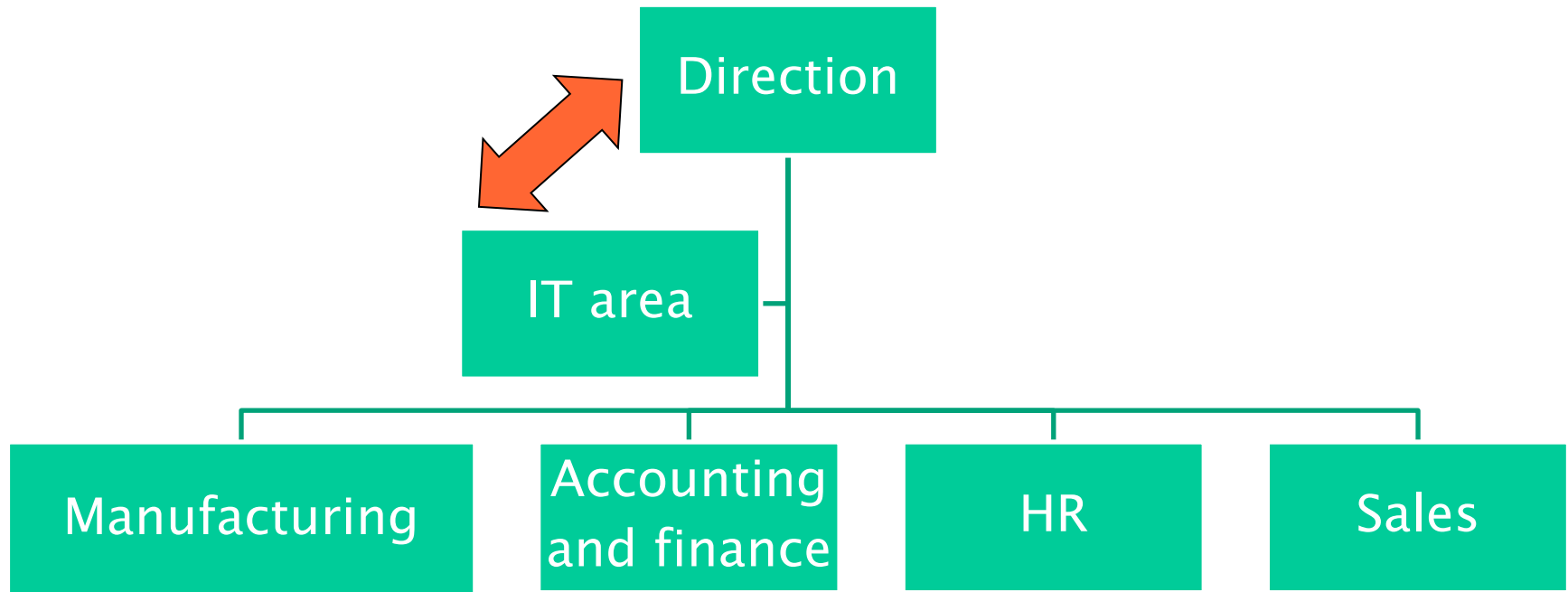

(IT) Economics

Context

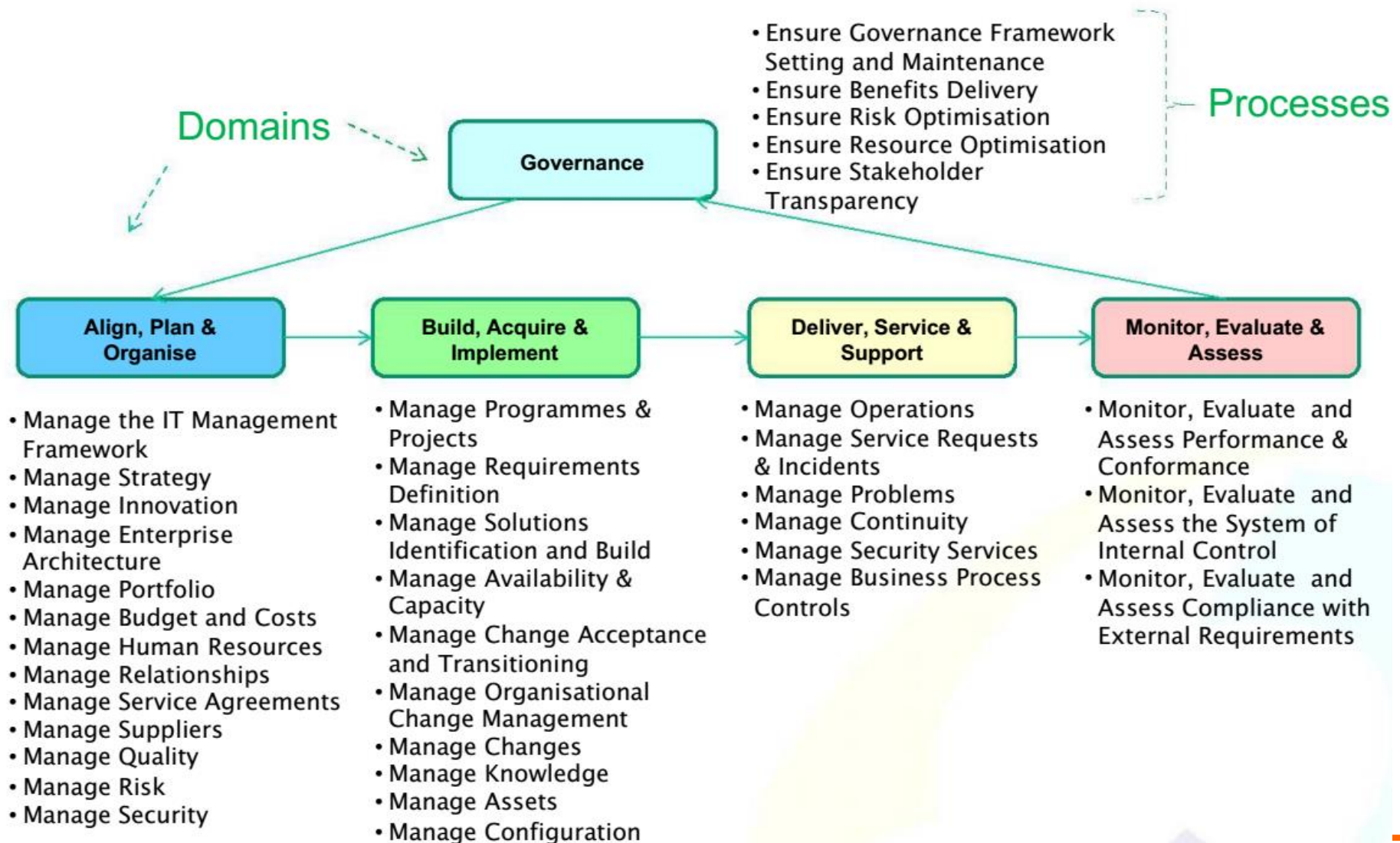
- CEO vs CIO



Questions

- What is the value/ benefit/ effect of IT in an organization?
 - ◆ How much to invest in IT in an organization, to do what?
 - Budget (future cost)
 - ◆ What is the cost of IT in an organization?
 - What are the sources of cost of IT?
 - Accounting (past cost)
 - ◆ What is the value provided by IT?
- IT inside or outside? (Outsourcing)

Processes (Cobit)



Processes involved

- Governance
 - ◆ Ensure benefits delivery
 - ◆ Ensure resource optimization
- APO
 - ◆ Manage strategy
 - ◆ Manage budget and cost
- MEA
 - ◆ Monitor performance
 - ◆ Monitor costs

Outline

- Recap of economic concepts
- Application to IT

Economics

- Costs
 - ◆ direct, indirect, fixed, variable
 - ◆ TCO
- ROI, Break even point
- Transactions, Transaction theory
- Agency theory
- Decision theory

Direct Indirect costs

- Direct / indirect cost
 - ◆ Direct: traceable to a product / service
 - ◆ Indirect: not traceable
- ◆ Ex: indirect. Facilities to build a car
Electricity to run computers
- ◆ Ex: direct. Steel in a car
Cost of software licenses

Fixed / Variable costs

- Variable / Fixed cost
 - ◆ Variable: depends on number of units built
 - ◆ Fixed: does not depend
 - ◆ Ex: variable. Car: steel, components, energy
Cost to repair software defects
 - ◆ Ex: fixed. Facilities, R&D
Cost of software licenses

Cost of unit =

$(\text{fixed cost} / \# \text{units_produced}) + \text{var cost}$

Economy of scale:

maximize $\# \text{units_produced}$ to minimize cost of unit

#units produced	Unit cost
3	$300\text{M} / 3 + 0,001 = 100\text{M}$
30M	$300\text{M} / 30\text{M} + 0,001 = 10,001$
With fixed cost = 300M, var cost = 0,001	

Cost of unit_k =

(fixed cost / #units_produced) + var cost_k

units_k + units_j + units_i + ...

Economy of scope:

use the same infrastructure (fixed cost) to produce largest *variety* of different units

(ex distribution network, distribute milk → distribute milk AND cookies)

(ex amazon, sell books → sell everything)

Cost of informational unit =
(fixed cost / #services_offered) + var cost

Informational economy of scale:

var cost is negligible

use the same infrastructure (fixed cost) to deliver
largest number of services to largest customer base
(ex booking.com sell hotel rooms to 10 or 10M
customers has ~ same fixed cost)

Cost of informational unit =
(fixed cost / #services_offered) + var cost

Informational economy of scale/scope:

use the same infrastructure (fixed cost) to deliver
different services to largest customer base

(ex booking.com sell hotel rooms →
sell hotel rooms + rental cars + restaurants + ...)

Network effect

- Demand side economy of scale
/Network effect/Network externalities
 - ◆ Value of service increases with number of users
 - Ex. Telephone network
 - Ex. Search engine
 - Ex. Social networks

TCO Total cost of ownership

- Financial estimate of all costs (direct/indirect, fixed/variable) of a product / service
 - ♦ 1 define lifecycle of product / service
 - ♦ 2 estimate costs in each phase of lifecycle

TCO

- By lifecycle
 - ◆ Construction / selection (make vs. buy)
 - ◆ Deployment
 - ◆ Operation + maintenance
 - ◆ Dismissal

Ex Car (Buy case)

- Selection
 - ♦ Define needs (requirements)
 - ♦ Find models and vendors
 - ♦ Select model and vendor
 - ♦ Define (or understand) contract, sign
 - ♦ Pay
- Deployment
 - ♦ Transportation factory – customer
 - ♦ Registration of purchase, taxes
- Operation
 - ♦ Fuel, taxes, cleaning, ..
- Maintenance, regular
 - ♦ Oil, filters, tyres, wipes, ..
- Maintenance, exceptional
 - ♦ ? (being exceptional, hard to estimate)
- Dismissal
 - ♦ Resale value, or scrapping cost

Ex. Car (Make case)

- Construction
 - ◆ Define needs (requirements)
 - ◆ Buy materials and machines
 - ◆ Design, implement
- Deployment
 - ◆ Registration of purchase, taxes
- Operation
 - ◆ Fuel, taxes, cleaning, ..
- Maintenance, regular
 - ◆ Oil, tyres, wipes, ..
- Maintenance, exceptional
 - ◆ ?
- Dismissal
 - ◆ Resale value, or scrapping cost

Ex. Software product (Buy)

- Selection
 - ◆ Define needs (requirements)
 - ◆ Find products and vendors
 - ◆ Select product and vendor
 - ◆ Define (or understand) contract, sign
- Deployment
 - ◆ Install (server / clients)
 - ◆ Train users
 - ◆ Migrate data
- Operation
 - ◆ Electricity, licenses
- Maintenance
 - ◆ Fix defects, add features, adapt to new environment
- Dismissal
 - ◆ Migrate data

Ex. Software product (Make)

- Construction
 - ◆ Define needs (requirements)
 - ◆ Design, implement, test
- Deployment
 - ◆ ..same as buy
- Operation
 - ◆ .. same as buy
- Maintenance
 - ◆ .. Same as buy, but made internally
- Dismissal
 - ◆ Migrate data

Ex Car

- Scenario 1
 - ◆ 10.000 km per year, 5 years,
 - ◆ better diesel or gas or electric or hybrid?
 - ◆ better new or used?
- Scenario 2
 - ◆ 100.000 km per year, 3 years,
 - ◆ better diesel or gas or electric or hybrid?
 - ◆ better new or used?

Better == has lower TCO

-
- In short: it makes no sense to consider only the 'label' price of an item at time of purchase to understand its cost
 - In particular if the time range the item will be used is long (as for IT products)

Ex House

- Buy vs rent?

Ex commercial airplane

- Lifecycle: 20–30 years
- Cost of operation + maintenance exceeds many times (on average 6) cost of purchase

TCO

- Depends on time horizon and lifecycle
- Depends on estimates
 - ♦ Cost of fuel in next 10 years?
 - ♦ Taxation?
 - ♦ Exceptional maintenance?
- ♦ In short, TCO is subject to estimation uncertainty, but is the correct approach to evaluate cost

TCO and service mode

- Payment mode 'as a service'
 - ◆ Reduces uncertainty
 - ◆ Can be more expensive, since uncertainty is taken care of by the vendor
- ◆ Ex: buy car and pay upfront lump sum
vs
rent car and pay monthly fee
(including all costs except fuel)

ROI

- Return on investment
 - ♦ $\text{ROI} = (\text{Benefit} - \text{Cost}) / \text{Cost}$
 - ♦ $\text{ROI} = \text{Profit} / \text{Cost}$
 - ♦ Ex. buy house at 100, sell at 120
 $\text{ROI} = 20/100 = 20\%$
 - ♦ Ex. 100 in bank, 105 after one year
 $\text{ROI} = 5/100 = 5\%$
 - ♦ Ex. Buy stock at 130, sell at 111
 $\text{ROI} = -19/130 = -14\%$

ROI

- Drawbacks

- ◆ Time is not considered

- 10% return in 10 years is not the same as in 1 year
 - Money has a cost (interest rates)
 - NPV Net Present Value addresses these problems
 - ROI on several time periods addresses partially this problem

ROI on several time periods

Period	0	1	2	Total
Benefit	0	300	500	800
Cost	400	200	100	700

- $ROI = (800 - 700) / 700 = 14\%$

Break even point

- How many periods to recover investment?

