

Management IS



SoftEng
<http://softeng.polito.it>

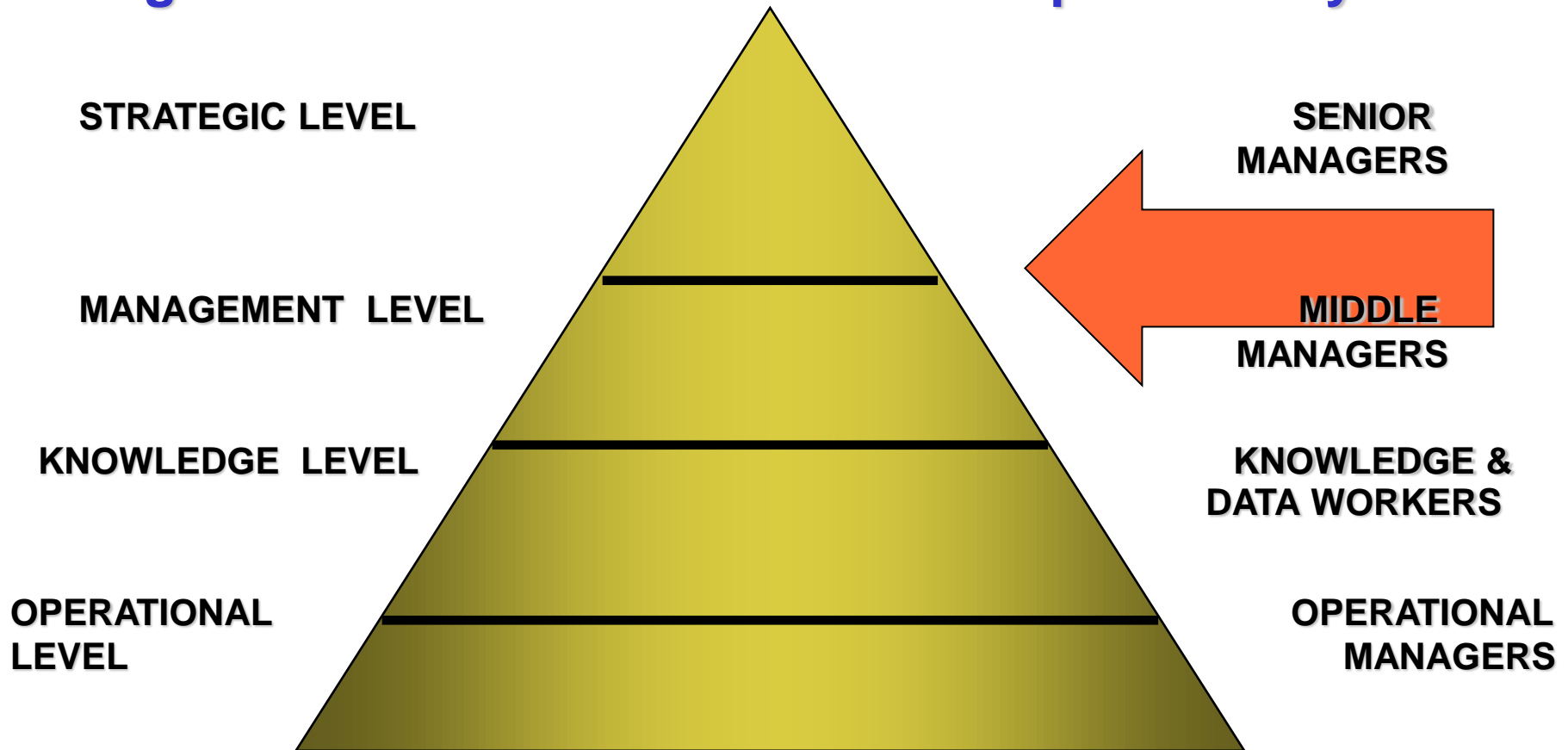
Management IS

What gets measured gets done

- ♦ Attributed to P.Drucker

Organizational level

Group served by IS



Process families

Managerial processes

Strategic planning
Control
Business Intelligence
...

GOAL: Lead the organization

Primary Processes

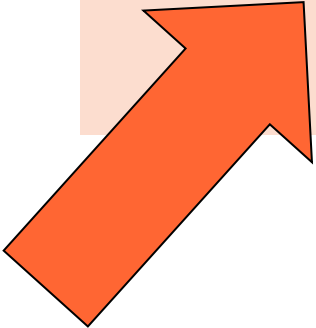
Production and provisioning of products and services

