Gestion du cycle de vie du système d'information industriel
basée sur
les normes et méthodes de gestion industrielles

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Jean Vieille

www.psynapses.com

j.vieille@psynapses.com

Agenda

- **Information & Systems**
- **Industrial Enterprise**
- **The Information Factory**
- **Combining Industrial & Information Systems**
- **CCM Process**
- **Improvement**

Information & Decision

- **Information surrounds everything**
  - Information might be the ultimate meta theory in Physics
  - Information might be the ultimate material component
- **Changing the world, giving existence to something implies Decision**
- **Decision reveals information, makes it "concrete"**
  - Information allows decision, which triggers action
  - Information is also involved in decision and action
  - The outcome of a decision is a new information leading to subsequent action, and ultimately changing the physical world

Decision is the Key – the OODA Loop

- **Each arrow involves information**

Observe — Orient — Decide — Act

John Boyd's OODA Loop
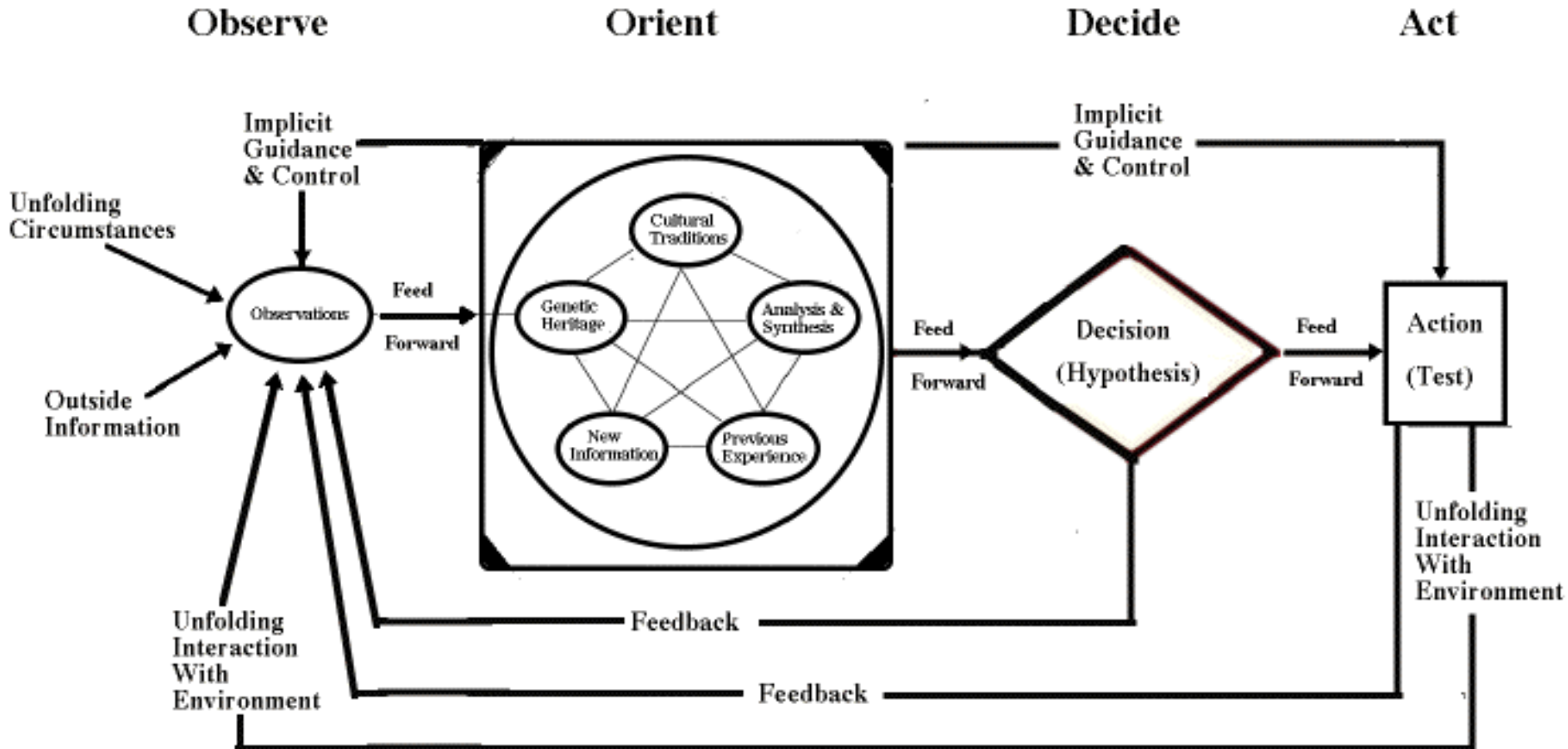
http://en.wikipedia.org/wiki/OODA_Loop

Information and Time

- **Information and Time**
  - Real time information : knowledge of the current situation
  - History information : memory of the past experiences
  - Prospective information : extrapolation of the future based on history, RT information and acquired knowledge
  - Time compensates for the lack of universal, extensive knowledge, information

Information is Knowledge : Time is Ignorance… (Alexei Grinbaum)

Information handling and processing

- **Information is supported by numerous media**
  - Sound, vision, smell, telepathy, waves, Quanta…
  - Electronics is an additional media
  - Computer HW and SW is only one part of the information system
- **The role of information system is to reveal information to physical observers (other computers, humans)**
  - Computing an « optimal schedule » is revealing a better way of arranging the activity program (the best is unkown because of the lack of computation power)

IIS and Information Processing

- **Information system deals with several dimensions**
  - ➢ Real time processing, Transactional processing, data storage, knowledge management, analytics, modelling, simulation and optimization, collaboration…
  - ➢ MRP, DBR or PID are examples of computational methods to achieve particular decision processes
    - Operations planning
    - Operations optimal scheduling
    - Physical measurement control
- **Information system**
  - ➢ can learn the corresponding algorithms :
    - explicit knowledge capture
  - ➢ can perform them
    - Apply / enforce captured knowledge

Value of the information system

- **Referring to IS in terms of HW/SW investment**
  - HW/SW are not the only way of achieving the requested information support, other media might satisfy the needs as well
  - Though information is critical, an information system on its own has no global value
    - Though local performance can be measured
  - The information system value is measured through the decision processes it supports and the contribution of these processes to the industrial enterprise success
- **How to assess the IS contribution to the Enterprise success ?**
  - It is the purpose of Strategic guidance and Master Plan CCM sub-processes
    - What if the IS would not perform a particular function?
    - What if it performs the function optimally?
    - How much are we going to progress because of this particular function?
    - How the IIS enables or prevents the implementing of our strategic roadmap?
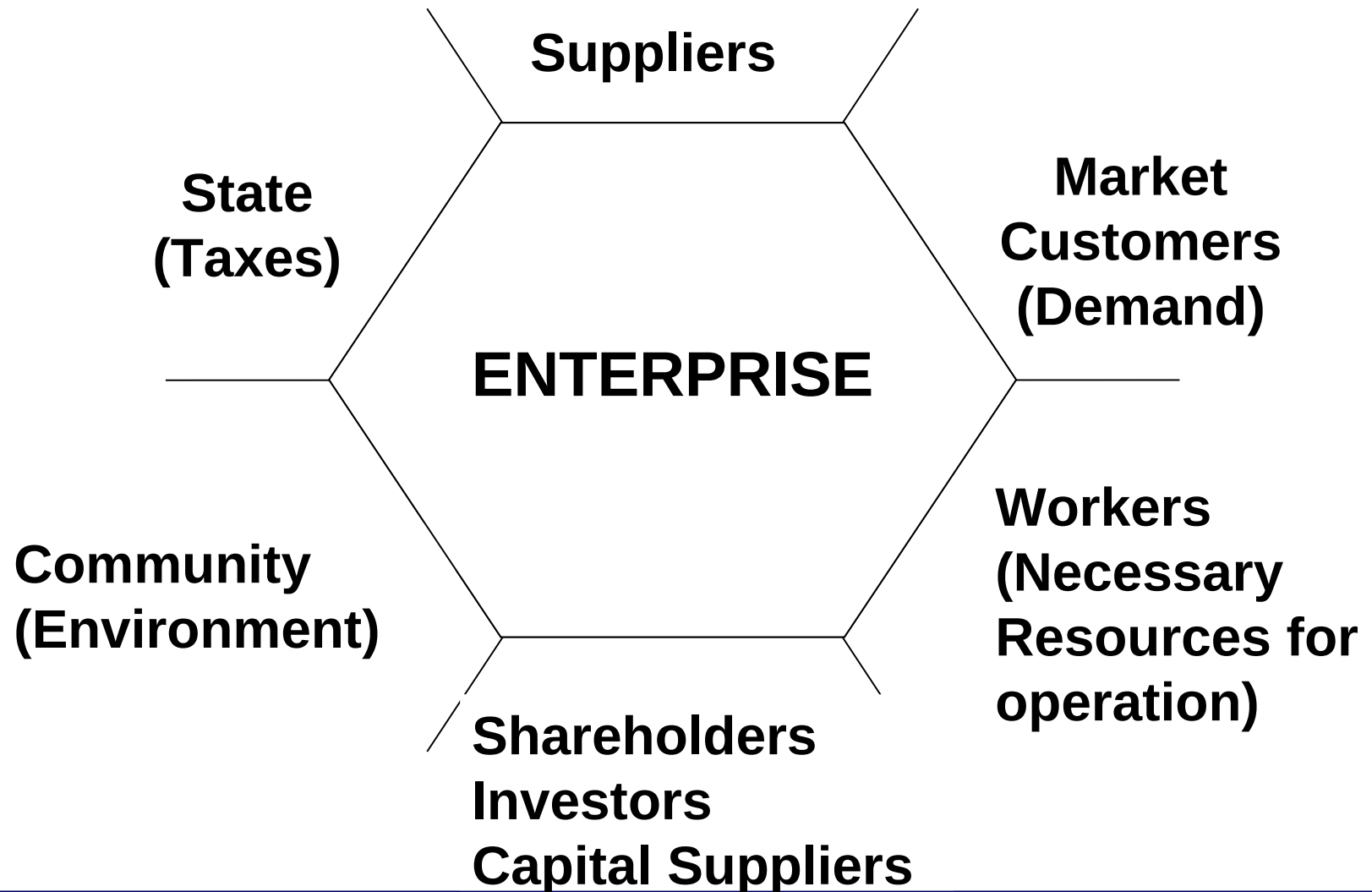
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Enterprise Stakeholders