Period	0	1	2	Total
Benefit	0	300	500	800
Cost	400	200	100	700
Benefit -cost	-400	-300	100	100

Period	0	1	2	3	4	5
Benefit	0	100	100	100	<u>100</u>	100
Cost	400	0	0	0	<u>0</u>	
Benefit– Cost	–400	–300	–200	–100	<u>0</u>	100

Period	0	1	2	3	4	5
Benefit	0	200	200	<u>200</u>	200	200
Cost	500	0	0	<u>0</u>	0	
Benefit– Cost	–500	–300	–100	<u>100</u>	300	500

Ex: construction of ERP (make)

	0	1	2	3	4	Total
Cost	Construction 400 Deployment 100	Operation 100 Maintenance 100	Operation 100 Maintenance 70	Operation 100 Maintenance 50	Operation 100 Maintenance 50	1170
Benefit	0	400	400	400	400	1600
Benefit – cost	–500	–300	–70	180	430	430

- ♦ TCO: 1170
- ♦ ROI: $(1600 - 1170) / 1170$
- ♦ Break even: 3 years

Ex: acquisition of ERP (license)

	0	1	2	3	4	Total
Cost	Selection 100 Deployment 100	Operation 100 Licence 100	Operation 100 Licence 100	Operation 100 Licence 100	Operation 100 Licence 100	1 000
Benefit	0	350	350	350	350	1 400
Benefit – cost	–200	–50	100	250	4003	400

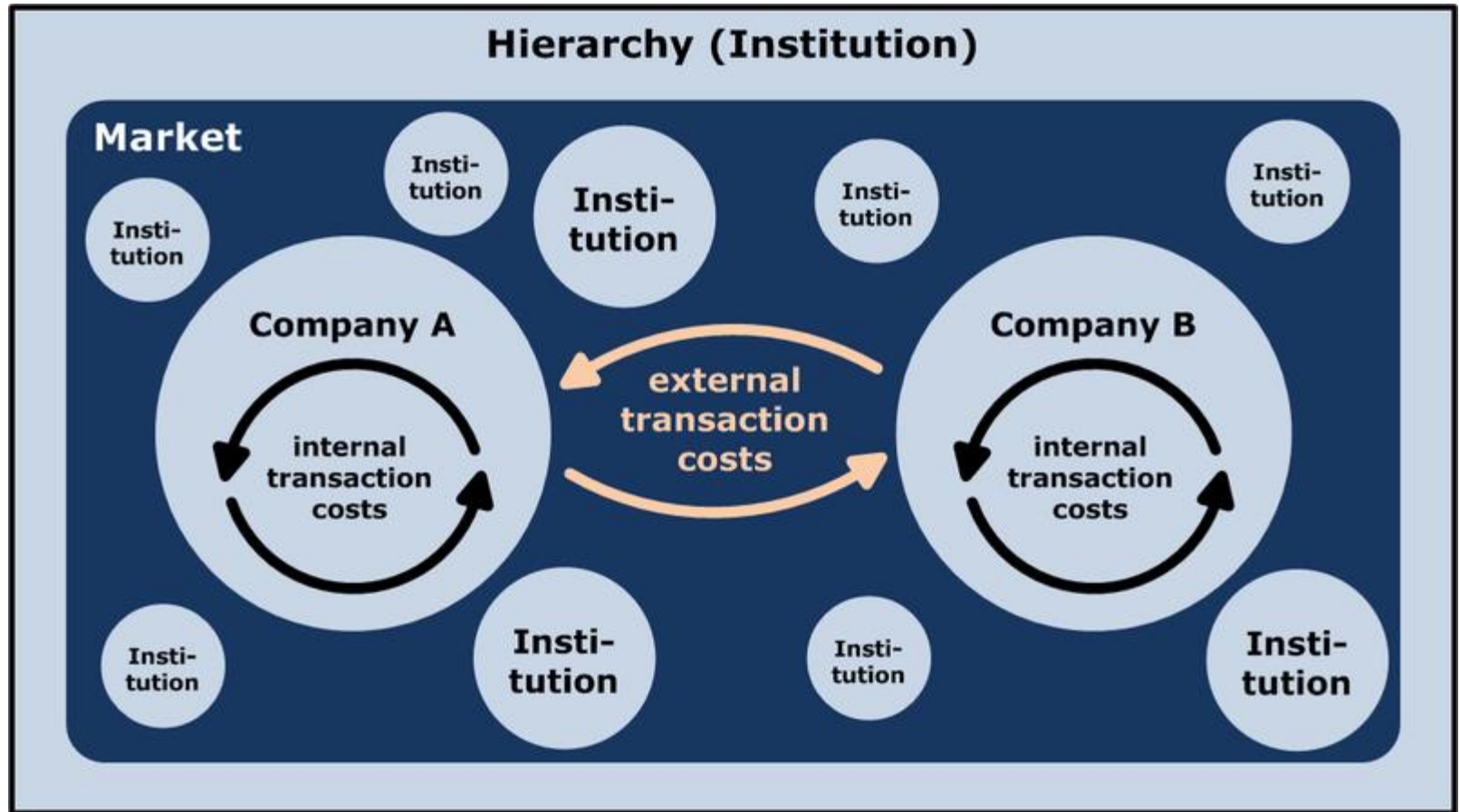
- Time frame: 5 years, acquisition from external vendor, on premise operation
 - ◆ TCO: 1 000
 - ◆ ROI: $(1\,400 - 1\,000) / 1\,000$
 - ◆ Break even: 2 years

Ex: acquisition of ERP (SaaS)

	0	1	2	3	4	Total
Cost	Selection 100	Service fee 250	Service fee 250	Service fee 250	Service fee 250	1100
Benefit	0	300	300	300	300	1200
Benefit – cost	–100	–50	0	50	100	100

- Time frame: 5 years, acquisition (as a service)
 - ◆ TCO: 1170
 - ◆ ROI: $(1200 - 1100) / 1100$
 - ◆ Break even: 3 years

Transaction, market transaction, internal transaction



- Transaction
 - ◆ Exchange of product or service between two parties (vendor, buyer)
- Market transaction
 - ◆ The two parties are independent
 - ◆ Buyer pays an amount, vendor delivers product / service
- Internal transaction
 - ◆ The two parties are two roles/org units inside an organization
 - Option1, buyer pays vendor
 - Option2, buyer does not pay, vendor is subsidized by higher org unit (hierarchy)

-
- A Market transaction has a cost that exceeds the nominal cost
 - ◆ See TCO
 - A Market transaction must be regulated by a legal contract

Market transaction – costs

- Software or service
 - ◆ Operational
 - Selection
 - ◆ Contractual
 - Writing
 - Enforcing (monitoring, litigation)
- Hardware or physical item
 - ◆ Operational
 - Search
 - Transportation
 - Communication
 - ◆ Contractual
 - Writing
 - Enforcing

Ex. Software product (Buy)

- Selection

- ◆ Define needs (requirements)
- ◆ Find products and vendors
- ◆ Select product and vendor
- ◆ Define (or understand) contract, sign



Transaction costs

- Deployment

- ◆ Install (server / clients)
- ◆ Train users
- ◆ Migrate data

- Operation

- ◆ Electricity, licenses
- ◆ Monitor and enforce contract



Transaction costs

- Maintenance

- ◆ Fix defects, add features, adapt to new environment

- Dismissal

- ◆ Migrate data

Contract

- Complete
 - ◆ The more complex the transaction, the more difficult to have completeness
- description of
 - ◆ Service or product
 - ◆ Delivery conditions
 - ◆ Guarranty conditions
 - ◆ ..
- With legal value

Contract (2)

- Hard to describe completely
 - ◆ The product or service
 - Functional and non functional properties
 - ◆ All possible exceptions in delivery and after delivery
- Incomplete description
 - ◆ Due to intrinsic difficulty in description, or information asymmetry
- allows for opportunistic behaviour of (one of) the parts

Ex.

- Liebeck vs. McDonald
 - ♦ Hot coffee lawsuit
- 1994 product liability lawsuit

-
- Internal transaction
 - ◆ Requires a looser description of product or service (internal hierarchy allows rearrangements)
 - ◆ Cost is unknown or unclear

Market vs. firm

	Market	Firm
Information	Not controlled, distributed	Controlled, centralized
Hierarchy	No	Yes
	Pricing as defined by market	Price imposed

-
- What is better? Internal or external transaction?

Transaction theory

- Assumptions (neoclassic economy theory)
 - ♦ Actors take decisions rationally, to maximize utility and profit
 - ♦ All actors have all information
 - ♦ All products (within a specified category) are equal

■ Consequence

- ◆ The market defines the ‘best’ price
- ◆ The market is the ‘perfect’ place to do transactions

In practice

- Actors do not (always) behave rationally
- All information is not available to all
- Not all products are equal

■ Consequence

- ◆ Market less suitable for complex products (hard to describe completely)
- ◆ Market less suitable to have full control on process and product quality

Market vs. Firm

- The higher the uncertainty of the market interaction, the higher the advantage of the firm as an economic entity to produce a good / service
- In case of uncertainty, the firm uses hierarchy to perform internally the transaction
- The choice depends on the good / service
 - ◆ How *standard* are the requirements for product or service

Ex.

	Tyre	Engine design
Product requirements	Standard (circumference, width, weight, speed, duration)	Specific (..)
Service requirements	Standard (conditions in case of faulty product, delay in delivery, ..)	Specific (what is faulty design? What is delay?)
	Market preferred	Internal preferred

Ex. IT service

	IT service / accounting	IT service / price definition for airline
Product requirements	Standard	Specific (..)
Service requirements	Standard (conditions in case of faulty product, delay in delivery)	Secrecy, reliability, fast changeability
	Market preferred	Internal preferred

Internal vs. External transactions

	Market transaction	Internal transaction
Efficiency (cost)	Lower (for standard products) Defined upfront	Higher May be undefined
Know how on building product / service	External (not available anymore internally)	Internal (but probably lower than available to specialized producer)
Problem resolution	Contract (must consider all cases)	Hierarchy (no need to consider all cases)

Market transactions and firm size

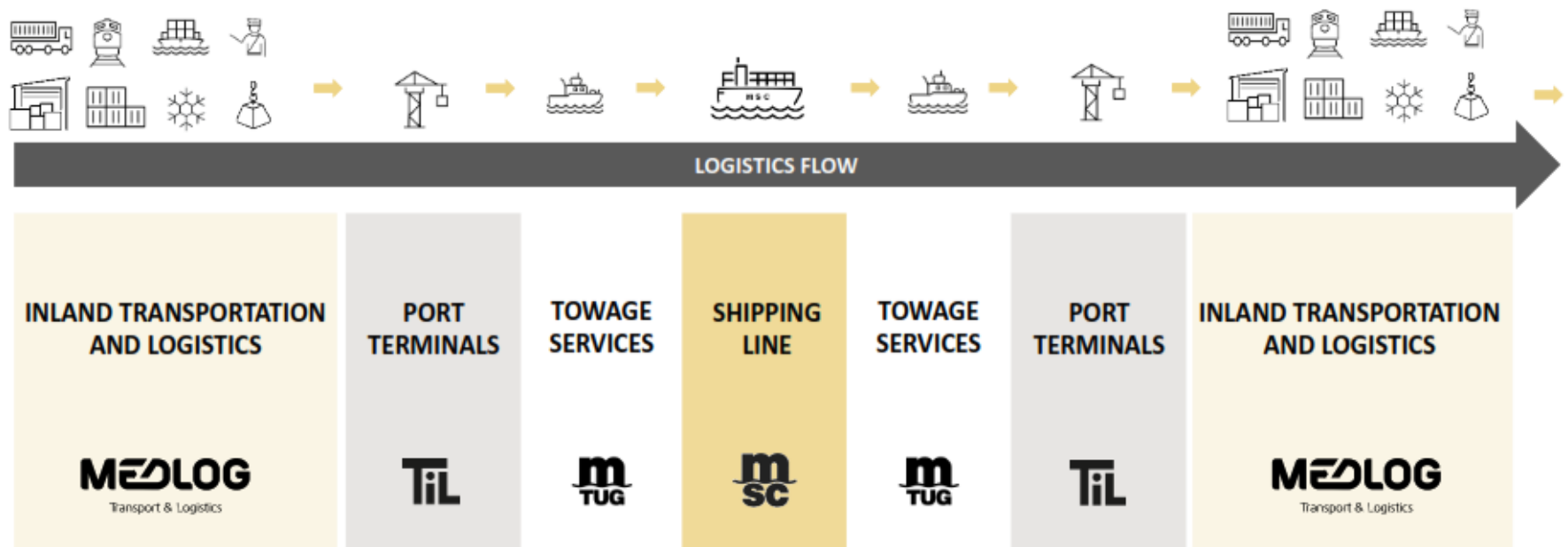
- Size of firms may change if the transaction type changes
- Vertical disintegration
 - ◆ Product/service
 - from developed internally
 - to bought on market
- Vertical integration
 - ◆ viceversa

The 'network' company

- As a consequence of dis-integration
 - ◆ Many independent companies, each specialized on a few components
 - ◆ Integrator company
 - ◆ Ex automotive

MSC

AN INTEGRATED BUSINESS MODEL



- IT services
 - ♦ Vertical integration: GM and EDS, 90s
 - ♦ Vertical disintegration: Fiat and Globalvalue, 90s
 - Global value, a joint venture Ibm – Fiat

(Dis)Integration

- Depends on
 - ♦ Cost of internal transaction vs. cost of external transaction
 - ♦ Importance of know how
 - ♦ Need of specific product / service

Ex. Electronics on car

	Fiat	Bmw	GM
Design of electronic systems for car	Marelli	Internal unit (around 1000 people)	?
Design of diesel injection control unit	Marelli or Bosch	Bosch	Internal unit

