

# Elements of Software Engineering and Information Systems

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## Introduction to Information Systems

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*Prof. Ing. Pasquale Cantiello, PhD., Prof. Ing. Mauro Iacono, PhD.*

# Why do we process information?

- Statistics: «the discipline of the State»
- Sciences: modeling and simulation
- Computer science and engineering: theoretical interest too
- Management disciplines: creating value from information, controlling organizations, developing business
- We will focus on the last perspective, which is historically preminent in *Information Systems*

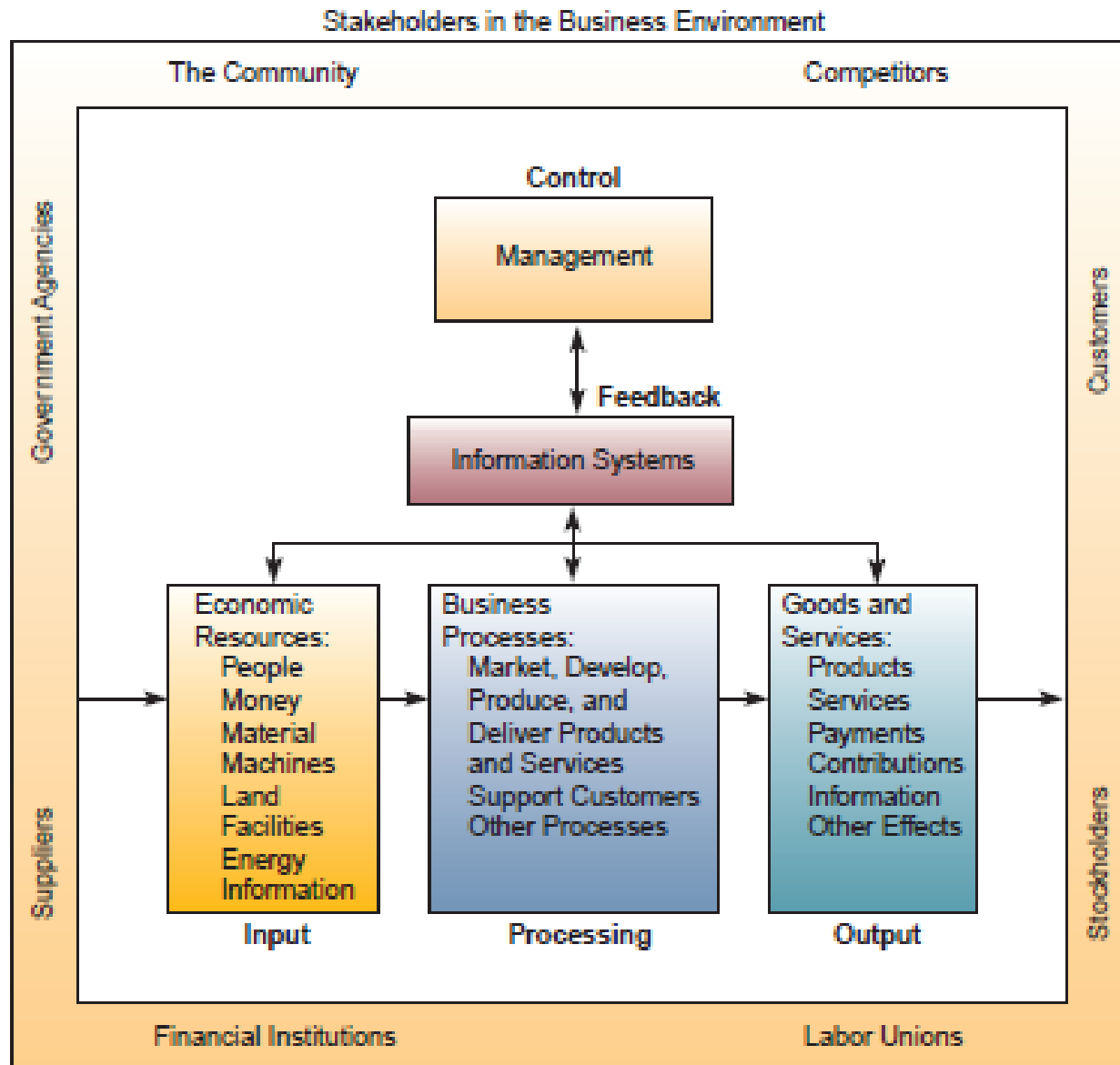
# Information Systems

- “*The system of procedures and infrastructures which define and support information flows in an organizational structure*”
- Includes people, data, manual procedures, automatic procedures, computing and communication infrastructure, software...
  - Part of the system is based on computers
- We will mainly consider *Enterprise Information Systems*:
  - Information systems dedicated to support all processes in an organization (companies, public administrations...)
  - Purpose: delivering needed information to all subjects in the organization, in order to correctly run the organization (including the *state* of the organization), when information is needed
- EIS perform:
  - data collection and organization with proper methods and models
  - information extraction from data by means of processing
  - data delivery and presentation

