standard cost / (labor cost + material cost + overhead cost)

$$\frac{400 \text{ units} * 10 € / \text{unit}}{(400 + 1000 + 300)€} = \frac{4000 €}{1700 €} = 2{,}35$$

Problem exercise 1.2.1. / Productivity, case state ferry

A state ferry charges 18 € / ticket + surcharge of 3 € for paper ticket. It expects to sell 4700 tickets during summer season. During that time the labor costs are 11 100 € and material (tickets, tourist information sheet …) cost is 1,3 €/ticket. Overhead cost is 79 000 €.

What is the multifactor productivity ratio?

What is the labor productivity?

Your job is to do a calculation sheet with parameters needed.

Problem exercise 1.2.2 / Productivity, how to measure it?

You have a workshop that manufactures

a) several items out of steel according to customers plans.

b) You produce five different types of freezers.

c) You sell computers and peripheral (auxiliary) equipment.

How would You measure productivity in each case?

Problem exercise 1.2.3. Productivity in University

Student tuition at University in US is $100 per credit point. The state supplements school revenue by matching student tuition, dollar for dollar. Average class size for a typical three credit course is 50 students. Labor costs are $4000 per class, materials costs are $20 per student per class, and overhead costs are $25000 per class.

a) What is the multifactor productivity ratio?

b) If instructors work an average of 14 hours per week for 16 weeks for each three-credit class of 50 students, what is the labor productivity ratio?

Problem exercise 1.2.4. Productivity, case garments

Natalie Attired makes fashionable garments. During a particular week employees worked 360 hours to produce a batch of 132 garments, of which 52 were “seconds” (meaning that they were flawed). Seconds are sold for $90 each at Attired’s Factory Outlet Store. The remaining 80 garments are sold to retail distribution, at $200 each. What is the labor productivity?

Exercise 1.2.5. Productivity, case uniform manufacturing

The Big Black Bird Company (BBBC) has a large order for special plastic-lined military uniforms to be used in an urgent Mideast operation. Working the normal two sifts of 40 hours, BBBC usually produces 2500 uniforms per week at standard cost of 120 €/pc. Seventy employees work the first sift and 30 the second. The contract price is 200 € per uniform. Because of the urgent need, BBBC is authorized to use around-a-clock production, six days per week. When each of the two sifts work 72 hours per week, production increases to 4000 uniform per week but at a cost of 144 € each.

a) Did the labor productivity ratio increase, decrease, or remain the same? If changed, by what percent did it change?

b) Did weekly profits increase, decrease or remain the same? What happened to profitability?

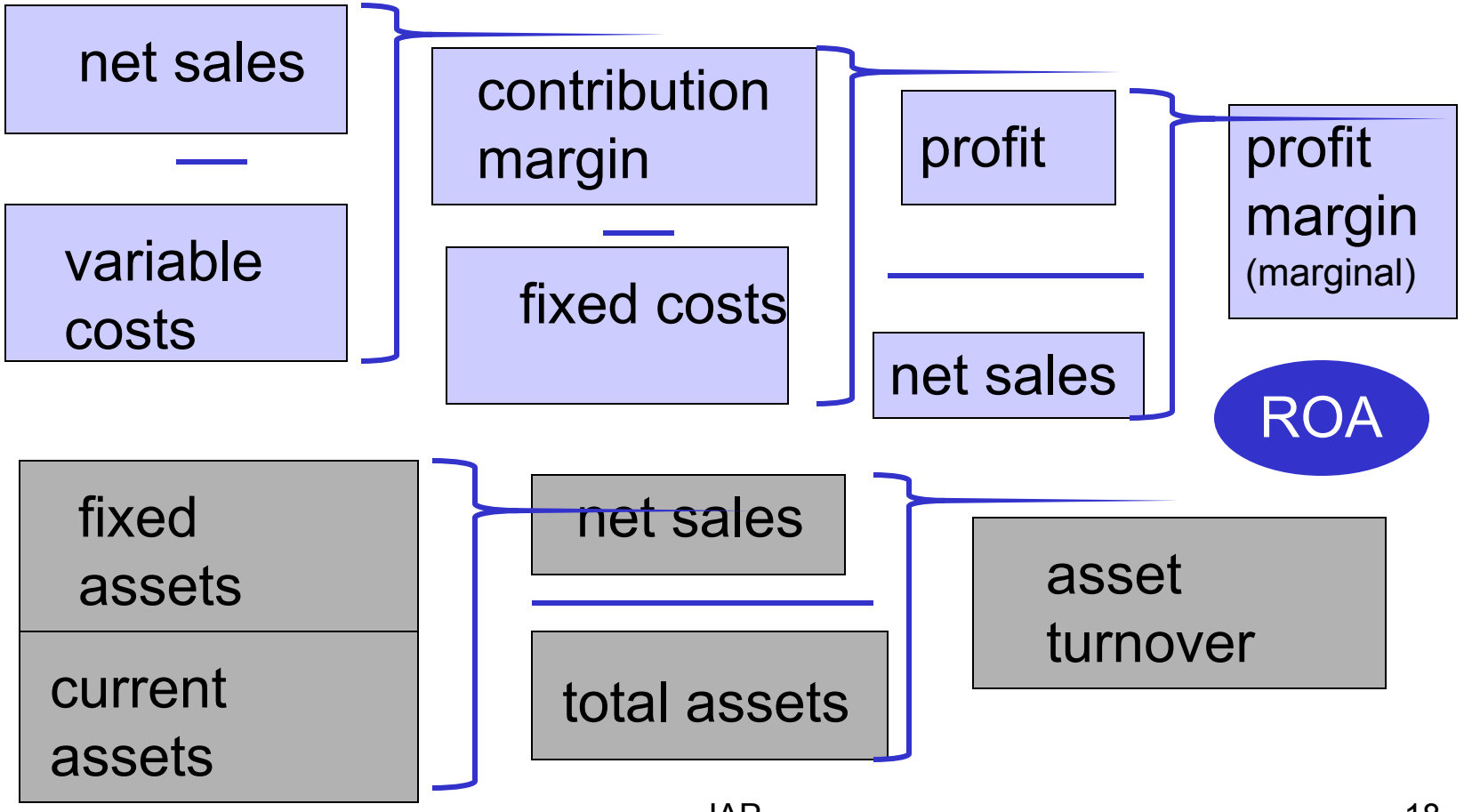
Profitable System versus Productive System

