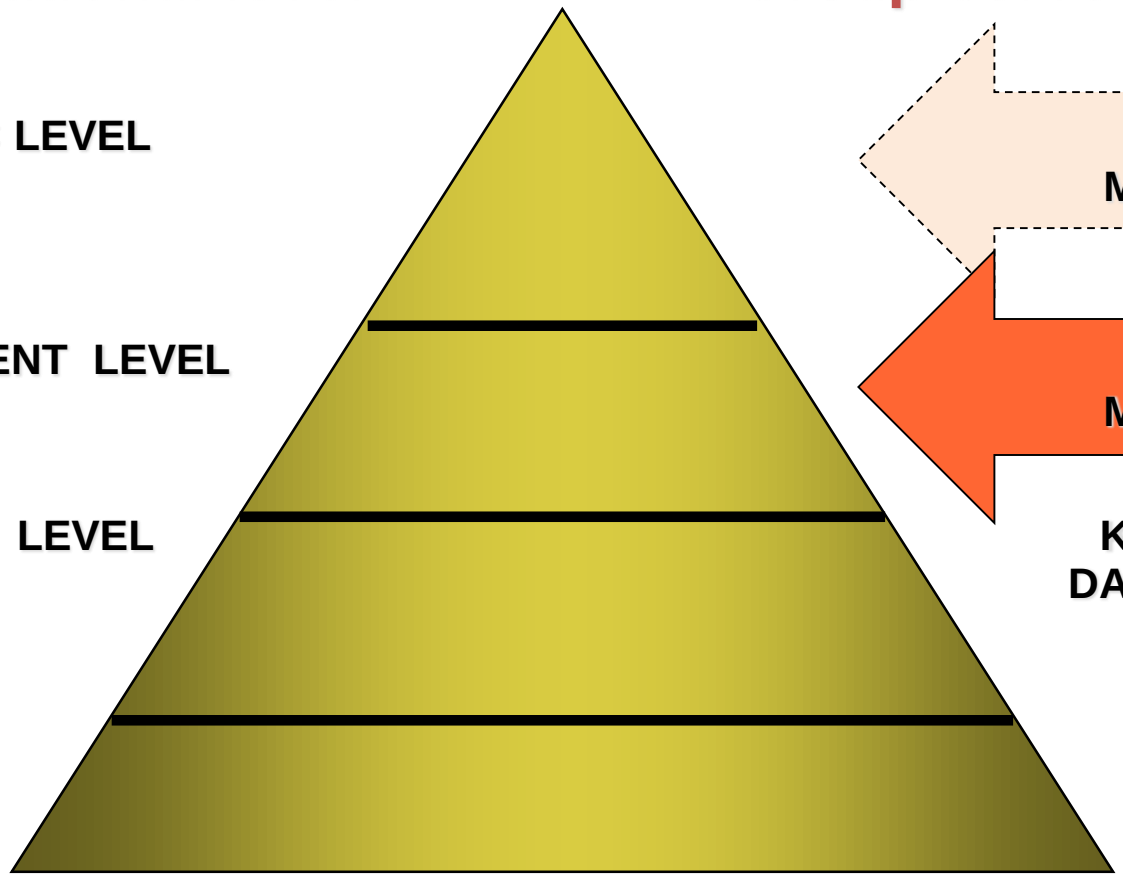
Management IS

SOftEng
http://softeng.polito.it

Version 5.1.1

Organizational level

Group served by IS



STRATEGIC LEVEL

MANAGEMENT LEVEL

KNOWLEDGE LEVEL

OPERATIONAL LEVEL

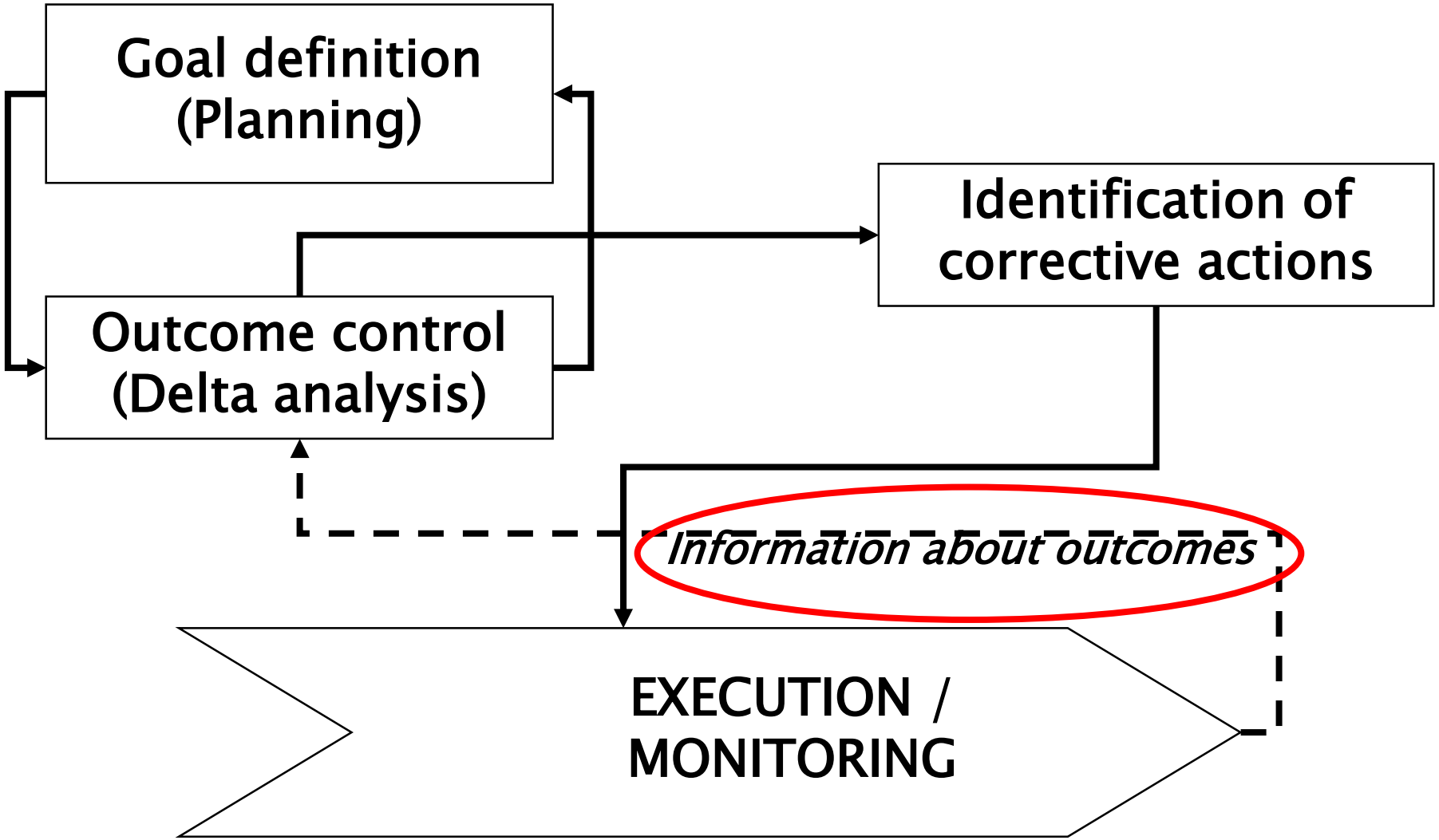
SENIOR MANAGERS

MIDDLE MANAGERS

KNOWLEDGE & DATA WORKERS

OPERATIONAL MANAGERS

Management Control



Guiding principle

What gets measured gets done

- Attributed to P. Drucker

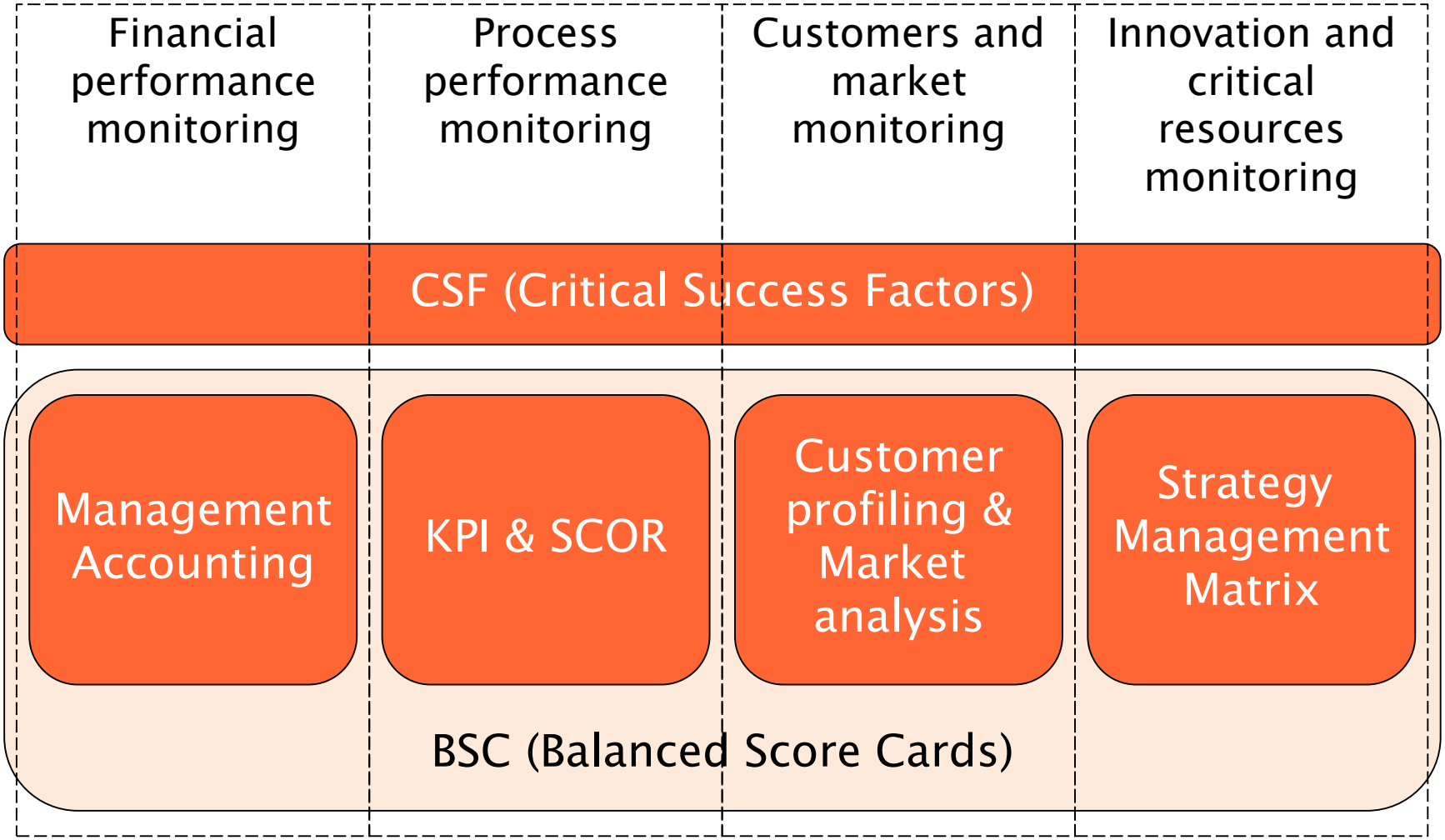
Indicators

- What gets measured, gets done
- Indicators are measures
- Management and Strategic level IS should support managers in
  - Monitoring and controlling
  - Using few, reliable indicators
- How to define the indicators?