# Main influences

- The design of an EIS depends on:
  - the type, nature, number and time scale of phenomena of interest, internal or external with respect to the organization
  - the type, nature, volume of the information (and target data)
  - how the organization wants to represent phenomena (when, how and with which precision the phenomenon is sampled)
- The EIS consists of
  - data (structured, semi-structured, unstructured)
    - about configurations, operations, state, for support
  - procedures
    - acquisition, check and processing, planning
  - tools and devices for processing
    - all HW/SW elements that compose the EIS

# EIS, organization, environment



# EIS: what do we focus on?

- In order to serve the purposes of the organization, the EIS will focus on *quantitative* and *qualitative* information about the *past*, *present* and *future* state of all phenomena of interest for the organization
  - Information needed to *monitor* the organization
  - Information needed to *control* the organization
  - Information needed to *manage* and *run* the organization
  - Information needed to *make the organization profitable*
- Traditionally, EIS are built on top of *relational databases*
  - Recent trends include other relevant data sources and additional technologies

# Example: relational database

## Relational Structure

Department Table

Deptno	Dname	Dloc	Dmgr
Dept A			
Dept B			
Dept C			

Employee Table

Empno	Ename	Etitle	Esalary	Deptno
Emp 1				Dept A
Emp 2				Dept A
Emp 3				Dept B
Emp 4				Dept B
Emp 5				Dept C
Emp 6				Dept B

Source: Adapted from Michael V. Mannino, *Database Application Development and Design* (Burr Ridge, IL: McGraw-Hill/Irwin, 2001), p. 6.

FIGURE 5.5

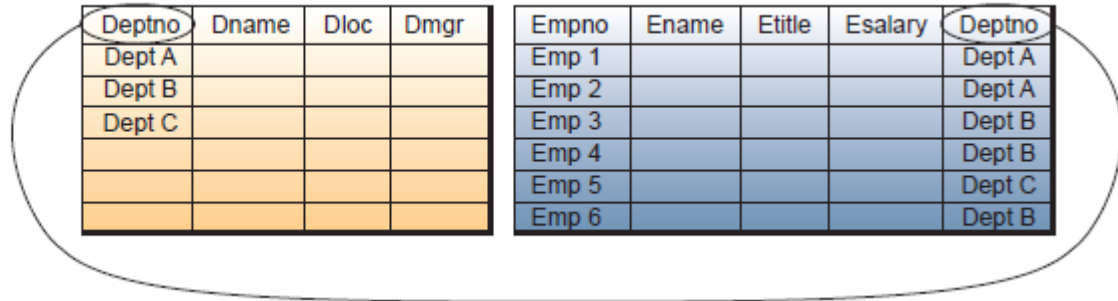
Joining the employee and department tables in a relational database enables you to access data selectively in both tables at the same time.