Suppliers

State (Taxes)

Market Customers (Demand)

ENTERPRISE

Community (Environment)

Workers (Necessary Resources for operation)

Shareholders Investors Capital Suppliers

Stakeholders Power on the Enterprise

Stakeholders	Want to get more	With less Effort
Employees	**Wages and other benefits**	**Work and Effort**
Customers	**Value**	**Cost of Ownership**
Community	**Life Quality**	**Self Annoyance**
State	**Taxes**	**Controls**
Suppliers	**Order volume and prices**	**Cost of Sales**
Shareholders	**Benefit**	**Invested Capital**

Industrial Enterprise Structure

- **An industrial enterprise's purpose is to make money by selling physical, tangible entities :**
  - ➤ products, goods, energy
- **The VAD (Direct Added Value) concept splits the Enterprise in 3 main entities** (Paul-Louis Brodier)
  - ➤ The Shareholders who expect revenue from their investment
  - ➤ The Company owned by the Shareholders, managing the shareholders capital and providing financial resources to the Business
  - ➤ The Business owned by the Company, leveraging Company's capital

2 main Business Processes and production system

An industrial Business has 2 main processes

- **The Value Chain**
  - ➢ Creates Value that is perceived by the customers – making requested products

- **The Sales Process**
  - ➢ Creates Value for the capital shareholders by connecting the Value Chain to the Market

Value Chain process

- **Create value that is perceived by the customers - making requested products**
- **Handles physical flows and transformation**
  - Includes facilities for processing physical entities (material, goods and energy)
  - Involves internal and external resources (sub-contracting)
- **Is at the bottom of the decision hierarchy of an Industrial Enterprise**
  - Receives orders from Business
  - Has capabilities and capacities able to fulfil these orders
- **Has its own domain of responsibility**
 - To serve the business diligently
  - To manage its resources efficiently

The production system is the main component of the Value Chain

Sales Process

The Sales Process

- **Creates Value for the capital shareholders by connecting the Value Chain to the Market**

- **Includes all activities which are not related to physical aspects of production, mainly**
  - Marketing, R&D
  - Sales, Purchasing
  - Planning

- **Directs the Value Chain**
  - Defining its mission (what to do, how to do, what to use)
  - Supervising its activities (for what it is important for the sales process)
  - Monitoring its performance from the sales process perspective

  At the appropriate level of detail and freedom

Enterprise global model
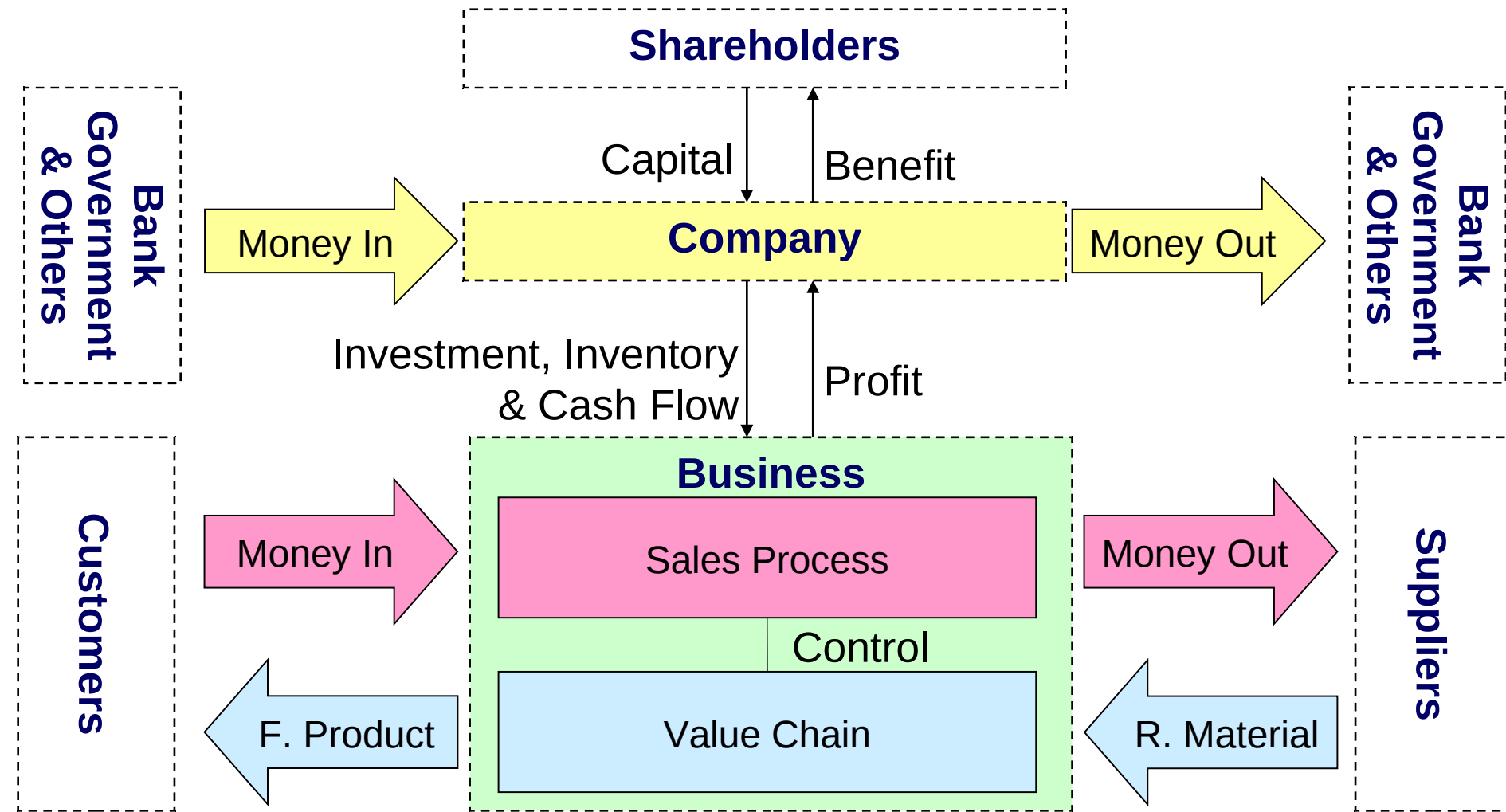
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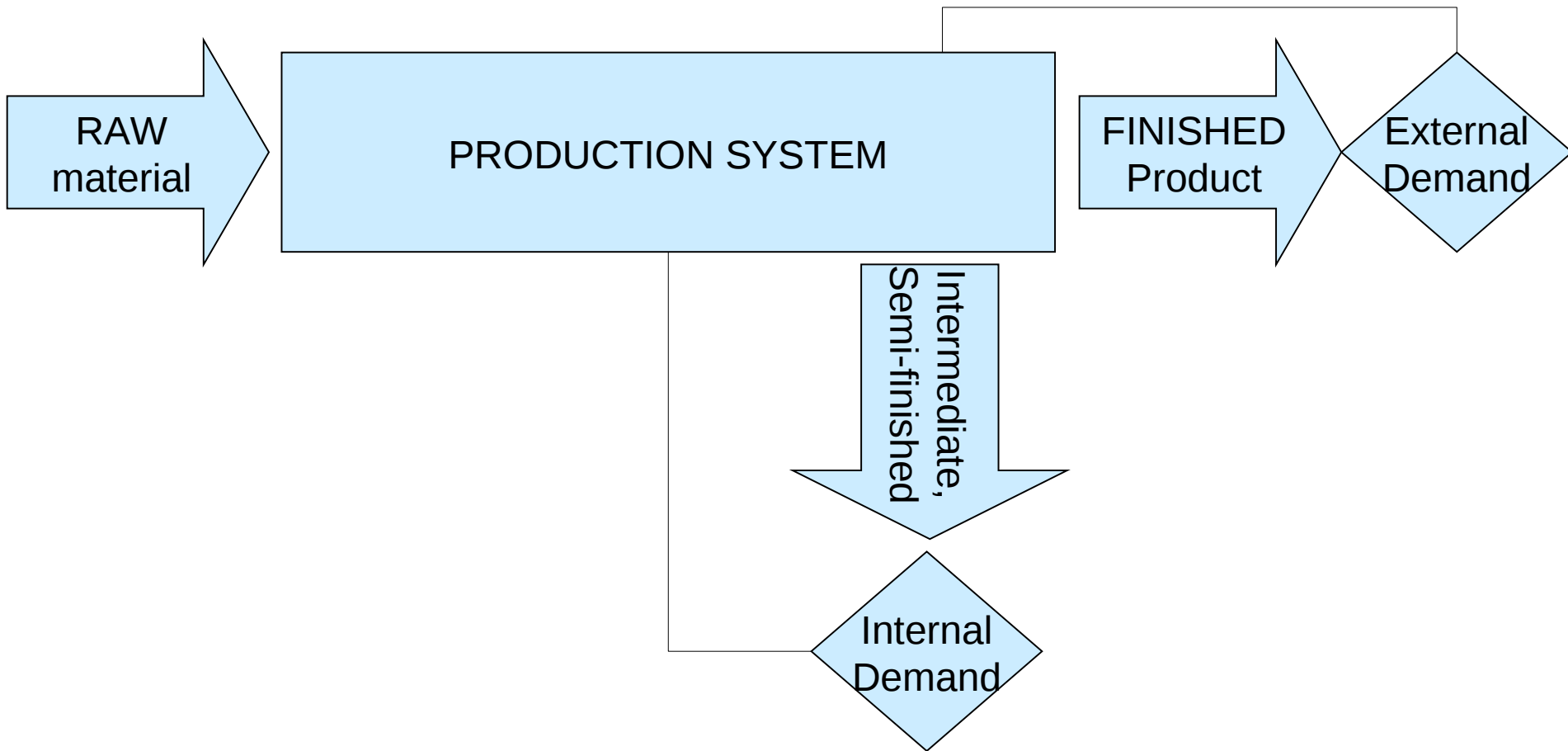- **Information & Systems**
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Industrial Information System Lifecycle Management