GOAL: Serve the customers

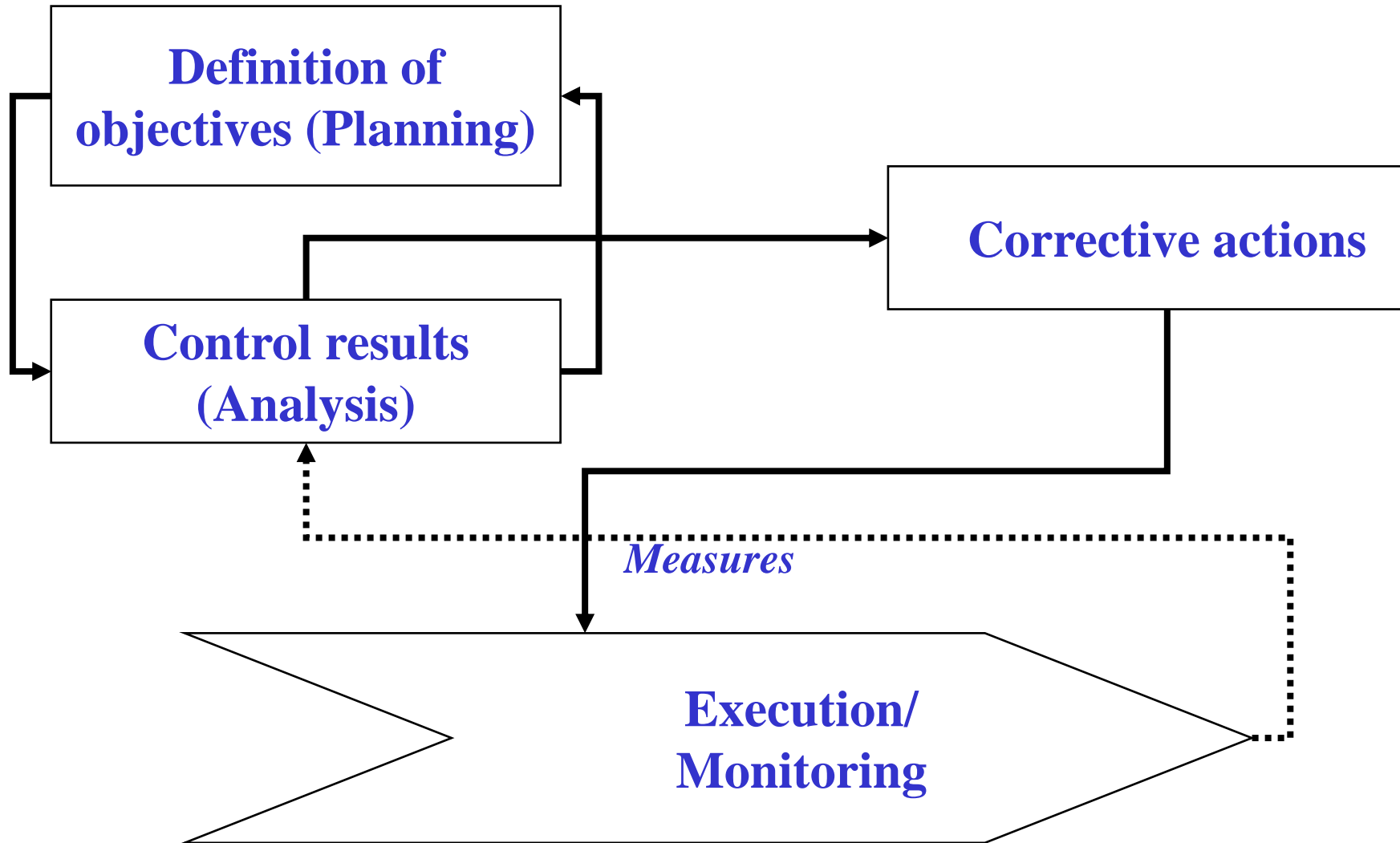
Support Processes

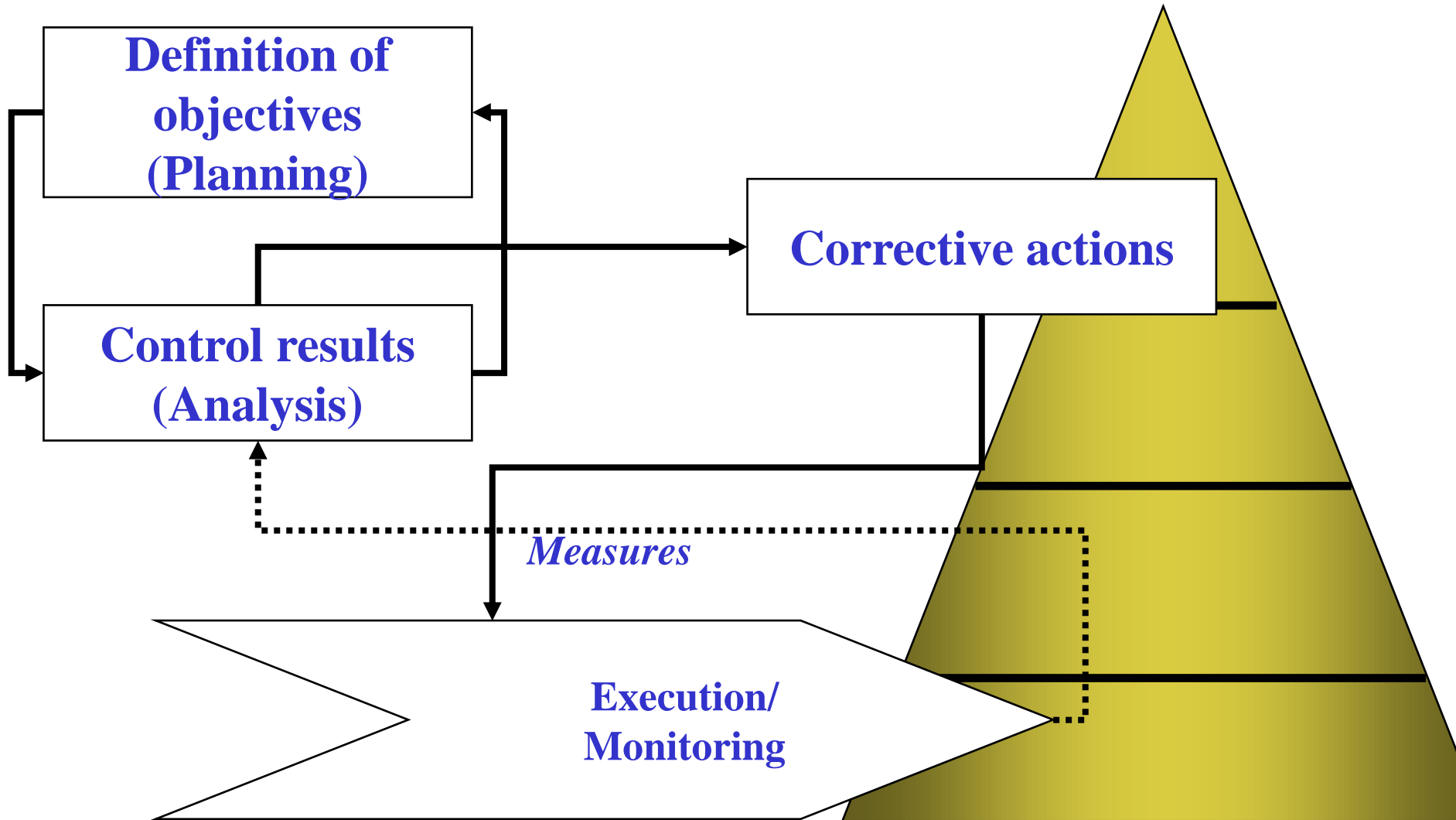
Accounting
Resources management (human, investments, estate)
Business support: (IT, general services)
...

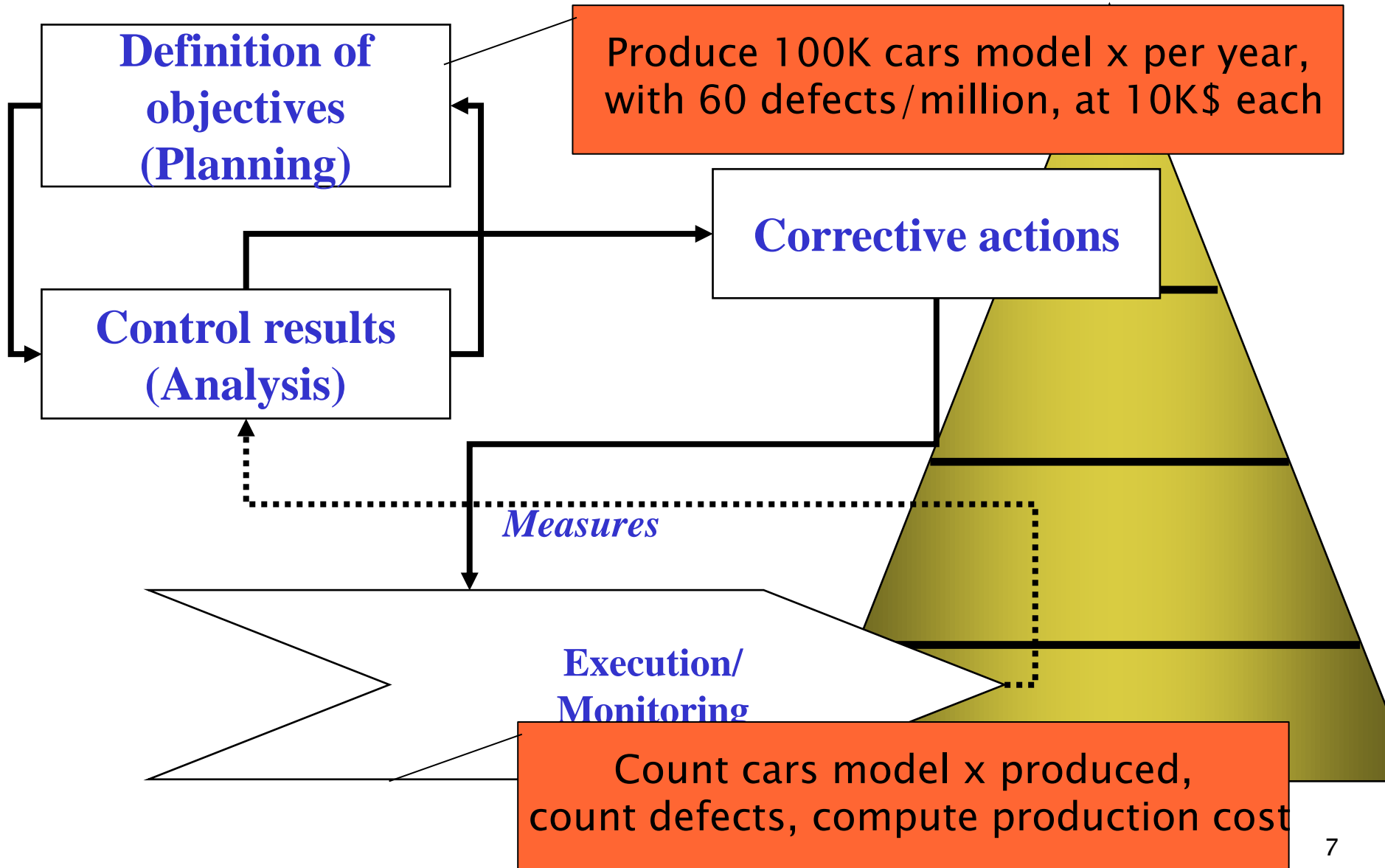
GOAL: Provide services to the organization and comply with law obligations



Management Cycle

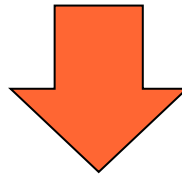




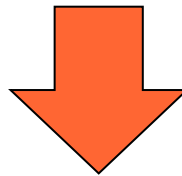


-
- Management and Strategic level IS should support managers in
 - ◆ monitoring and controlling the organization
 - ◆ Using few, reliable indicators
 - How to define these indicators?

Strategy, goals



Indicators



Measures

Indicators and measures

- Indicators
 - ◆ High level
- Measures
 - ◆ Detailed, possibly objective and repeatable
- One indicator → many measures
 - ◆ Ex: indicator = brand recognition
 - Measures:
 - % population aware of brand
 - number of announces in press

Measurement

*the process of empirical
objective assignment of
numbers to **entities**, in order
to characterize a specific
attribute thereof*

Measure

- Attribute of an entity
- Typical entities in organization
 - ◆ Resource
 - Ex. Employee, machine, web server
 - Ex of measures: age, salary of employee
 - ◆ Activity
 - Ex. Design, production
 - Ex. duration of design / cost of design
 - ◆ Product /service
 - Ex. Car, Book, Insurance
 - Ex cost of Car, defects of Car

Examples of measures

Entity	Attribute	Measure
Person	Age	Year of last birthday
Person	Age	Months since birth
Car	Cost	Euros, Dollars
Car	Weight	Kilograms
Car	Reliability	Number of defects per year
Car production process	Duration	Time in hours from start to finish
Car production process	Quality	Average number of defects found per car

Variants of measure

- Estimated value: what is forecasted
 - ◆ Ex estimated duration for car production: 15 days
- Actual value: what is real
 - ◆ Ex actual duration for car production: 17 days
- Target value: what is desirable
 - ◆ Ex target duration for car production: 12 days
- Benchmark: what the others do
 - ◆ Ex benchmark duration for car production: 14 days

Measurement process

- 1.1 Define / modify indicators / measures
 - ◆ Using approaches such as Management accounting, CSF, KPI
- 1.2 Verify
- 2.1 Collect and store
 - ◆ Strongly based on IS
- 2.2 Present, use day by day
 - ◆ IS and HMI definition
 - ◆ Dashboards
- 3 check if useful and used, goto 1

Measurement Process

- Not one shot
 - ◆ A continuous trial and err process
 - ◆ Step 1.1 From literature, experience, staff in company

1.2 Verify proposed indicator/measure

- Simple, understandable?
 - ◆ Users understand its meaning?
- Meaningfulness:
 - ◆ does it measure what it is supposed to measure?
- Cost
 - ◆ Cost and delay to process
 - ◆ Cost and delay to collect raw data
 - ◆ Initial and incremental
- Coverage
 - ◆ How much the measure covers the indicator
- Frequency /Obsolescence
 - ◆ How often the measure changes (and has to be recomputed)
- Objectivity
 - ◆ How much the indicator is objective/not ambiguous

Coverage

Indicator	Measure	Measure	Measure	
	% population knows brand	N announcements in press	N Customer complaints	
Brand recognition	x	x	–	
Product excellence	–	–	x	

1.2 Warning

- In this field most measures are unprecise
 - ◆ Ex effort collected via timesheets
 - ◆ Ex indirect costs
- Or expensive to collect and analyze
 - ◆ Ex Questionnaires
- Or subjective
 - ◆ Ex Questionnaires

But something is better than nothing..