Department Table

Deptno	Dname	Dloc	Dmgr
Dept A			
Dept B			
Dept C			

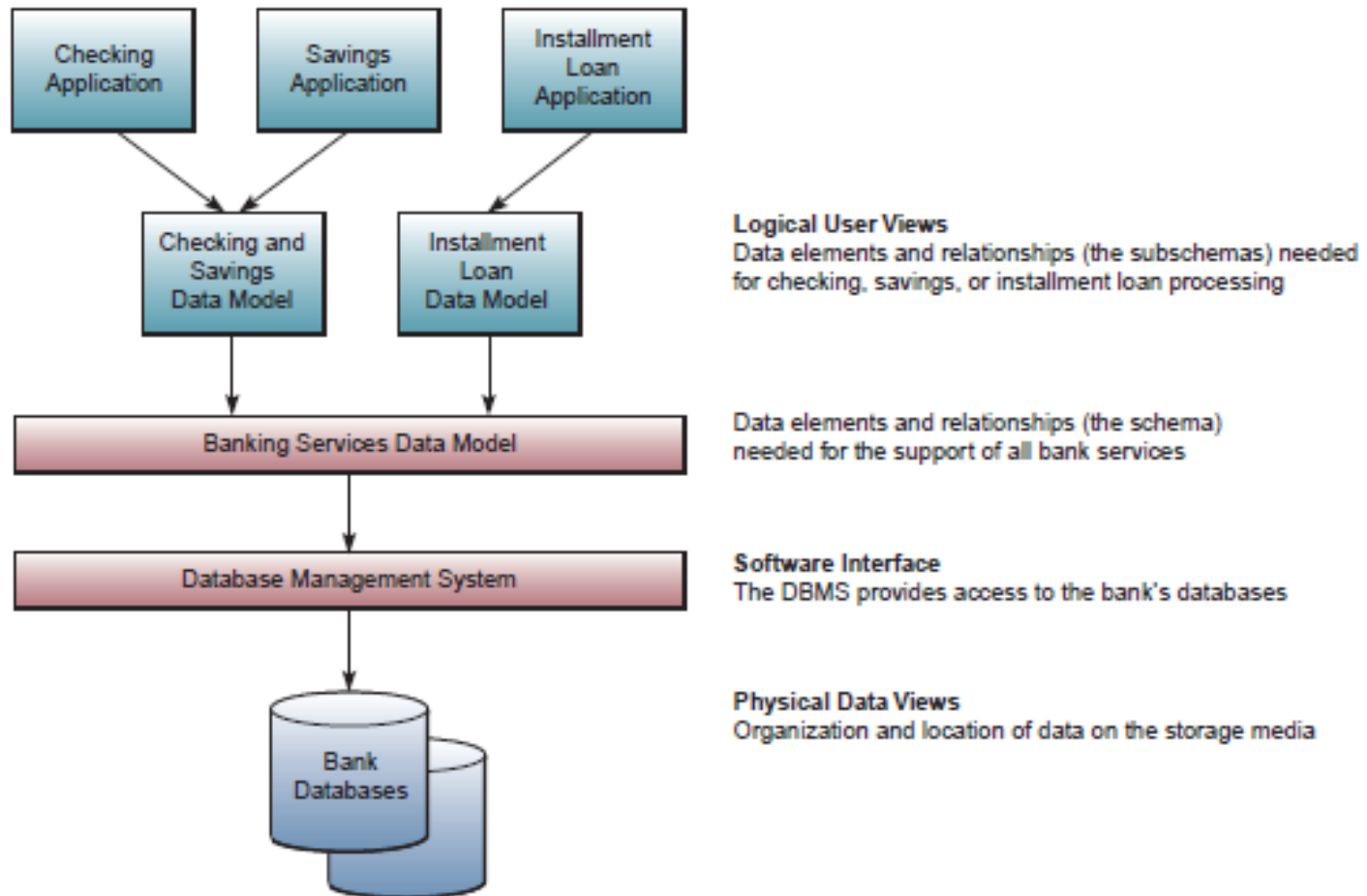
Employee Table

Empno	Ename	Etitle	Esalary	Deptno
Emp 1				Dept A
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Emp 3				Dept B
Emp 4				Dept B
Emp 5				Dept C
Emp 6				Dept B



# Example: relational database

**FIGURE 5.12** Example of the logical and physical database views and the software interface of a banking services information system.



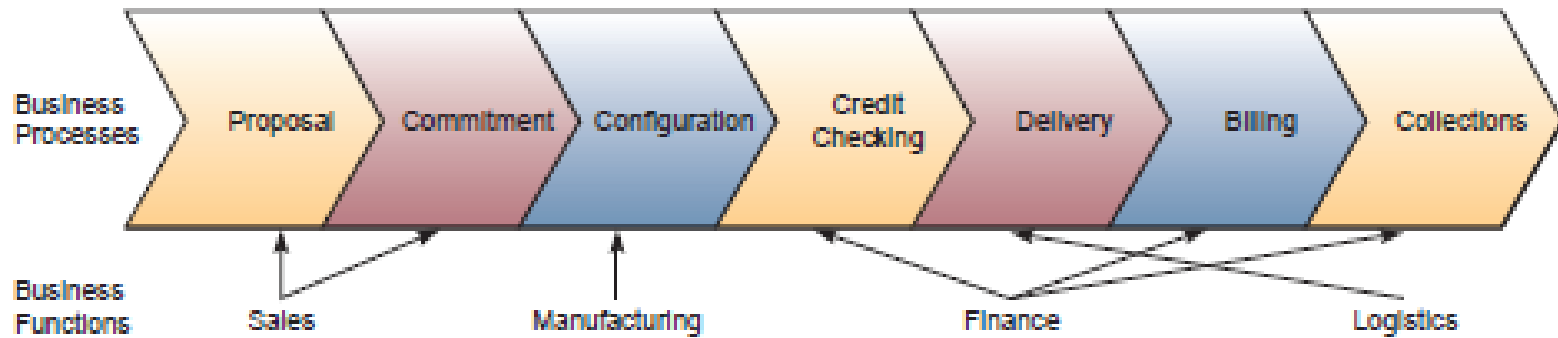


# An organization and its EIS

- Ideally, the EIS should support all processes of its organization
  - Tailored around the organization
  - Implements *best practices* and *business rules*
  - It must be adapted if the organization changes
- Ideally, an organization operates correctly and efficiently by means of its EIS
  - Automated or guided processes minimize errors and enforce a correct processing of data and information
  - The EIS reduces the uncertainty in the decisions for managers
  - The EIS guides and accelerates users' interactions
  - The EIS enforces standardization of procedures all over the organization