The Industrial Factory

RAW material → PRODUCTION SYSTEM → FINISHED Product → External Demand

Intermediate, Semi-finished → Internal Demand

PSynapses
Control Chain Management

The Information Factory
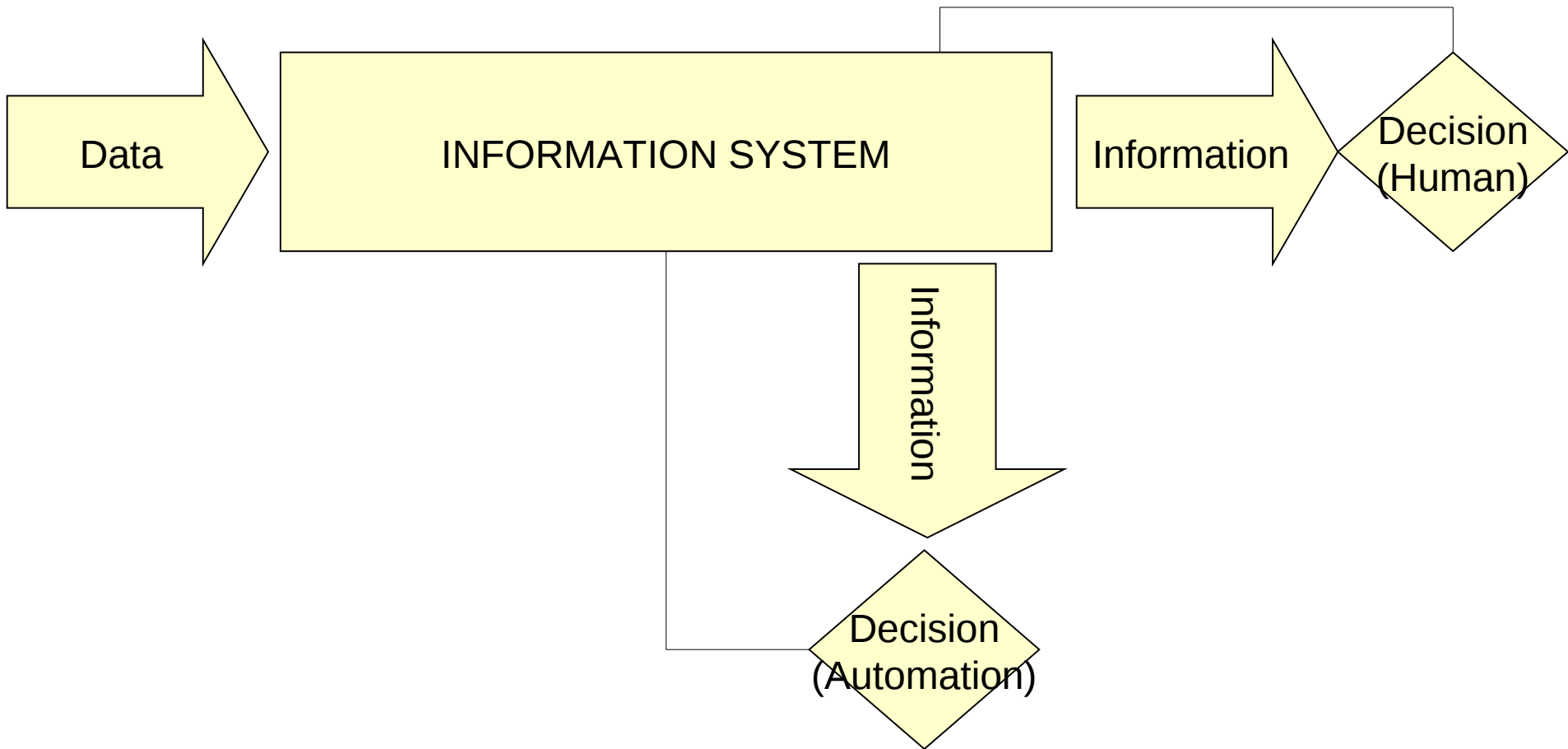
Industrial vs Information Factory

- **We just process data into information instead of raw material to finish products**
- **Decision need replaces product demand**
- **Automation is a specific case as the decision is made by the information system itself.**
  - This is generally the case when the IIS supports transformation processes
    - This can happen in other processes too
  - Automation addresses mostly internal processes
    - It can also apply externally i.e. when the product demand is self managed by sophisticated CRM (external demand) or Kanban (internal demand)

IIS as a information factory

An information system processes the information the same way an industrial facility makes products, involving 3 lifecycles

■ **Resources Engineering corresponds to:**

➢ the actual HW/SW solution and its inherent / implemented information processing capabilities = Information services (Corresponds to the manufacturing facility itself, including machinery, material, personnel)
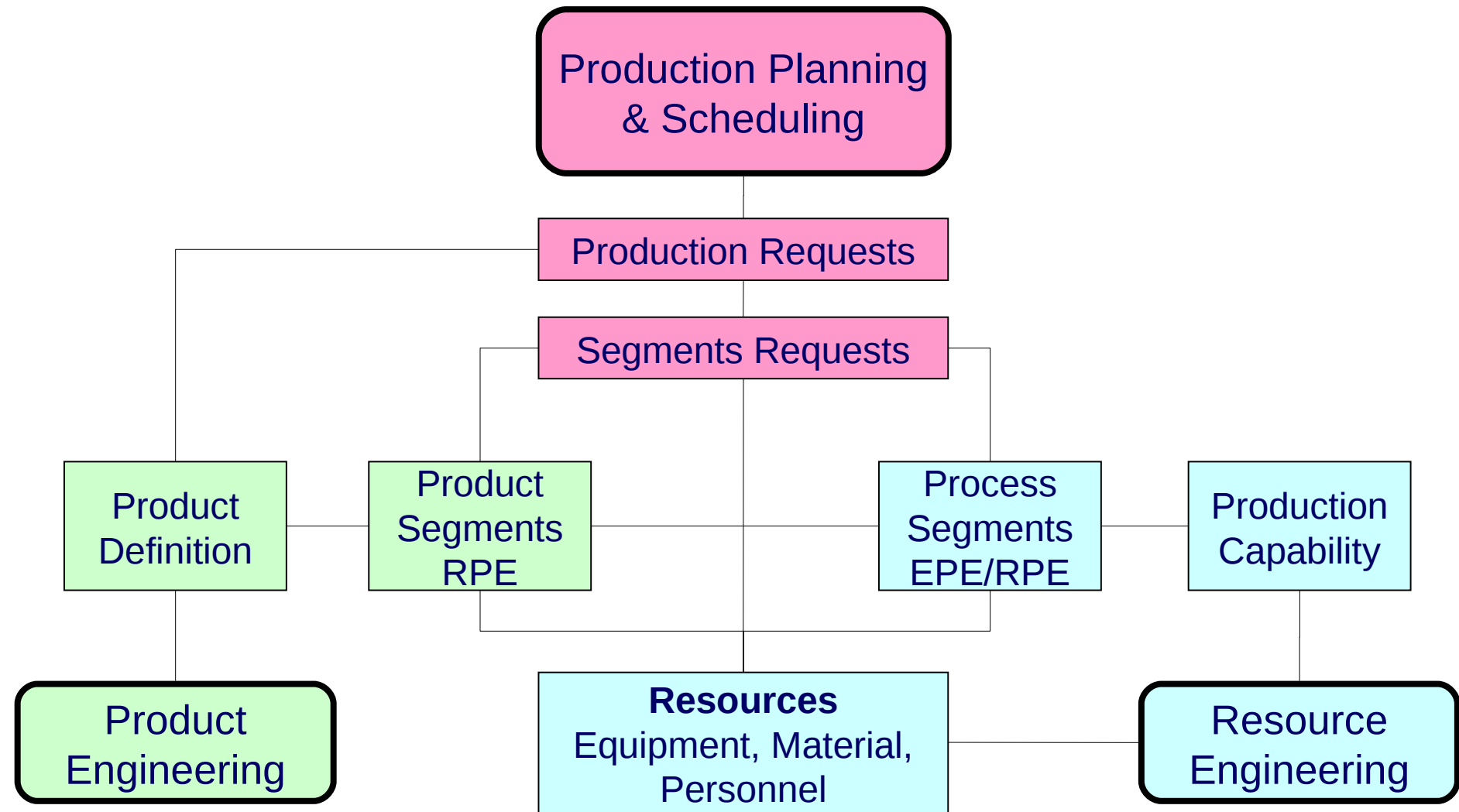
■ **Product Development corresponds to :**