cost of (money)

- labor
- materials
- machines
- facilities
- energy
- information

$$\frac{\text{income} - \text{costs}}{\text{capital invested}} = \text{profit}$$

THE DU PONT SYSTEM, RETURN ON ASSETS



Fixed Assets:

Machinery

Equipment

Facilities

Current Assets:

Materials

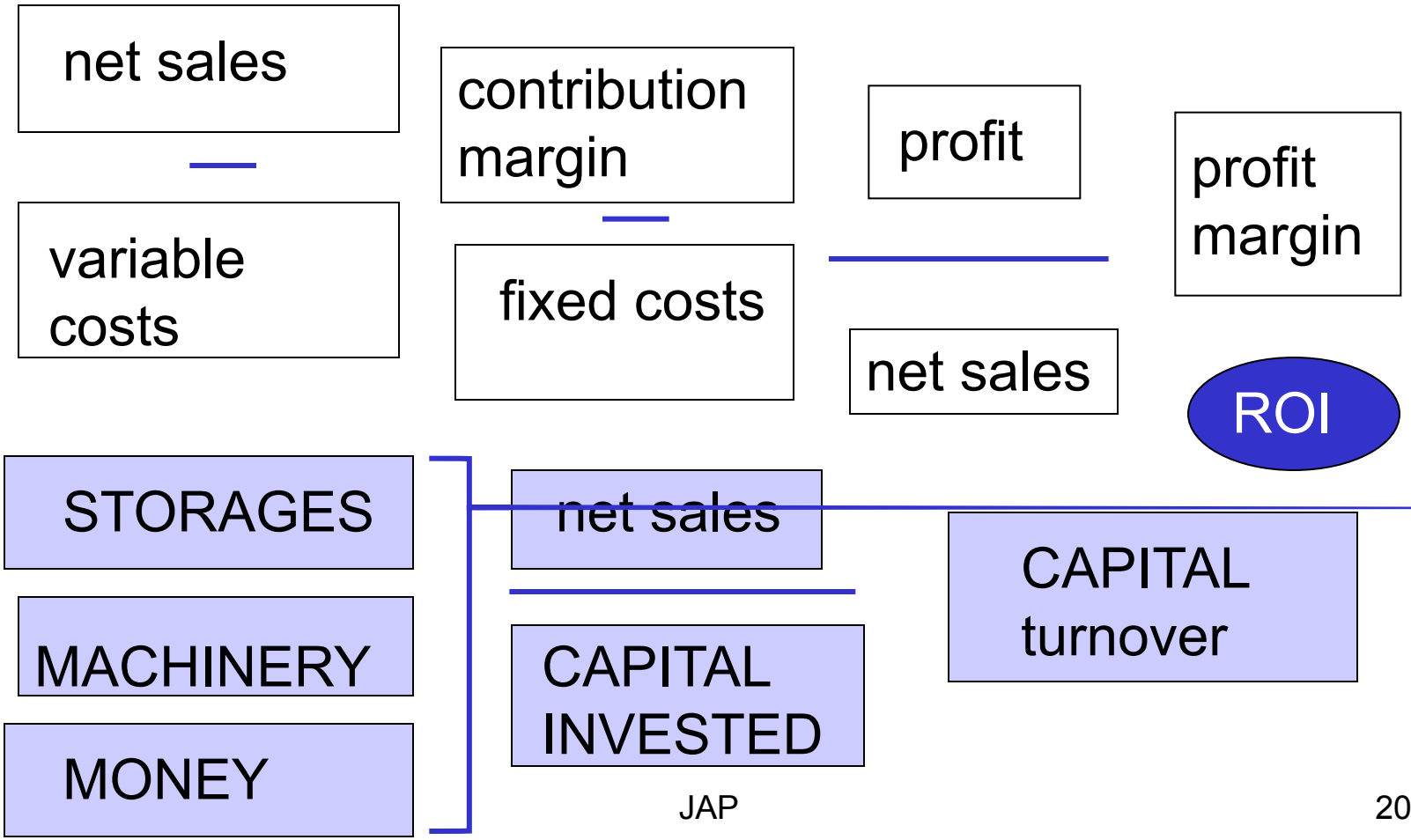
Work in Process

Final Products

Cash and Receivables

- Payables

THE DU PONT SYSTEM, REVENUE ON INVESTMENT (RETURN OF INVESTMENT, RETURN OF CAPITAL EMPLOYMENT)