1.2 Dimensions

- Or segmentation:
 - ◆ factor to which indicator is associated and therefore
 - ◆ Factor the indicator can be aggregated on

Common dimensions

- Time window
 - ♦ Sales per hours/per day/per month ..
- Hierarchical node in organizational – geographical structure
 - ♦ Sales per country/per region/per shop
 - ♦ Expenses per company/per division/per group/per person
- Product / product category
 - ♦ Sales per phone xy / per business phones
- Customer/ customer category
- Activity in process
 - ♦ Cost per design / production
 - ♦ Defects from design/ from production
- Project
 - ♦ Cost per project
 - ♦ Defects per project

2 Design, Implement

- Data collection
 - ◆ Human based
 - ◆ Automatic
- Data storage
 - ◆ DB schema
- Measure computation
- Measure presentation

Key problems

- Having indicators (and measures) that are
 - ♦ Useful
 - ♦ Reliable
 - ♦ Can be collected at reasonable cost

Approaches to define indicators

Approaches

- Management accounting
- CSF
- KPI
- Balanced scorecards (BSC)
- (Customer and market profiling)
- (Strategic analysis methods)

Approaches

Financial performance monitoring	Process performance monitoring	Customers and market monitoring	Innovation and critical resources monitoring
CSF (Critical Success Factors)			
Management Accounting	KPI & SCOR	Customer profiling & Market analysis	Strategy Management Matrix
BSC (Balanced Score Cards)			

Management accounting

Accounting

- Accounting
 - ◆ Focuses on cost, revenues, cash flow, investment, capital, return of investment
 - ◆ Financial accounting
 - Public data, accounting standards and laws
 - Historical perspective
 - ◆ Management accounting
 - Private, sensible data
 - Fit for use of company/managers (no standards)

Accounting

- Expenses
 - ◆ Cost for the organization
 - Fixed vs variable (see later)
- Revenue
 - ◆ Income for the organization
- Accounts receivable
 - ◆ Invoices issued to customers
- Accounts payable
 - ◆ Invoices received by suppliers

- Liquidity
 - ◆ Money available for the organization at a certain time
- Net income
 - ◆ Total revenues – total expenses

- Asset: what is owned
 - ◆ Current: will be converted to cash within one year
 - Cash, inventory, account receivable
 - ◆ Fixed: provide benefit on $>$ one year
 - Machinery, real estate, land
- Liability: what is due
 - ◆ Current: payable within one year (also called opex)
 - ◆ Long term: payable over $>$ one year (also called capex)

■ Liability

◆ Operating expenditure (OPEX)

- Recurring expenses for day by day operation
 - Rents, bills
 - Wages and salaries
 - Interest on debt

◆ Capital expenditure (CAPEX)

- Investments that benefit the company for more than one fiscal year
 - Machinery, real estate
 - Vehicles
 - Patents

Capex vs opex are treated differently

taxation is different

CAPEX implies depreciation or amortization

- Depreciation

- ◆ For tangible assets

- Ex vehicle, machinery

- ◆ Value of asset decreases each year in balance sheet

- Amortization

- ◆ For intangible assets

- Ex patent copyright

- ◆ Cost of asset is spread over its lifecycle

-
- Equity
 - ◆ Assets – liability

- Cash flow
 - ◆ Sum of cost – sum of revenues over a certain period (3 – 6 – 12 months)
 - Positive or negative
- Operating profit
 - ◆ Sum of invoices issued – sum of invoices received over a period
 - operating profit and cash flow are NOT the same
 - There is a delay between issue of invoice and its payment
 - Some invoices may never be paid

- Profitability

- ◆ Net profit margin =
$$\text{Net income} / \text{revenues}$$

- ◆ Operation profit margin
$$\text{Net income} + \text{taxes} + \text{interests} / \text{revenues}$$

- ◆ EBITDA

- Earnings Before Interest Taxes Depreciation
Amortization

Net income / net profit margin

	Revenues	Expenses
sales	50000	
suppliers		30000
rent		1000
salaries		3000
depreciation		500
interest		200
amortization		500
taxes		4000
Total expenses		39200
Net income	$50000 - 39200 = 10800$	
Net profit margin	$10800 / 50000 = 21.6\%$	

Operation profit margin

	Revenues	Expenses
sales	50000	
suppliers		30000
rent		1000
salaries		3000
depreciation		500
interest		200
amortization		500
taxes		4000
		35000
Operation profit	$50000 - 35000 = 15000$	
Op profit margin	$15000 / 50000 = 30.0\%$	

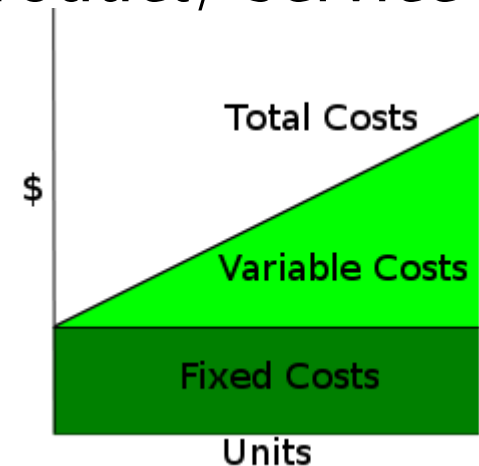
EBITDA

	Revenues	Expenses
sales	50000	
suppliers		30000
rent		1000
salaries		3000
depreciation		500
interest		200
amortization		500
taxes		4000
EBITDA	$50000 - 34000 = 16000$	

-
- Balance sheet
 - ◆ Summary of assets, liabilities and equity at a certain time

Management accounting

- Cost accounting
 - ◆ Budget and actual cost of operations, processes, departments, products
 - ◆ Analysis of variances and profitability
 - ◆ UNIT COST (of product / service)
- Direct and indirect costs
 - ◆ Direct: directly traceable to a product/ service sold to customer
 - ◆ Indirect: all others
- Fixed and variable costs
 - ◆ Fixed: do not depend on number of units produced
 - ◆ Variable: depend on..



Fixed / variable costs

- Car manufacturing company
- Fixed:
 - ◆ Infrastructure (factory buildings, long term contract personnel, machinery)
- Variable
 - ◆ Cost of raw materials and parts (tyres, iron,..)
 - ◆ Cost of energy
 - ◆ Short term contract personnel

Direct and indirect

- Car manufacturing company
- Direct
 - ◆ Car components and materials
 - ◆ Labor, energy to manufacture
- Indirect
 - ◆ Machines to manufacture car (if they are shared with other models)
 - ◆ Effort to design, advertise
 - ◆ HR, purchase (horizontal activities)

How to allocate indirect costs?

- Option1
 - ◆ Proportional to number of elements manufactured
- Option2
 - ◆ Activity based costing

Activity based costing

- A technique in management accounting
- Developed to overcome problems in proportional
- Requires to collect precisely (activity per activity) how costs are split

Car manufacturing

- Design costs for model A
- Research and development center, working for all models – costs 50M per year 2010
- Company produces
 - ♦ 3M cars model A
 - ♦ 2M cars model B

-
- Design cost – proportional
 - ◆ $50\text{M} / (3+2) \text{ M} = 10 \text{ euro /car}$
 - Design cost – activity based
 - ◆ Compute how much effort (time) was spent by R & D per activity (per model)
 - 75% of time for model B
 - 25% of time for model A
 - ◆ Model A = $(0.25 * 50) / 3\text{M} = 4\text{euro/ car}$
 - Model B = $(0.75 * 50) / 2\text{M} = 17\text{euro/ car}$

Activity based costing

- Activity based costing
 - ◆ From indirect (taxes, administration, security) to direct costs (traceable to product or service)
 - ◆ Allocates cost of each activity/resource to product and services in function of actual consumption
 - ◆ Aims at knowing true cost of product/service, identify profitable ones, define selling costs

Cost of a car – example

	indirect	direct	Per car
Design		50M	$50\text{M} / 1\text{M} = 50$
Advertising		40M	$40\text{M} / 1\text{M} = 40$
Production	300M (factory and machines)	4000 (physical parts, labor, energy)	$300/1\text{M} + 4000 = 4300$
Total			$50 + 40 + 300 + 4000 = 4390$

- The actual cost can be computed only when the number of cars produced is well known
- Otherwise the estimated cost can be computed, estimating number of cars produced (1M in the example) and all other costs

Cost of a car – example2

	indirect	direct	Per car
Design	10M (25% of 40)	50M	$60\text{M} / 1\text{M} = 60$
Advertising	1M (10% of 10)	40M	$41\text{M} / 1\text{M} = 41$
Production	300M (factory and machines)	4000 (physical parts, labor, energy)	$300 / 1\text{M} + 4000 = 4300$
Total			$60 + 41 + 300 + 4000 = 4401$

- Design has two parts: 40M to design the platform common to many models. Of these 25% can be attributed to a specific model X. 50M are specific to model X
- Advertising has two parts 10M to advertise the brand. Of these 10% can be attributed to model X. 40M are specific to advertise model X

Direct indirect vs. fixed variable

- Car, production
 - ◆ Tyres – direct, variable
 - ◆ Energy bill
 - Partially direct and variable (energy for machines), partially indirect and fixed (lights, heating for factory)
 - ◆ Salary of personnel
 - Partially direct (effort to manufacture product)
 - Partially indirect (ex time spent in learning, meetings)
 - Partially 2x indirect (horizontal functions: HR, IS)
 - Mostly fixed (long term personnel)

How to allocate costs

- Personnel
 - ◆ Time sheets
 - ◆ Every day, person allocates work to activity or product

- Resources
 - ◆ (building) (materials) (money)
 - ◆ Trace usage to activity or product

Time sheet, example

ID: Name: Surname: Dept:		Week:			
	mon	tue	wed	thu	fri
Task / project ID					

Time sheet, example

ID: Name: Surname: Dept:		Year: 2018 Week: 44			
Task / project ID	mon	tue	wed	thu	fri
Project X	4				
Project Y	4				8
Training				8	
Vacation / Leave		x			
Sick			x		

Personnel cost

- Salary (direct cost)
 - ◆ Average, or
 - ◆ Specific for person
- Overheads (indirect costs)
 - ◆ Office cost (rent, electricity, cleaning, heating, telephone, network)
- Ex
 - ◆ Average salary: 50K / year
 - ◆ Average overhead: 30%
 - ◆ Average personnel cost: 65K / year

FTE

- Employee works full time on a process
- Employee works part time on a process
- FTE: Full time equivalent
 - ◆ Virtual number of employees working full time on a process
 - ◆ Ex: 10 employees working 30% on process A → 3 FTE are working on process A