➢ Definition of the information processing requirements including Information services and their usage scenarios as Information Processes

■ **Production Planning & Scheduling corresponds to :**

➢ Run time usage of defined information services and processes

Industrial Information System Lifecycle Management

ISA88/95 production system life cycles

Production Planning & Scheduling

Production Requests

Segments Requests

Product Definition

Product Segments RPE

Process Segments EPE/RPE

Production Capability

Product Engineering

Resources
Equipment, Material, Personnel

Resource Engineering

Information system life cycles
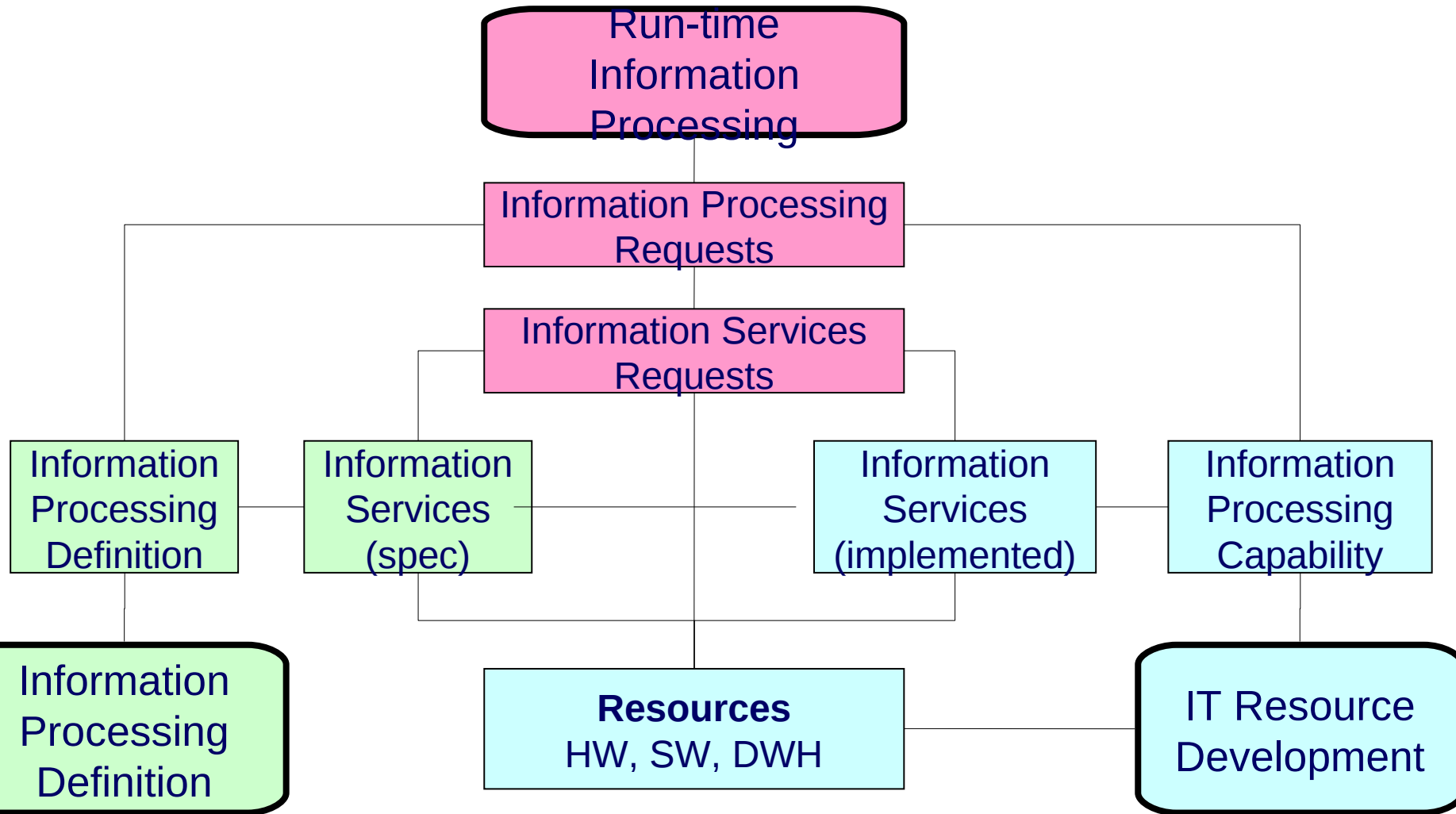
The Information Factory has specifics….

The performance of an industrial factory can be simply measured by its profit

- **For an industrial business, the information factory does not produce value**
  - IIS only supports and serves the value making processes
- **One way to assess the Information Factory performance is considering its users satisfaction : this is true at run time**
  - Satisfied users means that the provided functions perform appropriately
  - Concerns "IT Resource Development" and "Run-Time information Processing" lifecycles
- **That's not sufficient :**
  - "Good" functions may not bring value to business after all
  - Functions for improving business bottom line may be missing, with nobody realizing the lack
 - Concerns "Information Processing Definition" lifecycle

Business vs Industrial Information Systems

IIS vs BIS

- **Business Information System supports the Sales Process which is informational by essence – BIS is part of the process**
  - ➢ Sales Process is not related to facilities layout
  - ➢ BIS shall be built on the Enterprise specific practices, decision processes and roles
- **Industrial Information System supports the Value Chain Process which is physical by essence**
  - ➢ All Industrial information systems must be customized to match the supported specific physical facilities
  - ➢ IIS shall be build on the physical production system framework – the Enterprise physical model

IIS – Industrial Information System Scope
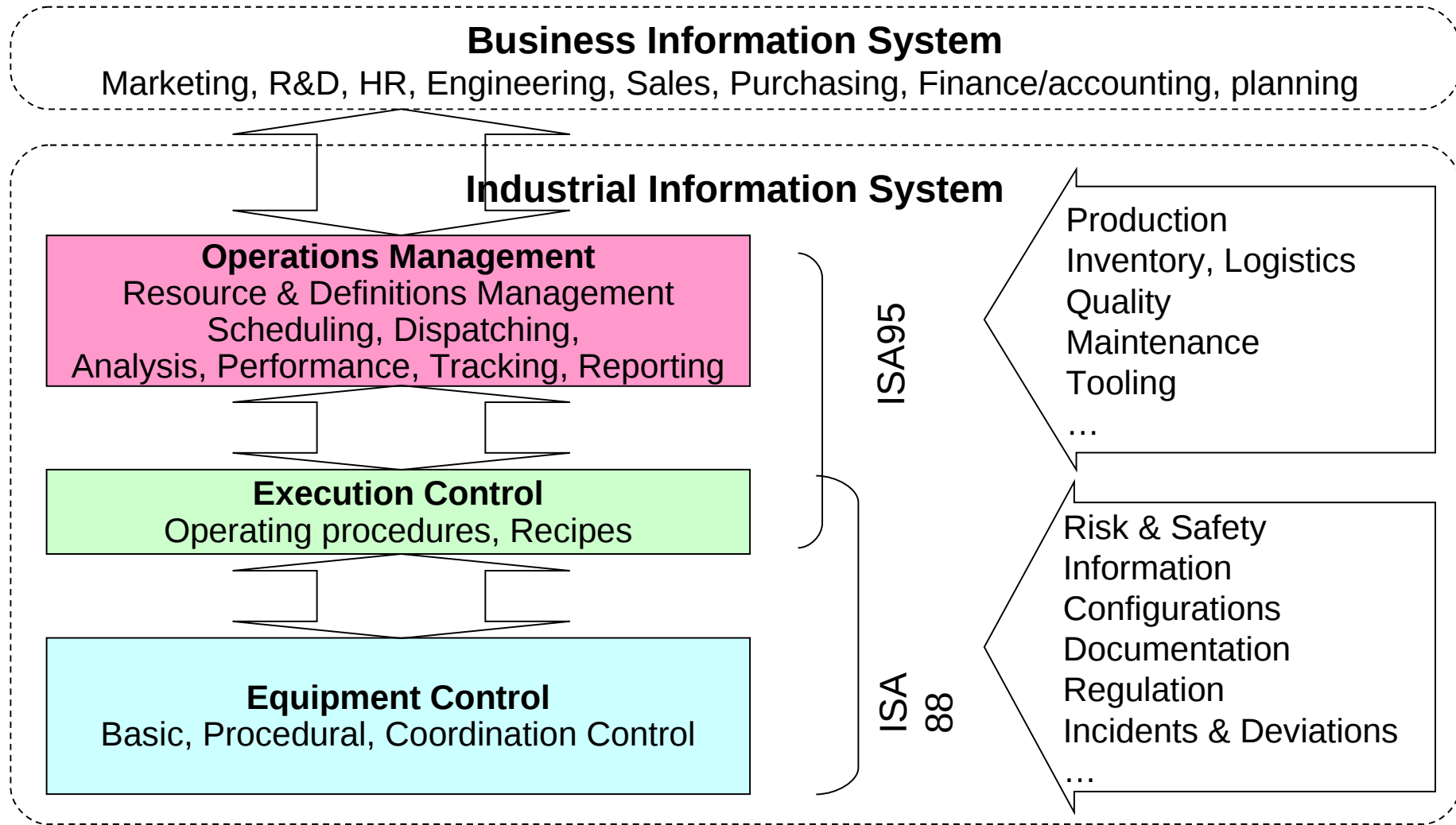
Information system : no longer THE framework