Beyond (Dis)Integration

- Joint ventures
- Long term contracts and collaborations

Types of market transactions

- Time and material
 - ◆ Contractual agreement on cost of work (time) and material
 - Ex, build a house: pay material + n person days, @M Euro / day
 - Issue: buyer may control quality in more depth
 - Issue: vendor may try to reduce productivity, final price not known in advance

Types of market transactions

- Fixed price
 - ◆ Contractual agreement on result and its value
 - Ex, buy a house, pay X Euro
 - Issue: price is known in advance, vendor may try to reduce quality
 - Issue: quality should be ‘perfectly’ described in technical annex to contract

Time and material, IT

- One person day (Italy, estimates)
 - ◆ Junior: 200 euro
 - ◆ Mid level: 300 euro
 - ◆ Senior, project manager: 600 euro
- ◆ Possibly x2 in other western countries
- ◆ Possibly /2 to /5 in lower income countries

Agency theory

Agency theory

- Assumption of transaction theory: firm is a monolithic entity aiming at one goal
 - ◆ Unlikely, due to non rational behavior of firms, and conflicting behaviour of individuals in them
- Agency theory has a radically different assumption

Agency theory

- Firm made of **principal** (owner or shareholders) and **agents** (employees and managers)
- Firm based on a web of (explicit or implicit) contracts between principal and agents
- Agents have own interests and goals, and they try to maximize individual utility – not only the firm's utility
- The contrast between goals of agents and principal causes agency costs (to be reduced as much as possible)

Agency costs

- Monitoring
 - ◆ Control of agent by principal
- Bonding
 - ◆ Reporting, by agent to principal, on activities done
- Residual loss
 - ◆ Lost profits by principal, due to suboptimal behaviour of agent

Ex. retail shop

- ◆ Owner (principal), 3 vendors (agents)
- Monitoring
 - ◆ Time spent by owner to check what agents do (instead of doing other work)
- Bonding
 - ◆ Time spent by vendors to report to owner (instead of selling)
- Residual loss
 - ◆ Customer asks for discount, vendor says no, customer does not buy
 - ◆ Owner would have granted discount, and completed the sale

Ex

- Retail shop, owner and salesclerk
 - ◆ Sales clerk less effective than owner
 - Fixed salary
 - ◆ Actions on rewarding
 - Fixed salary + Profit sharing
 - Fixed salary + bonus if sales goal achieved
- CEO and CIO
 - ◆ CIO requests excessive budget for IT area
 - ◆ Actions
 - Budget linked to performance measures

Decision theory

Decisions types

- Gorry and Scott Morton (1971)
 - ◆ Structured: follows an algorithm and is repeatable
 - Ex: grant scholarship
 - Ex: admit students to university
 - ◆ **Semistructured**: output is defined, inputs and decisions partially defined
 - ◆ Unstructured: no algorithm, subjective

Decision types

- ♦ Planned and unplanned decisions
 - Ex planned: produce budget at end of year
 - Ex unplanned: adjust strategy to covid19

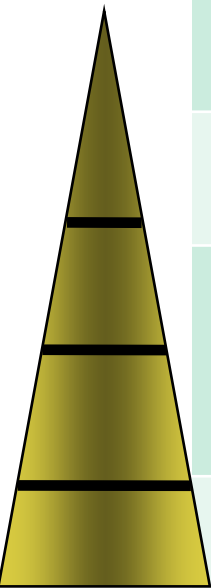
Decision process

- ◆ For structured, planned decisions
- Identify problem
- Identify alternatives
- Evaluate alternatives
 - ◆ Effect, probability of each one
- Select one
- Implement decision
- Evaluate decision

Decision types

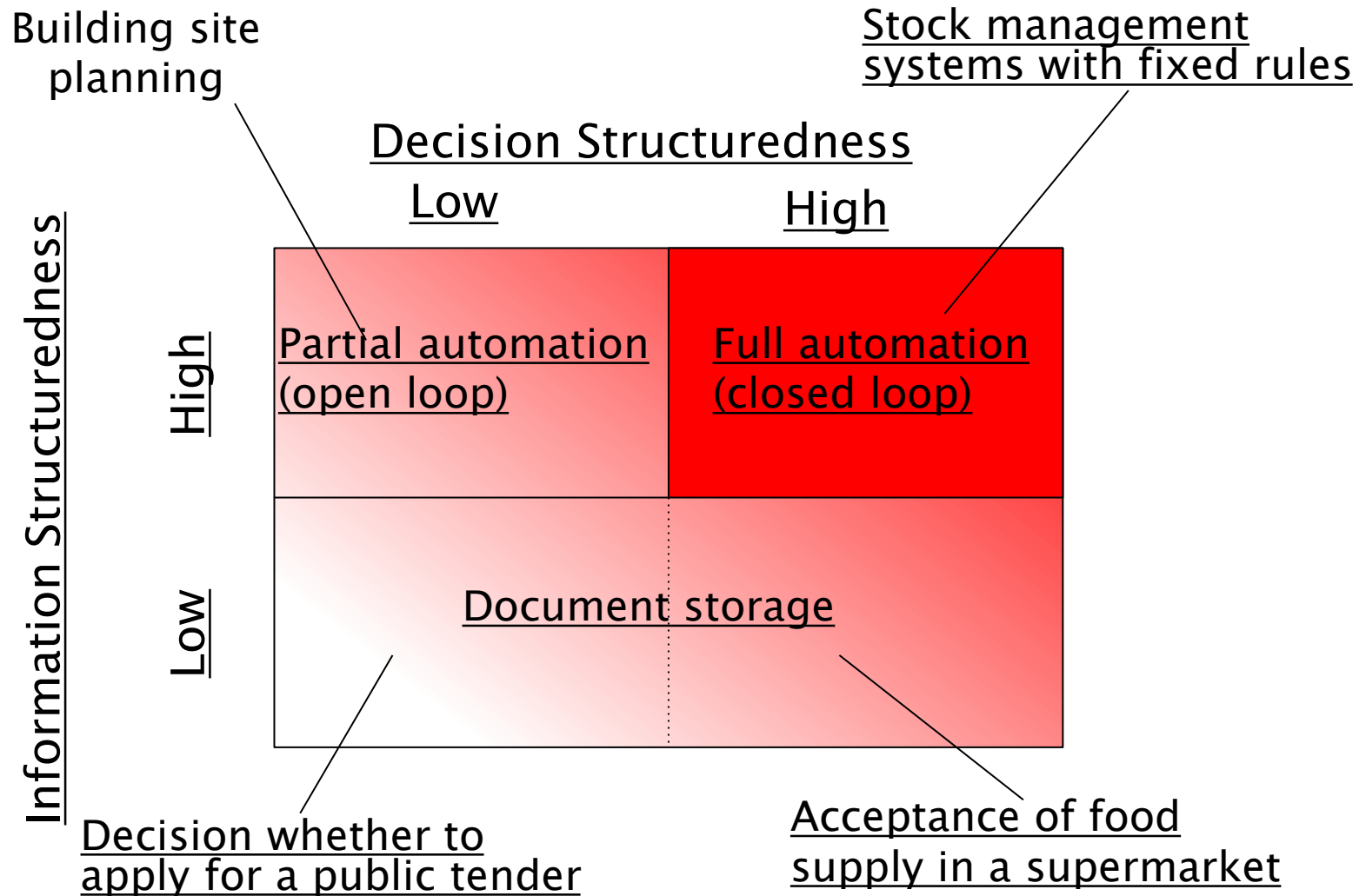
- Under certainty
 - ◆ Outcomes of every alternative is known
 - Turin to Milan, road vs train (no traffic, weather)
- Under noncertainty
 - ◆ Under risk
 - Some knowledge about probability of each outcome
 - Turin to Milan, road vs train (traffic, weather issues)
 - ◆ Under uncertainty
 - No information on outcomes

Decisions in organization



Level (Anthony)	Decision type		
	Structured	Semi structured	Unstructured
Strategic	Plant placement	Fund raising	RD strategy
Managerial	Maintenance budget	Sale budget	Manager hiring
Operational	Stock resupply	Bonds buy / sell	Select cover for magazine

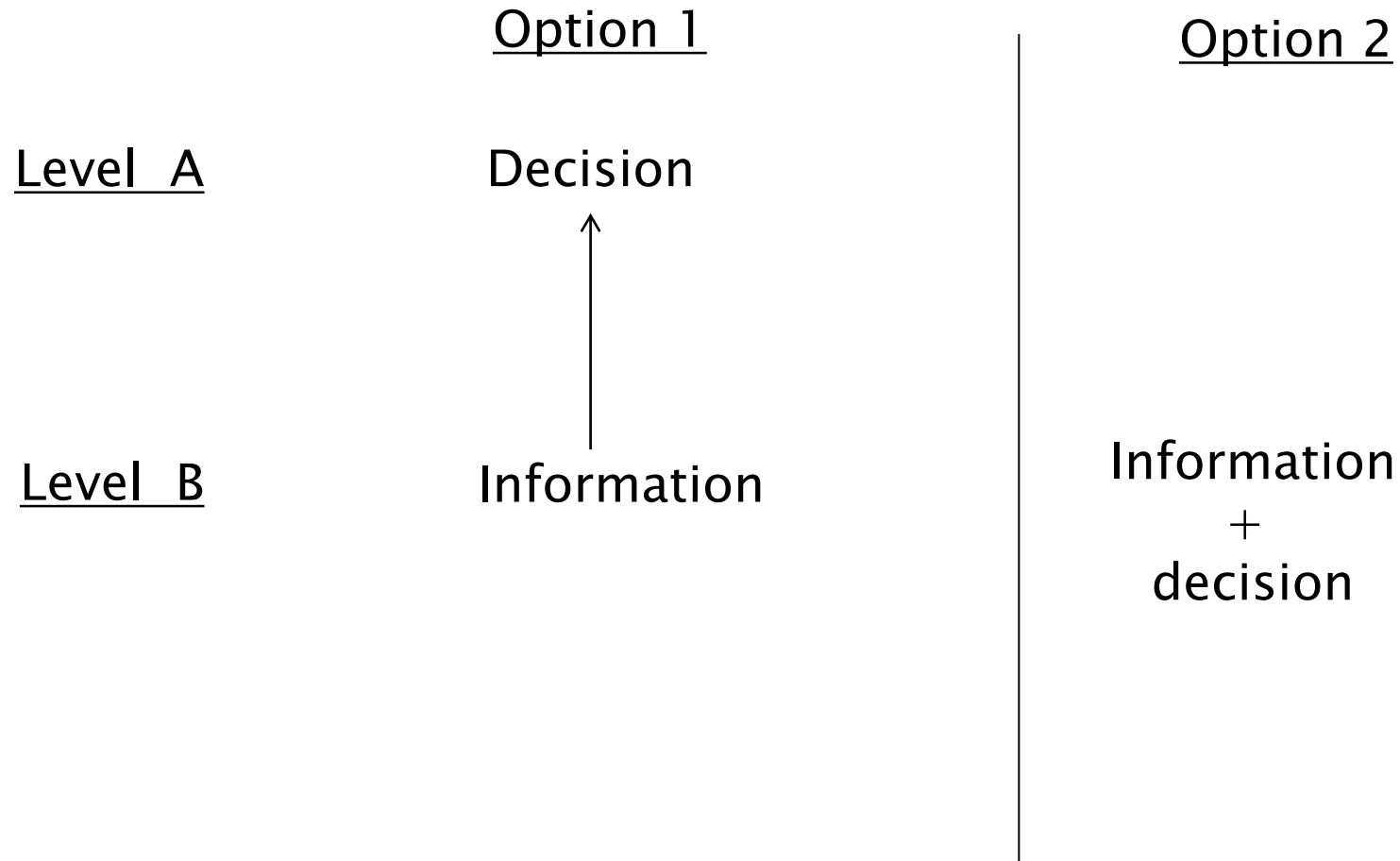
Control and Decisions



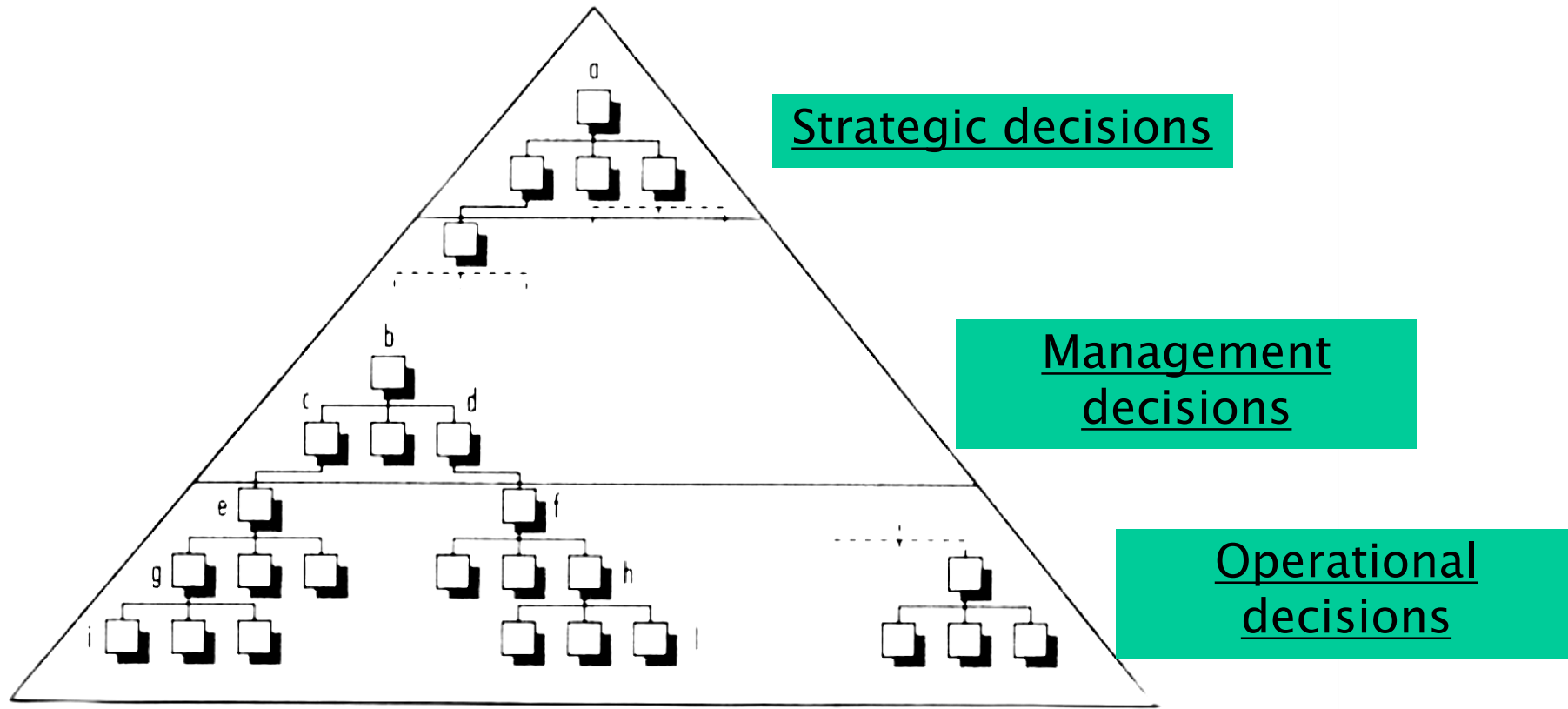
Decision theory

- Decisions are taken at many levels of organizations
 - ♦ allocation of decisions to levels in hierarchy is an organizational variable
 - ♦ Information is key to support decisions – but also imprecise, wrong, unavailable, delayed
 - ♦ Capacity of information management by individuals is limited