CSF

CSF

- Critical success factors [Rockart 79]
- Concept
 - ♦ Few areas (4–5) in a company are responsible for business success (or failure)
 - ♦ They should be monitored constantly
- CSF refer to internal areas, not objectives or targets
 - ♦ Ex. company objective: be market leader
 - ♦ Ex. company target : acquire 25% of market share in year xx

CSF

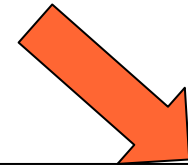
- CSFs should be considered in organization strategy

CSF – levels

- CSF exist at different levels, following org structure
 - ◆ Corporation
 - ◆ Function
 - Production, product design, etc
 - ◆ Role
 - Manager

CSF – example (automotive)

- Corporation
 - ◆ C1 Brand recognition, image
 - ◆ C2 Dealers network
 - ◆ C3 Equipment of cars
 - ◆ C4 Reliability of cars
 - ◆ C5 After sales service



- Function (manufacturing)
 - ◆ CM1 Production costs (from C3)
 - ◆ CM2 Quality of product (from C1, C3, C4)
 - ◆ CM3 Environment issues (C1)
 - ◆ CM4 Relationship with trade unions (C1)
- Manager (quality manager)
 - ◆ Skills of technicians (from CM2)
 - ◆ Process certification (CM2, CM3)
 - ◆ Technology for monitoring quality (CM2)

- Function (marketing)
 - ◆ CF1 Design of dealers shops (from C1)
 - ◆ CF2 Quality of dealers service (from C1, C2, C5)
- Manager (sales manager)
 - ◆ Quality of dealers service (from CF2)

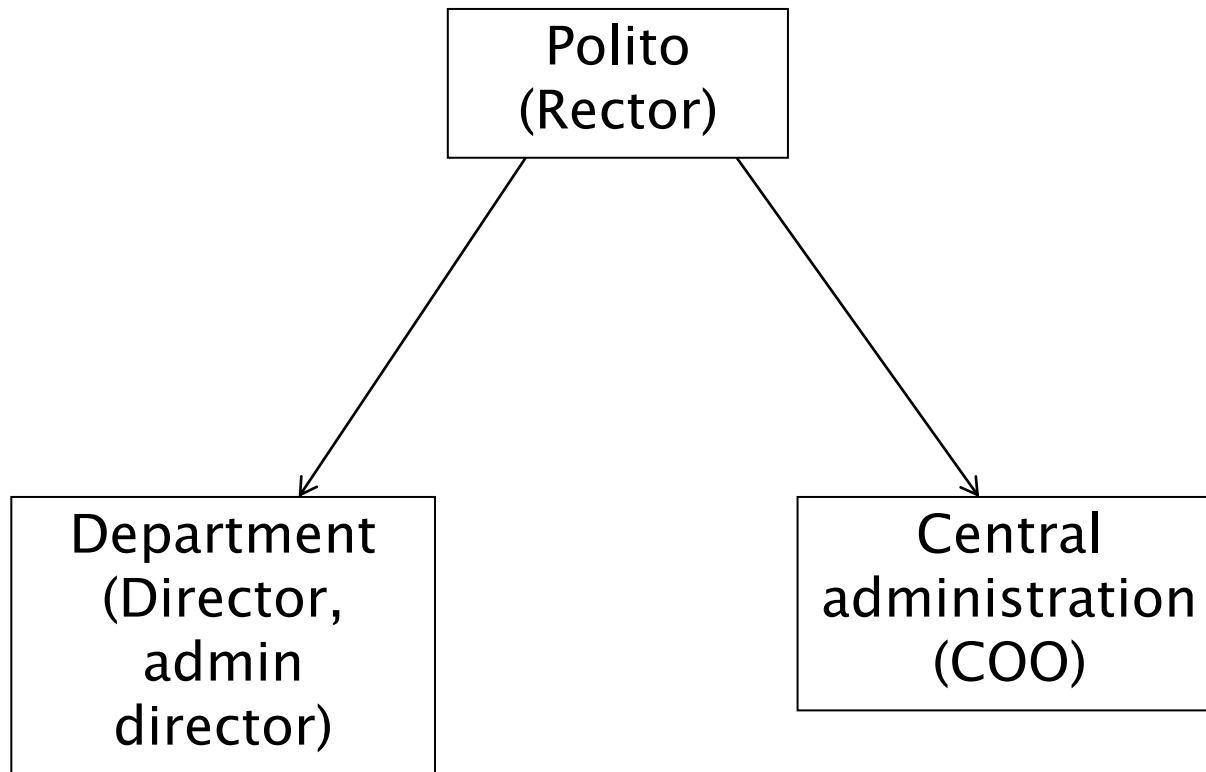
CSF types

- From business domain
 - ◆ Key areas for all companies in same business domain
 - ◆ Ex: cost for PC manufacturers, skill of personnel for consulting companies
- From competitive factors within business domain
 - ◆ Factors that differentiate company from others
 - ◆ Ex: for airlines, low cost vs. quality of service
- From environmental factors
 - ◆ Constraints from outside such as norms, rules, standards
 - ◆ Ex.: for car manufacturers, EuroX pollution norms
- From contingency factors
 - ◆ Temporary constraint
 - ◆ Ex.: merge IS of two companies after financial merge/acquisition
 - ◆ Ex.: recover brand reputation after failures (see Benz Class A, VW dieselgate)

CSF descriptor

- Name
 - Ex. Brand recognition
- Description
 - Ex. How well the brand is known by a sector of population in a geographical area
 - Ex. How the brand is associated to a product or service
- Type
 - ◆ Business domain, competitive, ..
- Level
 - ◆ Corporation, function, ..

Ex. Polito



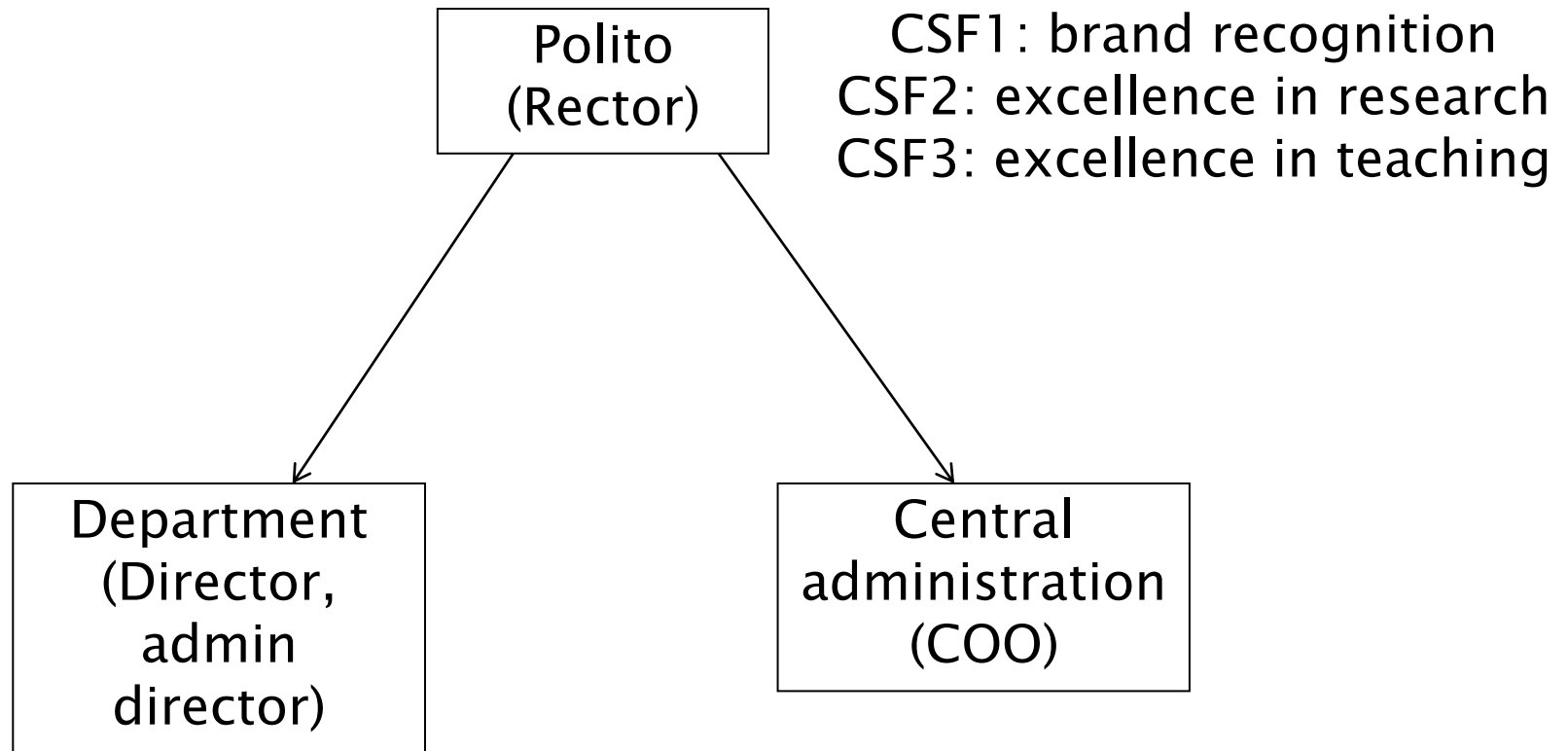
CSF – Rector

- Research university
 - ◆ Vs teaching university – distinguishing factor
- Research excellence
 - ◆ Common for the domain
- Teaching excellence
 - ◆ Common for the domain
- Brand recognition
 - ◆ Common for the domain

CSF – Rector

- Distant learning vs. On campus
 - ◆ Distinguishing
- Transition 509 law to 270 law
 - ◆ Contingency
- 270, Bologna system
 - ◆ Environmental