- **IT in Industry is still in infancy**
  - ➢ Still far from original intents. Just compare to the Internet public use
- **Control systems**
  - ➢ Currently the best achievement Mandatory real time Flexibility in operations led to "flexible" control systems - ISA88 forces the information system to hang on the actual facility
- **Business systems**
  - ➢ Most BIS still based on software with preconfigured functions & processes based on common practices
  - ➢ SOA architectures slowly come up
    - ▪ Yet confined within proprietary solution for improving maintenance and reliability
  - ➢ Customer still need to learn their IT system,
    - ▪ though this should be the opposite
  - ➢ Flexibility in business systems (BIS) is inexistent
- **What about "MES", extended control systems?**

Industrial Information System Lifecycle Management

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Combining Production & Information Systems, BIS & IIS
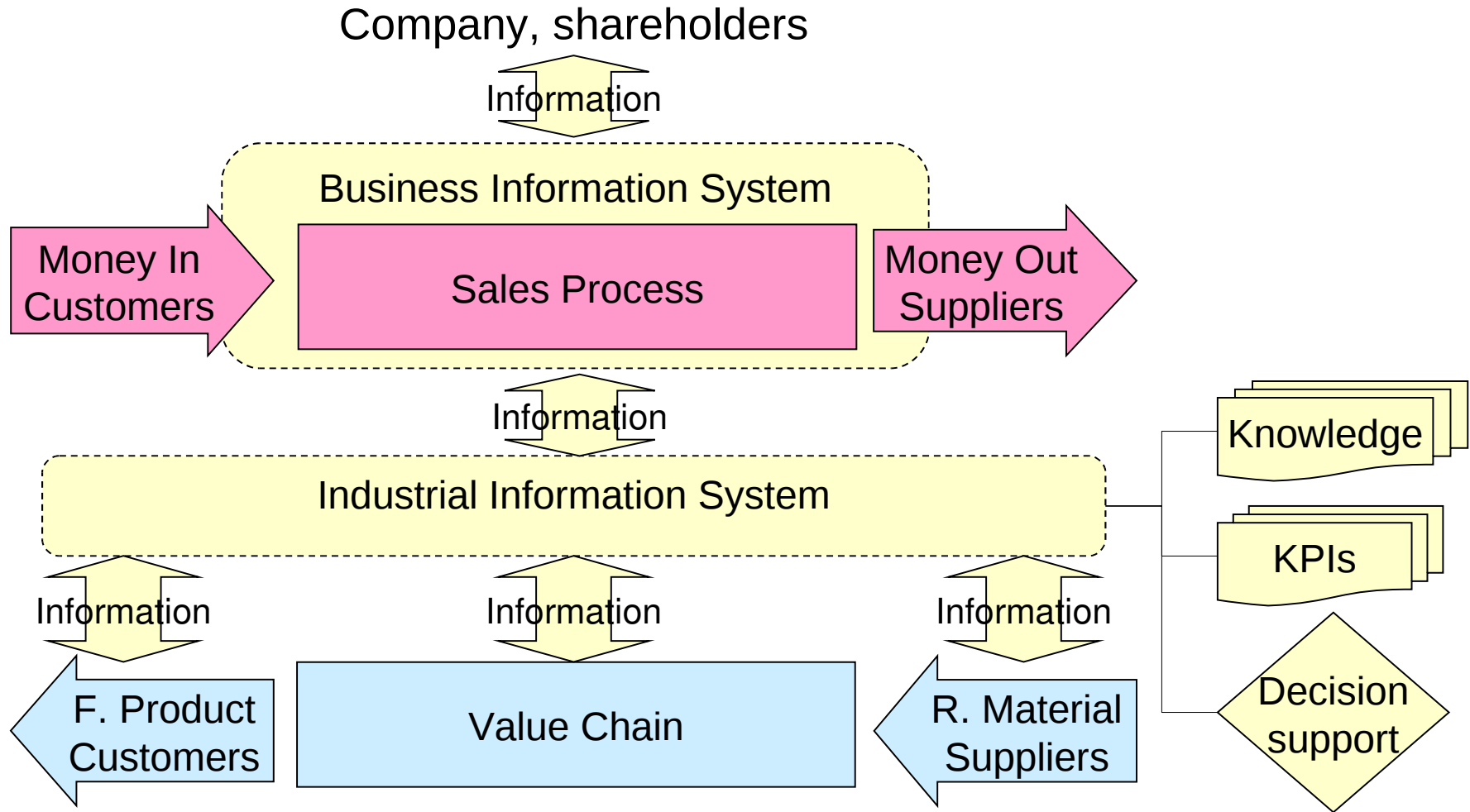
Combining Production / Industrial Information Systems

- **Production System as a physical entity is the Framework (ISA88)**
  - ➤ Physical hierarchy corresponds to Decision hierarchy
  - ➤ Any Information service or process is embedded within a specific Equipment entity, at any level
    - ▪ IIS doesn't exist by itself in the vacuum…
  - ➤ Information system is a supporting system, not a leading entity
- **Any part of the production system might need IIS support**
  - ➤ Or can live without it

Industrial Information System Lifecycle Management

Physical & Decisional hierarchy

Shareholders

Company

Enterprise

Site

Area

Work Center

Work Unit

Equipment Module

Control Module

Financial management

Planning

Scheduling

Operations
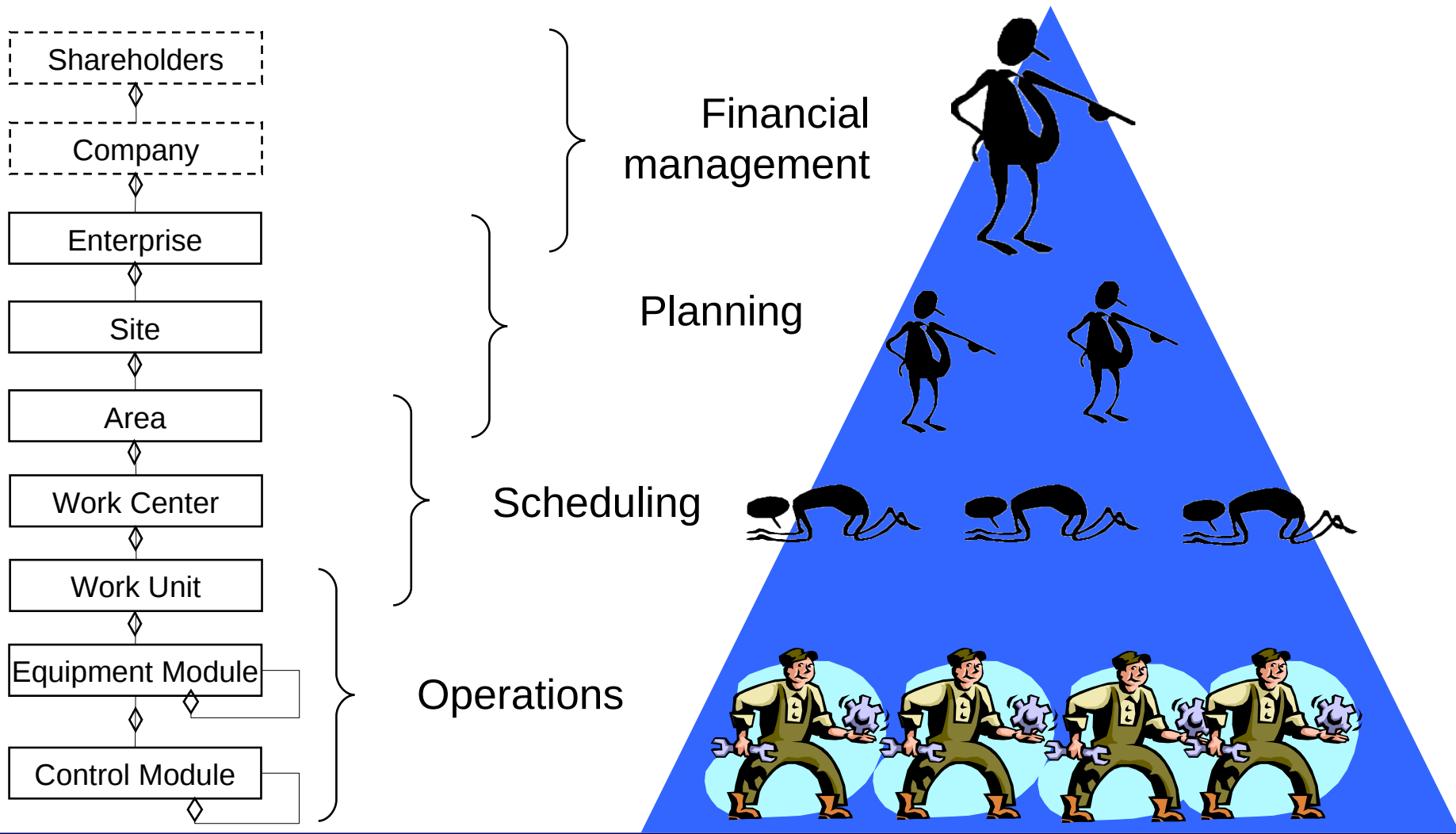
Equipment Entity embeds Equipment & Information