Decision and information



Levels and decisions



Decision issues

- ♦ Bounded rationality [Simon] (not all informations are available)
- ♦ Analysis paralysis (too much information does not help)
- ♦ Conflicting goals in decisions (cfr. Agency theory)

Decisions and cognitive bias

- Humans have built-in mechanisms that make rational decisions difficult
 - ◆ Cognitive biases
- Cognitive biases are often connected to Heuristics
 - ◆ Mental shortcuts in ‘reasoning’
 - ◆ (evolutionary explanation: speed vs precision: need to take decisions fast in dangerous situations)

-
- [Khaneman, Thinking fast and slow, 2011]
 - ♦ Nobel prize in Economy, 2002

Confirmation bias

- ◆ Search for, recall, interpret information that affirms one's prior belief or hypothesis
- ◆ Ex: smoking is not dangerous
 - My uncle died at 95 and did smoke all life long. The same for my cousin's father
(is this a significant data sample?)
- ◆ Ex: climate change is not happening
 - Last 12 th of august was freezing cold

Motivated reasoning

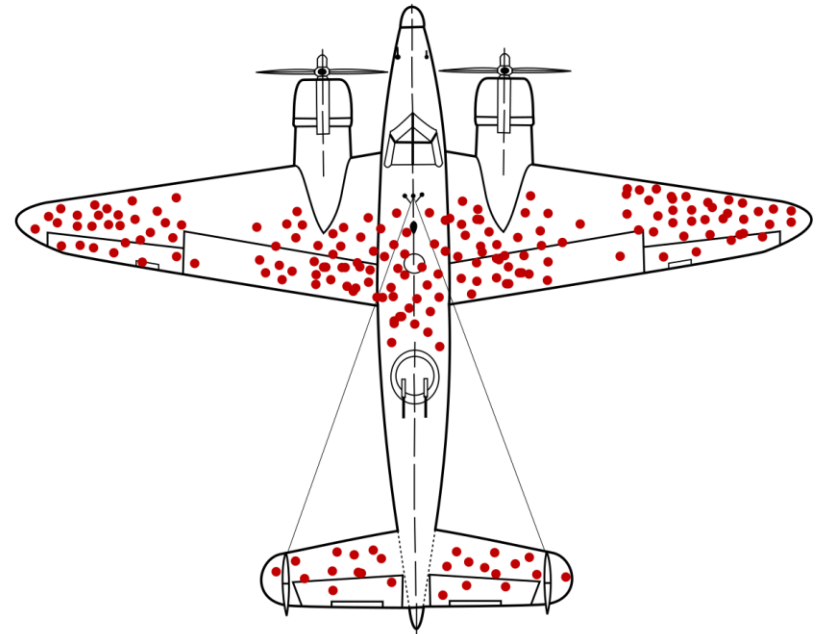
- ◆ Reason to produce desired outcomes, instead of logical outcomes
- ◆ Ex, given a crime, reason to demonstrate that person X is guilty (instead of analyze facts and find guilty person)

Survival bias

- Consider a dataset that contains only the ‘survivors’ to some selection filter
 - ◆ Ex. Bill Gates, Elon Musk, Mark Zuckerberg are billionaires and never got a degree
 - Conclusion: degree is useless
 - Complete dataset: people with a degree on average earn more than people without

Survival bias

- Abraham Wald, IIWW



Optimistic bias

- Tendency to underestimate costs and overestimate benefits
- ‘illusion of control’ effect [Langer]
 - ◆ Overestimation of ability to control events
- ‘overconfidence effect’
 - ◆ Confidence in one’s judgements is higher than objective accuracy of judgement

Bandwagon effect

- Bandwagon effect / social comformance
 - ◆ Do what others do
 - (decide what others decide, perceive what others perceive)
 - Can prevail on perception of facts [Asch 1955]

Bandwagon effect

- Groupthink
 - ◆ In working teams, uniform thinking
 - Linked to confirmation bias, optimistic bias, motivated reasoning can push to wrong decisions
 - Evidence: VW and Dieselgate

Bandwagon effect

- Against groupthink
 - ♦ Diversity in teams
- ♦ The fearless organization [Edmonton]

Cognitive biases

- Bandwagon effect / social comformance
 - ◆ Do what others do
 - (decide what others decide, perceive what others perceive)
 - Can prevail on perception of facts [Asch 1955]

Cognitive dissonance

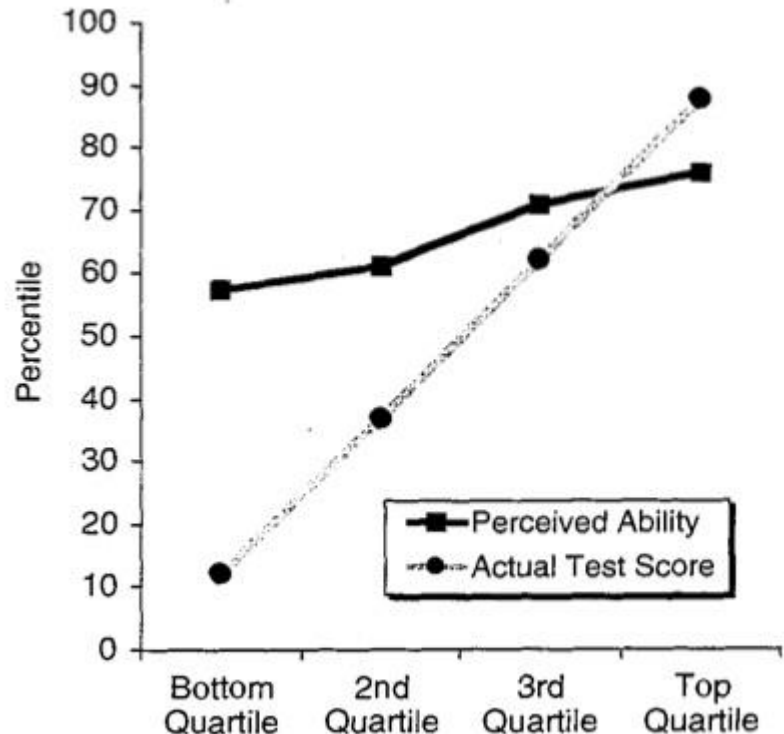
- ♦ Beliefs and behaviors (or decisions) must be consistent, otherwise cognitive dissonance (= psychic pain) happens [Festinger 1957]

-
- ♦ Dissonance can be fixed in two ways
 - Keep behaviours and change/tweak beliefs or facts
 - Keep beliefs and change behaviors
 - Ex: fact: smoke harms, I smoke
 - Decision1: Keep smoking but tweak facts
 - ‘my uncle smoke all his life and died at 95’
(see confirmation bias)
 - Decision2: quit smoking

-
- In short
 - ◆ We like having a meaningful and consistent view of the world
 - ◆ And we dont like to change it

Dunning Krueger

- Dunning Krueger effect
 - ◆ Incompetent people think they are better than they are



-
- (incompetent people lack the ability to recognize their inability, while competent people recognize the difficulty of problems, and their inability)

One thing only I know, and that is that I know nothing. [Socrates, 390 BC]

Repetition

- ♦ The more a statement is repeated, the more the belief in it strengthens

[Propaganda, Ed Bernays]

Authority bias

- Statement by an authoritative person is more trusted
 - ♦ ‘ipse dixit’

Anchoring

- First piece of information considered biases the subsequent process
[Khaneman Tversky]
 - ◆ And prevails on information presented later



-
- ◆ When Gandhi died was more than 100 years old?
 - Yes or no? How old was he when he died?
 - Answers tend to be higher
 - ◆ When Gandhi died was more than 35 years old?
 - Yes or no? How old was he when he died?
 - Answers tend to be lower
 - ◆ At what age Gandhi died?
 - This would be the correct way of posing the question

Loss aversion

- People prefer to avoid a loss than achieve a gain
- Value in a change in probability is not linear
 - ◆ Change from 0 to 10% highly valued
 - ◆ Change from 45% to 55% less valued
 - ◆ Change from 90% to 100% highly valued

Cognitive biases

- Cognitive biases are scientifically used to manipulate decisions
 - ◆ Commercials
 - ◆ Politics
 - ◆ Negotiations

A Special Announcement

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LOGIN

Cognitive Biases in Marketing: What You Don't Know Can Cost You Conversions

Last updated on January 3, 2020 by [Ted Vrontas](#) in [Conversion Optimization](#)



Cognitive biases and AI / ML

- An algorithm that reflects a biased decision will take biased decisions, even if implemented by a computer
 - ◆ Implications in machine learning algorithms
 - Biased datasets
 - Biased algorithms

Doctor 2016

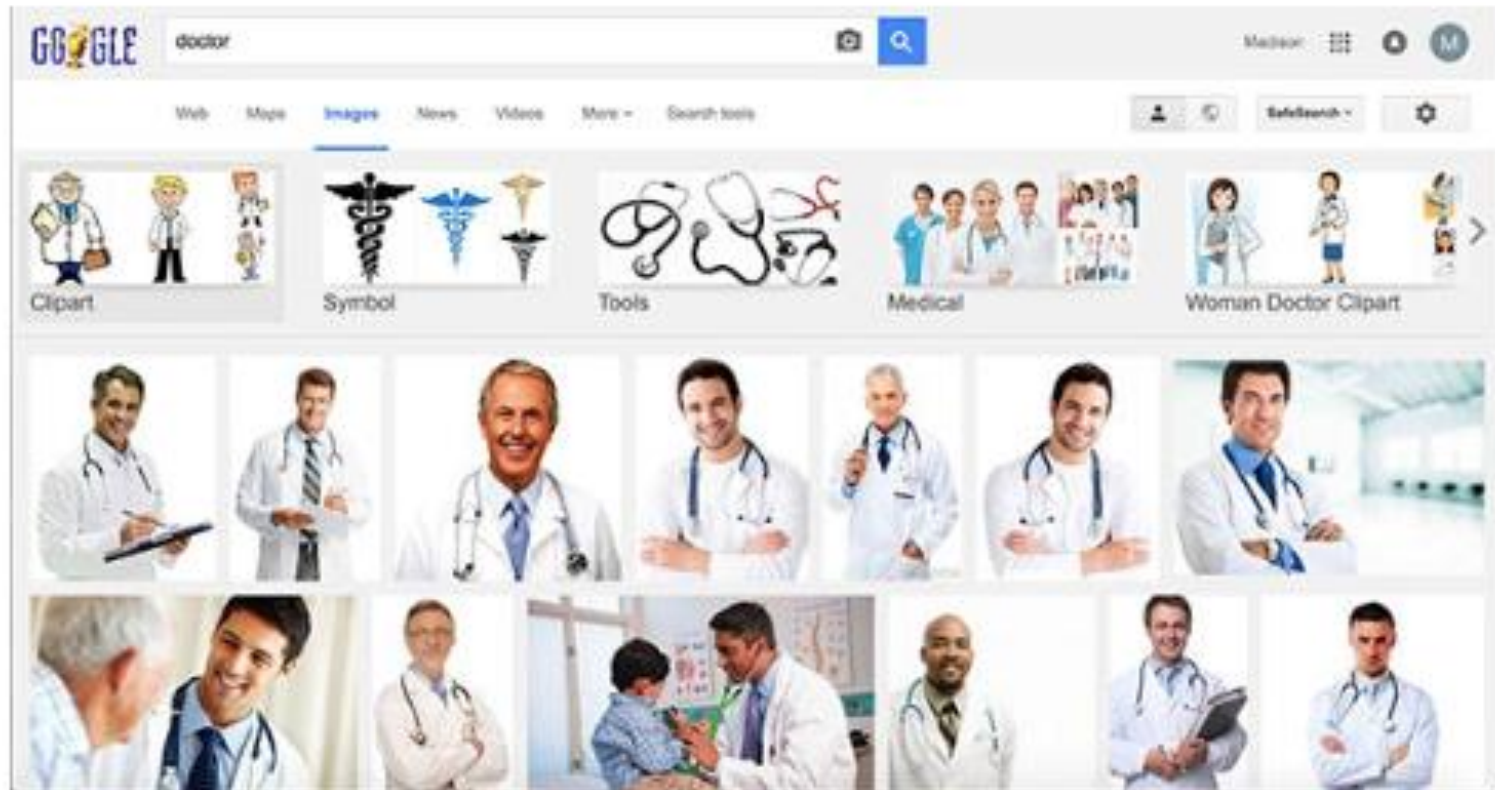


Figure 2.14. Google Images search on “doctor” featuring men, mostly White, as the dominant representation, April 7, 2016.