Level 1: Polito



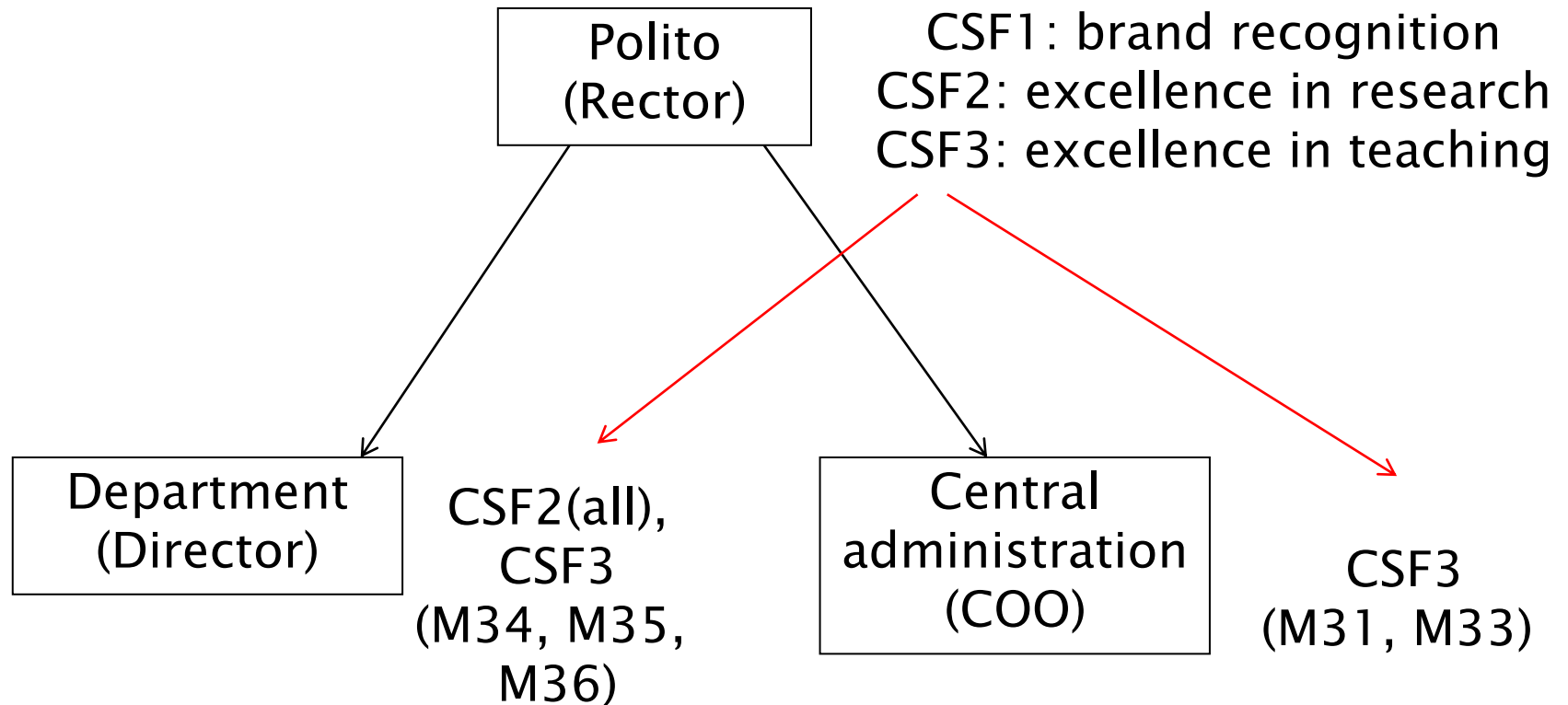
CSFi → measures

- CSF1 Brand recognition
 - ◆ M11 Good/bad press/tv/internet news
 - ◆ M12 Recognition of the city/region
 - Food, pollution, sport, security,
 - ◆ M13 Number of students (and its variation)
- CSF2 Research excellence
 - ◆ M21 International rankings
 - (Publications, citations..)
 - ◆ M22 Number of awards (Nobel prizes, ..)
 - ◆ M23 International collaborations
 - ◆ M24 Value of research contracts
- CSF3 Teaching excellence
 - ◆ M31 Infrastructure (spaces, secretaries, canteen,)
 - ◆ M32 Housing, transports, life price
 - ◆ M33 Cost for student (Tuition fees)
 - ◆ M34 Capabilities of graduate students
 - ◆ M35 Capabilities of teachers
 - ◆ M36 Student satisfaction

CSF3 → measures

- Cost
 - ♦ M33 Tuition fees (and their trend)
- Quality
 - ♦ M31 Quality of infrastructure
 - M311 Ratio student/teacher
 - M312 Spaces (square meter / student)
 - M313 Labs (lab square meter / student)
 - M314 Video lessons (satisfaction of students)
 - M315 Libraries (lib square meter / student)
 - M316 Secretary services (satisfaction of students)
 - M3161 satisfaction of students
 - M3162 lead time to deliver service_x
 - ♦ M34 capability of graduates
 - M341 Delay to find a job
 - M342 Salary at first job / after 5 years (evaluate Alumni careers)
 - M343 Certification – success rate

Level 2:



Remarks

- Selection, decomposition, assignment of CSF is not algorithmic
 - ◆ Not unique, others are possible
- Continuous verification on the field and improvement is therefore essential (see measurement process)
- Some of the measures derived from CSF may correspond to KPIs (see later)

Remarks – 2

- CSF (and measures in general) can be linked with compensation (performance based compensation)
 - define annual target for employee
 - link annual bonus with achievement of target

KPI

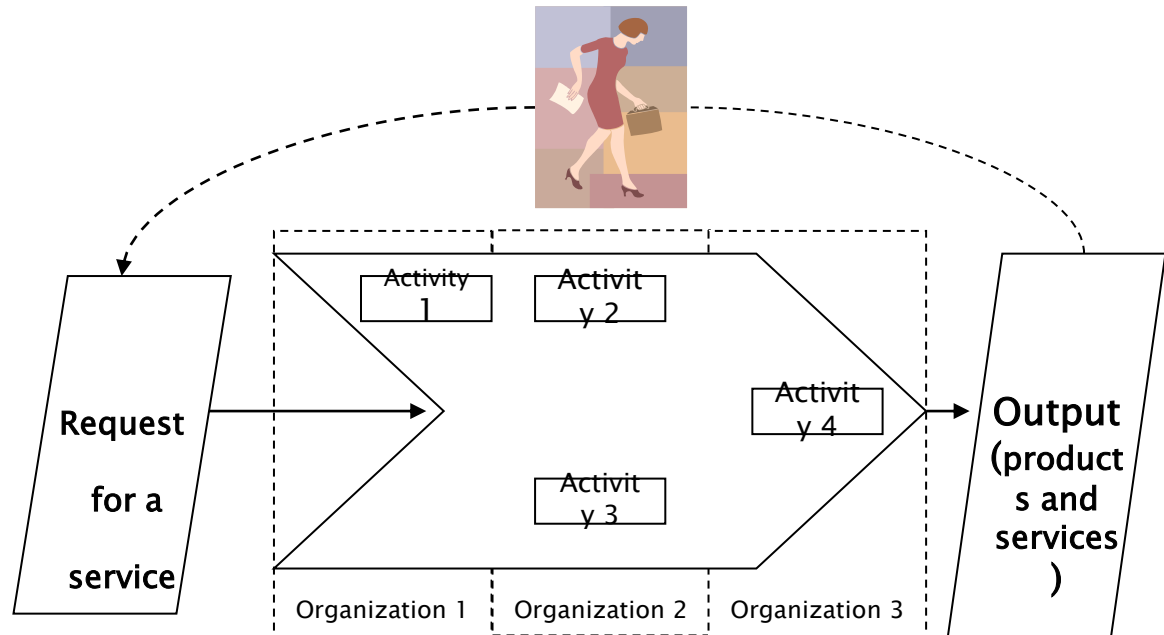
Key Process Indicator

KPI

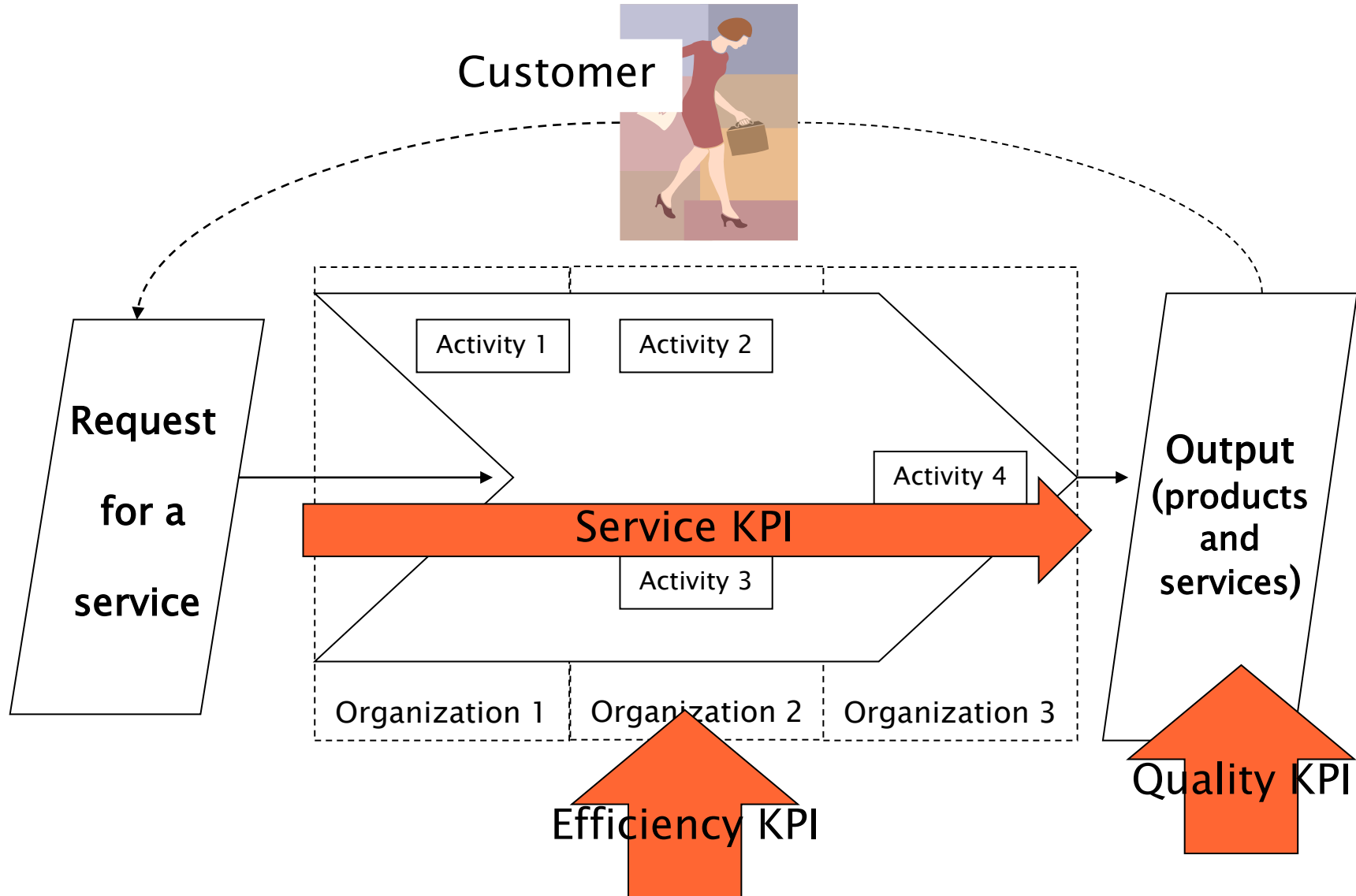
- Process perspective
 - ◆ Cfr CSF, focuses on areas
 - May correspond to process but in general wider and cross processes
 - ◆ Cfr financial indicators (traditional management accounting), focus on finance only
 - ◆ Cfr. SLA (service level agreement), ITIL, focuses on process