# A business process

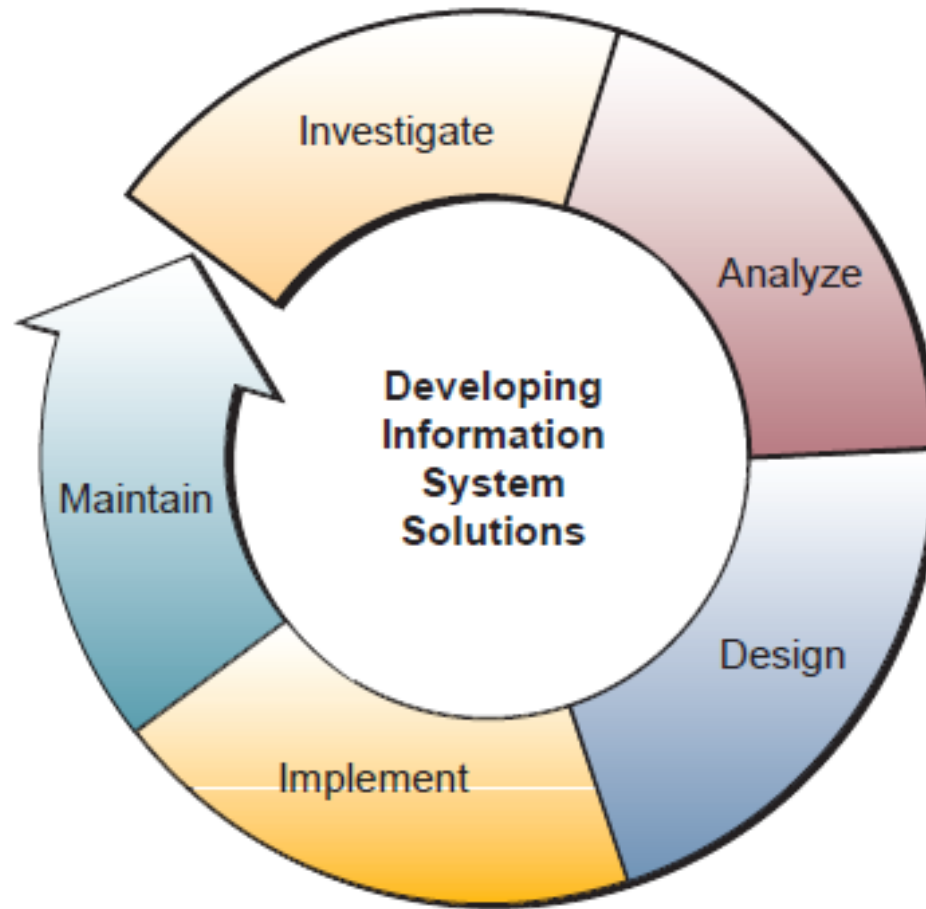
FIGURE 2.11 The order management process consists of several business processes and crosses the boundaries of traditional business functions.



# Evolution in an EIS

- EIS are not static: their evolution must be constantly planned and implemented according to the needs
- Evolution in an EIS is driven by:
  - Internal factors: change of procedures, organizational changes, reorganization, reengineering of business processes, performance issues, evolutive maintenance of the infrastructure...
  - External factors: regulation, business partners, customers, market shifts, push for a change in business strategy...
  - Technological factors: new solutions, new tools, different resources, new paradigms, that might enable the implementation of a new process, or its reengineering, or a redesign

# A design and evolution cycle



# What do EIS do for organizations?

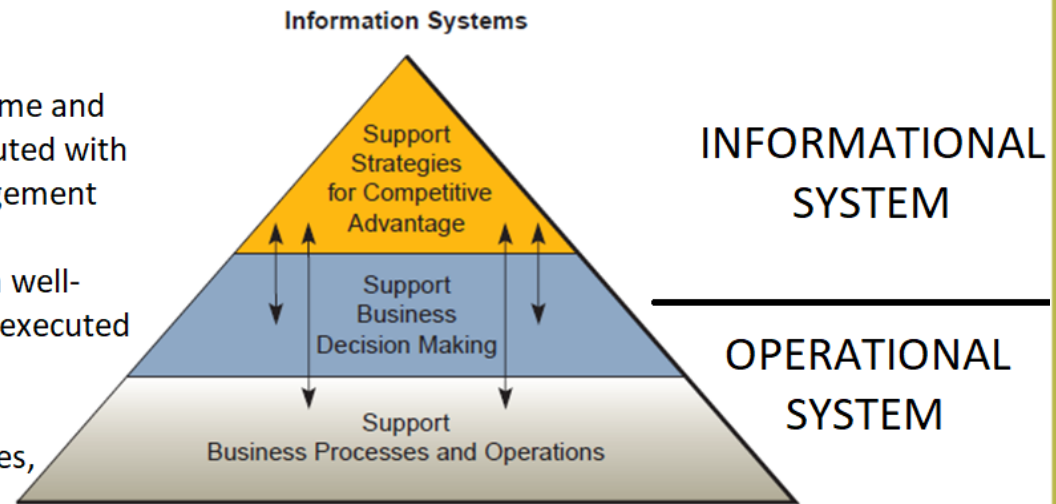
- Three main categories of supported processes:
  - *operations support*: elementary processes that build value in single operations or transformations run in the organization by employees or during single interactions with customers or business partners
  - *planning*: processes that assist decisions and allow strategy definition on the basis of the current state of the organization and of its surrounding environment
  - *control*: processes that generate alerts, alarms or reactions by detecting anomalies or expected events