Doctor 2020

Google doctor

Q All Images Maps Videos News More Settings Tools

clip art medical patient hospital background drawing family logo heart ico

What's in a title? When it come...
theconversation.com

How to Spot a Bad Doctor | ...
mdmag.com

best doctor for your patients ...
mdlinx.com

Key stages for training as a ...
mendeley.com

5 steps to take to become a doctor | AZ ...
azbigmedia.com

The 7 greatest challenges of being
mdlinx.com

Kensington to receive new doctor at ...
journalpioneer.com

medical doctor statistics for National ...
patientpop.com

Home | Doctor-4-U
doctor-4-u.co.uk

HOW TO FIND THE BEST NO-FAULT DOCT...
wrcbtv.com

How Becoming a Doctor Works | HowStuffWorks
people.howstuffworks.com

Logical fallacies

- Flaws in reasoning
 - ♦ Or
- Tricks to obfuscate truth

Ad hominem

- Attack the person to attack the argument
 - ♦ “Bill claims that this was an accident, but we know Bill to be a liar, so we can't take his word for it.”

Anecdotal

- Use a personal experience as an argument
 - ◆ “My grandmother smoked all her life and she died at 90”
 - ◆ Cfr confirmation bias

Appeal to emotion

- Emotion as argument
 - ◆ “happy smiling family having breakfast with product A”
 - ◆ “beautiful lady with beautiful legs and Z stockings”
 - ◆ Product A as maker of a happy family
 - ◆ Product Z as maker of beautiful legs
 - ◆ Almost every commercial is an appeal to emotion.

Appeal to authority

- “the mayor said that crime rate is low”
 - ◆ So statistics saying the opposite must be wrong
 - ◆ Cfr Authority bias

Ambiguity

- Use an unclear description to support an argument
 - ◆ “I know John very well, he would never do X”
 - What exactly means ‘I know John very well?’

Burden of proof

- Make a claim and let others prove it is false
 - ♦ John: “ghosts do exist”
 - ♦ Mary: “ how come?”
 - ♦ John: “then prove they do not exist”

Circular reasoning

- Use argument to prove argument
 - ◆ “Whatever is less dense than water will float, because such objects won't sink in water.”

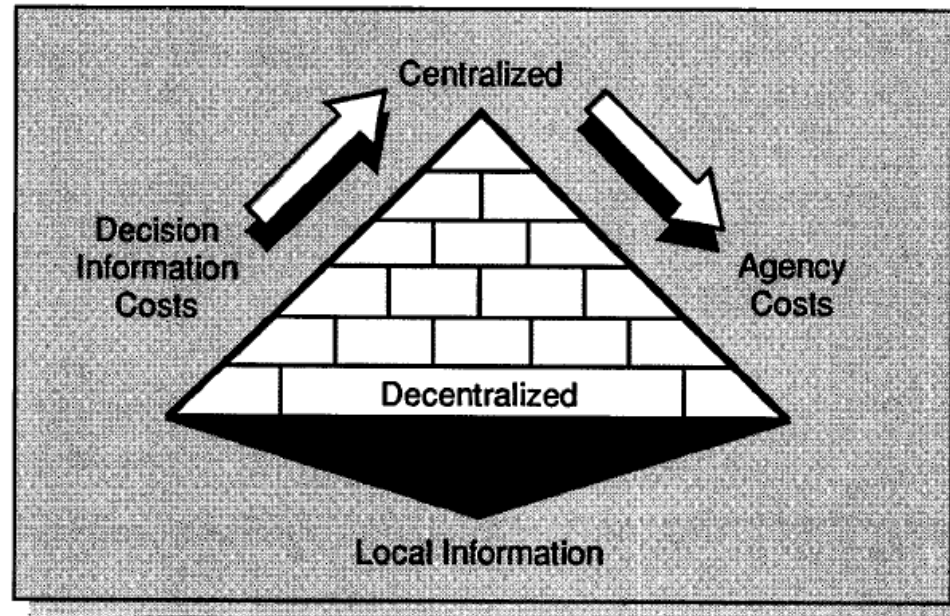
Decision costs

- If decisions are taken where information is not produced
- Decision information cost
 - ◆ Communication, documentation (miscommunication)
 - Cost of collection and transmission of data to higher levels
 - ◆ Opportunity cost
 - Delays in availability of information at higher levels and lost opportunities
 - ◆ Suboptimal decisions
 - Because of delays / imprecision/ cognitive biases

Internal coordination costs

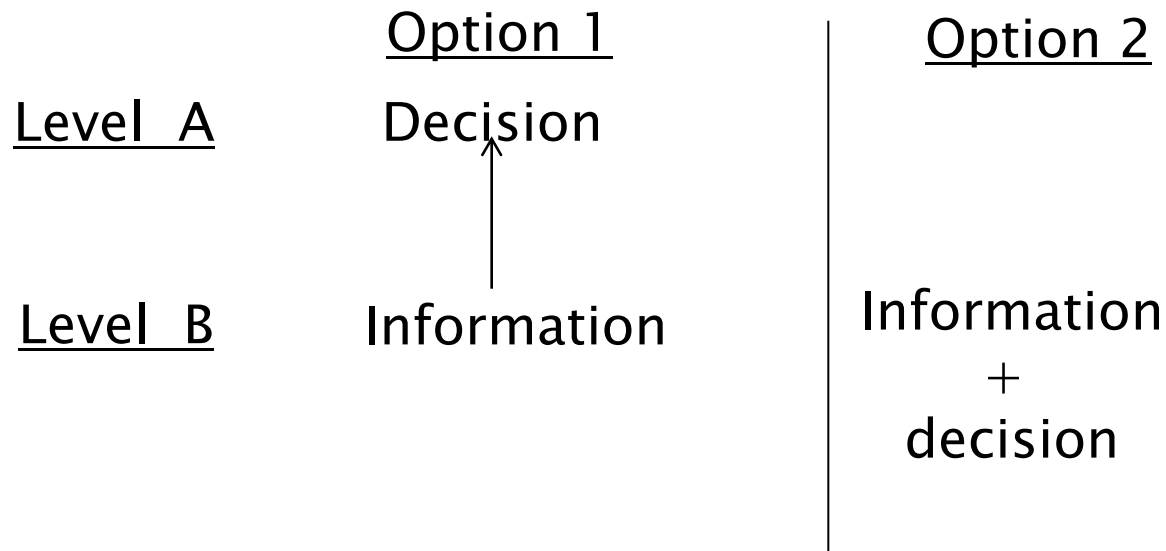
■ Internal coordination costs

- ◆ Agency costs
 - Monitoring
 - Bonding
 - Residual loss
- ◆ Decision information costs
 - Communication, documentation (miscommunication) cost
 - Opportunity cost
 - Suboptimal decisions



ICC

- Jensen: Allocate the decision capability in order to minimize internal coordination cost



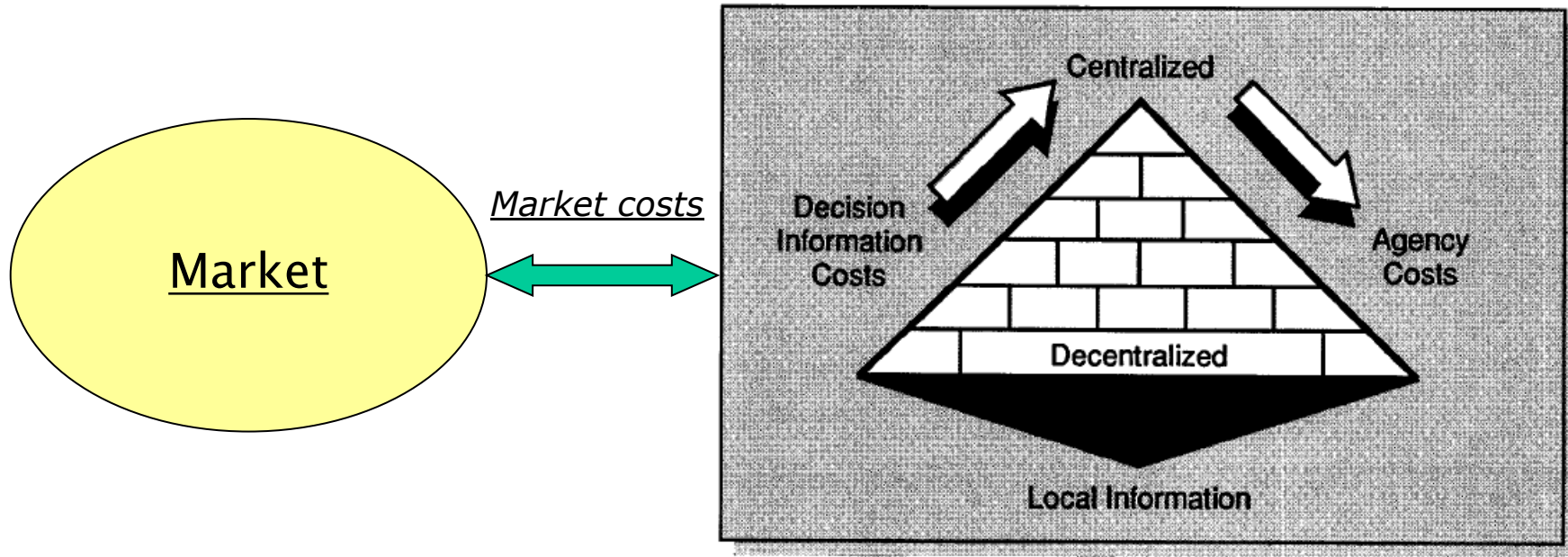
Ex

- Where information is available vs. where decision is taken
 - ◆ Trading company
 - Information becomes obsolete in seconds
 - Trader takes decision
 - Profit sharing to lower agency cost
 - ◆ Burocracy
 - Lower levels do not decide anything, SOPs or pass to higher level
 - Agency cost zero (but low efficiency)

Overall costs

- Internal coordination
- Market/External coordination
- Operation

Overall costs



IT Economics

What is cost of IT in an organization?

Cost

- Cost of IT area / unit
- Cost of IT project/applications

Cost of IT area (direct)

- Fixed costs
 - ◆ Personnel, facilities
 - ◆ Hardware and software (if bought)

- Variable costs
 - ◆ Services from other companies (see outsourcing chapter)
 - Rental, licences for hardware and software
 - Rental of personnel

Cost of IT area

- Typical figures: 1–3% of turnover
 - ♦ ENI: 800M / year
 - ♦ Intesa: 500M/ year, 10% new projects

Cost of IT – indirect

- Indirect costs are outside IT area
- Ex:
 - ◆ Learning cost of non IT people to learn using IT tools
 - ◆ Suboptimal decisions because of IT tools
 - ◆ Time lost because of IT downtime
- As usual, indirect costs are very difficult to compute

Cost of IT project

- Must use TCO, per time period
 - ♦ Consider all costs
 - direct and indirect
 - Internal and external (buy)
 - ♦ On all phases
 - Construction / selection (make vs. buy)
 - Deployment
 - Operation + maintenance
 - Dismissal

TCO phases

- Construction (see COBIT domain BAI)
 - ◆ Requirement definition, design, coding, testing ..
- Selection (see COBIT domain BAI)
 - ◆ Requirement definition, vendor/product identification evaluation selection, contract definition

TCO phases

- Deployment
 - ◆ Install product / service on machines
 - ◆ Training of users, learning curve
 - ◆ Data entry / data reformat
- Operation (see COBIT domain DSS)
 - ◆ Day by day support
- Maintenance (see COBIT domain DSS)
 - ◆ Changes
- Dismissal
 - ◆ Uninstall and dispose product

Ex, TCO per periods

Year 1	Year2	Year3	...	Year n
Construction /selection costs	Operation costs	Operation costs		Dismissal costs
Deployment costs	Maintenance costs	Maintenance costs		

Ex: construction of ERP (make)

	0	1	2	3	4	Total
Cost	Construction 400 Deployment 100	Operation 100 Maintenance 100	Operation 100 Maintenance 70	Operation 100 Maintenance 50	Operation 100 Maintenance 50	1170
Benefit	0	400	400	400	400	1600
Benefit – cost	–500	–300	–70	180	430	430

- Time frame: 5 years, construction
 - ◆ TCO: 1170
 - ◆ ROI: $(1600 - 1170) / 1170$
 - ◆ Break even: 3 years

Ex: acquisition of ERP (license)

	0	1	2	3	4	Total
Cost	Selection 100 Deployment 100	Operation 100 Licence 100	Operation 100 Licence 100	Operation 100 Licence 100	Operation 100 Licence 100	1000
Benefit	0	350	350	350	350	1400
Benefit – cost	–200	–50	100	250	400	400

- Time frame: 5 years, acquisition from external vendor, on premise operation
 - ◆ TCO: 1000
 - ◆ ROI: $(1400 - 1000) / 1000$
 - ◆ Break even: 2 years

Ex: acquisition of ERP (SaaS)

	0	1	2	3	4	Total
Cost	Selection 100	Service fee 250	Service fee 250	Service fee 250	Service fee 250	1100
Benefit	0	300	300	300	300	1200
Benefit – cost	–100	–50	0	50	100	100

- Time frame: 5 years, acquisition (as a service)
 - ◆ TCO: 1170
 - ◆ ROI: $(1200 - 1100) / 1100$
 - ◆ Break even: 3 years

TCO

- Computing TCO is difficult, especially for indirect (hidden) costs, and for time span considered (years)

Ex.

Phase	Direct	Indirect
Selection	Effort to find and evaluate vendors	Effect of lockin to vendor Effect on processes and business
Deployment/training	Effort for training (teachers) Facilities for training (classrooms)	Effort for training (trainees)
Deployment / data entry	Effort to define data entry procedures	Effort to perform data entry Learning effect (hidden) Delay of other activities (hidden)
Deployment/ installation	Effort to install new hardware, and software	Delay of other activities (hidden)

Construction costs – estimation

- COBIT domain BAI
 - ◆ Implement activities
- How to estimate construction costs?
 - ◆ Expert opinion
 - ◆ Function points
 - ◆ Effort estimation based on size estimation

Maintenance cost – estimation

- See function points

What is value of IT in an organization?