INCOME STATEMENT

NET TURNOVER

- Variation in stock of finished goods and work in progress
- Work performed by undertaking its own purposes and capitalized
+ Other operating income
- Raw material and consumables
  - Purchases during the accounting period
  - Variation in stock
- Other external charges

- Staff costs
  Wages and salaries
  social security costs
+- Value adjustments
  in respect of tangible and intangible assets
  of current assets
- Other operating charges
= OPERATING PROFIT OR LOSS
+ Interests receivable and similar income
- Interest payable and similar charges
= PROFIT OR LOSS BEFORE TAXES

EXAMPLE / ROA

Your firm wants to have ROA (return on assets) minimum of 20 %. You are planning a new production line which would cost € 2,5 million and the profit margin (per year) for those products produced would be round 10 %.

How much should the turnover (net sales) be?

Is there enough capacity for manufacturing those products if the contribution margin ratio is 40 % and fixed costs (per year) are 1,5 million €?

EXAMPLE / Profitability

a) ROA = Net profit / capital invested

net profit = 20 % * 2,5 million €

Profit margin (10%) = net profit (20%*2,5 million) / turn over (net sales)

turn over = 500 000 / 10 %

b) contribution margin ratio = contribution margin / turn over (net sales)

=> contribution margin = 40 % * 5 000 000 €

contribution margin – fixed costs >= profit minimum (500 000 €/year)

there is just enough capacity in the production line to earn the profit wanted.

Problem exercise 1.2.6. / Profitability

Your job is to plan and actually do a calculation table for aggregate planning. By the table you should be able to test different physical and financial possibilities for a year's plan.

Normal situation: sales 115 000, variable costs 36750, fixed costs 50 125, fixed assets 163 000, current assets 22 792. What are the profit, profit margin ratio, assets turnover and ROA? What are the sequences if one factor changes 5 % at time?

Exercise 7 / Profitability

As a president of Mölkky Oy you find that one of your pressing problems is to understand how the plant is doing financially. The owners of the company have hired you to run the business and it is your responsibility to make sure that the business is financially sound.

There is a great problem ahead. You need to know how individual product lines perform. Is each line profitable or not?.

How can you add this new calculation to your ROA/ROI program.

help for exercises 1.2.6 and 1.2.7

net sales	115000
Prod A	20000
Prod B	45000
Prod C	50000

minus

variable costs	
Prod A	3000
Prod B	2750
Prod C	31000

contribution margin		margin ratio
Prod A	17000	85 %
Prod B	42250	94 %
Prod C	19000	38 %
total	78250	68 %

minus

fixed costs	
Prod A	13500
Prod B	25125
Prod C	11500
total	50125

profit (before interests)		profit%
Prod A	3500	18 %
Prod B	17125	38 %
Prod C	7500	15 %
total	28125	24 %

fixed assets		current assets	asset turnover	ROI
Prod A	80000	10500	0,22	3,9 %
Prod B	47000	7125	0,83	31,6 %
Prod C	36000	5167	1,21	18,2 %
total	163000	22792	0,61897286	15,1 %

total assets
185792

Problem exercise 1.2.8. /Profitability

How can You reach a 100% increase in profit when the following facts of Your company:

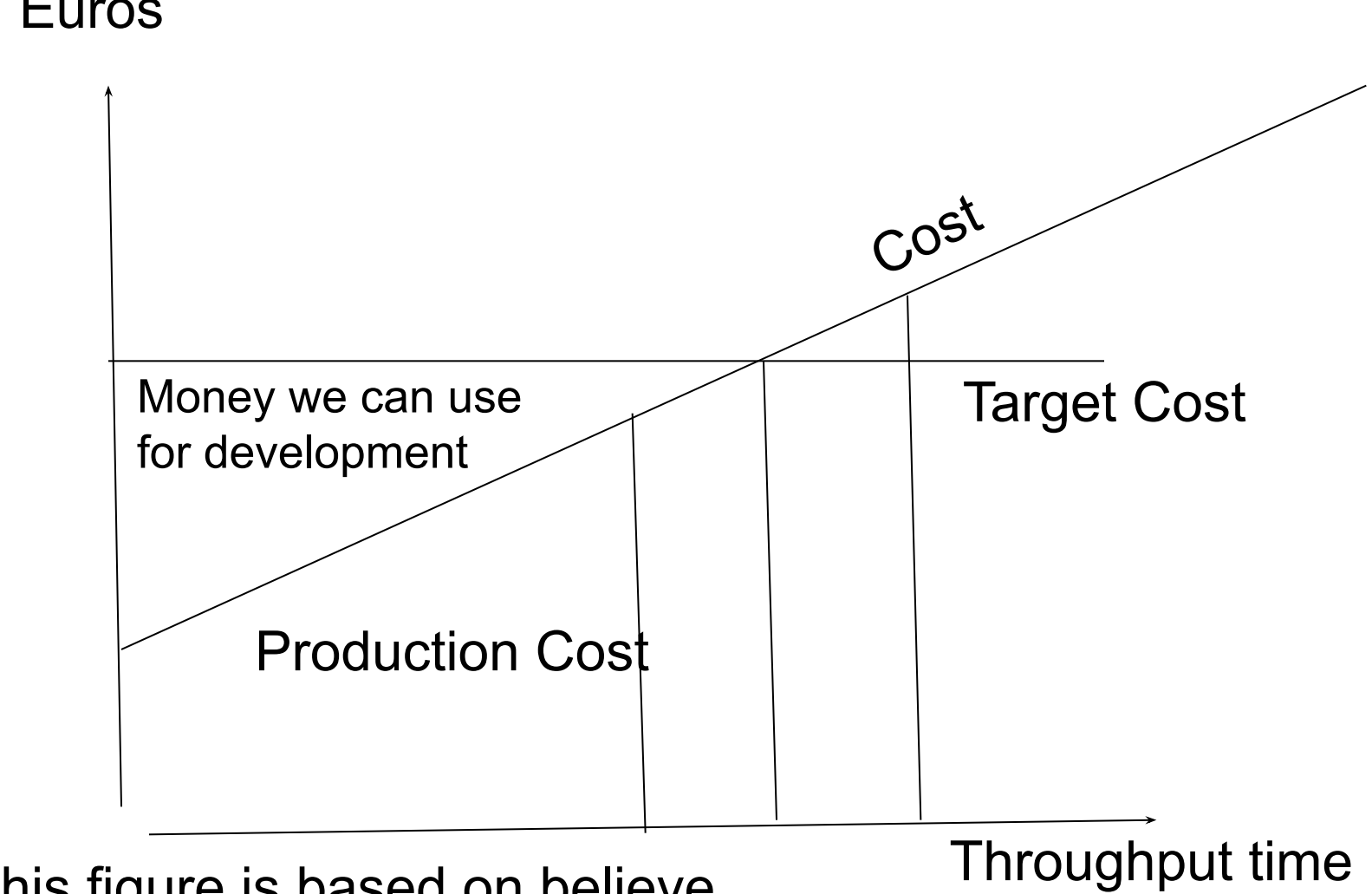
Sales (per period)		100
- Direct materials	50	
- Direct labor	15	
= Prime cost		
- Manufacturing overhead	15	
- Other overhead costs		15
= Profit		5

Compare the impact of each variable to the profit and try to figure out how difficult it would be to reach such development in practical life.

Target Costing

Market Price (an estimate or real price of a product a company is interested to develop and launch on the market) – Owner's expectation of profitability (ROI and Profit percentage, EBIT =Earnings before interest and taxes)

= Target Cost, that is the cost of developing a product and production system, including machinery, facilities …



This figure is based on believe that production cost depends on throughput time

Example of New Production Method development project

	at planning phase	at half way
Estimated Output (sales)	5 M €	5 M €
Estimated Target cost	3 M €	6 M € (need 3 M more and 3 is used)
Profit estimate	2 M €	-1 M €

Is it wise to continue?

What is a Process?

- We define process to be any activity or group of activities that take one or more inputs, transforms and adds value to them, and provides one or more outputs for its customers.
- **External customer** either is an end user or an intermediary (such as manufacturers, wholesalers, or retailers) buying the firm's finished products and services.
- **Internal customer** is an other employee who rely on inputs from earlier processes in order to perform processes in the next shop, office or department.

Information on performance

Inputs:

Workers

Managers

Equipment

Facilities

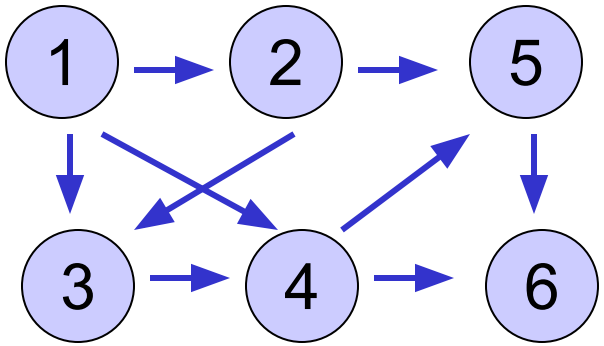
Materials

Services

Land

Energy

PROCESSES AND OPERATIONS



Outputs:

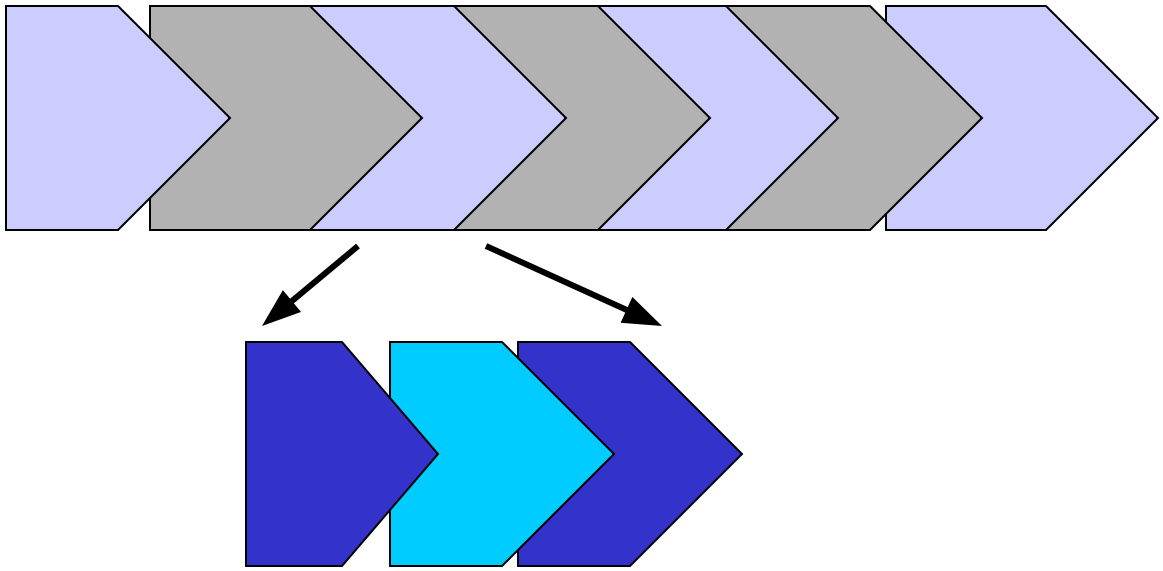
services

goods

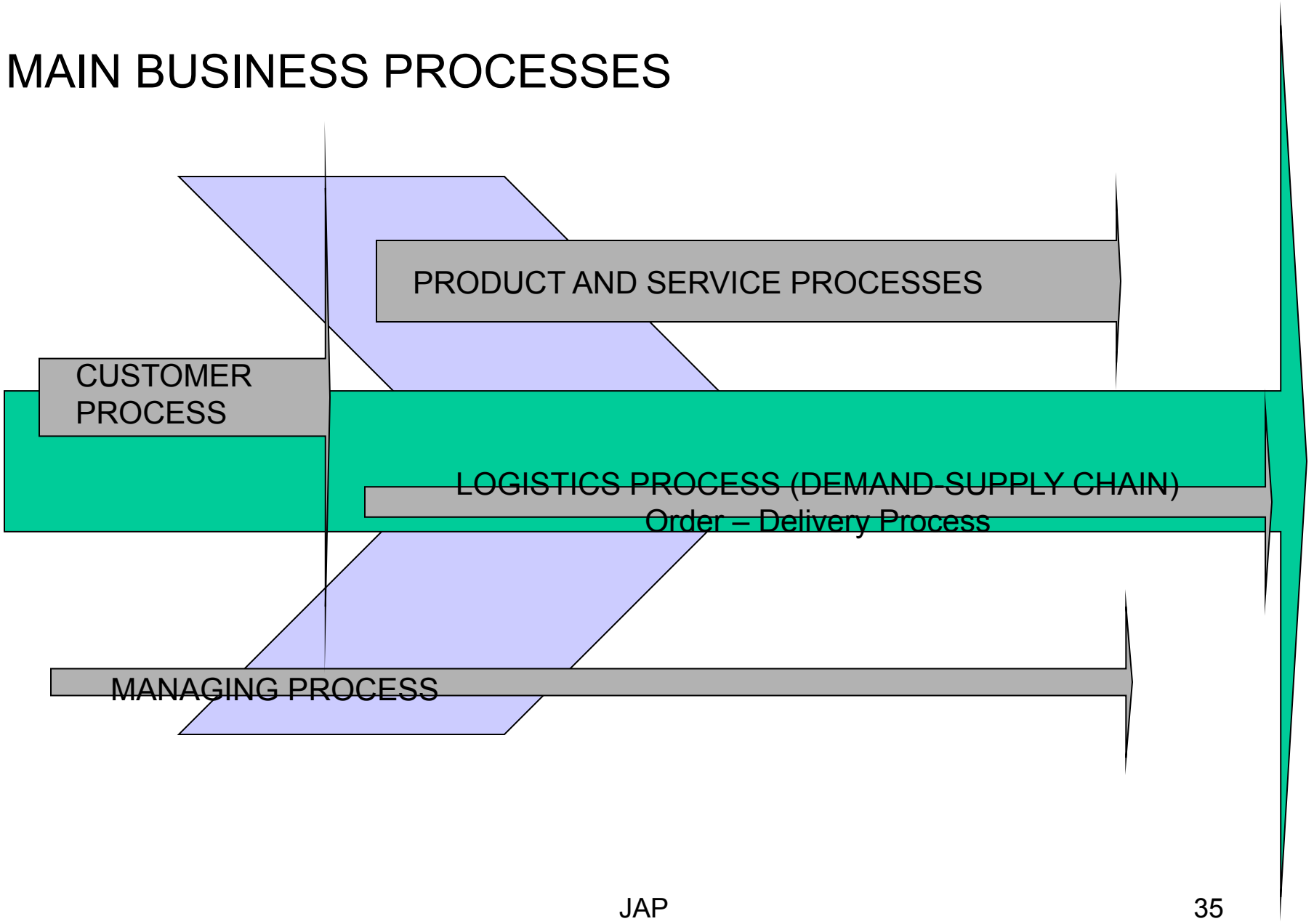
Managing the processes and operations is managers job

NESTED PROCESSES, the concept of a process within a process.