# Anthony's pyramid

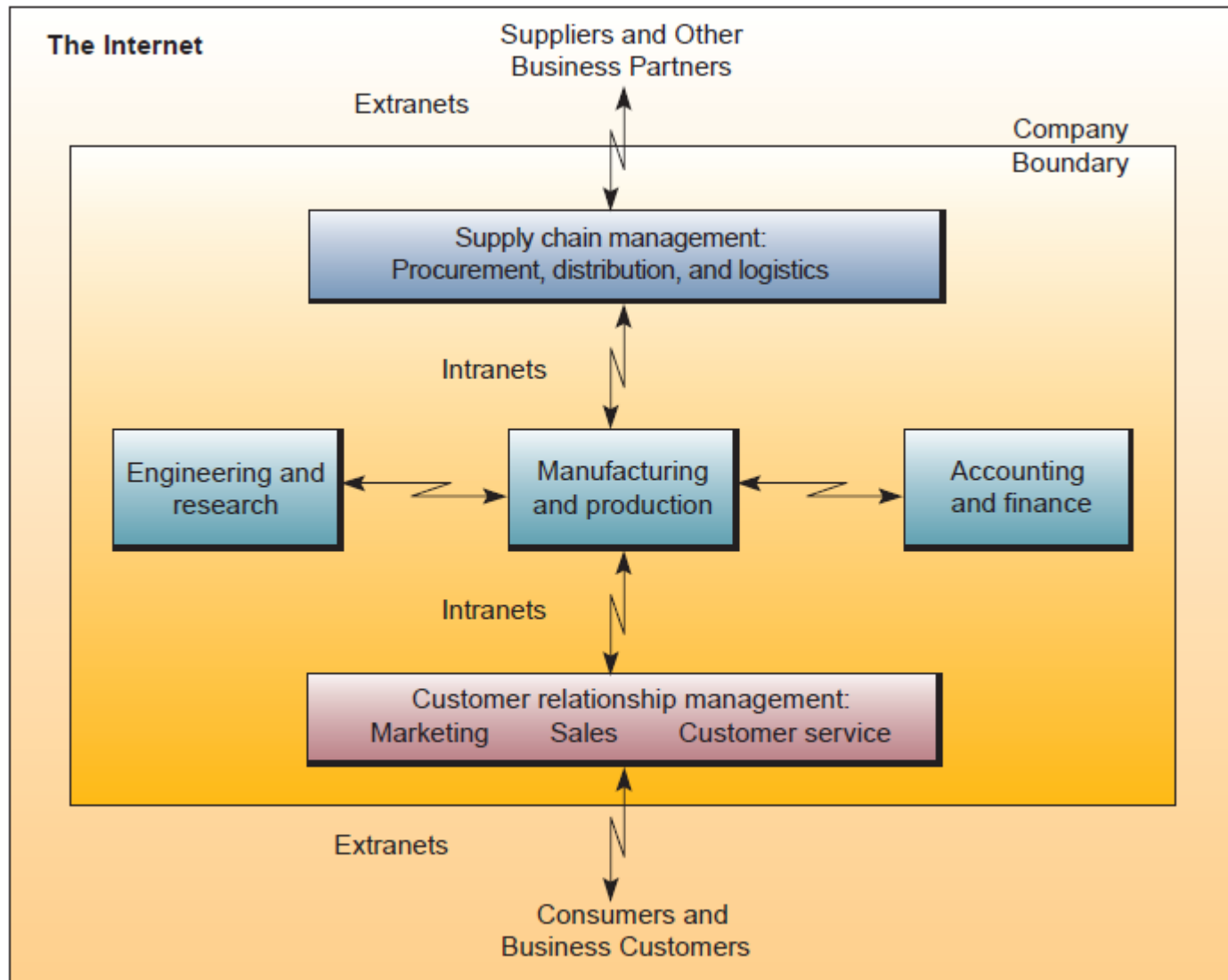
Few synthetic information obtained by aggregating time and space related internal or external massive data, executed with low frequency, custom ad-hoc processing, top management

More structured synthetic information obtained from well-defined data collections about divisions or functions, executed with medium frequency, middle management