KPI

- Process view
 - ◆ Involves one or more hierarchical nodes
 - ◆ Financial and non financial indicators



KPI + CRASO model



KPI descriptor

- Name
 - ◆ Average delay to satisfy order (DO)
 - ◆ Average productivity of resource
- Definition
 - ◆ How the KPI is computed
 - DO_{11} : 30 / number of orders satisfied in month
 - Computed per calendar month: jan, feb, ..
 - DO_{12} : 30 / number of orders satisfied in month
 - Computed every day, for last 30 days
 - DO_2 : 365 / number of orders satisfied in year
 - DO_3 : $\text{average}_i(\text{delay to satisfy order } i)$
 - ◆ Measurement unit
- Type
 - ◆ General, service, quality, efficiency
- Segmentation

KPI – general framework

- General
 - ♦ Input volume
 - ♦ Output volume
 - ♦ Human resources
 - ♦ Non human resources (plants, machines, facilities)
 - ♦ Inventory
 - ♦ Other resources
- Efficiency
 - ♦ Cost per unit
 - ♦ Productivity of resources
 - ♦ Utilization of resources
- Quality
 - ♦ Conformity
 - ♦ Reliability
 - ♦ Customer satisfaction
- Service
 - ♦ Response time, Lead time
 - ♦ On time
 - ♦ Perfect orders
 - ♦ Flexibility toward customer

General KPIs

- Used as basis to compute the others
 - ♦ Volume, characterizes the number of requests (input) and the results (output) processed
 - ♦ Resources, characterizes the number and type of resources used (human, non human)
 - ♦ Inventory, characterizes the stock of components or products used

General KPIs – examples

General KPIs	Hotel reservation	Lift maintenance	Product sale supermarket	Book sale on web	Building licence (e-gov)
Input volumes	#of reservation requests, modif, delete	#urgent requests, #normal requests	#sales (person passing at register)	# orders	#licences requested
Output volumes	#reserved rooms	#services made	#invoices #products sold	# shippings # books sold	#licences issued
Human resources	#full time, part time employees	#personnel for maintenance (technical)	#personnel (at cash register, security)	#personnel for sales and distribution	#employees
Non human resources	Call center, reservation system , rooms and supplies	Reservation and dispatch system, tools	Sales building, storage building, products	CRM, call center, web site, storage building	Supporting IS
Inventory	#rooms	--	#products on shelves	#books	--
Other resources	--	--	--	--	Laws

Efficiency KPIs

- Cost per unit
 - ◆ Total cost/volume
- Productivity
 - ◆ Volume/resource
- Utilization
 - ◆ Used resource /available resource

General rule

- Cost per unit is low if
 - ◆ Productivity is high
 - ◆ Utilization is high

■ Politecnico

- ◆ Total cost = 200M /year
- ◆ Cost for teaching = 100M
- ◆ Number of students
 - Input = 30k
 - Output = 20k
- ◆ Cost per student = $200/20 = 10K$
 - Not correct, only cost for teaching is relevant
- ◆ Cost per student = $100/20 = 5K$
 - Using output volume is meaningful?
(providing classrooms and labs has a cost also for students who do not reach the degree)
- ◆ Tuition fee = ??
- ◆ Compare with benchmark

-
- Car manufacturer
 - ◆ Input volume
 - N Orders from customer
 - N internal orders
 - ◆ Output volume
 - N cars produced
 - ◆ Total cost = turn over
 - 20B
 - ◆ Number of cars produced
 - 2M
 - ◆ Cost per unit = $20B / 2M = 10K$

Efficiency KPIs

	Unit cost	Productivity	Utilization
Input/output	Cost per unit of input Cost per unit of output	--	--
Human resources		Output/ # employees	
Non human resources		Output/ resource (ex # machines)	Used capacity / available capacity
Inventory		Sales/ stock	Load factor
Time		Time to produce service)/output	Time to service/ total time
Information	Amount information/ output		Amount information / total amount information

Efficiency KPI – examples

Eff KPIs	Hotel reservation	Lift maintenance	Product sale supermarket	Book sale on web	Building licence (e-gov)
Cost per unit	$\frac{\text{Total cost (call center)}}{\text{\# reservation requests}}$ $\frac{\text{Total cost (call center)}}{\text{\# reserved rooms}}$	#	$\frac{\text{Totalcost(registers)}}{\text{\# person passing at register}}$ $\frac{\text{Totalcost(registers)}}{\text{\# products sold}}$ $\frac{\text{Totalcost(registers)}}{\text{\# invoices}}$		
Productivity = $\frac{\text{Volume}}{\text{resource}}$	$\frac{\text{\#reservation request}}{\text{\#employees}}$ $\frac{\text{\#reserved rooms}}{\text{\#employees}}$		$\frac{\text{\#Invoices}}{\text{\#employees}}$ $\frac{\text{\#products sold}}{\text{\#employees}}$		
Utilization=	$\frac{\text{\#hours worked(call center)}}{24\text{hrs}}$ $\frac{\text{\#hours worked (human resource)}}{8\text{hrs}}$		$\frac{\text{\#hours worked(register)}}{\text{open hours for shop}}$ $\frac{\text{\#hours worked (human operator)}}{8}$		

- Politecnico

- ◆ Output volume / teachers

- $$\frac{\text{\#graduated students}}{(\text{\#administrative staff dedicated to teaching activities} + \text{\#teachers})}$$

- Car manufacturing
 - ◆ Efficiency1
 - Cars produced / employees
 - ◆ Efficiency2
 - Cars produced / factories
 - ◆ Efficiency3
 - Cars sold / cars in inventory
 - ◆ UtilizationStaff
 - Hours worked per day / 8
 - ◆ UtilizationFactory
 - actualProduction/potentialProduction
 - 500 cars produced/1000 cars could be produced

- Compare

- ◆ Volume input AND Volume output
 - ◆ If similar, not important which is used
 - ◆ If not, then decide case by case
-
- ◆ Reservation request/rooms sold
 - ◆ Person passing at register/ invoices
-
- ◆ Products sold/invoices

Quality KPIs

- **Conformity**
 - ◆ With defined service/product description
 - ◆ Non conform items/total # items
 - ◆ Items
 - Input requests (from customer)
 - Intermediate output
 - Final output (defects, complaints from customer)
- **Reliability**
 - ◆ Probability that product /system satisfies its function after time T
 - ◆ MTTF – mean time to failure
 - ◆ MTTR – mean time to repair
 - ◆ MTBF – mean time between failures (= MTTF + MTTR)
- **Customer satisfaction**
 - ◆ Satisfaction through interviews/questionnaires
 - Qualitative scales (very high, high ..)