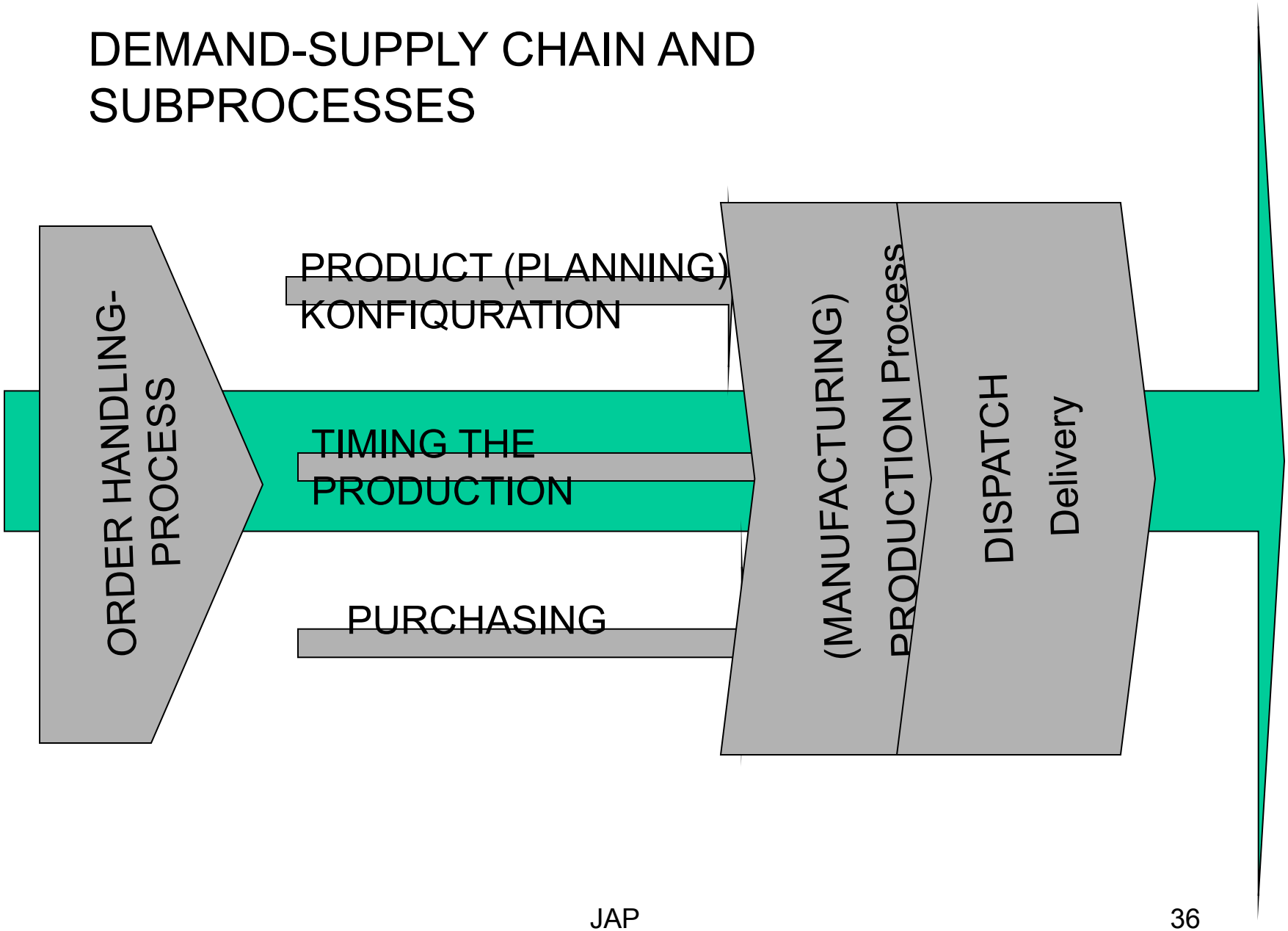
Processes can be broken down into subprocesses.



MAIN BUSINESS PROCESSES



DEMAND-SUPPLY CHAIN AND SUBPROCESSES



CASE NOKIA:

CUSTOMER SATISFACTION PROCESS is a process for systematic customer satisfaction and competition/competitor evaluations.

CONCURRENT ENGINEERING is a parallel and cooperative product development process using continuous development principle.

GLOBAL LOGISTICS process controls material- ,information and money flows internationally.

COMPETENCE AND SYSTEM DEVELOPMENT is a supportive process which aims to develop staff's skills and cooperation.