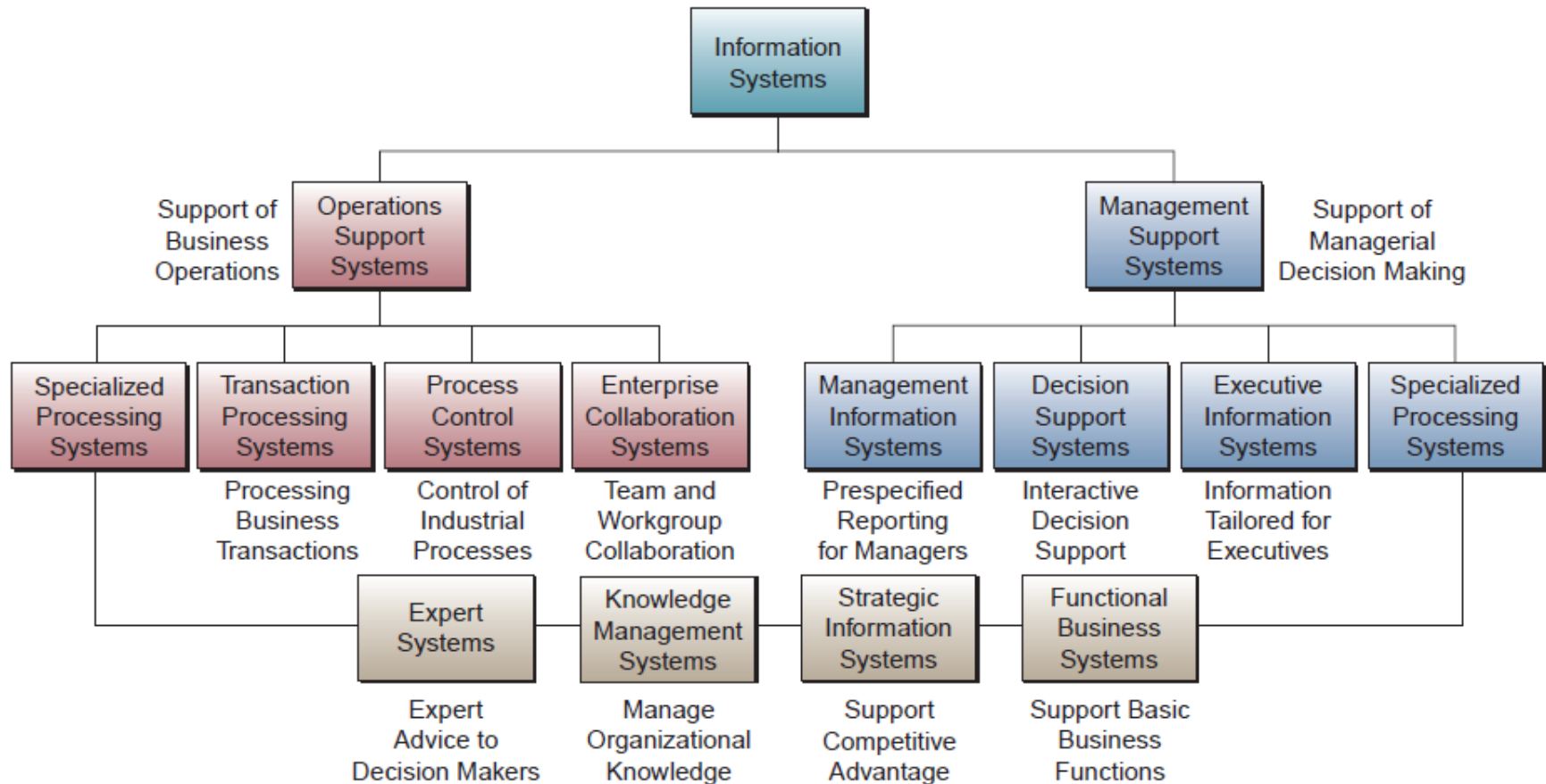
Manipulation of single records, high frequency updates, automated systems or workers