Approaches

- Management accounting
- CSF
- KPI
- Balanced scorecards
- (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)

Warning

The more any quantitative social indicator is used for social decision-making, the more subject it will be to corruption pressures and the more apt it will be to distort and corrupt the social processes it is intended to monitor.

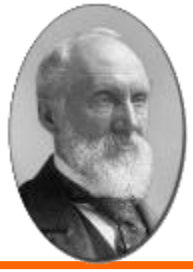
- Campbell's law

MEASUREMENT

Measurement

I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind.

If you can not measure it, you can not improve it.



William Thomson, 1st Baron Kelvin

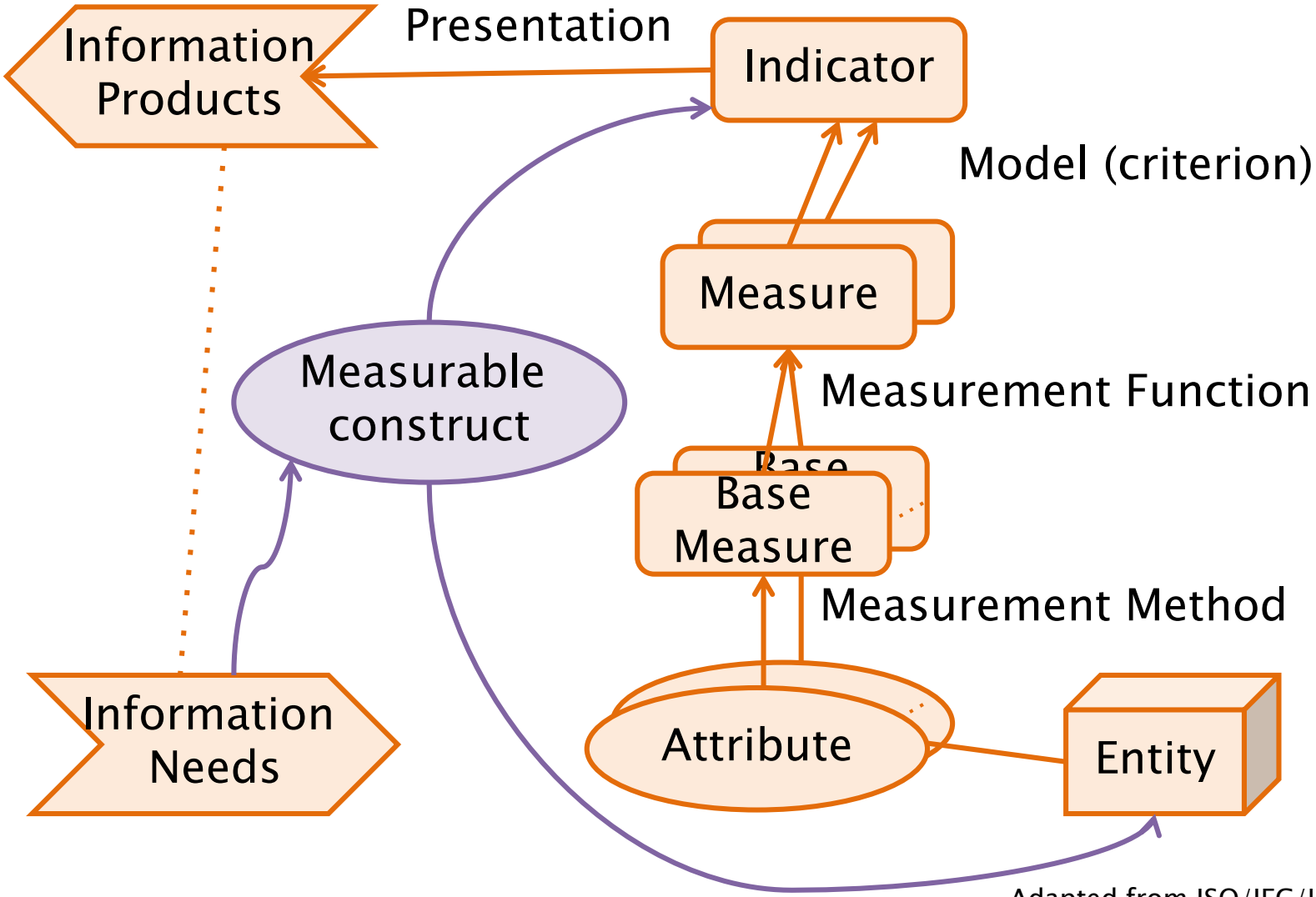
Measurement

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

Measurement

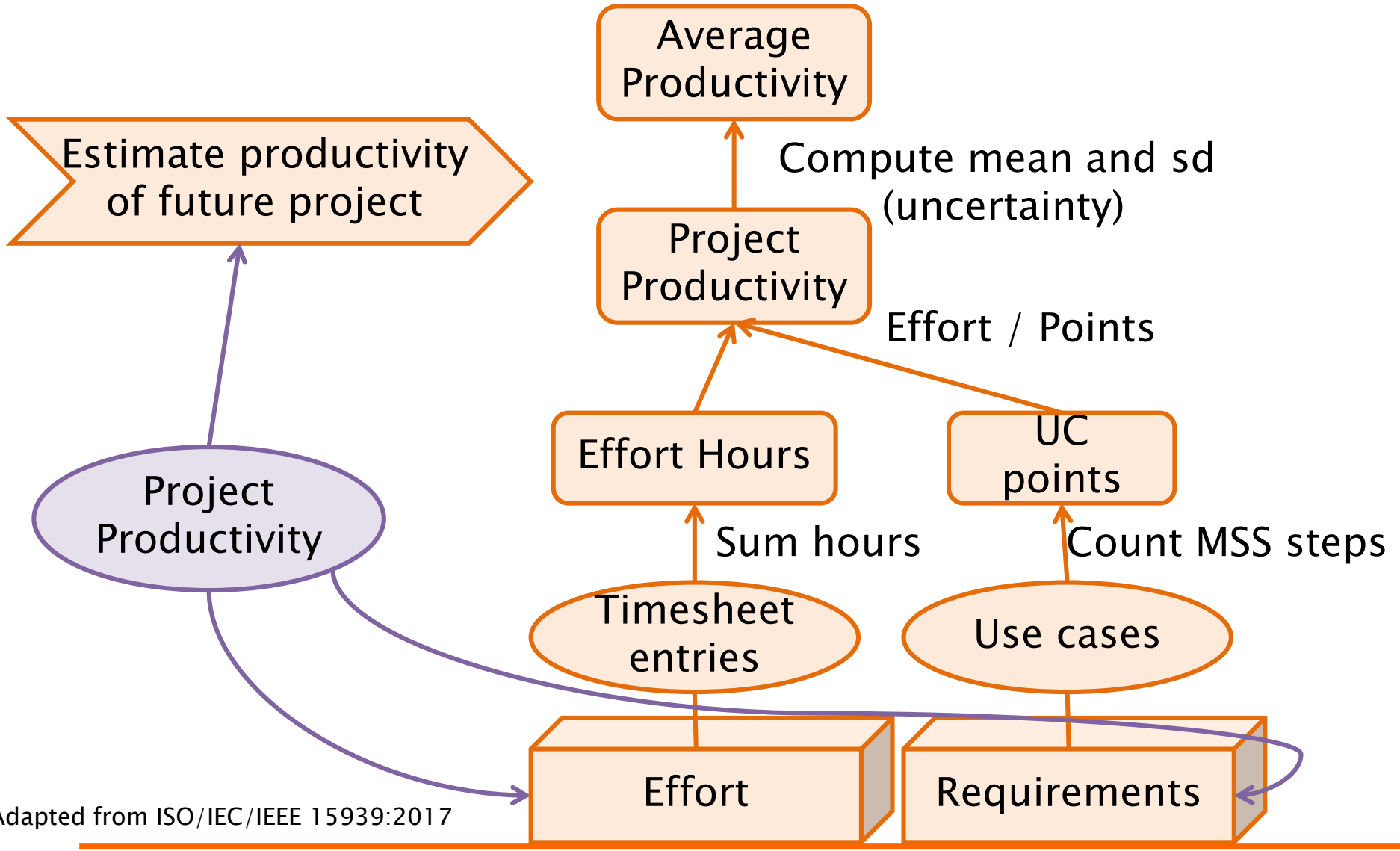
- Entity:
  - an object or event
- Attribute:
  - a feature or property of an entity
- Objective:
  - the measurement process must be based on well-defined rules whose results are repeatable

Measurement Conceptual Model



Adapted from ISO/IEC/IEEE 15939:2017

Measurement Example



Adapted from ISO/IEC/IEEE 15939:2017

Terms

Measure (noun): variable to which a value is assigned as the result of measurement.

Measure (verb): Make a measurement.

Measurement: The process of assigning a number or category to an entity to describe an attribute of that entity.