Quality KPIs

	Quality in input	Quality internal	Quality in output
Conformity	Non conform requests	Number of defective products / total Number discarded/re worked items Cost/effort for rework	
Reliability		MTTF MTBF MTTR	MTTF MTBF MTTR
Satisfaction			Number satisfied

Quality KPIs – example

Quality KPIs	Hotel reservation	Lift maintenance	Product sale supermarket	Book sale on web	Building licence (e-gov)
Conformity	#reservations with problems/ #reserved rooms Problems = wrong date, wrong room type, wrong location ..				
Reliability	#lost reservations/ #reserved rooms		#wrong invoices/ #invoices Wrong = missing product, added product, wrong price of product		
Satisfaction	Interviews to customers Complaints from customers Social networks analysis		Interviews to customers Complaints from customers		

Conformity

- How much the product /service is close to its specification
- Defect: case when product is NOT respecting the specification

Service KPIs

- Lead time (or response time)
 - ◆ Time to satisfy order, from reception of order to delivery of good/service
 - To be checked in normal / peak periods
- Punctuality
 - ◆ delay = actual lead time – nominal lead time
 - ◆ Average delay
 - ◆ #delayed orders
- Perfect orders
 - ◆ On time and within specifications
- Flexibility towards customer
 - ◆ # modified orders/ total # orders
 - ◆ value modified orders/ total value of orders
 - It is NOT internal flexibility = how internal resources can respond to changes in mix/number of orders

Service KPIs – example

Service KPIs	Hotel reservation	Lift maintenance	Product sale supermarket	Book sale on web	Building licence (e-gov)
Lead time (customer view, with queues)	$T \text{ service customer} = t \text{ end call} - t \text{ answer call center}$		$T \text{ service customer} = T \text{ invoice issue} - t \text{ queue start}$		$T \text{ licence issue} - T \text{ licence request}$
(producer view no queues)	$T \text{ service operator} = t \text{ end call} - t \text{ operator answer}$		$T \text{ service cashier} = T \text{ invoice issue} - t \text{ scan first product sold}$		
Punctuality					$T \text{ licence issue} - T \text{ licence issue estimated}$
Flexibility					
Perfect orders					

Example

- First year subscription to MS
- Input: request for subscription
- Output: subscription accepted
- Efficiency kpis
- Quality kpis
 - ♦ $\# \text{requests not accepted} / \# \text{requests}$
 - ♦ $\# \text{requests not accepted because doc missing, and secretary did not tell upfront}$
- Service kpi
 - ♦ Time from request To acceptance

Processes and stakeholders

- Process has several stakeholders
 - ◆ Employee
 - ◆ Manager
 - ◆ Customer
- Process (and consequently KPIs) should be designed considering all stakeholders
 - ◆ Ex cost
 - Cost for employee: work fatigue
 - Cost for manager: financial cost
 - Cost for customer: price tag + cost for finding ordering and obtaining the product

KPIs and stakeholders

	Cost	Quality	Service
Operator	<ul style="list-style-type: none"> • T non value activity / T total • T occupied / T total • T info access 	<ul style="list-style-type: none"> • Conformance and internal reliability (System error rate) • Operator satisfaction 	<ul style="list-style-type: none"> • System response time by Operator process
Manager	<ul style="list-style-type: none"> • Unit cost • Resource Productivity • Resource saturation • Time saturation 	<ul style="list-style-type: none"> • Conformance (input & output quality) • Internal reliability (MTBF, MTTR) • Customer satisfaction 	
Customer	<ul style="list-style-type: none"> • Price / Supplier cost • Time and cost to get product or service 	<ul style="list-style-type: none"> • Conformance to request • Product/service reliability • Satisfaction 	<ul style="list-style-type: none"> • Response time, lead time • Timeliness • Perfect orders • Flexibility

Reminder – measrmnt process

Measurement process

- 1.1 Define / modify indicators / measures
 - ◆ Using approaches such as Management accounting, CSF, KPI
- 1.2 Verify
- 2.1 Collect and store
 - ◆ Strongly based on IS
- 2.2 Present, use day by day
 - ◆ IS and HMI definition
 - ◆ Dashboards
- 3 check if useful and used, goto 1

KPI Process as refinement of previous

- 1.1 Propose KPIs
 - ◆ 1.11 model processes
 - ◆ 1.12 for each process refine KPIs
 - 1.2 Verify
 - ◆ Check coverage vs CSF
- 2.1 Collect and store
- 2.2 Present
- 3 check if useful and used, goto 1

1.1.1 model processes

- Starting from models
 - ◆ SCOR
 - ◆ AP
 - ◆ Business domain specific

1.12 refine KPIs

- Using KPI descriptor
 - ◆ Name
 - ◆ Type
 - General, Efficiency, quality, service
 - ◆ Definition
 - ◆ Segmentation

1.2 Verify

- Are KPIs covering strategic areas?
 - ◆ Cross check with CSF
- Verify
 - Understandability
 - Cost
 - ...

Balanced scorecards (BSC)

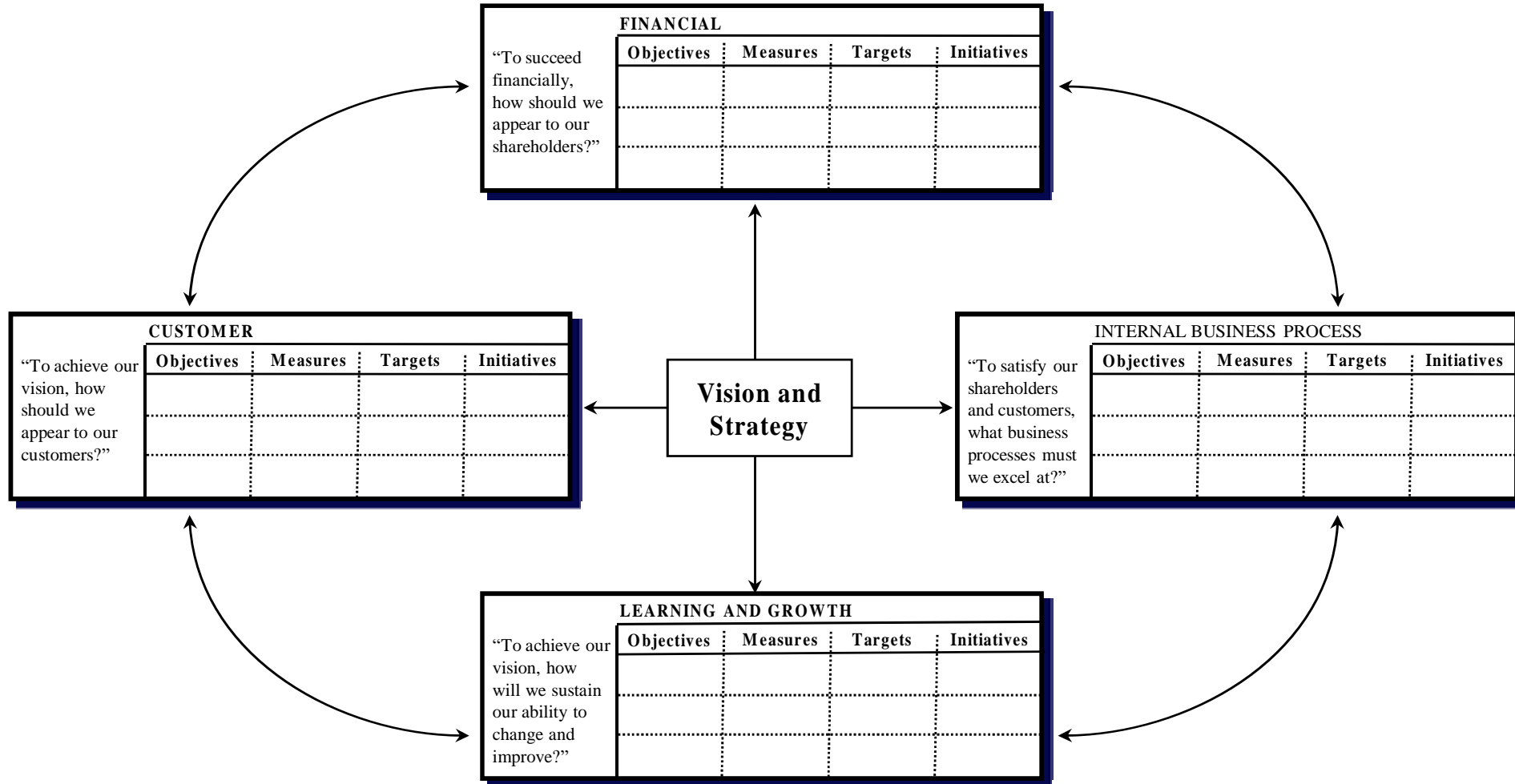
Balanced scorecards

- [Kaplan and Norton 1992]
- Financial perspective on company performance is limited
- Managers can only partially act on financial outcome of a company
- Better to focus on more perspectives

Perspectives

- Financial
- Customer
- Internal process
- Innovation and learning

Perspectives



Perspectives and indicators

- Financial
 - ◆ Cash flow
 - ◆ Return on investment
 - ◆ Financial result
 - ◆ Return on capital invested
 - ◆ Return on equity
- Customer (the value proposition)
 - ◆ Customer satisfaction
 - ◆ Returning customers
 - ◆ Market share
 - ◆ Quality

Perspectives and indicators

- Internal process (that deliver the customer value proposition)
 - ◆ Number of activities
 - ◆ Opportunities success rate
 - ◆ Accident ratios
 - ◆ Manufacturing indicators (loading, availability, performance quality)
- Innovation and learning
 - ◆ Investment rate
 - ◆ Illness rate
 - ◆ Internal promotions %
 - ◆ Employee turnover
 - ◆ Gender ratios

Dashboard BSC

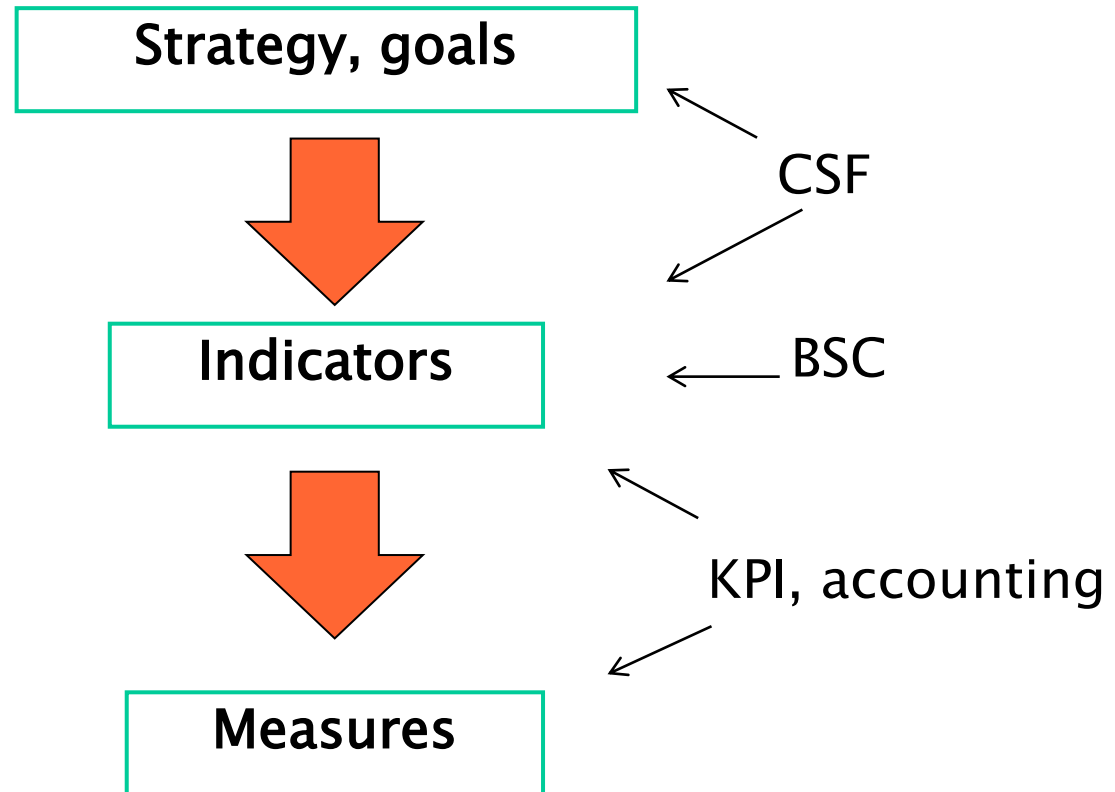
Financial perspective –turnover –ROI	Customer perspective
Internal processes	Innovation and learning