Value

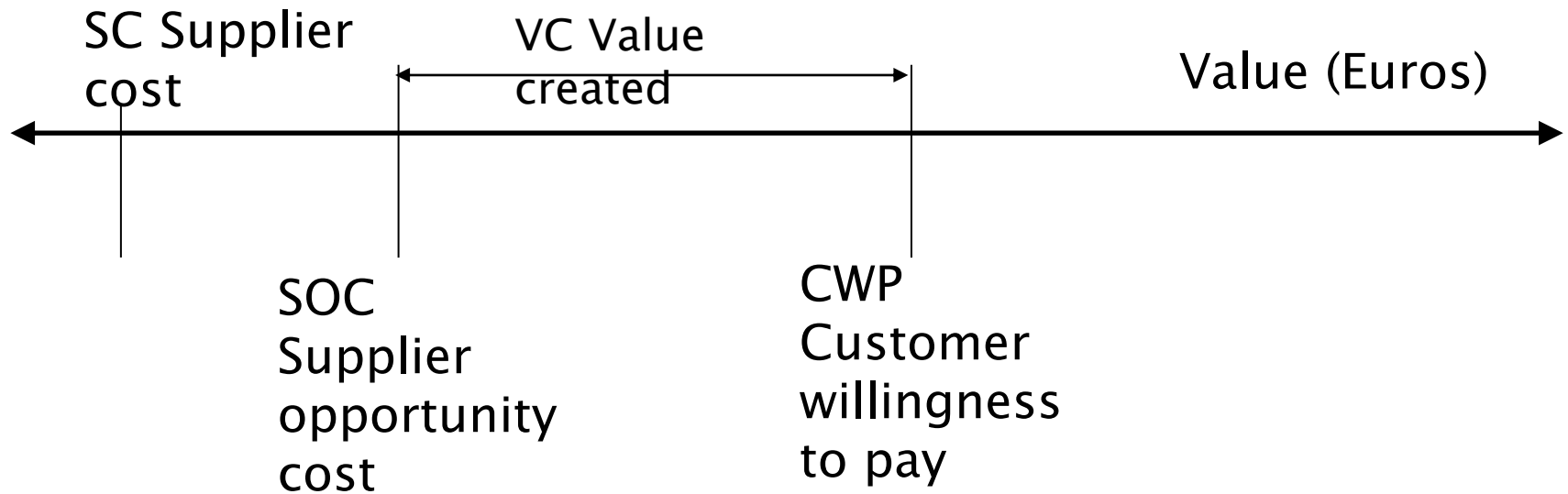
- Several definitions and theories on value
 - ♦ Intrinsic: is a property of an object
 - ♦ Labor: depends on how much labour (effort) is needed to produce it
 - ♦ Monetary: price is the form of appearance of value
 - Value of exchange
 - ♦ Subjective: value depends on the consumer
 - Value of use

Value

- Marginal utility
 - ◆ Value does not depend on whole usefulness
 - ◆ But on most important use for a person

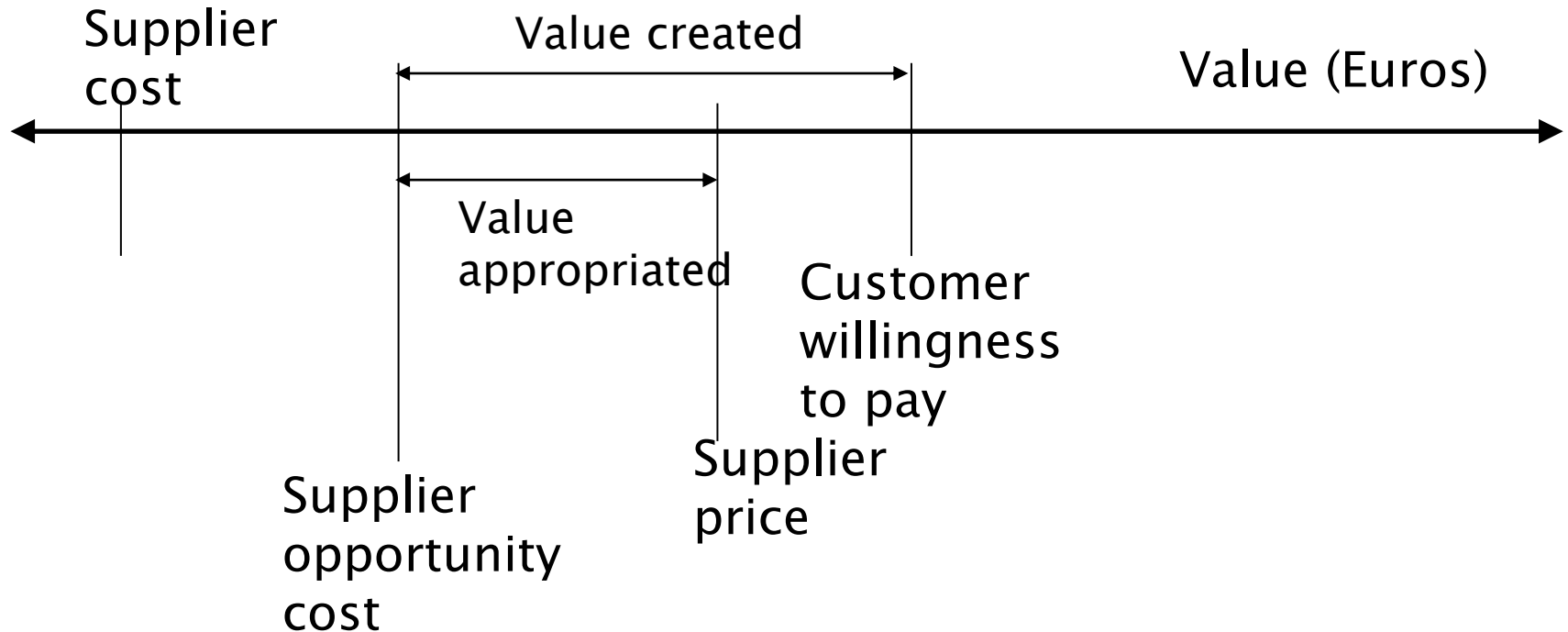
 - ◆ Farmer has 4 sacks of grain
 - Value of 1st: survival, make bread (highest value)
 - Second: feed animals (lower value)
 - Third: make whisky (lowest value)
 - Fourth: feed pigeons (lowest lowest value)

Value creation



- Ex: SC 17, SOC 18, CWP 26, $VC=8$

Value appropriation



- Supplier sells at 24, customer saves 2, value appropriated 6

Value of IT in organization

- Capability of
 - ◆ Supporting the strategy of the organization
 - ◆ Supporting the business processes

i.e. Value of IT is in supporting Alignment
at_best

Effect of IS/IT on Transaction cost

- External transaction costs
 - ◆ Lower cost for search, evaluation, selection
 - Internet (market places)
 - ◆ Lower cost for communication
 - Internet, supply chains and integration of IS supplier purchaser (Electronic Document Interchange)
- Internal transaction costs
 - ◆ Lower cost for coordination, communication
 - Email, document repositories, mobile phones

Effect of IS/IT

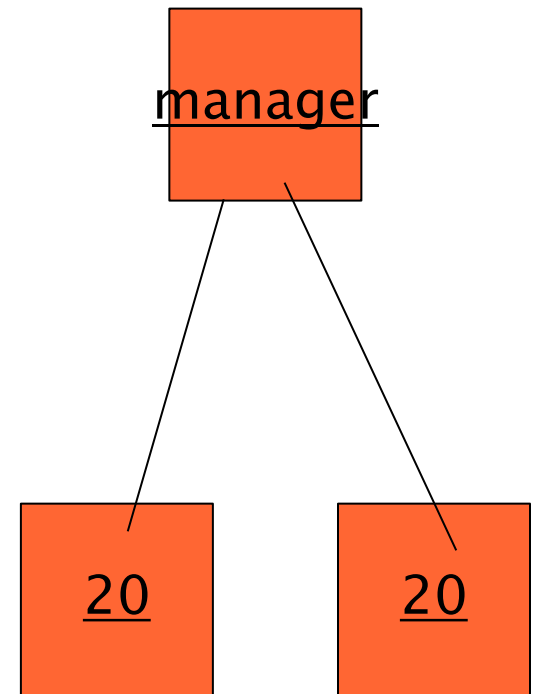
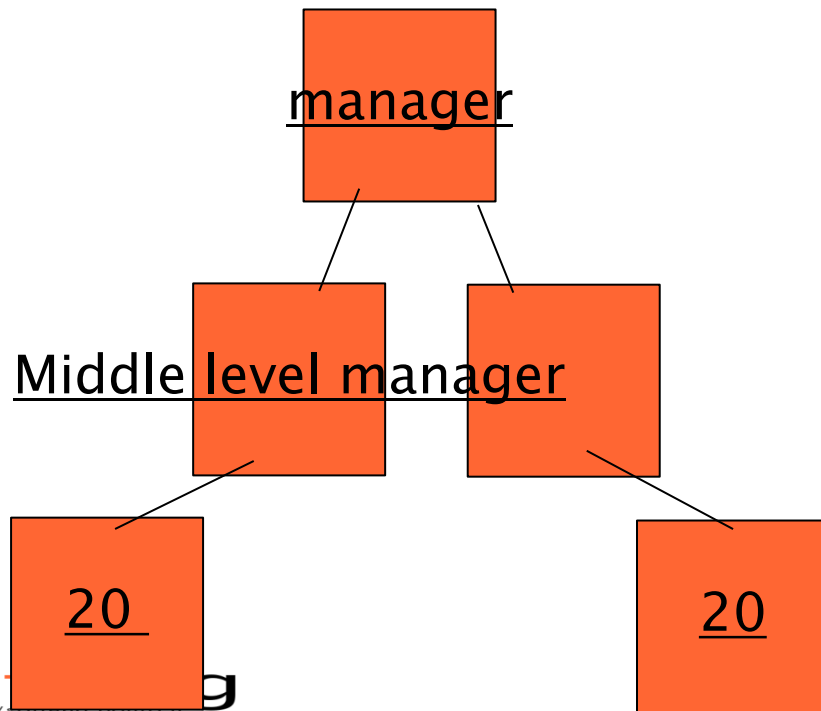
- Overall, reduction of size of large companies, increase of size of medium companies
 - ♦ Network companies
 - ♦ Vs. Vertical company

Effect of IS/IT on agency costs

- Eased collection of information from lower levels
 - ♦ Reduces bonding, monitoring costs
 - ♦ May avoid need of intermediate management levels – reduces depth of hierarchy
 - ♦ May reduce specialization needs of lower levels / increase decision power of lower levels

Effect of IT

Reporting and bonding	Without IT support	With IT support
	1 manager controls at most 20 agents	1 manager controls 40 agents



Effect of IS/IT on decision cost

- Positive effect on quantity and quality of information
- Positive effect, availability of powerful tools to support decision process
 - ◆ Model building, what if analysis, browsing and exploration of data
- Negative effect on quantity of information
 - ◆ Information overload

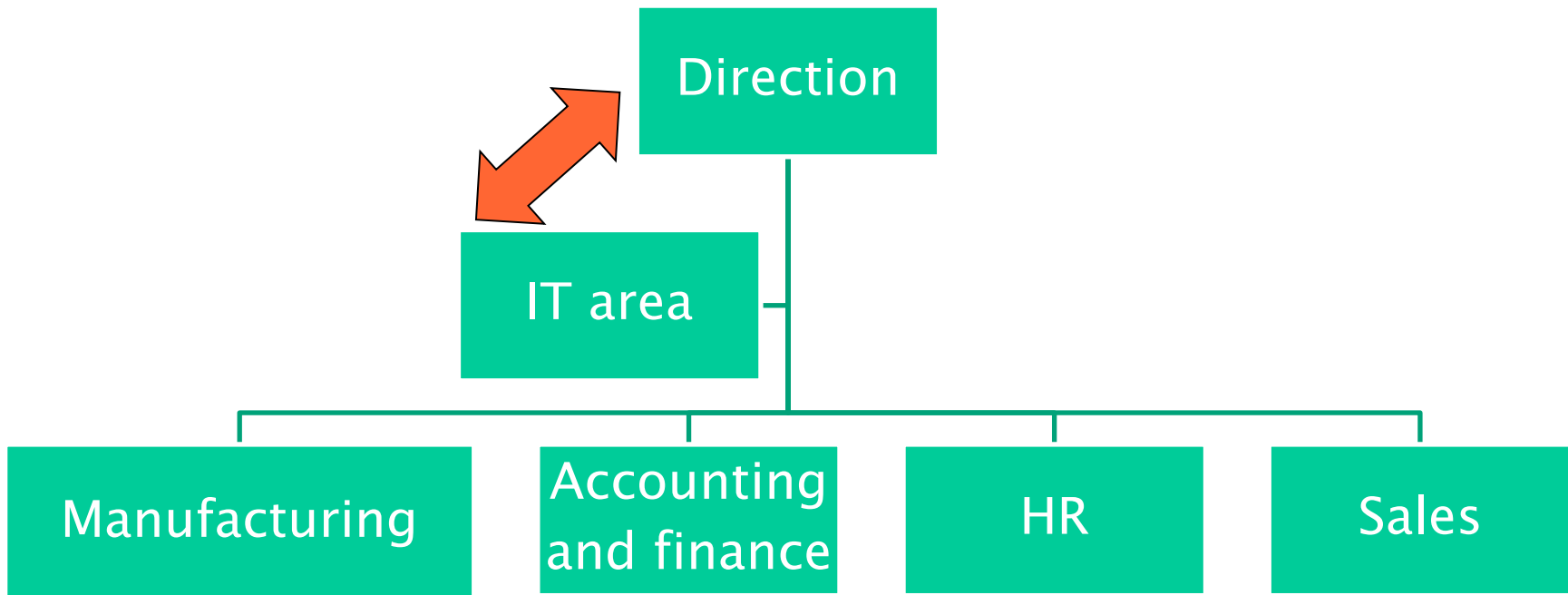
In short

- IT /IS value is in:
 - supporting alignment
 - reducing
 - ♦ Market transaction costs
 - ♦ Agency costs
 - ♦ Decision costs