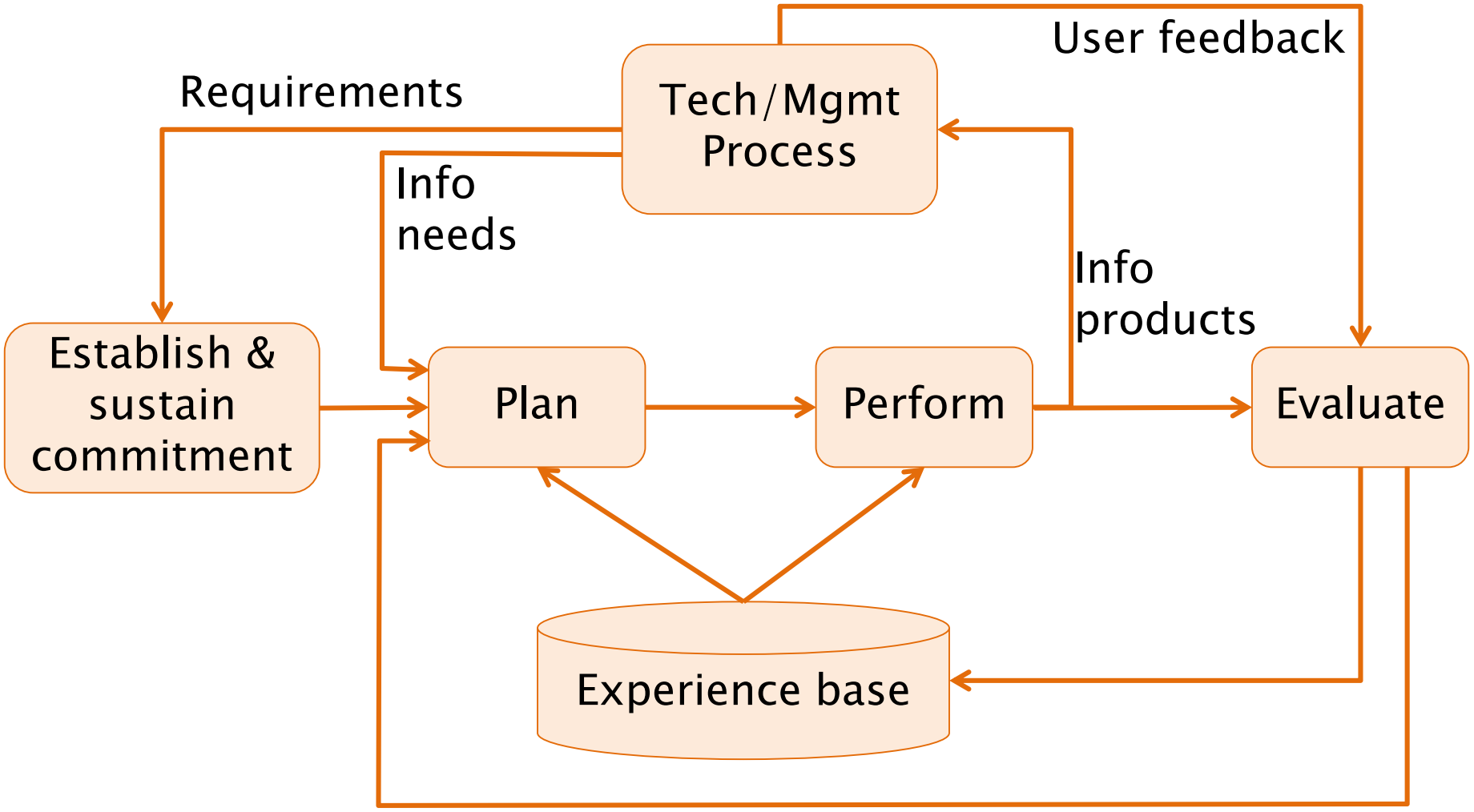
Metric: A measurement scale and the method used for measurement

Indicator: Measure that provides an estimate or evaluation derived from a model with respect to defined information needs

Examples of measures

Entity	Attribute	Measure
Person	Age	Year of birthday
Person	Age	Months since birth
Source code	Length	# Lines of Code (LOC)
Source code	Length	# Executable statements
Testing process	Duration	Time in hours from start to finish
Tester	Efficiency	Number of faults found per KLOC
Testing process	Fault frequency	Number of faults found per KLOC
Source code	Quality	Number of faults found per KLOC
Operating system	Reliability	Mean Time to Failure

Measurement Process



Adapted from ISO/IEC/IEEE 15939:2017

Rules

- Specify both entity and attribute
  - The entity must be defined precisely
- You must have a reasonable, even intuitive understanding of the attribute before you propose a measure.
- You must not re-define an attribute to fit in with an existing measure.

Base measures (direct)

- ***Length*** of source code
  - E.g. measured by LOC
- ***Duration*** of testing process
  - E.g. measured by elapsed time in hours
- ***Number of defects discovered*** during the testing process
  - E.g. measured by counting defects
- ***Effort*** of a programmer on a project
  - E.g. measured by person months worked

Derived measures (indirect)

$$\text{Programmer productivity} = \frac{\text{LOC produced}}{\text{person months of effort}}$$

$$\text{Module defect density} = \frac{\text{number of defects}}{\text{module size}}$$

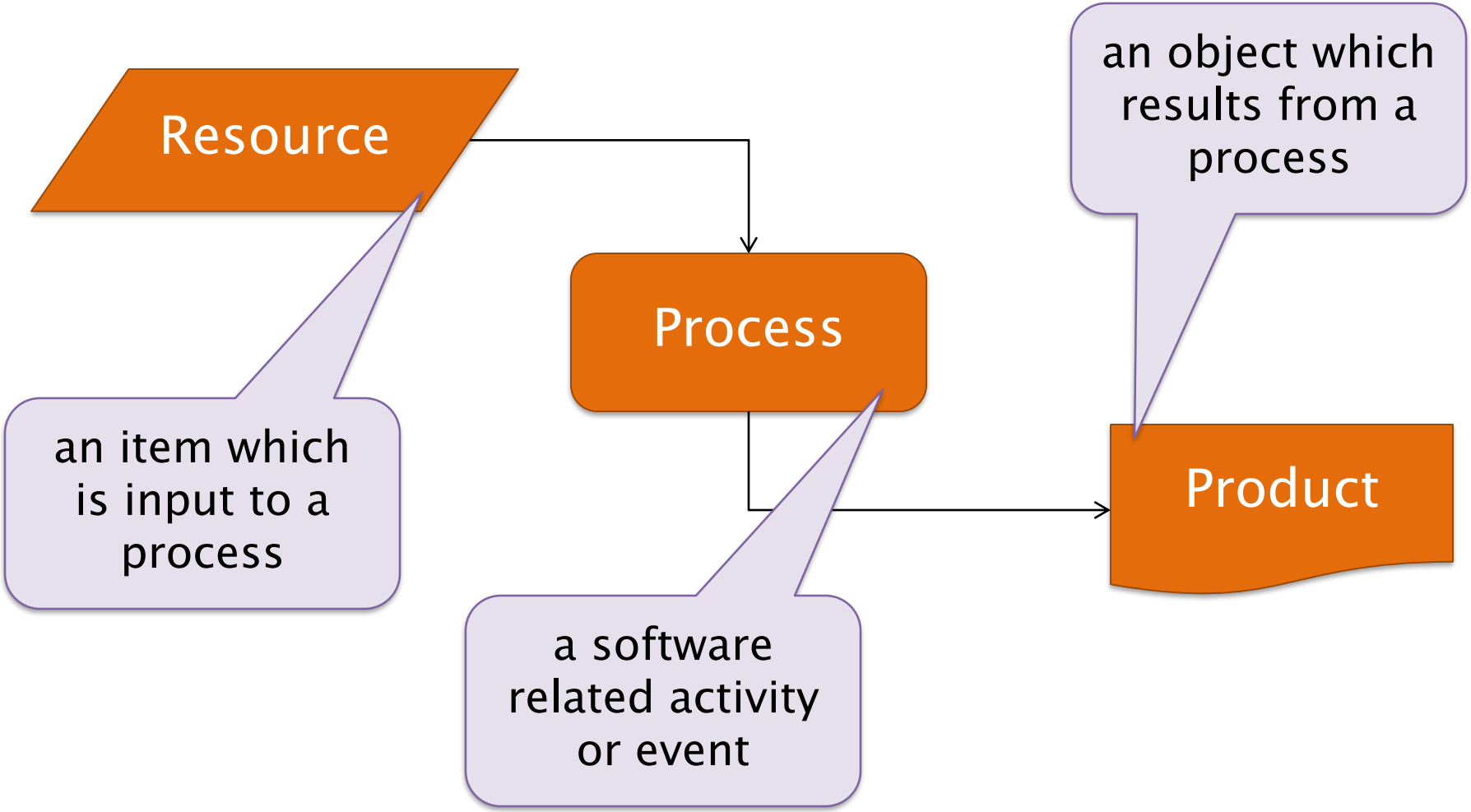
$$\text{Defect detection efficiency} = \frac{\text{number of defects detected}}{\text{total number of defects}}$$

$$\text{Requirements stability} = \frac{\text{\# of initial requirements}}{\text{total \#of requirements}}$$

$$\text{Test effectiveness ratio} = \frac{\text{number of items covered}}{\text{total number of items}}$$

$$\text{System spoilage} = \frac{\text{effort spent fixing faults}}{\text{total project effort}}$$

Entity classes



Internal vs. External

Given an entity:

- Internal (intrinsic) measures can be collected in terms of the entity itself
  - e.g. length or structuredness of source code
- External measures can only be collected observing the entity in its environment
  - e.g. reliability or maintainability of source code (product)
- In-Use measure depends on the use of the entity by different user classes
  - e.g. user satisfaction or usability

Metrics

	Attributes	
Entities	Internal	External
PRODUCTS Specification Source Code	Length, functionality modularity, structuredness, reuse	maintainability reliability .....
PROCESSES Design Test	time, effort, #spec faults found time, effort, #failures observed	stability cost-effectiveness ....
RESOURCES People Tools	age, price, CMM level price, size	productivity usability, quality ....