# Example of coarse grain EIS structure



# A partial classification of EIS



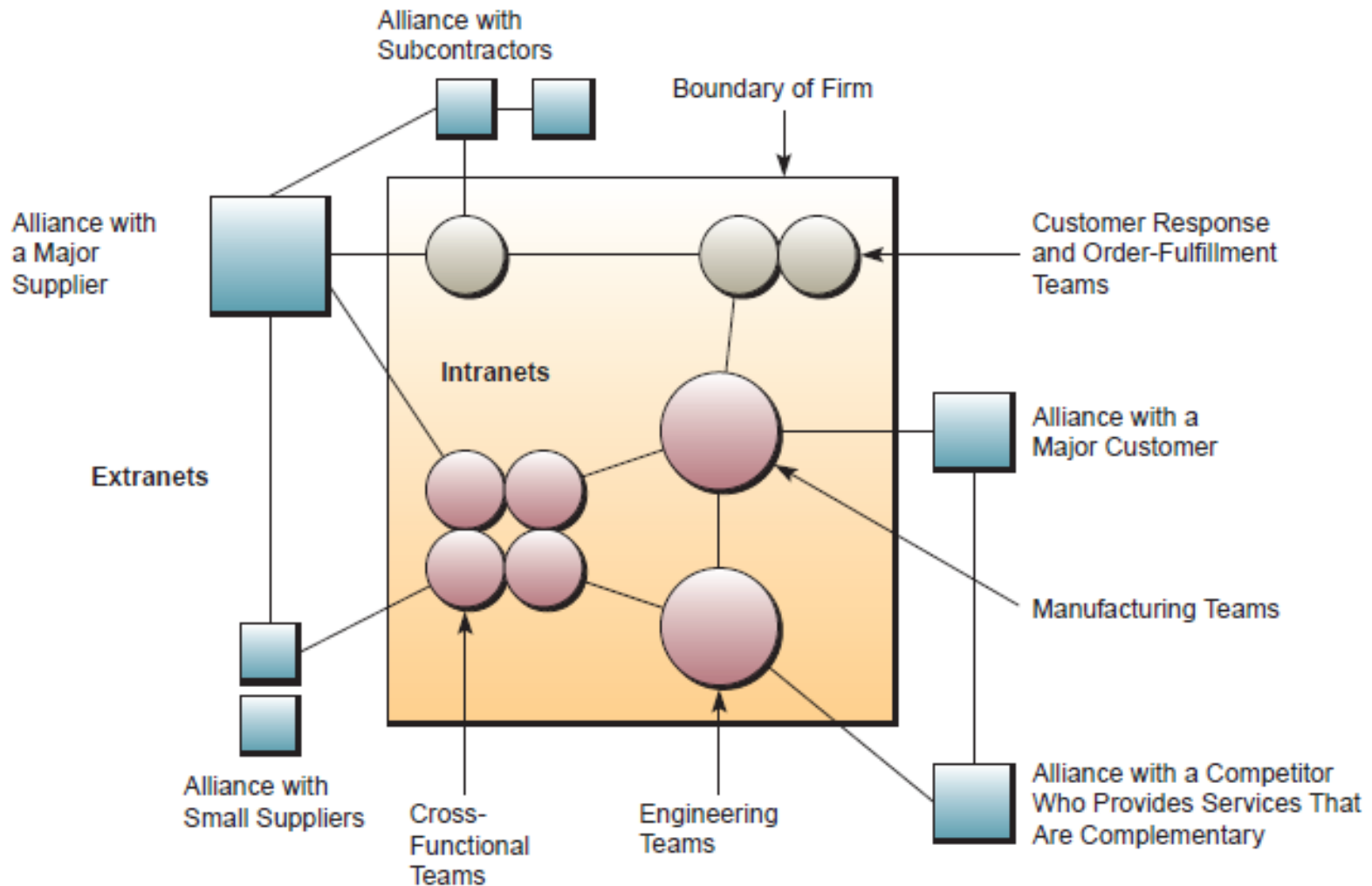


# Organizational impact of EIS

- A good EIS becomes the foundation of the whole organization. This impacts on:
  - the structure of the organization (including dimensions, outsourcing...)
  - the organizational model of the organization
  - the roles and responsibilities of people in the organization at all levels
  - the relationships and interactions of the organization with its partners
  - the communication flows of the organization
- An EIS may be used *to improve performances and force best practices in an organization*

