

Master Degree Programme in Computer Science

1. Information Organization



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Some Basic Concepts

Organization

Information System

(Computer-based) Information System



Organization

- based on diversified roles and functions - characterized by purposes, methods, rules - operates through (nested) processes
- has at least the (macro) processes:
 - operating / productive
 - control and management
- offers resources (including information ...)

Information System

- born well before computer science ...
 - information management: collection, storage, access & retrieval, dissemination (within and outside the organization), transmission, exploitation, (re)organization, defense (accident, negligence, intentional)
- > actors, information flows, information repositories >
information flows: internal exchange, external exchange,



(Computer-based) Information System

- portion of the “information system” directly supported by information and communication technologies
- information system deployed upon an ICT infrastructure, including:
 - hardware: interconnected computing devices
 - software: implementing processes, data sharing and synchronization features



Efficiency and Effectiveness

Production systems: input, objectives, outcome

- Effectiveness: the degree of achievement of objectives

$$\text{Effectiveness} = \frac{\text{I actual outcome I}}{\text{I target outcome I}}$$

- Efficiency: the cost for achieving objectives

$$\text{Efficiency} = \frac{\text{I actual outcome I}}{\text{I input resources I}}$$

Note: There are many ways to measure the objectives, outcomes, resources, and so many ways to measure efficiency & effectiveness

Impact of IT at operational level

IT-based innovation at the operational level →

→ simplification of individual tasks

→ greater "specialization" (training)

→ increased interdependence

→ increase of some forms of criticality

→ increased complexity of management (due to a larger amount of information)



Peculiarities of the resource INFORMATION

- main resource used in coordination and control
- produced by any activity (including operational)
- intangible asset, the basis of other intangible assets
- not destroyed by the use
- ambiguous relationship with time (...)
- self-generating (produces new information) → virtuous circle (accentuates differences, up to a competitive advantage)



Amount of information and decisions

- **Information underload:** availability of information below the processing capacity of individual → **oversimplification of the decision** (decision can be fast, but without a full knowledge of implications and/or alternatives)
- **information overload:** the availability of information that are beyond the ability of individual processing → **slowdown** (the “right ” decision could arrive too late) **or worse decisions** (crucial information is “hidden”)



A possible classification of information technology

Analysis by type of activity (based on usage):

1. **automation**: part of the production process (eg .: industrial process control, robotics, etc.)
2. **decision support**: management of the production process (e.g.: accounting, personnel, email, office applications, etc.)
3. **embedded**: part of products or services (mobile technologies, on-board devices, home banking, etc.)
4. **networks**: information exchange among organizations, operational units, and/or individuals



Main Models for information processing

Decision-Making

Transactional Approach

Agency Costs



Decision-Making

Information Processing Capacity (IPC)

"Adequacy of an organization, with respect to the need to process information, imposed by its goals and the context in which it operates"

Uncertainty

- Uncertainty → decisions
- Management → exception handling required:
 - replanning
 - decisions outside of planned procedures
- Greater uncertainty → greater processing capacity

Factors of uncertainty

Uncertainty due to environmental factors:

- (variety) homogeneity / heterogeneity
- (time) stability / variability
- (vulnerability) safety / risk
- (ext. relationships) isolation / interdependence
- (stakeholders) coordination / non-coordination