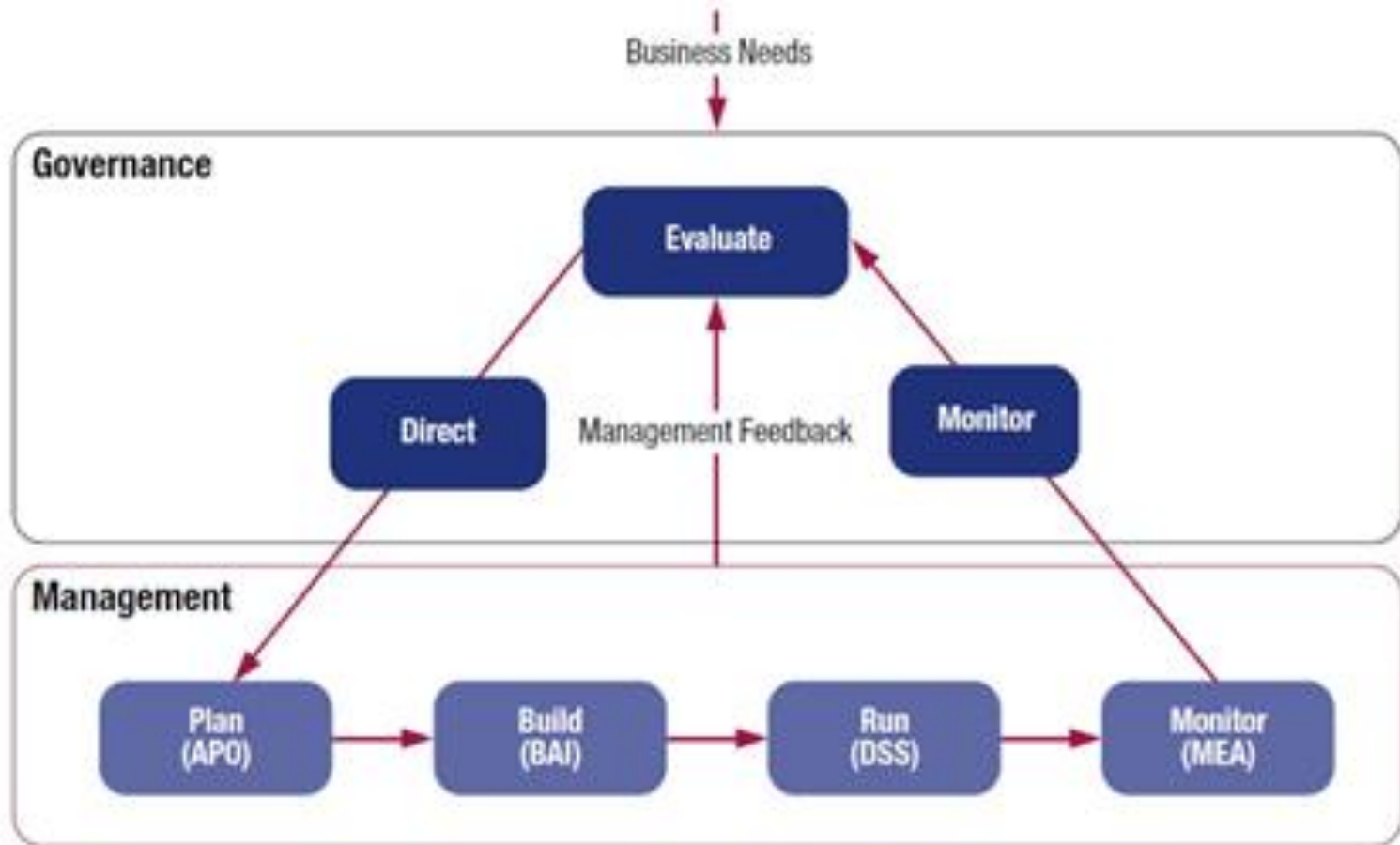
IT Governance

Context

- how to use IT in an organization to maximize value and reduce costs? (CEO vs CIO)



Cobit – Governance



IT Governance

- Governance processes in COBIT are all about decisions re IT in the company
 - ◆ Define strategic IT plan
 - ◆ Define information architecture/technology direction
 - ◆ Define IT processes, organization
 - ◆ Manage IT investment
- IT Governance is about these decision
- A never ending process

-
- Key decisions in Governance:
 - ◆ Importance of IT, budget allocated to IT
 - Key decisions in IT governance:
 - ◆ Buy or make software?
 - ◆ What contractors to use? What technology?
 - Ex: microsoft/.net vs google/oracle/java?
 - OSS or proprietary?
 - *Alignment is the key point*

Corporate governance

- the processes by which all companies are directed and controlled
 - ◆ Involves different stakeholders
 - Shareholders, board of directors, management
 - Employees, suppliers, customers
 - Banks and lenders
 - Environment

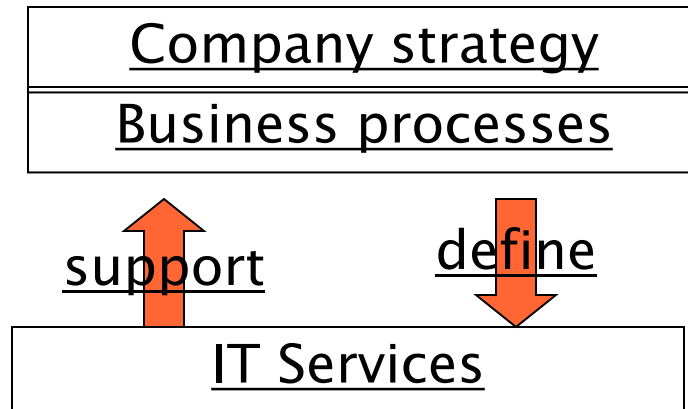
IT Governance

- Subset of corporate governance, dealing with IT systems/services
 - ◆ Performance
 - ◆ Risks
 - ◆ Resources
- ◆ IT area must support the organization strategy. IT Governance deals with that.

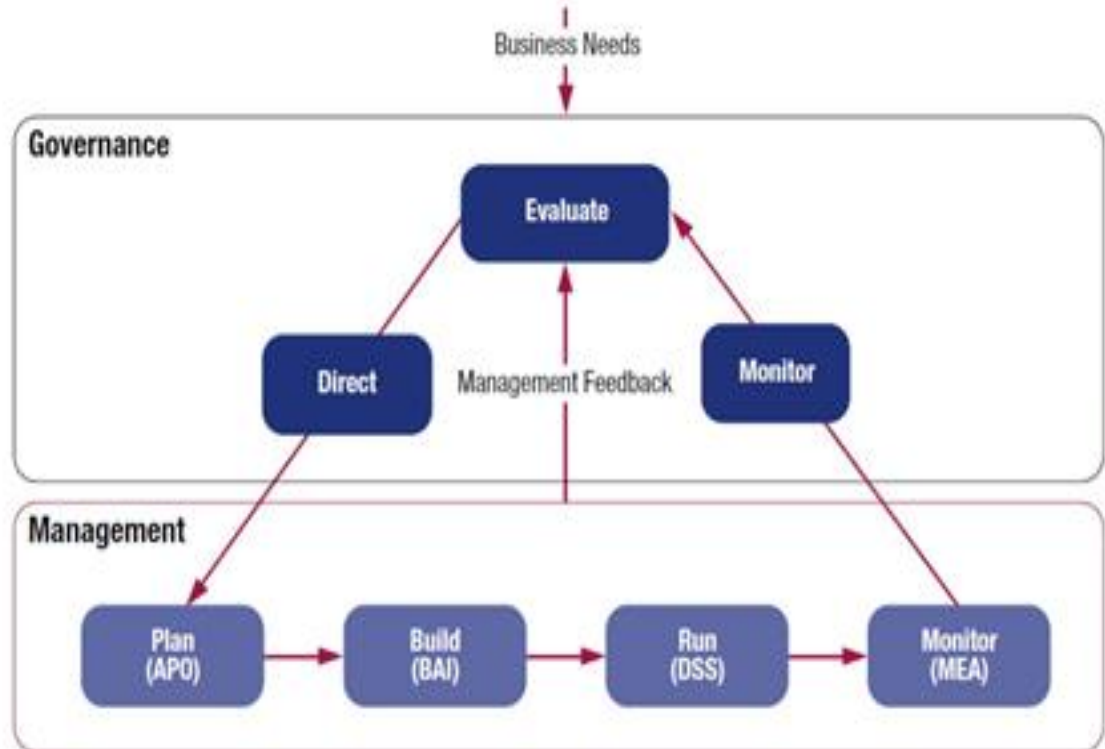
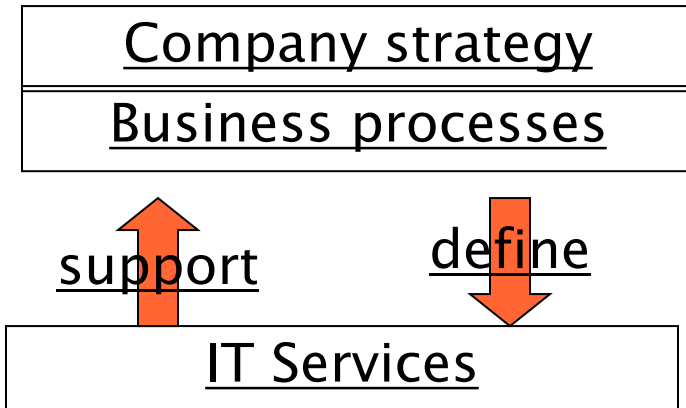
Strategy and IT strategy

- Strategy is key result of corporate governance
 - ◆ Long term objectives and means of achieving them
- IT strategy is part of / supports overall strategy

IS and company



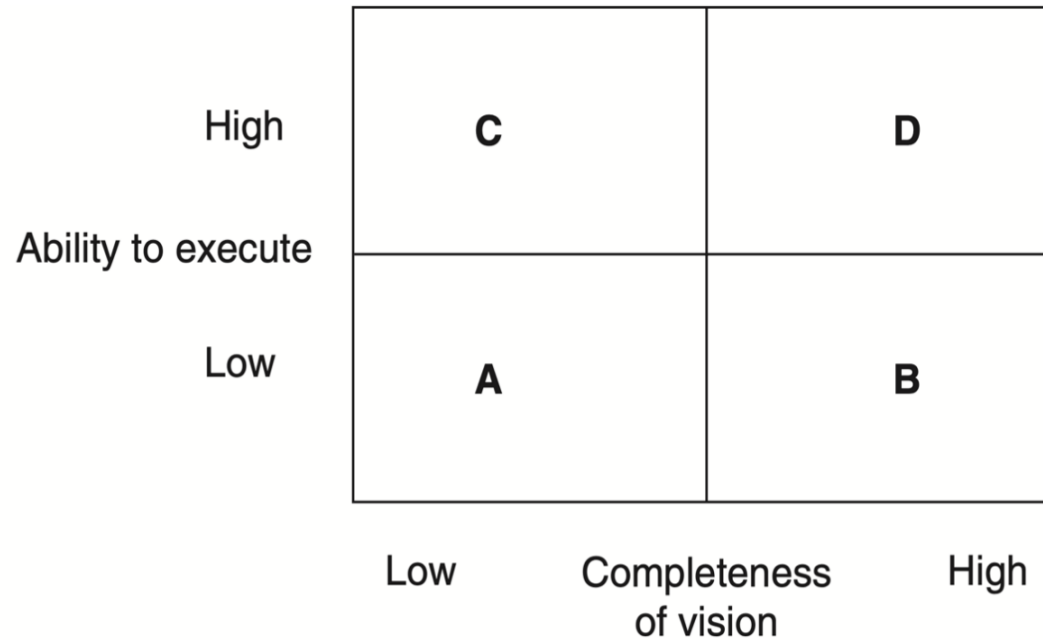
IS and company – COBIT



IS alignment

- Do IT services support company strategy and business processes?

IT strategy and maturity

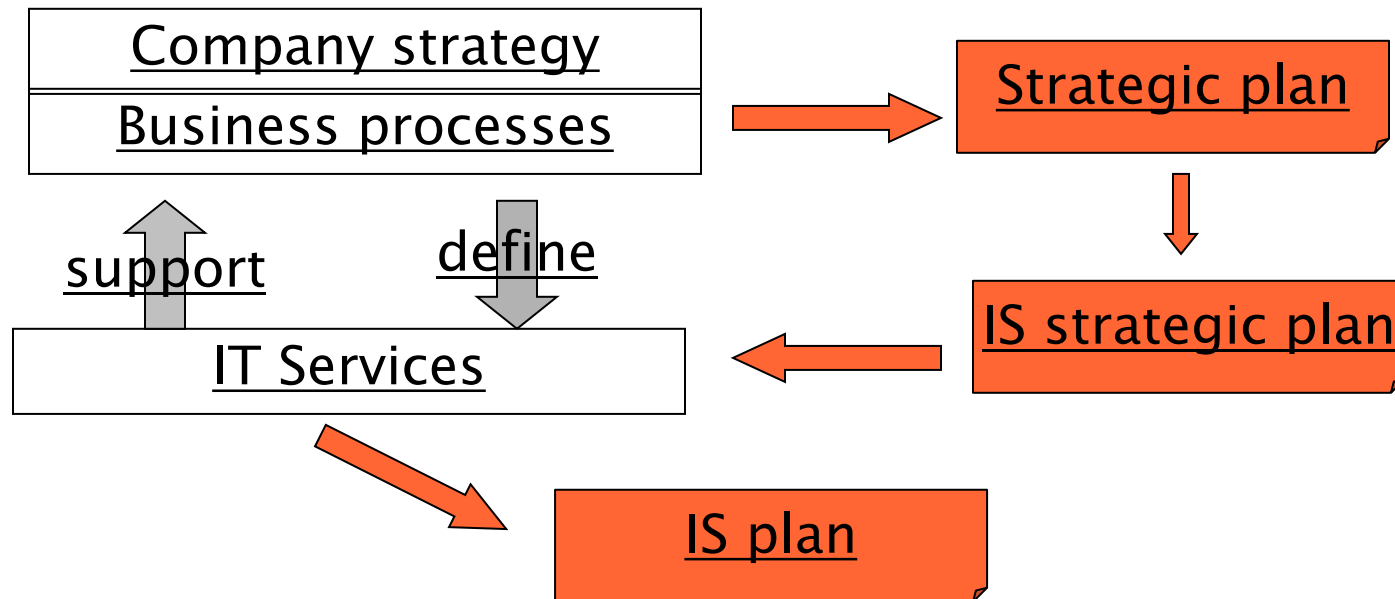


IT strategy and maturity

- “Beginner”: IT strategy is poorly defined, and the IT functions would be poorly executed against the strategy.
- “Visionary”: a company with a defined IT strategy, but the IT function is unable to execute.
- “Challenger”: IT strategy is not defined or is inadequate; nevertheless, the IT function can execute any strategy.
- “Master”: IT strategy is well placed by the IT function.
- [Rold 2001]

IS and company

- Key documents: strategic plan and IS strategic plan (== IT strategic plan in COBIT), IS plan



IS Strategic Plan

Strategic plan: strategy and goals of organization

IS strategic Plan: how IS supports strategy, roadmap for IS development, rationale, budget.