MEASUREMENT THEORY

Evolution of measures

- More sophisticated measures can be defined as understanding of an attribute grows
- E.g. temperature of liquids:
  - 200BC: rankings, “hotter than”
  - 1600: first thermometer still “hotter than”
  - 1720: Fahrenheit scale
  - 1742: Centigrade scale
  - 1854: Absolute zero, Kelvin scale

Measurement theory

- Scientific basis to determine formally:
  - When we have defined an actual measure
  - Which statements involving measurement are meaningful
  - What the appropriate scale type is
  - What types of statistical operations can be applied to measurement data
- Based on foundation laid down by S. S. Stevens (1946)

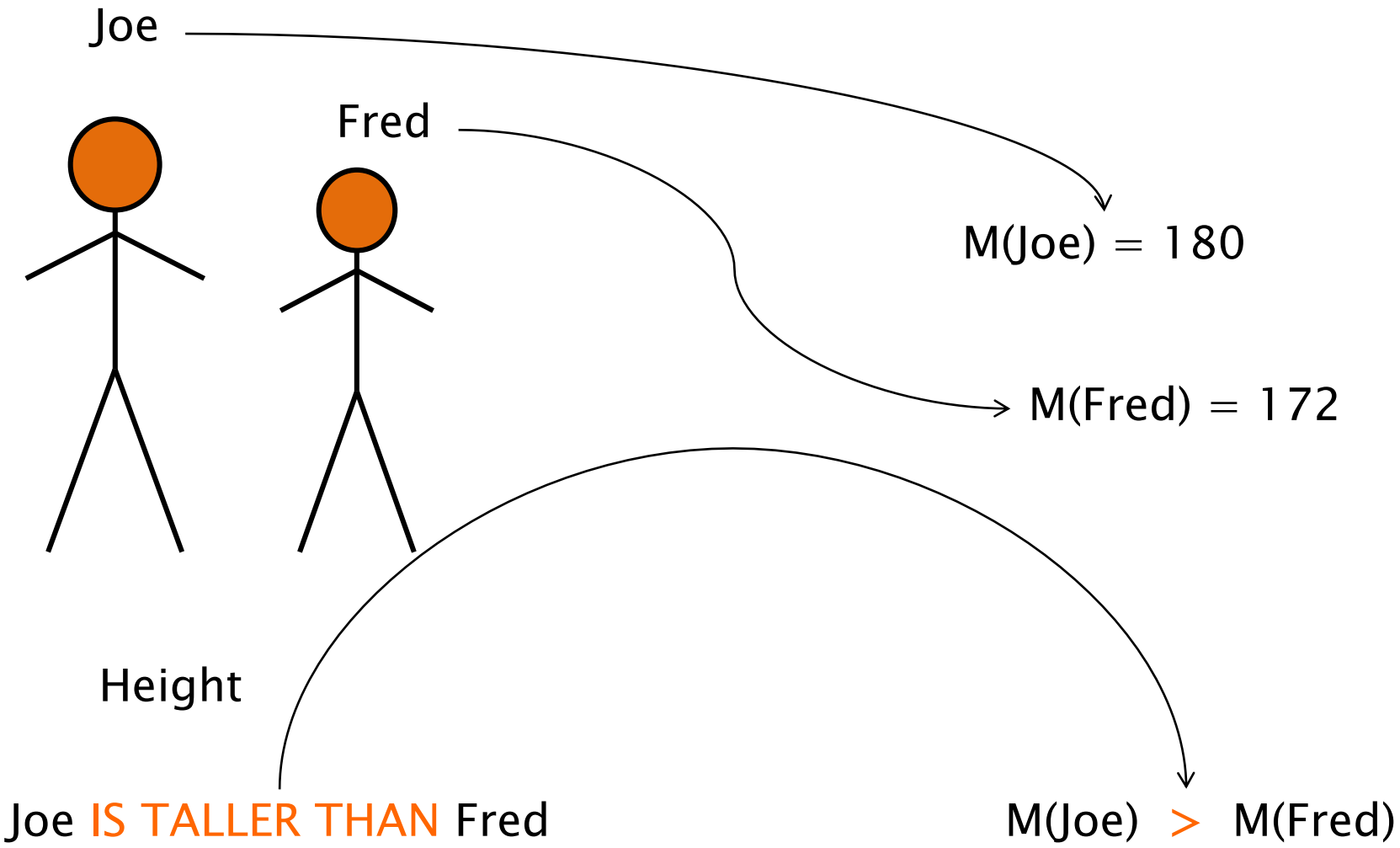
Empirical relation system

- A set of entities
- The relations which are observed on entities in the real world which characterize our understanding of the attribute in question
  - e.g. 'Fred taller than Joe' (for ***height*** of ***people)***
- The closed operations that can be performed on the objects

Measurement mapping

- Mapping from the empirical relation system onto a formal relation system
- Consists of
  - Metric
  - Relation mapping
- A.ka. representation, homomorphism
- Measure: the value (formal element) assigned to an entity in order to characterize an attribute

Measurement mapping



Representation condition

- Measurement mapping implies that all empirical relations are preserved in formal (numerical) relations and no new relation is introduced
  - e.g. M(Fred) > M(Joe) precisely when Fred is taller than Joe
- Admissible metric if the representation condition holds
  - Measurement scale

Formally

- We can define a homomorphism *m*

$$
\begin{aligned}
\text{scale:} \quad & (\mathfrak{E}, \mathfrak{F}, m) \\
\text{empirical system:} \quad & \mathfrak{E} = (E, \text{taller}) \\
\text{formal system:} \quad & \mathfrak{F} = (\mathbb{R}, >) \\
\text{mapping function:} \quad & m : E \rightarrow \mathbb{R}| \\
& \forall a, b \in E, a \text{ taller } b \implies m(a) > m(b)
\end{aligned}
$$

Additive metric

- A possible additional requirement is to have and additive measure

$$
\begin{aligned}
\text{scale:} \quad & (\mathfrak{E}, \mathfrak{F}, m) \\
\text{empirical system:} \quad & \mathfrak{E} = (E, \text{taller}, \text{added}) \\
\text{formal system:} \quad & \mathfrak{F} = (\mathbb{R}, >, +) \\
\text{mapping function:} \quad & m : E \to \mathbb{R} | \\
& \quad \forall a, b \in E : \\
& \quad\quad a \text{ taller } b \implies m(a) > m(b) \\
& \quad\quad m(a \text{ added } b) = m(a) + m(b)
\end{aligned}
$$

Admissible transformation

- Metrics are not unique, in general there are several homomorphisms
- Admissible transformation Φ
  - $\Phi \circ m$ is an homomorphism
  - Mapping between two measures, e.g. length
    - Admissible transformation: M' = a*M
    - Inadmissible transformation: M' = a*M + b

Issues

- Representation problem
  - How do we know if a particular empirical relation system has a representation in a given numerical relation system?
- Uniqueness problem
  - How do we deal with several possible alternative representations (scales) in the same numerical relation system?
- Pragmatic problem
  - Which is the preferred numerical relation system for a given empirical relation system?

Relation System richness

- RS_A is richer than RS_B if all relations in RS_B are contained in RS_A
- The richer the empirical system the more sophisticate the scale
- Complex and well understood phenomena require more sophisticate measurement scales

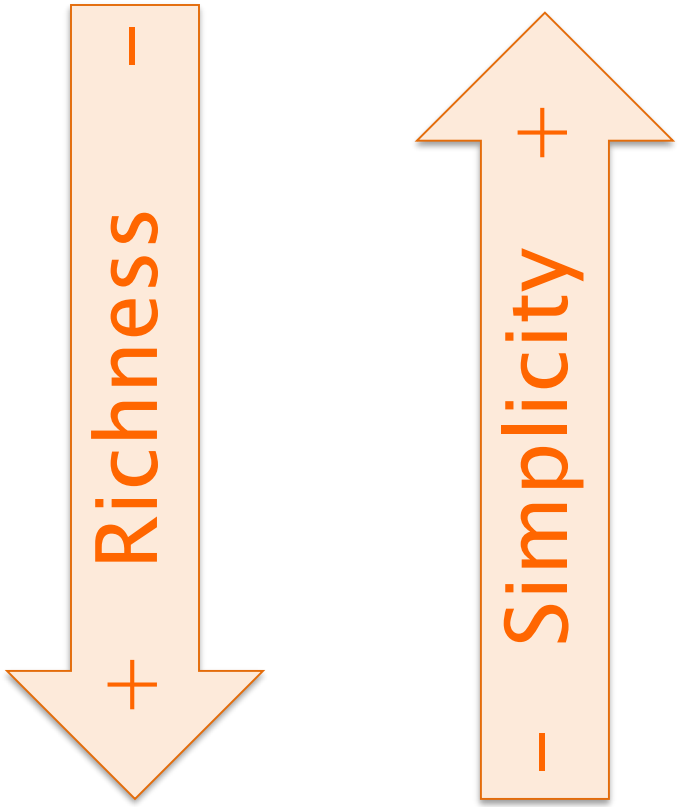
MEASUREMENT SCALES

Scale classification

- Measurement scales can be classified according to the class of admissible transformations
  - The larger the set of admissible transformations, the looser, less accurate, and less rich the scale
  - The smaller the set of admissible transformations the more accurate and richer the scale

Scale types

- Nominal
- Ordinal
- Interval
- Ratio
- Absolute



Nominal scale

- Places elements in classification scheme
- Empirical relation: different classes
  - No ordering relation
- Any distinct numbering or symbolic representation is acceptable
  - No notion of magnitude

Nominal scale example

- Empirical system
  - Entity: person
  - Attribute: origin
    - Italy, EU, Extra-EU
- Admissible mapping
  - M(p) =

if *p* is from Italy

if *p* is from any EU country

if *p* is from a non EU country

Nominal Statistics

- Only a base operation: count
- Available statistics
  - Frequency (per category)
  - Mode

Ordinal scale

- Empirical system: classes of entities ordered w.r.t. attribute
- Empirical relation: total order
- Acceptable mapping: any mapping preserving the order
  - Measure represent ranking only
  - Acceptable transformations are the set of all monotonic mappings
  - $<C1, C2, .. Cn> \rightarrow <a_1, a_2, .. a_n>$
  - Where $\forall$ i>j, $a_i > a_j$

Ordinal scale example

- Empirical system
  - Entity: statement
  - Attribute: agreement
    - Completely disagree, Mostly disagree, Mostly agree, Completely agree
- Admissible mapping
  - M(x) =

-2 if x is Completely disagree

-1 if x is Mostly disagree

1 if x is Mostly agree

10 if x is Completely agree

Ordinal Statistics

- Operations:
  - Counting
  - Sorting
- Available statistics
  - Frequency (per category)
  - Mode
  - Rank
  - Quantiles (Median)

Interval scale

- Empirical system: order and differences between classes
- Empirical relation: distance from a reference point
- Acceptable mappings: preserve order and difference
  - Addition and subtraction make sense
  - The ratio makes no sense
- Acceptable transformations are affine transformations
  - M' = a * M + b

Interval scale example

- Empirical system
  - Entity: activity
  - Attribute: calendar start time
    - Gregorian calendar
    - Months since project begin
- Admissible transformation
  - PM counts month since project start
    - Jan 1, 2010
  - CEO uses calendar year
  - $M_{PM} = 12*(M_{CEO}-2010)$

Interval Statistics

- Operations:
  - Counting, sorting
  - Sum, Difference, Scalar division
- Available statistics
  - Frequency, Mode, Rank, Quantiles
  - Mean (Arithmetic Average)
  - Variance (and derivatives)

Ratio scale

- Empirical system: there is a zero element
  - Represents total lack of attribute
  - Measurement starts at zero and increases at equal intervals (or part of): called units
  - All arithmetic can be applied meaningfully to classes in the range of the mapping
- Empirical relation: ratio between entities
- Admissible transformation
  - Ratio transformation
  - M' = a*M

Ratio scale example

- Empirical system
  - Entity: person
  - Attribute: age
    - Years, Months
- Admissible transformation
  - $M_{Months} = a * M_{Year}$
    - Where $a = 12$

Ratio Statistics

- Operations:
  - Counting, sorting
  - Sum, Difference, Scalar division
  - Division, (Multiplication)
- Available statistics
  - Frequency, Mode, Rank, Quantiles, Mean (Arithmetic Average), Variance (and derivatives)
  - Standardized mean difference, etc.
  - Geometric mean, etc.