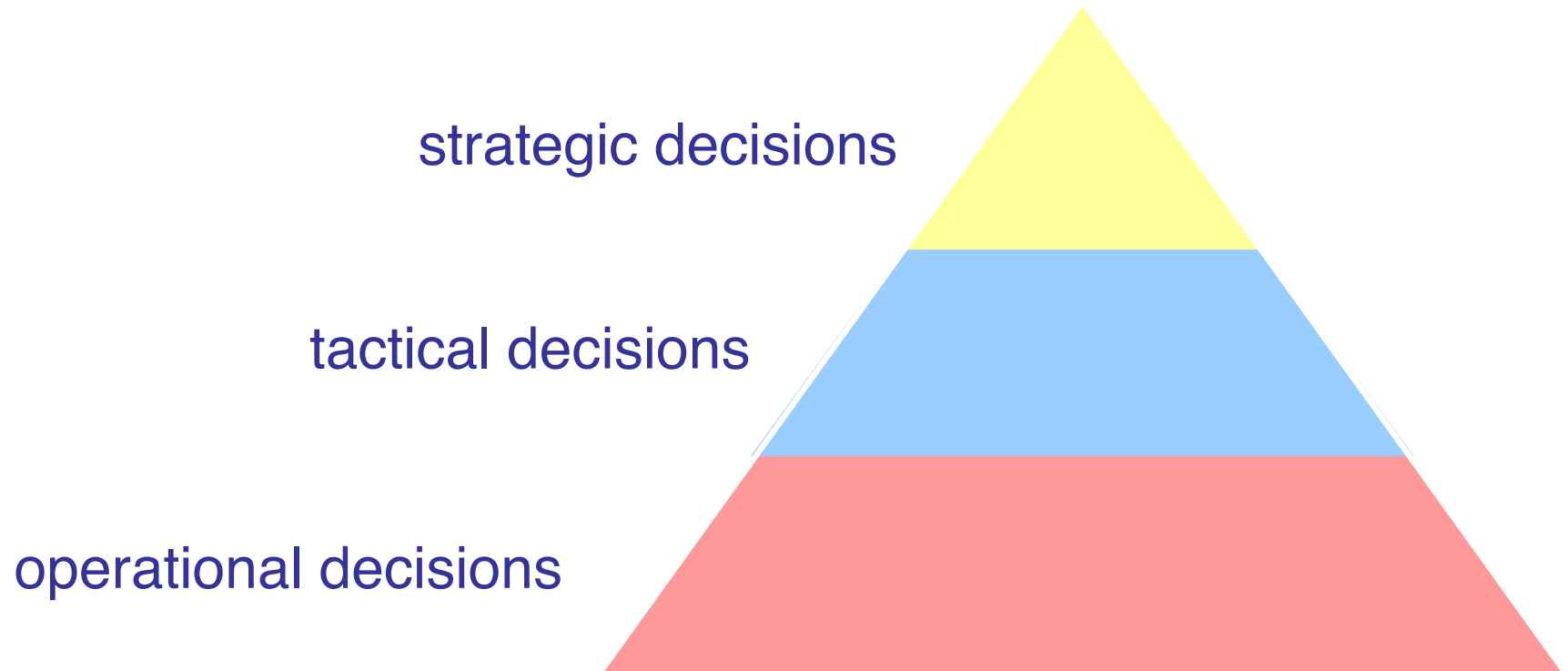
Division of tasks and information

- need to divide the decision-making tasks (beyond the individual processing capacity)
- decide who should have the necessary information
- high level of sharing (large amounts of) information among different actors