What is Operations Management / Process Management (Krajewski & Ritzman)?

Operations Management term refers to direction and control of the processes that transforms the inputs into products and services.

Process management is defined as following: The selection of the inputs, operations, work flows, and methods that transform inputs into outputs (Krajewski & Ritzman 2002 p.93).

In manufacturing, operations management is responsible for decisions concerning plant and factory layout, capacity, production process and its quality, and controlling systems planning and aggregate planning and timing of production.

Major Process for manufacturing/production process decisions:

Process choice: A process decision that determines whether resources are organized around products or processes. What type of production system??

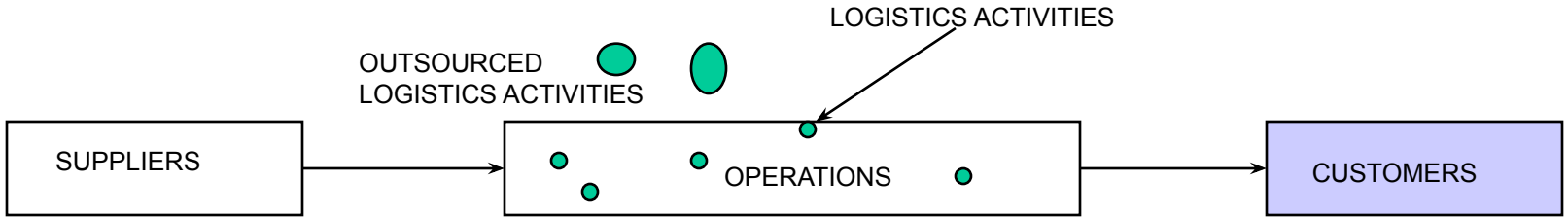
Vertical integration: The degree to which a firm's own production system or service facility handles the entire supply chain. Subcontracting??

Resource flexibility: The ease with which employees and equipment can handle a wide variety of products, output levels, duties, and functions.

Customer involvement: The ways in which customers become part of process and the extent of their participation. Need of customization??

Logistics (vertical) Integration

A) Separate functions within an organisation

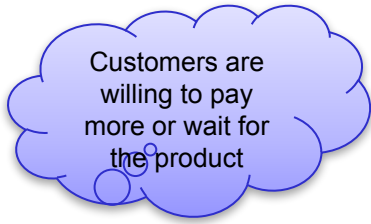


B) Integration within the organisation

C) Logistics with external integration -> Supply Chain Management

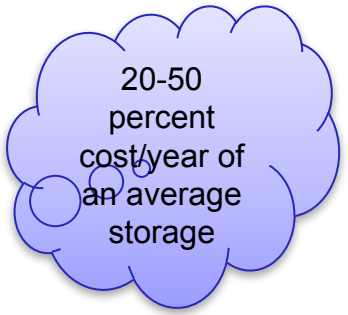
Enterprise Competitiveness and Operations Function

- There are four (five) dimensions of competitiveness that measure the effectiveness of the operations function:
  - Cost effectiveness (-> emphasized in Lean Production)
  - Quality + CONTROL ON VARIATION
  - Time (off-the-shelf availability or logistical speed (delivery time) and on-time delivery)
  - Dependability as a Supplier
  - Flexibility / Service (-> Agile Production)
- Relate competitive priorities to market segments