Absolute scale

- Measurement made simply counting items in the entity set
  - Number of occurrences
  - Only one possible mapping
  - All arithmetic analysis is meaningful

Absolute scale (counter)examples

- Empirical system
  - Entity: project
  - Attribute: full time staff
    - Number of full time developers
- The attribute definition implies the items to be counted!
  - Length is not measurable on an absolute scale, # of lines it is
  - Age is not measurable on absolute scale

Scales

Scale	Admissible Transformations	Example
Nominal	1-to-1 mapping	Labeling, classifying entities
Ordinal	Monotonic increasing function	Preference, hardness
Interval	M' = a*M+b With: a>0	Relative time, temperature
Ratio	M' = a*M With: a>0	Time interval, length
Absolute	M' = M	Counting entities

Statistical operations

- Central tendency

Type	Mean	Median	Mode
Nominal	✗	✗	✓
Ordinal	✗	✓	✓
Interval	✓	✓	✓
Ratio	✓	✓	✓
Absolute	✓	✓	✓

Meaningful statements

- A statement involving measurement is meaningful if its truth is invariant of transformation of allowable scales
  - i.e. the conclusion is the same after an admissible transformation is applied

Meaningful statements

- Statements
  - ✓ The number of errors discovered during the integration testing was at least 100
  - The cost of fixing each error is at least 100 ?
  - ✓ A semantic error takes twice as long to fix as a syntactic error
  - A semantic error is twice as complex as a syntactic error

Meaningful statements?

- Fred is twice as tall as Jane
- The temperature in Tokyo today is twice that in London
- The difference in temperature between Tokyo and London today is twice what it was yesterday

Objective vs. Subjective

- Objective measures do not depend on the environment or the person collecting the measure
  - A small portion of subjectivity cannot be avoided
- Subjective measures depend on the context where they are collected
  - Can change according to the person
  - They reflect the perception and judgment of the person performing the measurement

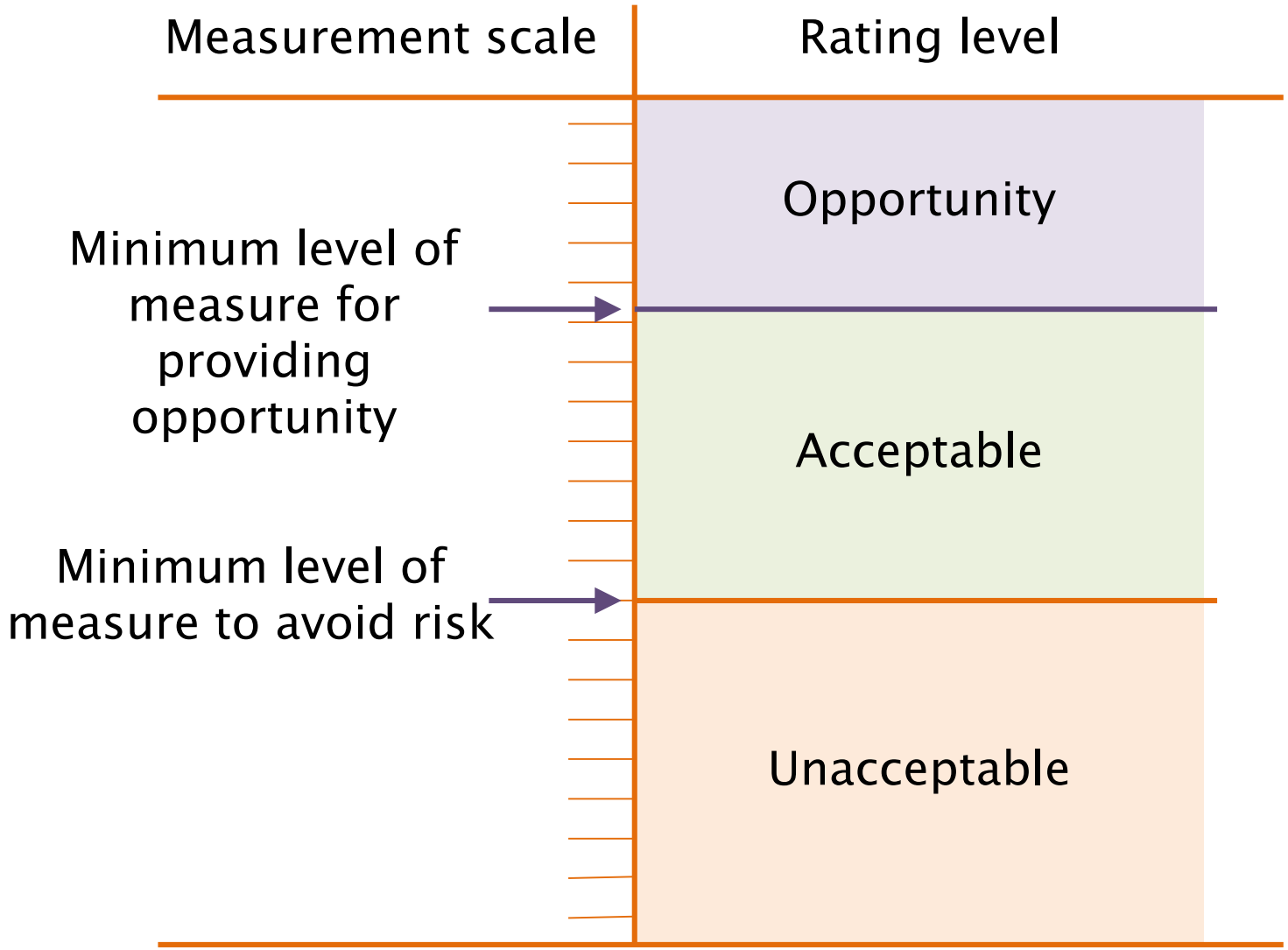
Interpretation

- If only measure values are available you know nothing
- Interpretation requires a reference to
  - Target
  - Benchmark
  - Time series
  - Population norm

Interpretation

- Target: compare to a specific business or usage requirement
- Benchmark: compare with a benchmark for similar product or system
- Time series: observe trend in time
- Population norms: compute quantile
  - Require a db of previous values

Interpretation: rating



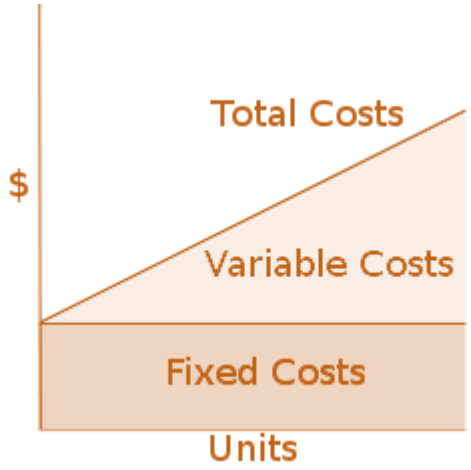
MANAGEMENT ACCOUNTING

Accounting

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

Management accounting

- Cost accounting
  - Budget and actual cost of operations, processes, departments, products
  - Analysis of variances and profitability
- 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 the number of units



Activity based costing

- Management accounting technique
- Developed to overcome problems in direct/indirect costs
  - Traditionally, indirect costs were attributed proportionally to all products
    - Ex, direct cost 100, indirect cost 40%
  - Since indirect costs grow, proportional allocation hides costs of some products
    - Ex. Product1 consumes much more design or manufacturing than product2, true cost of product1 is higher

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

Critical Success Factors

CSF

CSF

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

[Rockart 79]

CSF – levels

- CSF exist at different levels
- Following organizational structure
  - Corporate
  - Function
    - Production, product design, etc.
  - Role
    - Manager

CSF – examples

- Corporate
  - Brand recognition, image
  - Dealers network
  - Equipment of cars
  - Reliability of cars
  - After sales service
- Function (manufacturing)
  - Production costs
  - Quality of product
  - Environment issues
  - Relationship with trade unions
- Manager (quality manager)
  - Reputation w.r.t. other functions/roles
  - Skills of technicians
  - Process certification
  - Technology for monitoring quality

CSF – Types

- Industry / Domain
  - the structure of the particular industry
- Strategy
  - competitive strategy, industry position, and geographical location
- Environment
  - the macro environment
- Temporal / Contingency
  - problems or challenges to the organization
- Management
  - management perspective

CSF objective

- To identify in top down mode essential information for managers
  - Cfr. bottom up: starting from currently available information
  - Cfr. Information vs. data
- To define / modify a reporting system within IS

CSF method

1. Identify candidate CSFs
2. Interview managers and identify indicators
3. Indicator robustness analysis
4. Refinement, presentation, implementation

1) Identify candidates

- For each candidate CSF
  - Level (corporate, function, role)
  - Name
  - Type
  - Description

CSF Examples

- Business domain
  - Key areas for all companies in same business domain
  - Ex: cost for PC manufacturers, skill of personnel for consulting companies
- Competitive factors within business domain
  - Factors that differentiate company from others
  - Ex: for airlines, low cost vs. quality of service

CSF Examples

- Environmental factors
  - Constraints from outside such as norms, rules, standards
  - Ex.: for car manufacturers, euroX pollution norms
- Contingency factors
  - Temporary constraint
  - Ex.: merge IS of two companies after financial merge/acquisition
  - Ex.: recover brand reputation after failures (see Benz Class A, BP oil spill)

Example: Restaurant CSF

CRITICAL SUCCESS FACTOR	TARGET
Customer Satisfaction	83% extremely satisfied
Market Share	20% of 10 mile radius
Employee Turnover	25% per year
Food Quality	5% returned meals

Example: Non-profit Org. CSF

CRITICAL SUCCESS FACTOR	TARGET
Number of Donors	15,000 monthly donors
People Served	2000 per month
Volunteers	350 active volunteers
Customer Satisfaction	92% extremely satisfied

2) Interview managers

- Interview managers on candidate CSFs
  - CSF for function and role (max 5) and
  - measures (1 or more) for each CSF
- Output, for each CSF
  - Measures,
  - Source of (raw) data,
  - Rationale
  - Reference