Time horizon: 3–5 years (updated every year)

IS strategic plan is (must be) linked to and dependent from Strategic plan (alignment)

IS plan

- Horizon: 1 year
- Derived by IS strategic plan

IS Strategic plan –1

- Current situation
 - ◆ Architecture, Applications (AP Application portfolio), Systems (hw, OS, DB,...)
 - ◆ Personnel
 - ◆ Organization
 - includes make / buy
 - Vendor choices (ex Java vs Microsoft)

IS Strategic plan –2

- Company strategy
 - ◆ Overall IS budget
- New situation
 - ◆ Architecture, Applications, Systems
 - ◆ Personnel
 - ◆ Organization
 - ◆ New projects

IS plan

- Budget
- Projects
 - ◆ Schedule, budget
 - ◆ Total budget for IT function for 2018: 1000
 - ◆ Staff, infrastructure, licenses, services: 800
 - ◆ New projects / investment: 200
 - 8 projects, with estimated costs >200 : which to select?
 - P1 80, P2 45, P3 20, P4 45, P5 40, P6 50, P8 20

IT Governance, enablers + inhibitors

Enablers

1. Senior executive support for IT
2. IT involved in strategy development
3. IT understands the business
4. Business/IT partnership
5. Well prioritized IT projects
6. IT demonstrates leadership

Inhibitors

1. IT/Business lacks close relationship
2. IT does not prioritize well
3. IT fails to meet its commitments
4. IT does not understand business
5. Senior executives do not support IT
6. IT management lacks leadership

[Luftman Brier 1999]

IT alignment – aspects to be considered

- Business strategy
 - ♦ Scope
 - ♦ Distinctive competencies
 - ♦ Business governance
- Organization infrastructure and process
 - ♦ Org structure
 - ♦ Processes
 - ♦ Skills
- IT strategy
 - ♦ Technology scope
 - ♦ Systemic competencies
 - ♦ IT Governance
- IT infrastructure and process
 - ♦ Architecture
 - ♦ Processes
 - ♦ Skills

[Luftman Brier 1999]

Example

- ♦ Retail bank1

- Strategy: attract customers with better services
- IS function: more budget to improve services at counter, web site, call center: delays, flexibility ..

- ♦ Retail bank2

- Strategy: attract customers with higher interest rates, no frill services
- IS function: less budget to save money, less investment in front end

Example

- ♦ Benetton (1990)

- Strategy: increase market share with larger offer, same or higher quality, lower cost

Organization + IS functions

- Franchising shops
- Each evening sales figure (models sold, colors, size) are available to headquarters
- Every week rescheduling of production
- Using heavily subcontractors
- Effect on cost: lower inventory and returns
- Effect on value: customers find in shop what they want

-
- Typical mistakes:
 - ◆ IS goals not aligned with strategy
 - ◆ IS goals incompatible
 - Ex Better service and lower cost

Example

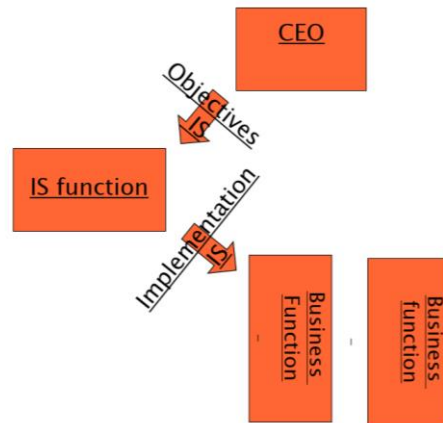
- Inconsistency between organizational variables
- Firm produces electric systems to order
 - Job = tasks to fulfill an order
 - Production plan = schedule of jobs
 - ♦ Some jobs early, some jobs late
 - ♦ No detailed production plan
 - ♦ Strategy: punctuality in job due date
 - ♦ IS Goal: automate production scheduling

-
- Automated scheduler sometimes schedules idle time to wait for materials for critical job instead of starting non critical job
 - workers paid by the hour do not respect sequence suggested by schedule
 - Result: due date not respected, scheduler abandoned
 - Conflict between organizational variables
 - ◆ Scheduling
 - ◆ Compensation of work force

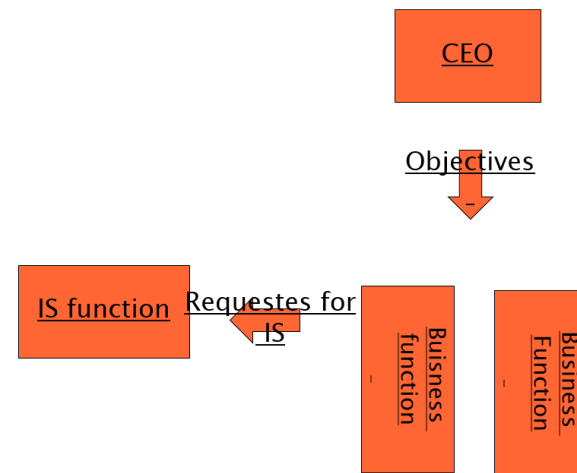
Alignment

- ◆ Explicit
- ◆ Implicit
- ◆ Cfr push / pull interaction between IT area and other functions

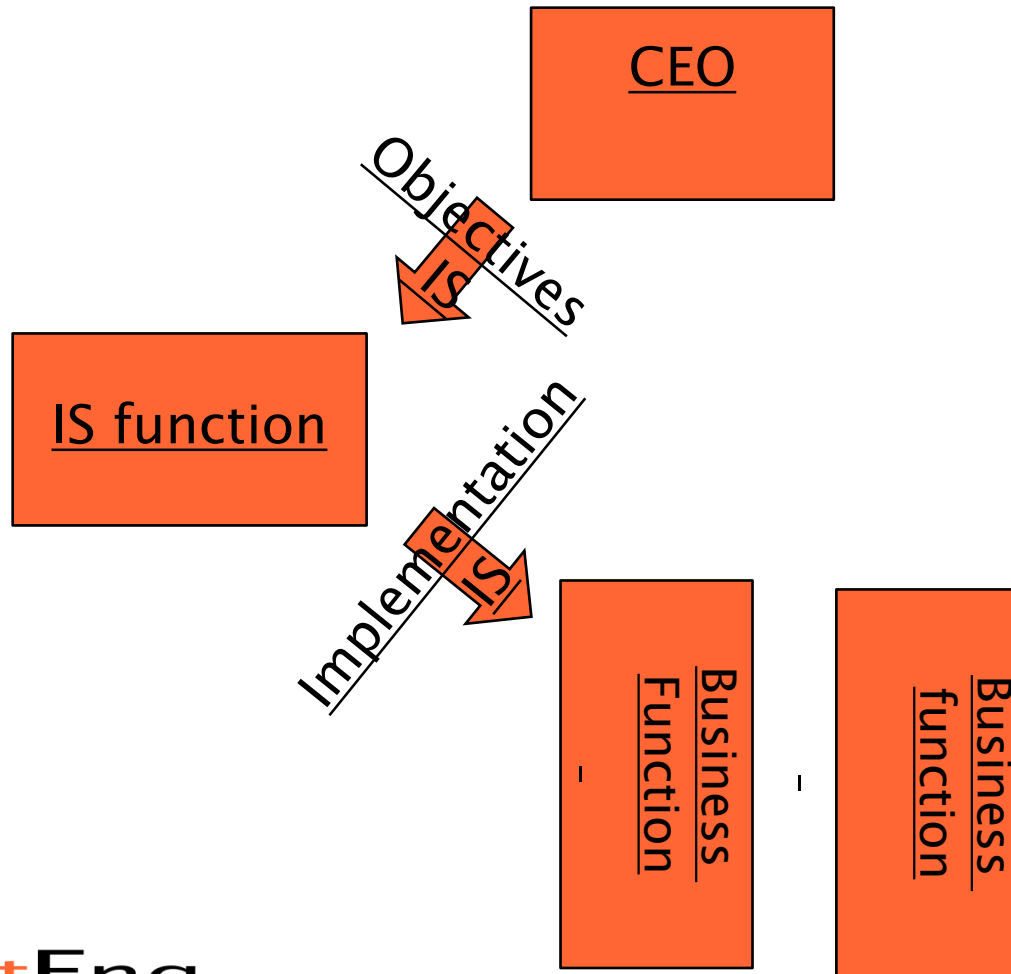
Push



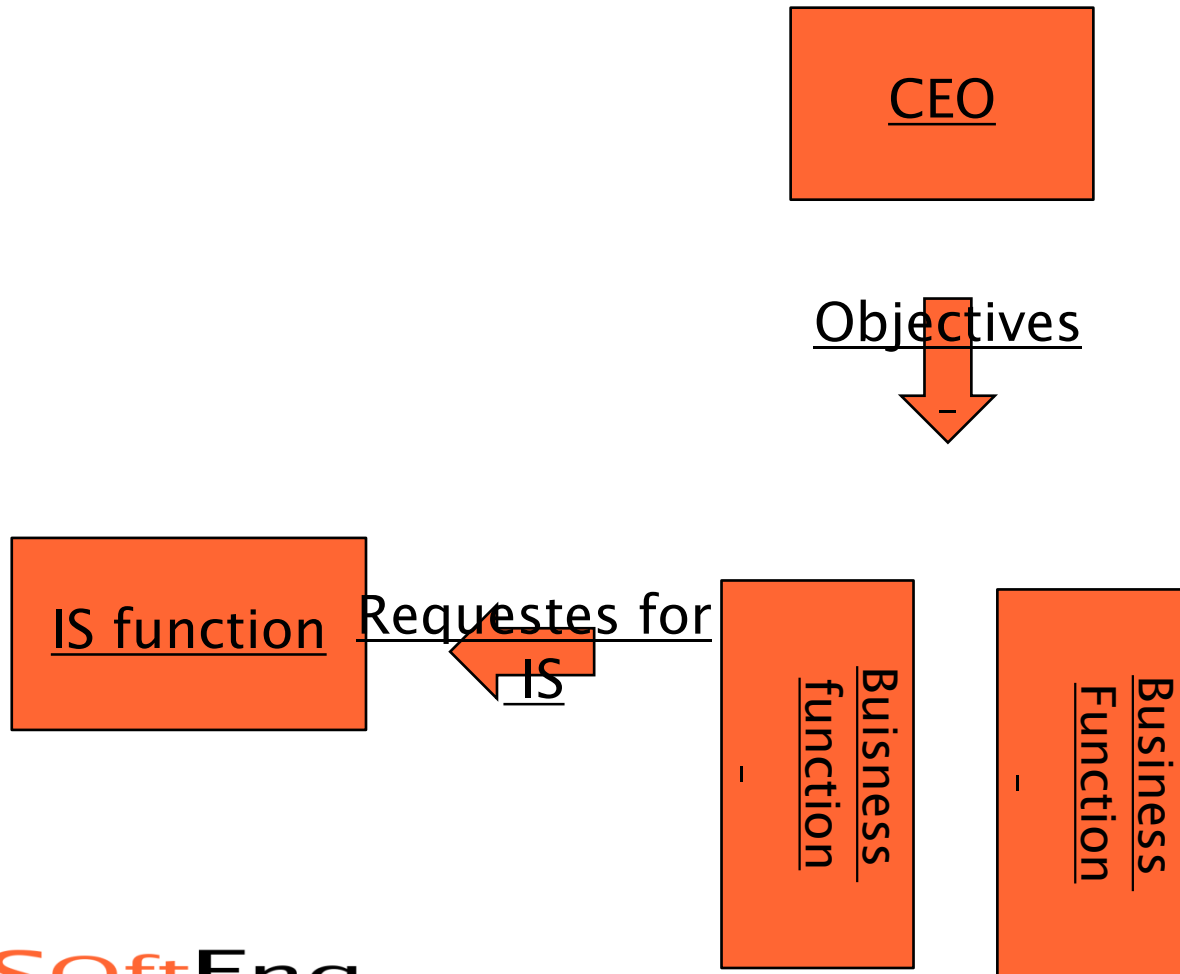
Pull



Explicit



Implicit



Explicit

1. Identify what in strategy depends on IS
2. define *critical functions* in IS
3. Assign to CIO (chief IS) *goals* corresponding to *critical functions*
4. Verify that IS function can (availability of technologies, HR, budget) satisfy goals
5. Verify that IS, as an organizational variable, is consistent with other organizational variables
6. If needed, change IS function
 - Ex, acquire needed skills
 - Ex, change allocation of IS costs

Implicit alignment

- CEO assigns objectives to business functions
- Business functions negotiate IT needs directly with IS function
- Requires
 - ♦ Management by objective (per business functions)
 - ♦ Charge out of IS costs
 - Internal market
 - Evolution in outsourcing possible (competition between IT services from inside or outside)

-
- Alignment is a continuous (trial and error) process