Physical **Equipment**

Information Processing

Operation Management (MES)
Execution Control (Recipes / Routings)
Equipment Control (Automation)
  Instruments, sensors, actuators
  Basic, Coordination & Procedural Control
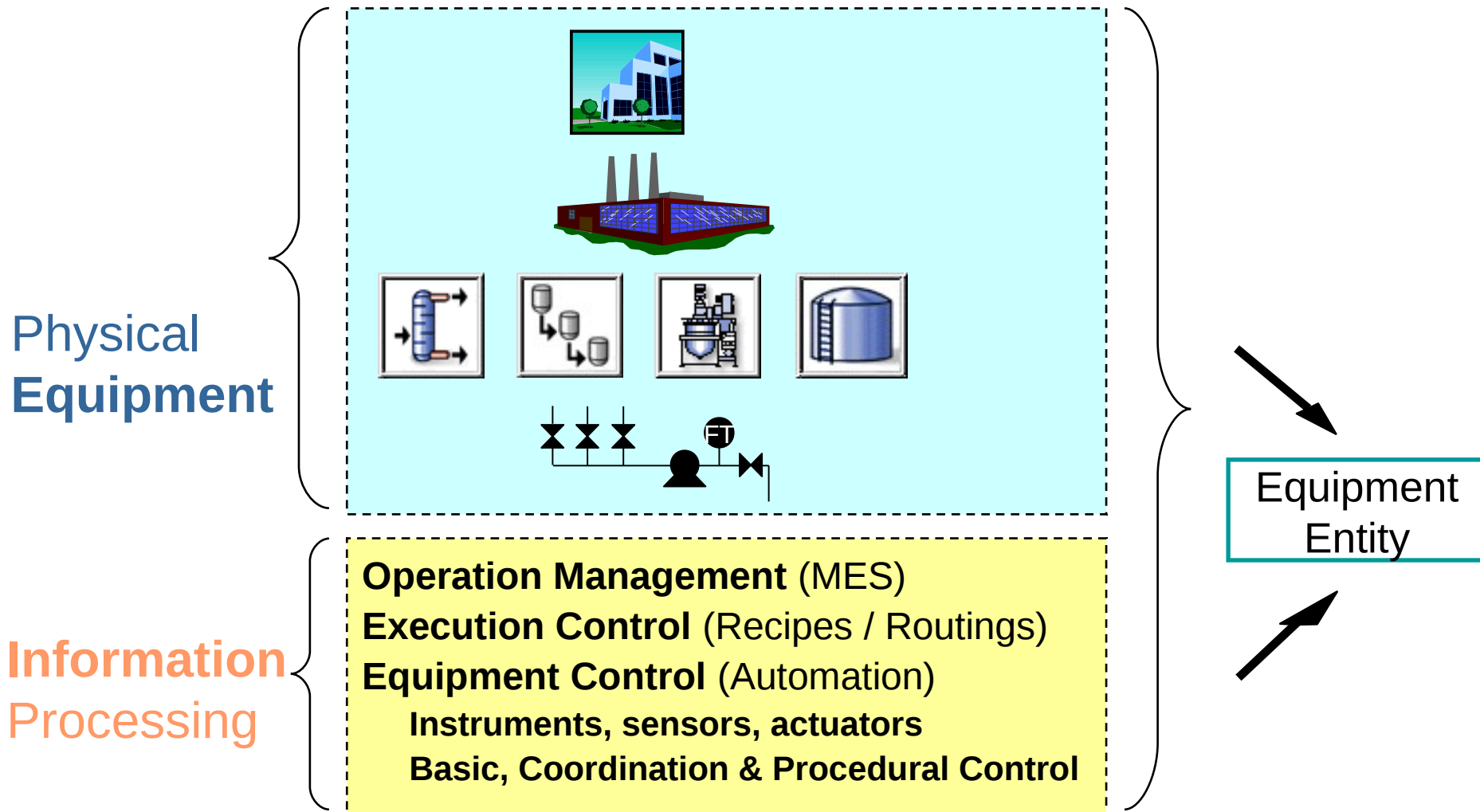
Equipment Entity

Equipment Entity – Low level example
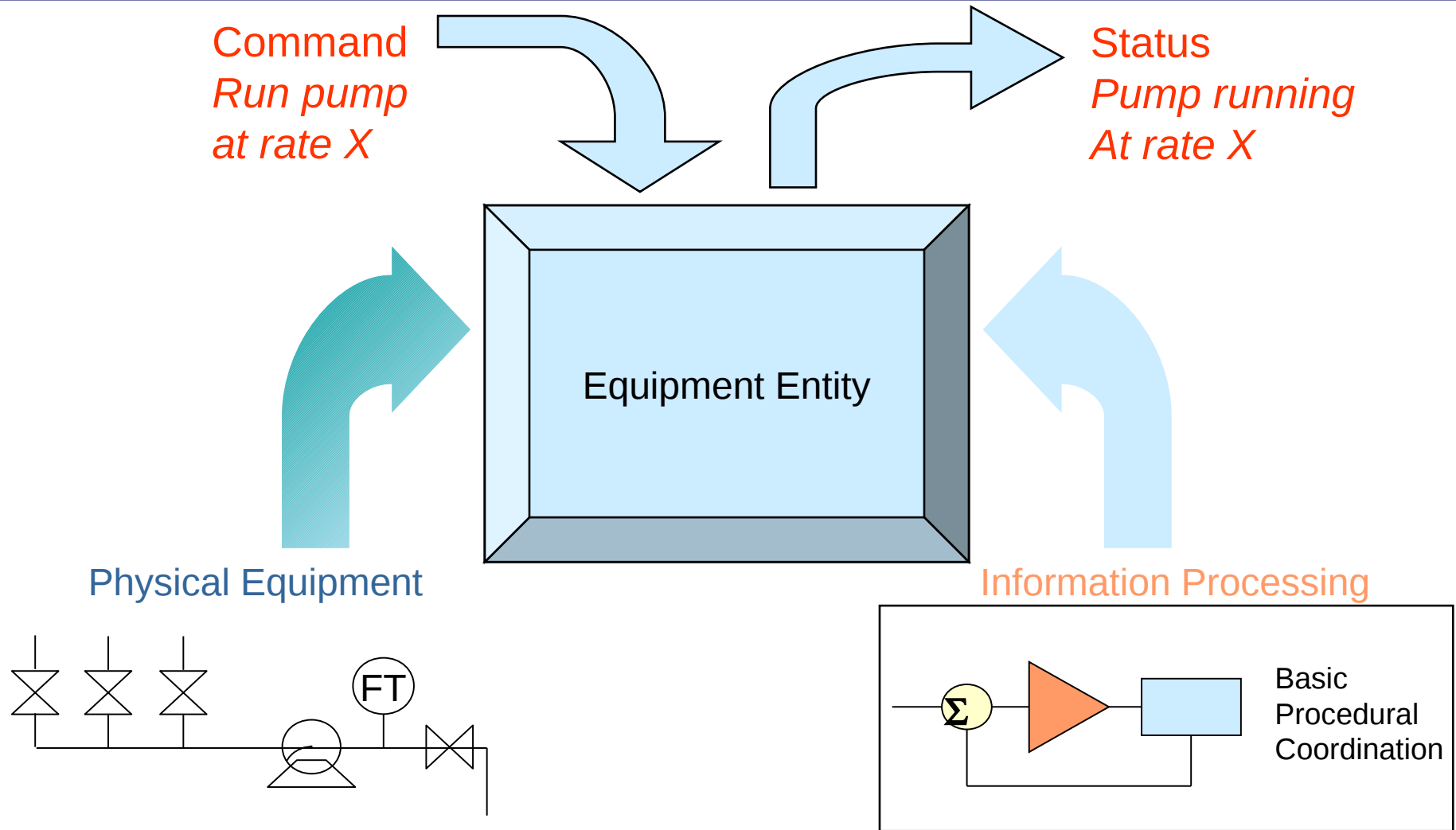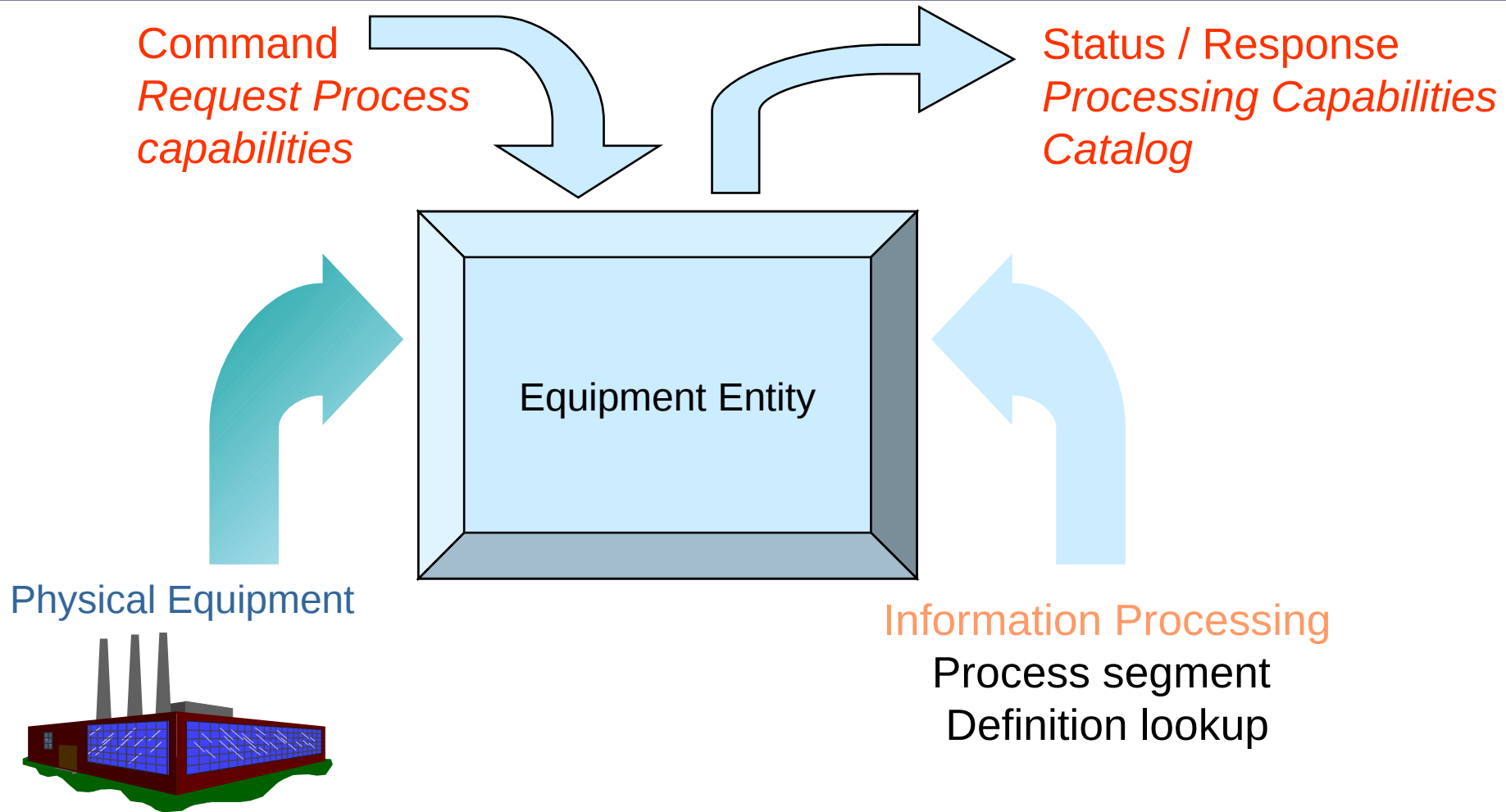
Command
*Run pump
at rate X*