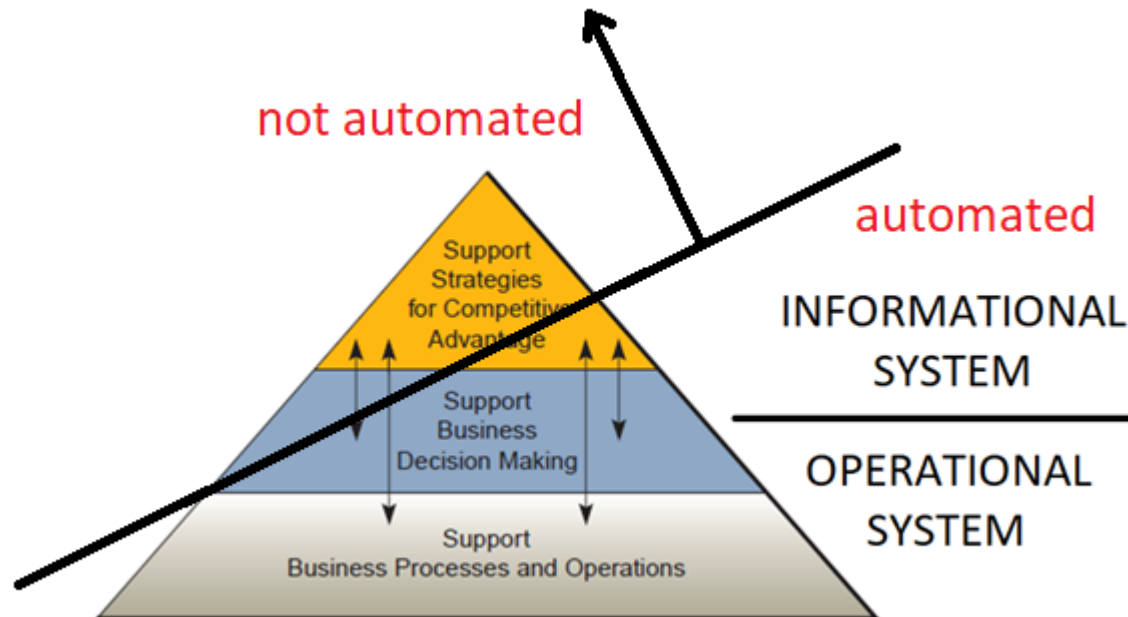
# Example: a virtual company

**FIGURE 2.14** A virtual company uses the Internet, intranets, and extranets to form virtual workgroups and support alliances with business partners.



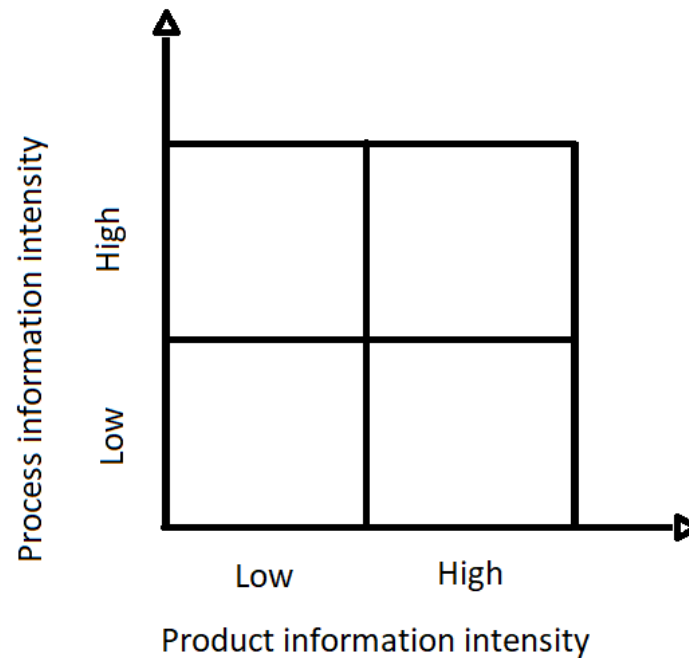
# Why and when?

- Information systems are needed for any organization, or simply arise spontaneously in it: the question may concern the extent of the efforts and investments to automate the IS by means of ICT (Information and Communication Technologies)
- Effects of ITC:



# Why and when?

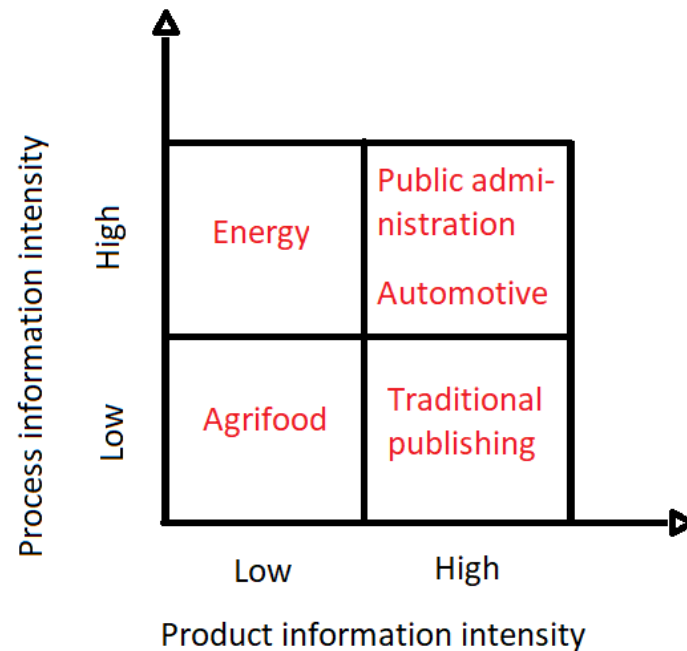
- Is it worth investing in ITC?
- If it is, where should we invest?
- Porter-Millar information intensity model:



- Examples?

# Why and when?

- Is it worth investing in ITC?
- If it is, where should we invest?
- Porter-Millar information intensity model:



# References

- O'Brien, Marakas chap. 1, 2, 5
- Pighin chap. 1, 2, 4

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Prof. Ing. Mauro Iacono

Professore associato in Sistemi di Elaborazione delle Informazioni

Prof. Ing. Pasquale Cantiello

Tecnologo, Osservatorio Vesuviano, Istituto Nazionale di Geofisica e Vulcanologia

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