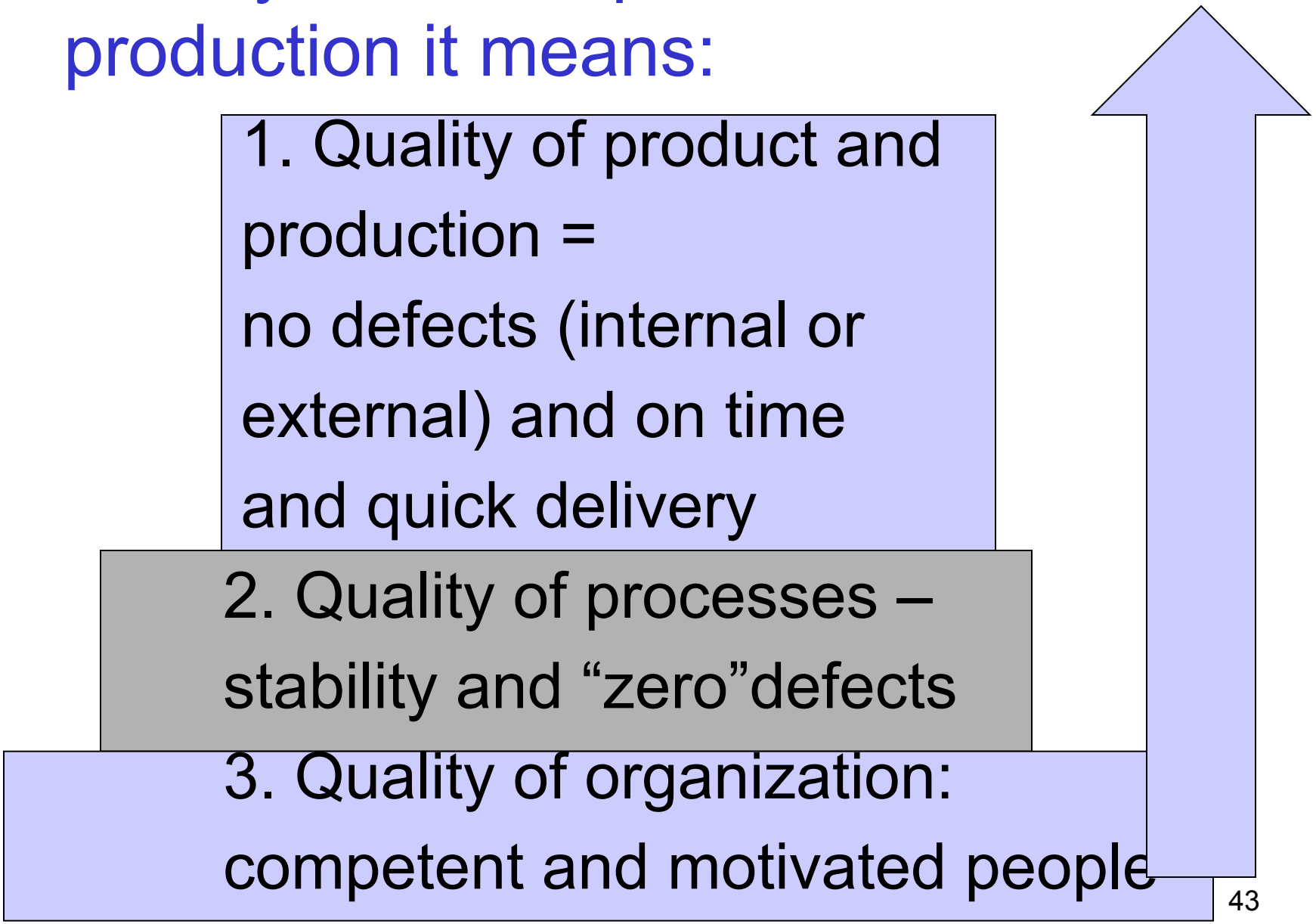


cost reduction by organizational learning

- improved production methods and tools
- improved product design -> manufacturability
- Standardization + modular product structure
- improved material utilization
- reduction of system inventories
- improved layout and flow
- economics of scale
- improved organization
- improvement in quality costs



Quality is a wide phenomena but in production it means:



High-performance design: Determination of the level of operations performance required in making a product or performing a service.

Consistent quality: Measurement of the frequency with which the product or service meets design specifications.

“Time is money”:

Short delivery time: The elapsed time between receiving a customer’s order and filling it.

Lead time: The way industrial buyers often refer to delivery time.

On-time delivery: Measurement of the frequency with which delivery-time promises are met.

Development speed: Measurement of how quickly a new product or service is introduced, covering the elapsed time from idea generation through final design and production.

Time based competition: The process by which managers define the steps and time needed to deliver a product or service, and then critically analyze each step to determine whether they can save time without hurting quality.

TBM (Time based Management) term was used by many companies such as ABB… The basic idea was that by cutting the throughput time to half 25 % of costs will disappear (will be cut down).

Concurrent engineering: A process during which design engineers, manufacturing specialists, marketers, buyers, and quality specialists work jointly to design a product or service and select the production process.

Measuring the Supply Chain – SCOR-model and Production as a part of it

	Customer-Facing			Internal-Facing	
Performance Attribute	Reliability	Responsiveness	Flexibility	Cost	Assets
Delivery Performance	3				
Fill Rate	3				
Perfect Order Fulfillment	3				
Order Fulfillment Lead Time		3			
Supply-Chain Response Time			3		
Production Flexibility			3		
Total Supply Chain Management Cost				3	
Cost of Goods Sold				3	
Value-Added Productivity				3	
Warranty Cost Or Returns Processing Cost				3	
Cash-To-Cash Cycle Time					3
Inventory Days Of Supply					3
Asset Turns					3

Flexibility of Production means:

1. Capability to produce several different products with the machinery (customization).
2. Capability to adjust the rate of production to the market need (fluctuation). Volume flexibility is the ability to accelerate or decelerate the production rate. Change production capacity!
3. Capability to speed up the production cycle time (throughput time) when necessary. Change production speed!

Problem 1.2.9 Productivity

A health –check clinic has five employees and "processes" 200 patients per week. Each Employee works 35 hours a week. The clinic's total wage bill is € 3900 and its total overhead expenses are € 2000 per week. What are the clinic's single factor labor productivity and its multi-factor productivity?

Problem exercise 1.2.10 Determining billing hour's price

You are running a maintenance service business and you have ten mechanics (mounters) working for you. The billing hours are approximately 1700 hours / year / mechanic. The variable costs for maintenance work are 20 €/hour and you have financed the business by investing 50 000 € yourself. There is also a bank loan of 120 000 € with fixed interest of 12 %. You want to have 12 % interest for your investment (ROE) and the fixed costs of the firm are 70 000 € and the depreciation of a year is 35 000 €.

Calculate the price of a billing hour. How does the ROE change if the bank interest rises to 18 % or drops to 6 % percent?