Status
*Pump running
At rate X*

Equipment Entity

Physical Equipment

Information Processing

FT

Σ

Basic
Procedural
Coordination

Equipment Entities – High Level Example

Command
*Request Process
capabilities*

Status / Response
*Processing Capabilities
Catalog*

Equipment Entity

Physical Equipment

Information Processing
Process segment
Definition lookup

Equipment Entities – High Level Example

Command
Optimize Orders' Scheduling

Status / Response
Optimized Orders' schedule

Equipment Entity

Physical Equipment

Information Processing
Schedule Orders
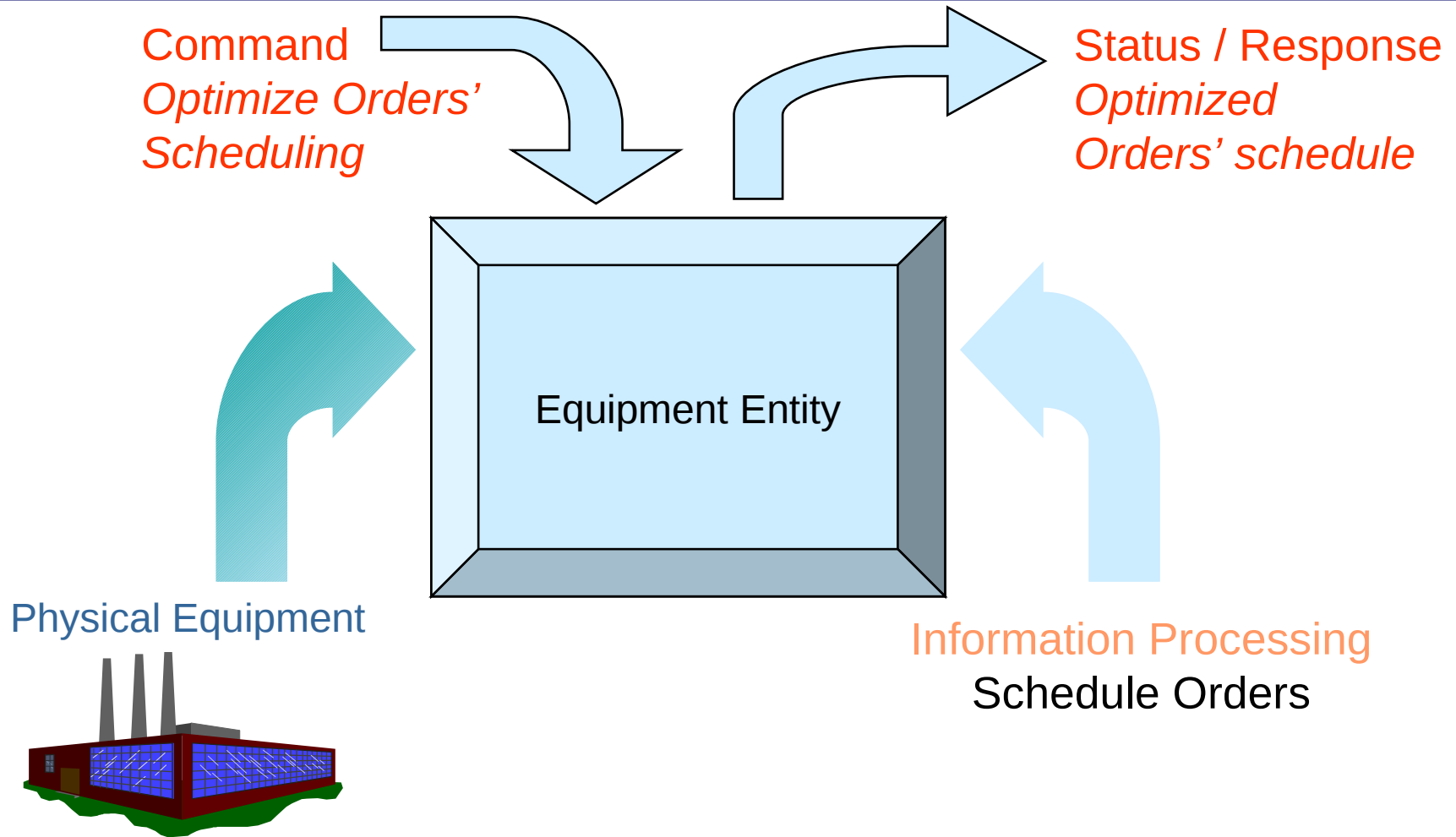
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What is CCM

Control Chain Management® is a process to:

- **Build and maintain the IIS**
  - ➤ Building the Information Factory, selecting and installing software solutions
- **Define and design the information processing requirements**
  - ➤ Business, execution, and transformation processes support requirement
  - ➤ Software components design and mapping
- **Plan & Deploy the IIS**
  - ➤ Managing IIS master plan and deployment
- **Improve continuously**
  - ➤ IIS evolution tied to strategic directions, user feedback and technology

CCM process overview

1. SGU - Strategic Guidance
Get and interpret Directions from Top Management

2. MPL - Master Plan
Develop, maintain and monitor IIS development planning

3. FRP - Functional Repository
Develop and maintain global Information Processing / Services Definition

4. TRP - Technical Repository
*Implement information processing / services capabilities from FRP definitions
Develop and maintain global Technical components*

5. DPL Deployment Projects
Build, and maintain actual systems by implementing technical components (System engineering)

CCM / Information Factory Relationship

Management

- 1. SGU
  Strategic Guidance
- 2. MPL
  Master Plan

Execution

- 3. FRP
  Functional
  Repository
- 4. TRP
  Technical
  Repository
- 5. DPL
  Deployment
  Projects