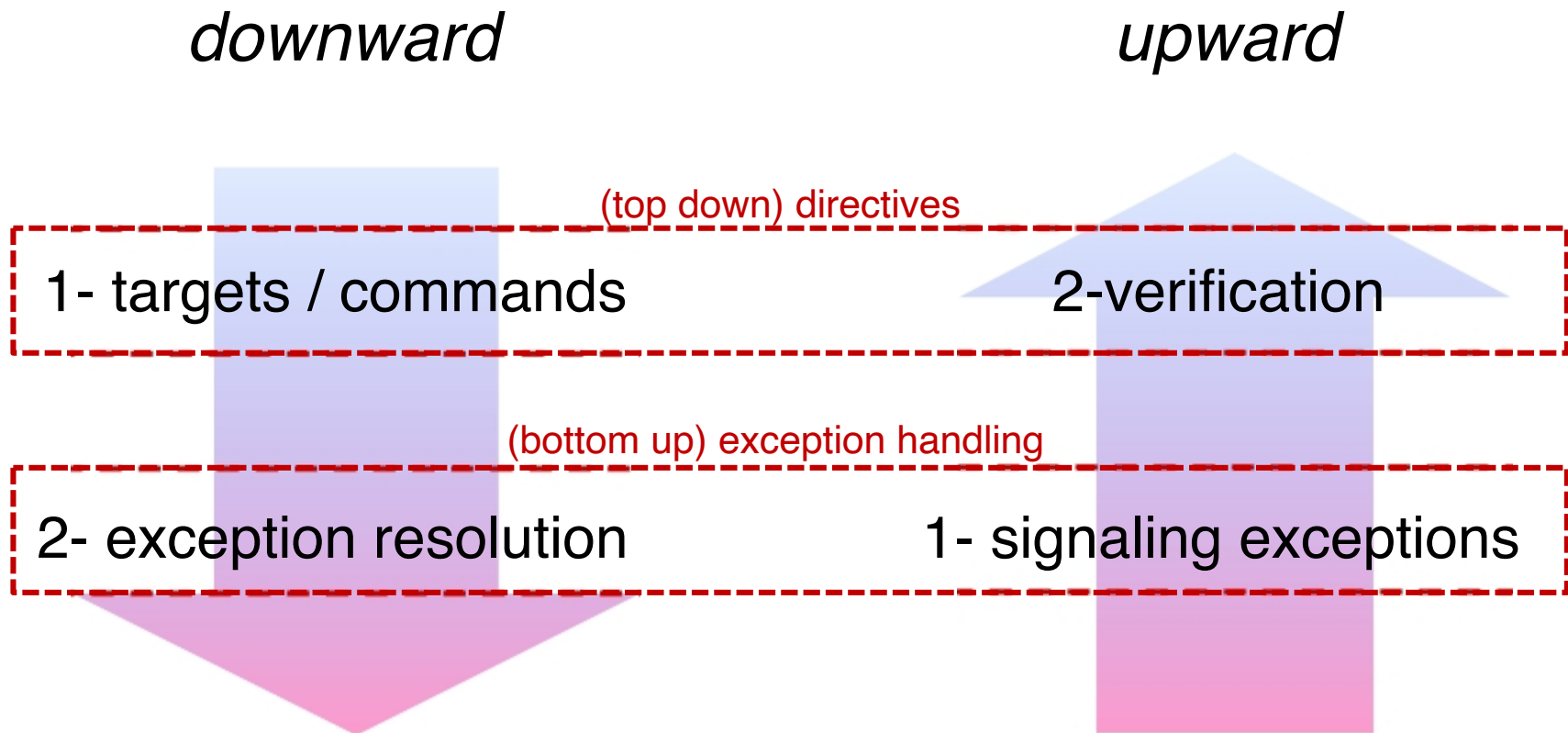
Hierarchical view of management structure

Antony's Triangle / Pyramid



- maximizing parallelism
- reduction of interdependencies

Information flows in hierarchical structures



Structural alignment

required in case of failure to balance between: -

(demand) requirements for processing capacity

- (offer) processing capacity

Environmental uncertainty: LOW

lowering of the processing capacity:

- increase reserve resources (slack resources)

- creating self-sufficient units

Environmental uncertainty: HIGH

increase processing capacity:

- vertical information systems → centralization

- horizontal information systems → devolution



Transactional Approach

uncertainty related to:

- external aspects → environment

(such as decision-making approach) •

internal aspects → individual behavior

(opportunistic)

Coordination of transactions: market

- economic transactions: exchange agreements tangible or intangible assets between different economic actors
- coordination:
 - exchange of information (e.g., research / trading / control-regulation)
 - required to counterbalance the opportunistic behavior



Costs related to information

- production costs:
 - decision-making
 - reconciliation results
- coordination costs
 - splitting tasks
 - control (to fight opportunism)



Agency Costs Approach

Organization [AD72, JM73]:

“set of contracts among agents with conflicting interests”

Agency costs:

management of the divergence of interests between different actors in the organization

Agency Costs

- control costs
 - verification of behavior (by the controller)
- warranty costs
 - production of documentation (by the controlled entity)
- residual loss
 - to be accepted in order to avoid higher costs

What are the effects of the number of hierarchical levels on agency costs?

Costs of Decision Making

- costs of individual decisions
 - number of decisions, volume of information
- communication between decision makers
 - coordination at the same hierarchical level
- opportunity costs
 - to be accepted in order to avoid higher costs (eg.: sub-optimal solutions)