Summary

- Need to steer and control an organization (manage it) using (also) objective techniques
 - ◆ Indicators + measures to support management
 - Strategy definition (CSF, BSC)
 - Management cycle (KPI, BSC)
 - ◆ Definition + implementation + usage

- Disclaimer

- ◆ Management is much more than measures and indicators



Statistics – basics

Central tendency

- Dataset: age of people died of Covid 19

18, 20, 35, 35, 36, 40, 50, 60, 70, 71, 72,
75, 75, 75, 80, 80, 80, 81, 81, 82, 82, 82, 82

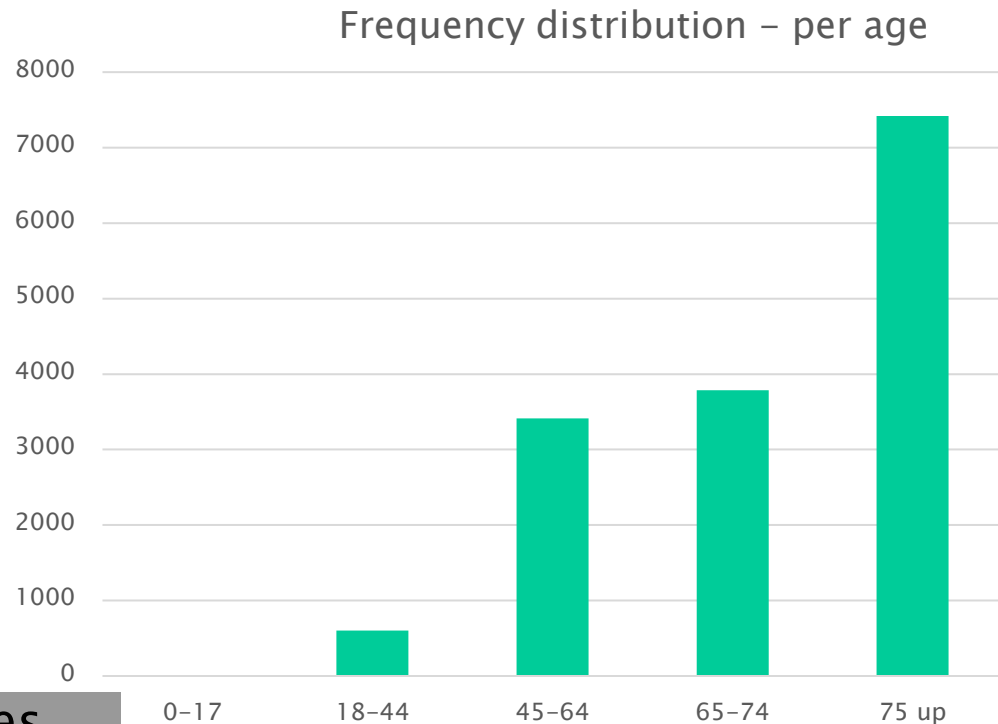
Mode: 82 item recurring more times

Median: 75 middle value

Mean: 63.5 sum of all / #items

Frequency distribution

0-17	9
18-44	601
45-64	3413
65-74	3788
75 up	7419

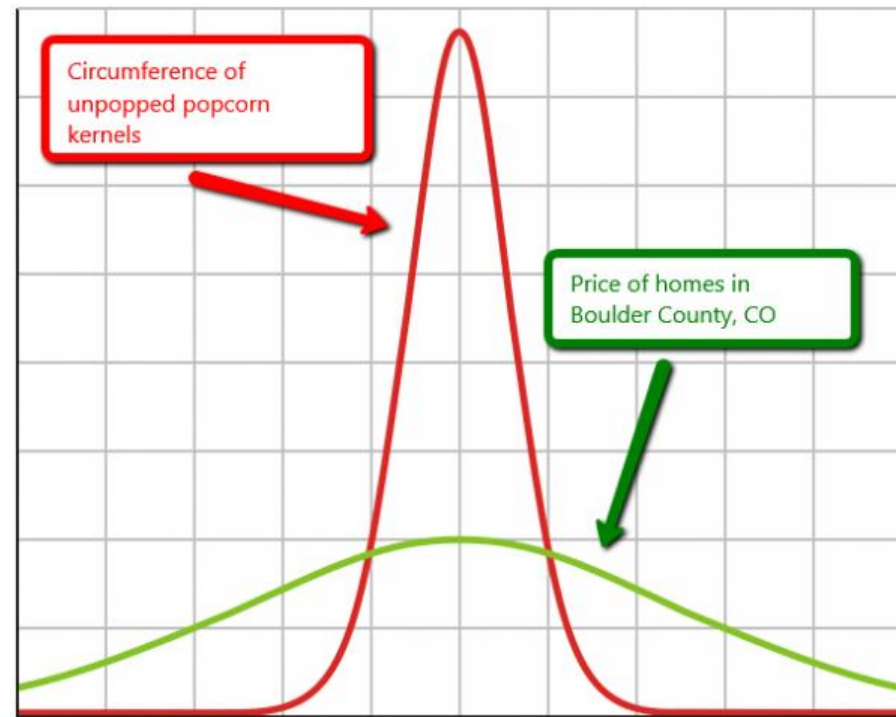


The goal is to find what ranges are most common in a dataset

Variance

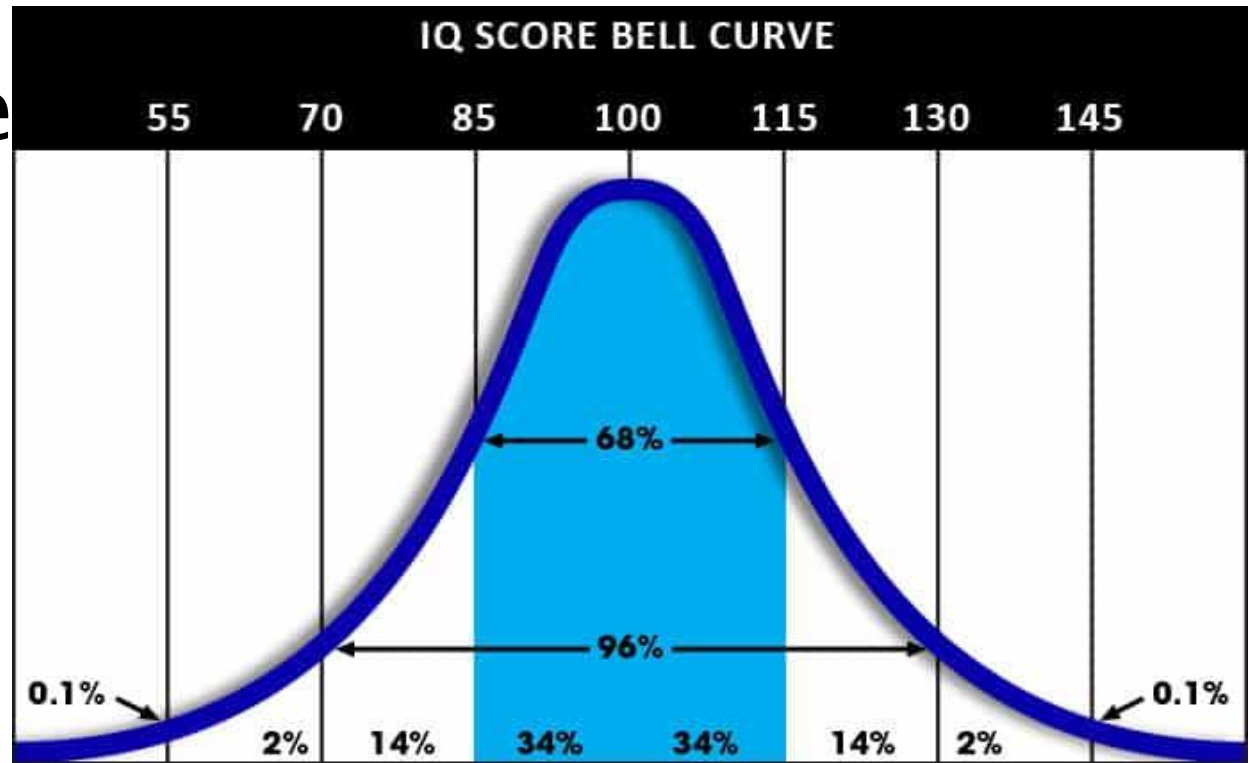
How the datapoints are spread out?

Standard deviation: depends on distance of each data point from the mean



Variance – IQ

Standard deviation



If the dataset is bell shaped mean and variance completely summarize it

Application to a process in a company

- Process: reimburse medical claim
- Data set (KPI): completion time (claim submitted to claim reimbursed)

Average time?

Frequency distribution?

Variance?

- Data set: processing cost per claim

Average?

Frequency distribution?

Variance?

These simple measures are typically used to analyze KPIs and control processes