2) Output

	Indicator	Unit	Source	Motivation
Cost	Unit product cost	EUR	ERP	Key factor for production process competiveness
	Unit overhead	EUR	ERP	
Quality	Production defect	Ratio	ERP	Measure of objective quality
	Support defect	Ratio	Post-sale IS	

2) Output

	Indicator	Unit	Source	Motivation
Quality	Customer judgment	Score	Sample interviews	Perceived quality
	Comparison to competitors	Score	Test and sample interviews	Actual gaps
	Comparison with historical data	Score	Test	Achieved improvements
Environ	Produced waste	Tons	Ad-hoc measure	Key for green image of organization
	Recyclable materials	Tons	Ad-hoc measure	
	Energy consumption	Kw	Ad-hoc measure	Energy efficiency

3) Indicator Robustness

- Understandability
- Processing cost
- Significance
- Frequency
- Structuredness

3) Indicator Robustness

- Comprehensibility / Understandability
  - How simple
- Processing Cost
  - Cost and delay to process
  - Cost and delay to collect raw data
  - Initial and incremental
- Significance / Meaningfulness
  - How much the indicator covers the CSF
- Frequency
  - How often indicator varies
- Structuredness
  - How much the indicator is objective/not ambiguous

Robustness

Indicator	Understand.	Cost	Relevance	Frequency	Structure	Robustness
Unit direct cost	5	4	5	5	5	**4.8**
Unit overhead	4	5	4	2	4	**3.8**
Production defects	4	5	4	5	5	**4.6**
Support defects	5	4	4	4	5	**4.4**
Customer rating	5	2	2	3	3	**3.0**
Competitor comparison	2	3	5	3	3	**3.2**
Past comparison	4	3	3	2	3	**3.0**
Waste processing	4	3	3	5	4	**3.8**
Recyclable materials	4	3	3	3	4	**3.4**
Energy consumption	2	5	4	3	5	**3.8**

4) Refinement, presentation

- Refinement
  - Aggregate, simplify CSFs
- Presentation
  - And acceptance from managers
- Implementation
  - Define requirements and design for IS
  - Implement

CSF – Case study

- Company: Politecnico di Torino
- Missions
  - Education 
  - Research
  - Technology transfer

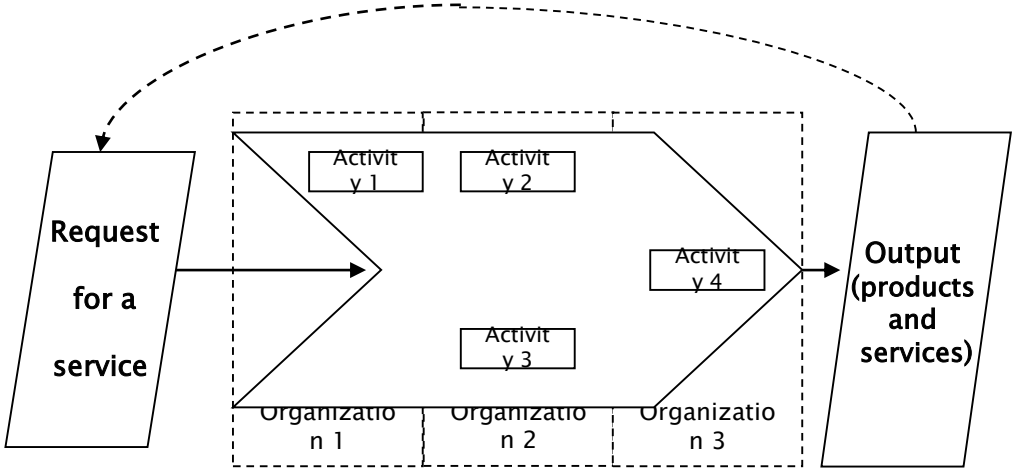
KPI – KEY PROCESS INDICATOR

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

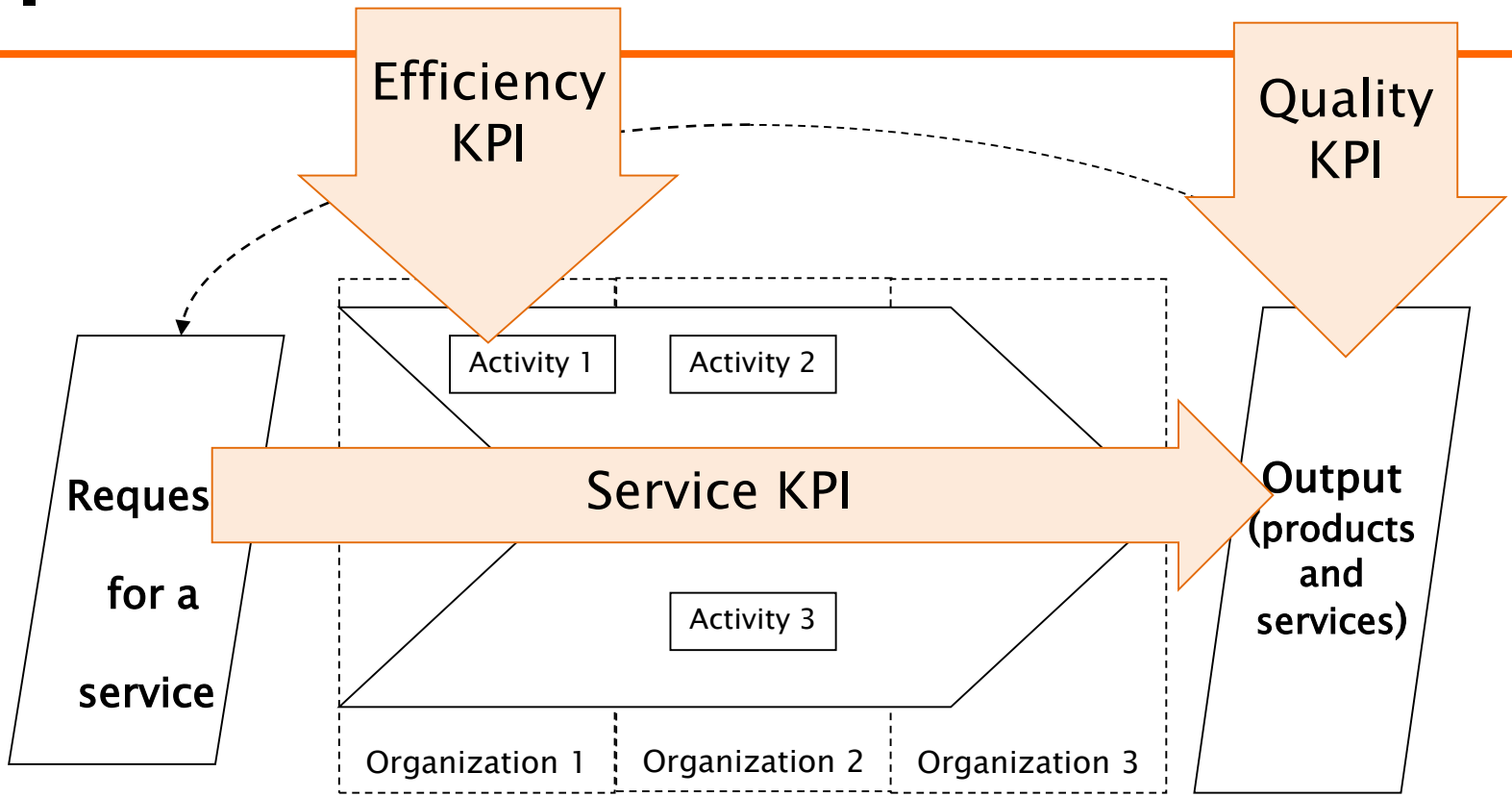
- Process view
  - Involves one or more hierarchical nodes
  - Financial and non financial indicators
  - Process as a chain of services



SMART KPI

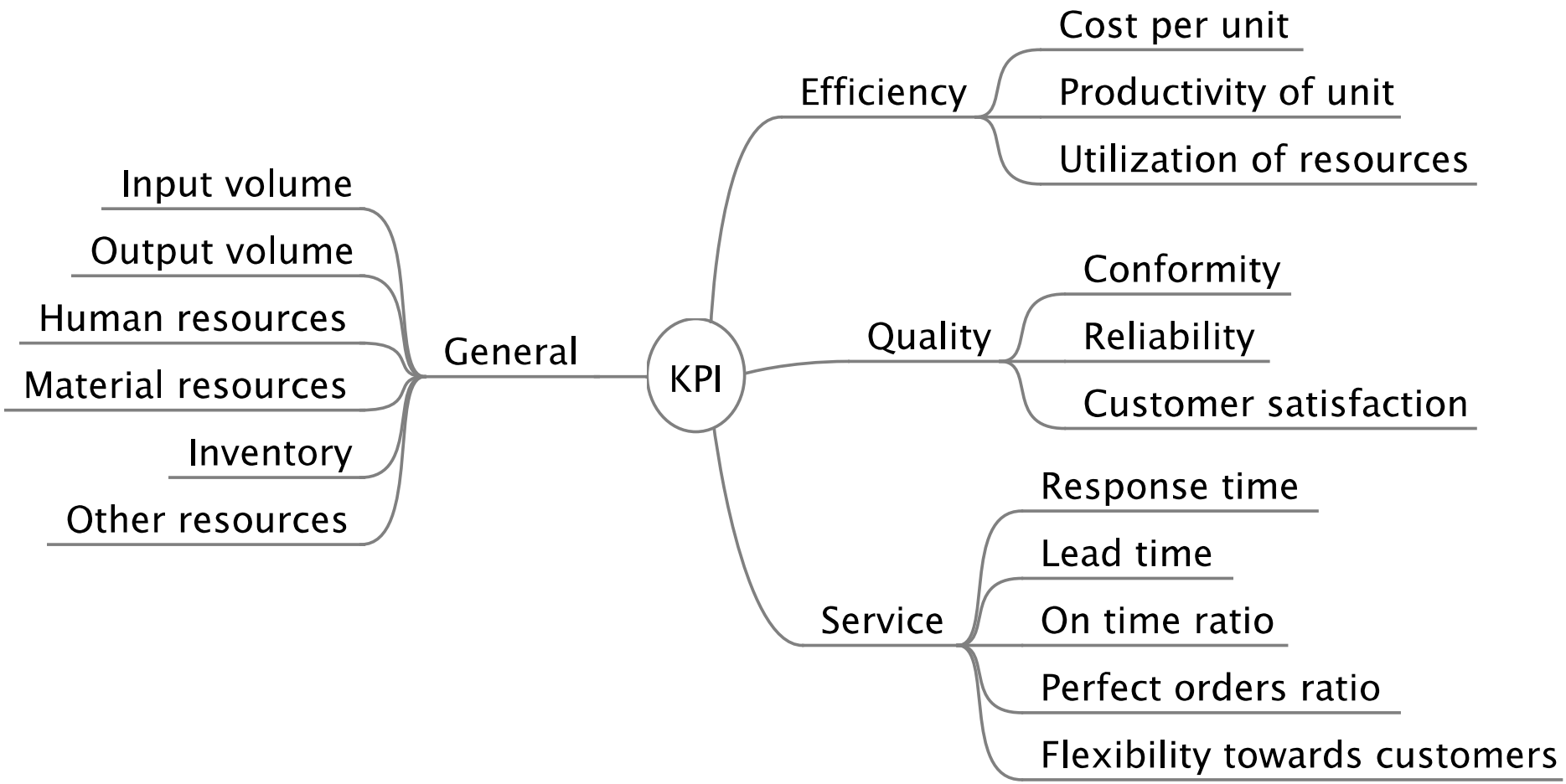
- Specific purpose for the business,
- Measurable
- Achievable
- Relevant
- Timely