Feedback

- Information Processing Definition
- Run-time Information Processing
- IT Resource Development
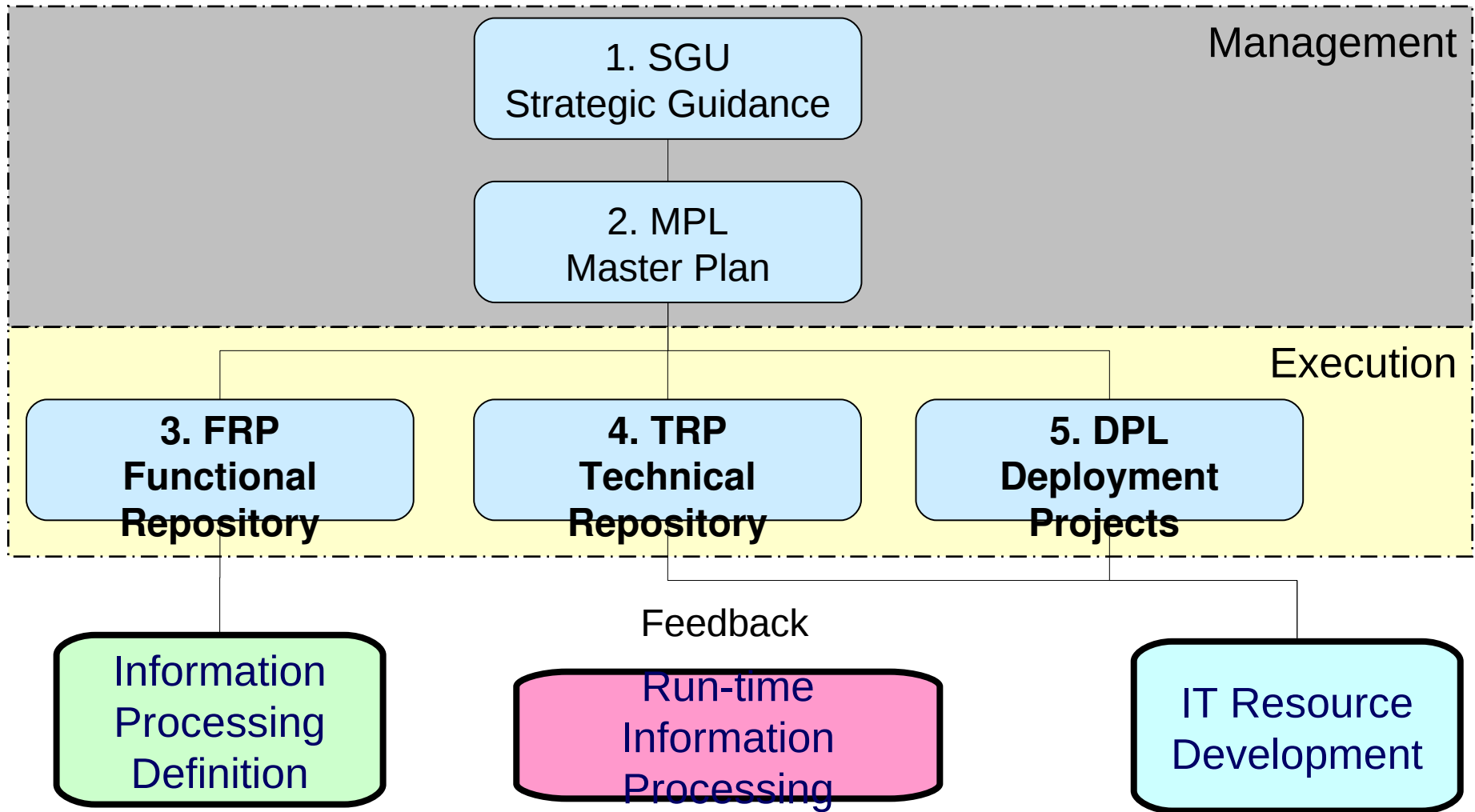
CCM process

Linking IIS development to Enterprise Bottom Line

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Improvement Areas

- **Information System as an Information Factory**
  - ➤ Information Processing Definition
  - ➤ IT Resources Development
  - ➤ Run-Time Information Processing
- **CCM as a process**
  - ➤ How Industrial IT performs within the Enterprise

Improving the Information Factory

- **VAD, Theory of Constraints**
  - The Information Factory shall prioritize and focus on supporting the most constraining processes regarding the Enterprises Goal of making more Money
  - It shall provide relevant information to help reaching the Enterprises Goal of making more Money
- **Lean Management**
  - The Information Factory has to consider the client most valuable service in the most responsive way
  - The information Factory eliminates "Mudda", unneeded features and complexity
- **Six Sigma**
  - Quality of Information features provided by the Information Factory to its clients (users) are constantly monitored and improved

Industrial Information System Lifecycle Management

Improving the CCM Process

- **VAD Theory of Contraints**
  - Value the Information Technology Department activity
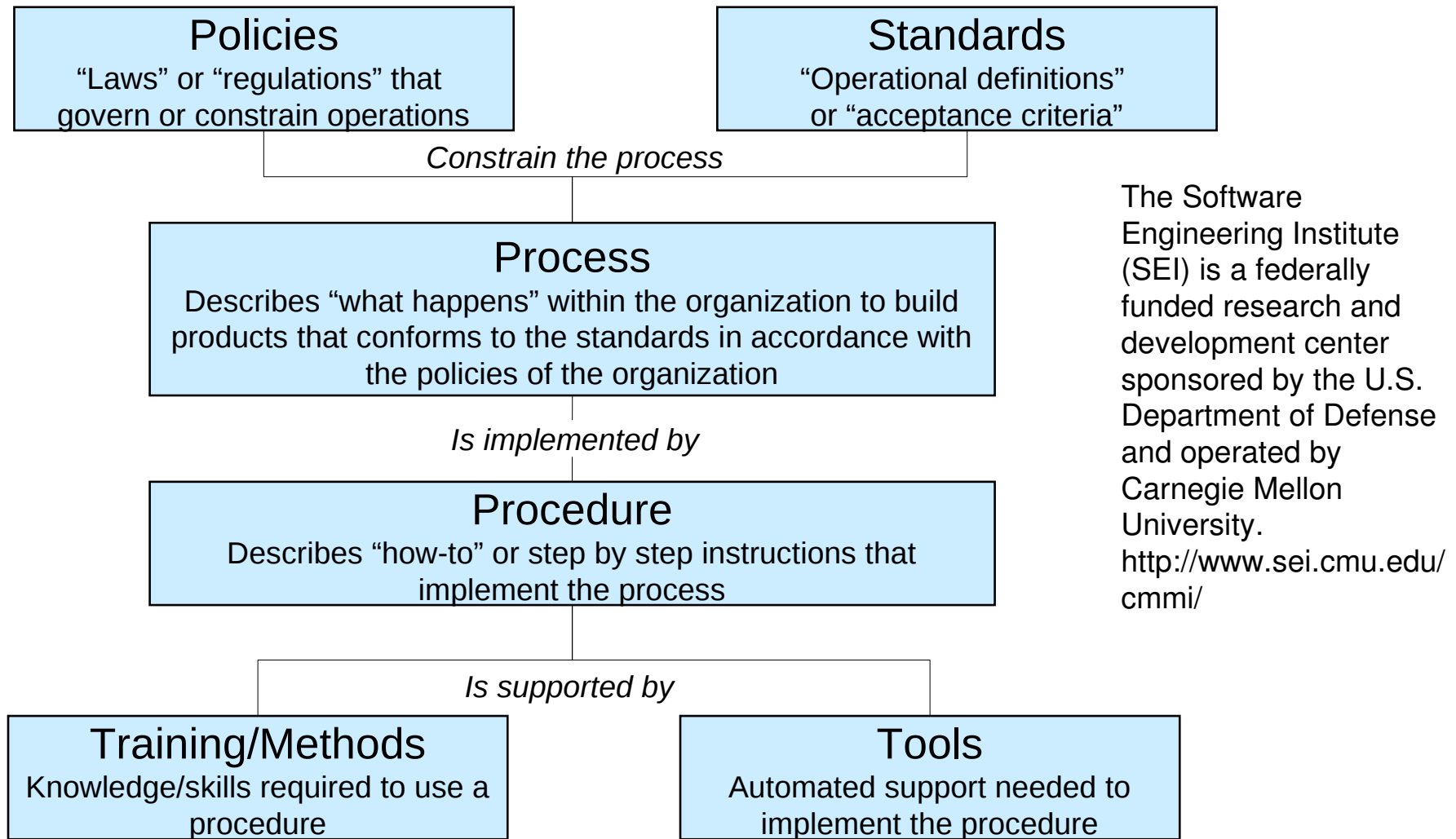 - Sets IT Objectives
- **Lean Management**
  - Keep the process simple and responsive
- **Six Sigma**
  - Monitor and improve sub-processes performance
  - Monitor and improve sub-process links
- **Maturity management**

CMMI / SEI operational framework

Policies
"Laws" or "regulations" that govern or constrain operations

Standards
"Operational definitions" or "acceptance criteria"

Constrain the process

Process
Describes "what happens" within the organization to build products that conforms to the standards in accordance with the policies of the organization

Is implemented by

Procedure
Describes "how-to" or step by step instructions that implement the process

Is supported by

Training/Methods
Knowledge/skills required to use a procedure

Tools
Automated support needed to implement the procedure

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