KPI



- Ex. Average delay to satisfy order
- Ex. Average productivity of resource

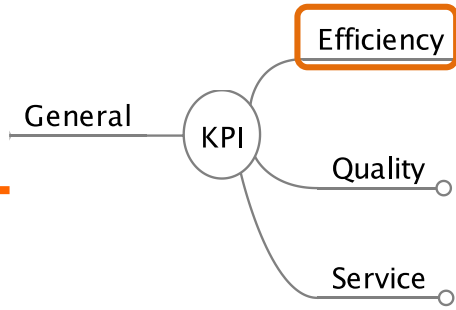
KPI General framework



General KPIs – examples

General KPIs	Hotel reservation	Lift maintenance	Product sale supermarket	Book sale on web	Building license (e.gov)
Input volumes	# reservation requests, modify, delete	#urgent requests, #normal requests	#sales (person passing at register)	# orders	#licences requested
Output volumes	#reserved rooms	#services completed	#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
Material resources	Call center, reservation system, workstations, 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/ I/O *volume*
- Productivity
  - *Volume*/resource
- Utilization
  - Used *resource* /available *resource*

Volumes and Resources refer to any general → indirect measures

Efficiency KPI

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

Efficiency KPI

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

Design and Sw Industries

Depends on industry

Immaterial sales e.g. plane seats

Inventory turnover

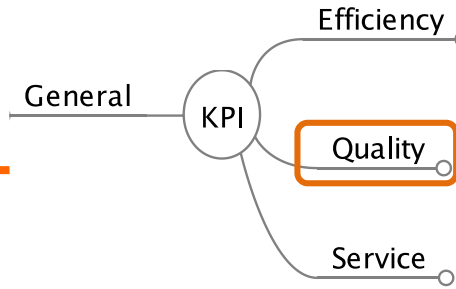
Exercise

- List efficiency KPIs for the following processes
  - Hotel reservation
  - Product sale supermarket

Hotel Reservation	Unit cost	Productivity	Utilization
Input/output		--	--
Human resources	--		
Non human resources	--		
Inventory	--		
Time	--		
Information		--	

Hotel Reservation	Unit cost	Productivity	Utilization
Input/output	Total cost / # reservation reqs Total cost / # reserved rooms	--	--
Human resources	--	#reservation reqs/ #employees #reserved rooms/ #employees	Time servicing/shift duration
Non human resources	--	#reservation reqs / #workstations	#hours worked(call center)/24hrs
Inventory	--		
Time	--		Distribution of requests per hours
Information		--	

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

	Input	Internal	Output
Conformity	Non conforming requests	Number discarded Reject ratio Rework cost/total costs	Complaints Non conformity to to requests, contract, or expectations
Reliability	--	MTTF MTBF MTTR	MTTF MTBF MTTR
Satisfaction	--	--	Satisfied customers ratio Evaluation of product/service

Quality KPIs

	Input	Internal	Output
Conformity	Non conforming requests	Numb Reject ratio Rework cost/total costs	mplaints Non conformity to to requests, contract, or expectations
Reliability	--	MTTF MTBF MTTR	MTTF MTBF MTTR
Satisfaction	--		Satisfied customers ratio Evaluation of product/service

Depends on industry

Judgment collected through polls

Exercise

- Define quality KPI for
  - Hotel reservation process

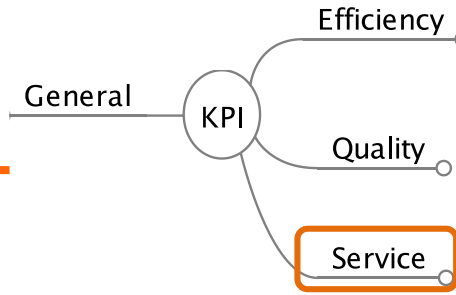
Quality KPIs

Hotel Reservation	Input	Internal	Output
Conformity			
Reliability	--		
Satisfaction	--	--	

Quality KPIs

Hotel Reservation	Input	Internal	Output
Conformity	#reservations with problem/ #reserved rooms	#cancelled reservations/ #reserved rooms	Complaints from customers
Reliability	--	#lost reservations/ #reserved rooms	
Satisfaction	--	--	Customers' opinion

Service KPIs



- Response time (supplier pov),
  Lead time (customer pov)
  - Time to satisfy order, from reception to delivery of good/service
    - To be checked in peak periods
- Timeliness
  - 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

Processes and stakeholders

- Process has several stakeholders
  - Operator
  - Manager
  - Customer
- Process (and consequently KPIs) should be designed by considering all stakeholders
  - Ex cost
    - Cost for operator: 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	• T non value activity / T total • T occupied / T total • T info access	• Conformance and internal reliability (System error rate) • Operator satisfaction	• System response time by Operator process
Manager	• Unit cost • Resource Productivity • Resource saturation • Time saturation	• Conformance (input & output quality) • Internal reliability (MTBF, MTTR) • Customer satisfaction	
Customer	• Price / Supplier cost • Time and cost to get product or service	• Conformance to request • Product/service reliability • Satisfaction	• Response time, lead time • Timeliness • Perfect orders • Flexibility

Interpretation

- If you only have absolute values you know nothing

- Reference to
  - Target
  - Benchmark
  - Time series
  - Population norm

KPI – steps

1. Select processes to monitor
2. For each process, select KPIs
3. Profile KPI
4. Robustness and CSF
5. Dimensions
6. Requirements and design

1.Select processes

- Starting from models
  - SCOR
  - AP
  - Measurement standards (e.g. SQUARE)
  - Business domain specific

2.Select KPIs

- Using KPI templates
  - General
  - Efficiency
  - Quality
  - Service

3.Profile KPI

- Name
- Category
- Goal
- Metric definition
  - Measurement procedure
  - Formula
  - Unit of Measure
  - Scale
  - Interpretation
- Source (where the data comes from)

4.Robustness

- Are KPIs covering strategic areas?
  - Cross check with CSF
- Are KPIs robust?
  - Comprehension
  - Cost
  - Meaningfulness
  - Frequency
  - Structure

4.Indicator Robustness

- Comprehensibility / Understandability
  - How simple
- Processing Cost
  - Cost and delay to process
  - Cost and delay to collect raw data
  - Initial and incremental
- Significance / Meaningfulness
  - How much the indicator covers the CSF
- Frequency
  - How often indicator varies
- Structuredness
  - How much the indicator is objective/not ambiguous

5.Dimensions

- Or segmentation:
  - Entities to which indicator is associated and therefore
  - Data the indicator can be aggregated on
  - Dimensions are typically nominal or ordinal metrics

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

6.Requirements and design

For supporting IS

- Define requirements
- Design
  - Presentation (visual literacy)
  - Interaction (exploration)
  - Dashboard

KPI vs CSF

- CSF
  - vital for a strategy to be successful.
  - drives the strategy forward, it makes or breaks the success of the strategy
  - “Why would customers choose us?”
- KPI
  - quantify management objectives
    - along with a target or threshold
  - enable the measurement of strategic performance.

BALANCED SCORECARDS

Balanced scorecards

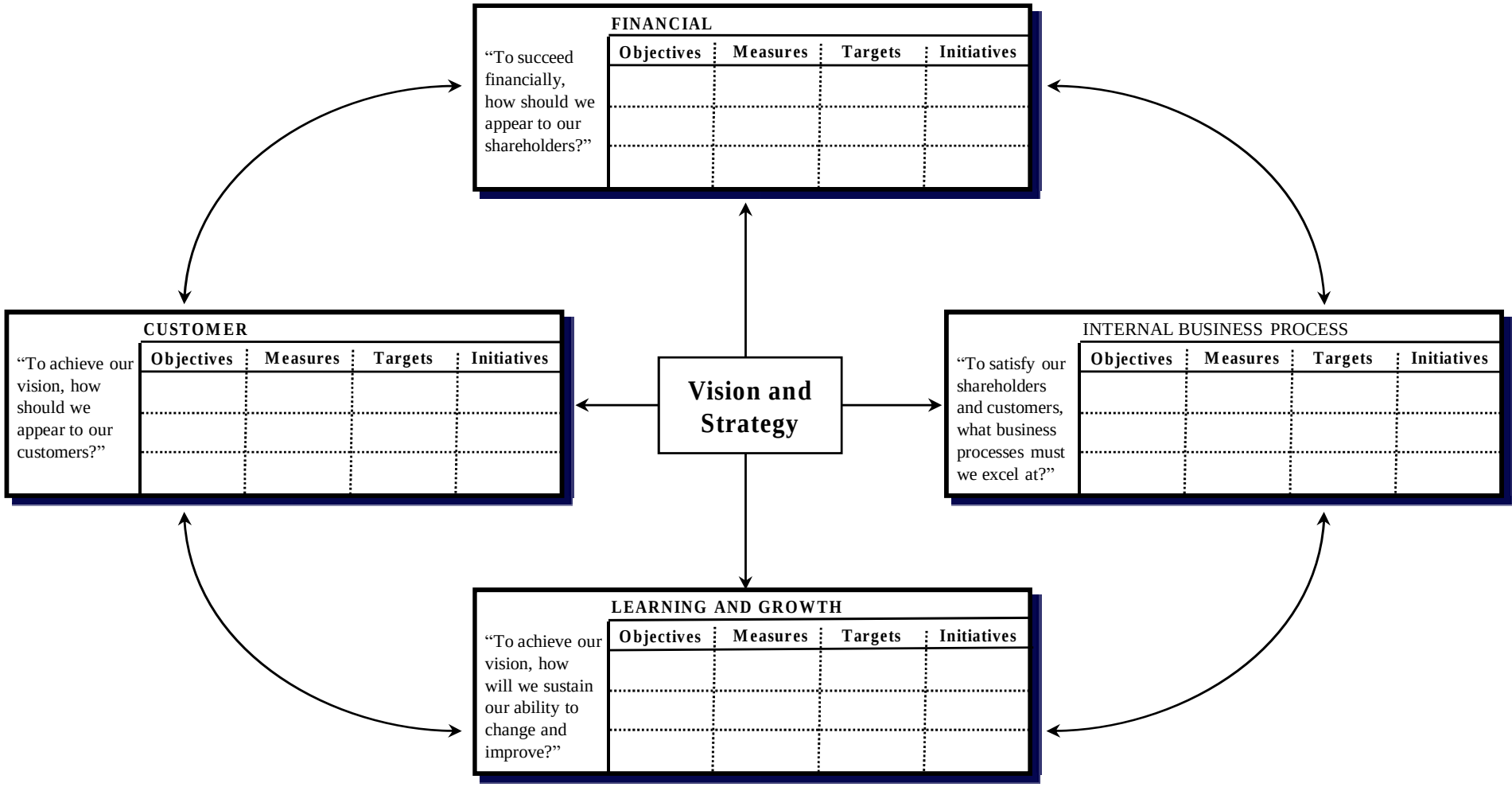
- Financial perspective on company performance is limited
- Managers can only partially act on financial outcome of a company
- Better to focus on more perspectives

[Kaplan and Norton1992]

Perspectives

- Financial
  - To succeed financially how should we appear to our shareholders?
- Customer
  - To achieve our vision, how should we appear to our customers?
- Internal process
  - To satisfy our shareholders and customers, what business processes must we excel at?
- Innovation and learning
  - To achieve our vision, how will we sustain our ability to change and improve?

Perspectives



Indicators

- Objectives
- Measure
- Target
- Initiative

Perspectives and indicators

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

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

How to implement

- Define vision, translate into operational goals
- Communicate vision, link to individual performance
- Business planning
- Feedback

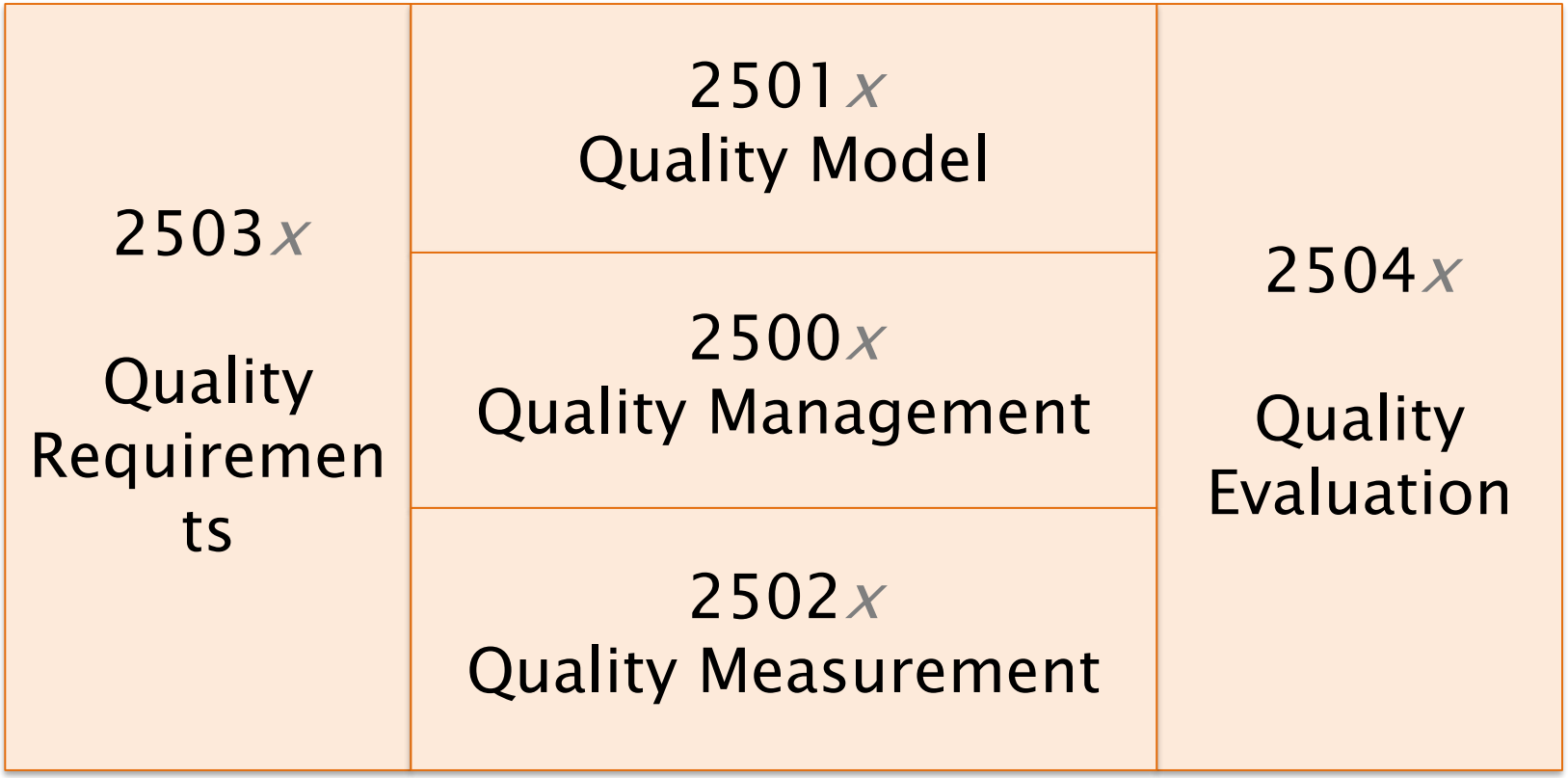
DATA QUALITY

Data Quality

- Decisions taken on the basis of indicators are as good as the quality of the indicators themselves
- Data quality is a key factor

ISO – SQuaRE

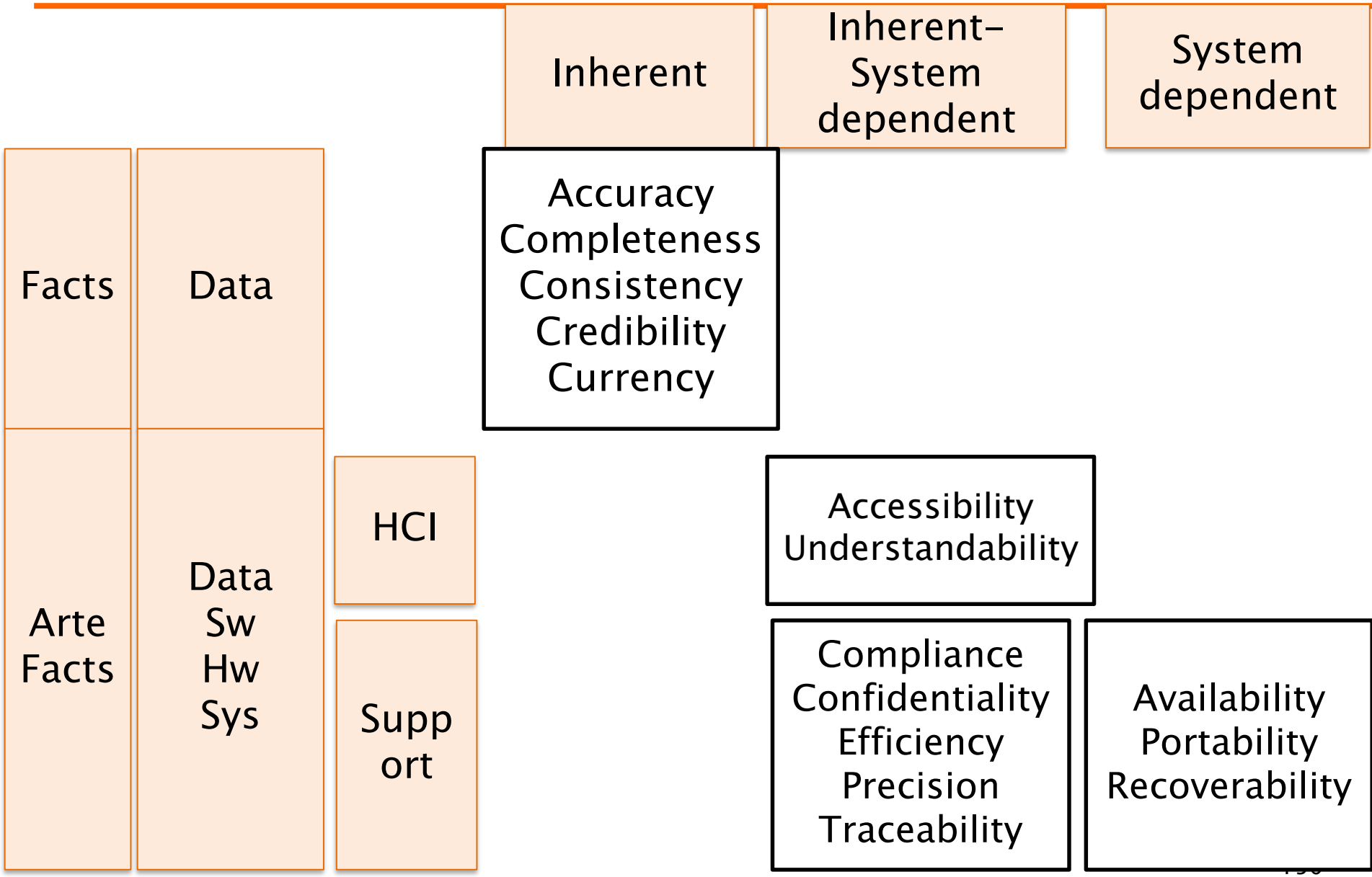
Family of standards



Data Quality Standard

- ISO 25012-Data Quality Model
  - Quality characteristics
- ISO 25024-Data Quality Measurement
  - Measures

Characteristics



ACCURACY (Acc-I-1)

ID	Name	Description	Measurement function	DLC Target entities Properties
Acc-I-1	**Syntactic data accuracy**	Ratio of closeness of the data values to a set of values defined in a domain	X=A/B A= **number of data items** which have related values syntactically accurate B= **number of data items** for which syntactic accuracy is required	All DLC except Data design Data file Data item, data value
NOTE 1 A single value is considered "syntactically accurate" when it is the same as one from an identified source of validated information: the result is "yes" or "no". NOTE 2 An example of a low degree of syntactic accuracy is when the word Mary is stored as Marj. NOTE 3 See ISO/IEC 25012, 5.3.1.1.				

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