Industrial Information Systems ISA88/95 based Functional Definition

Jean Vieille, Associate Consultant (Psynapses)

José Gramdi, Researcher & Professor (UTT)

Agenda

- Industrial Enterprise
- The Information Factory
- Combining Industrial & Information Systems
- IIS lifecycle management
- ISA88/95 Functional framework

Industrial Enterprise Structure

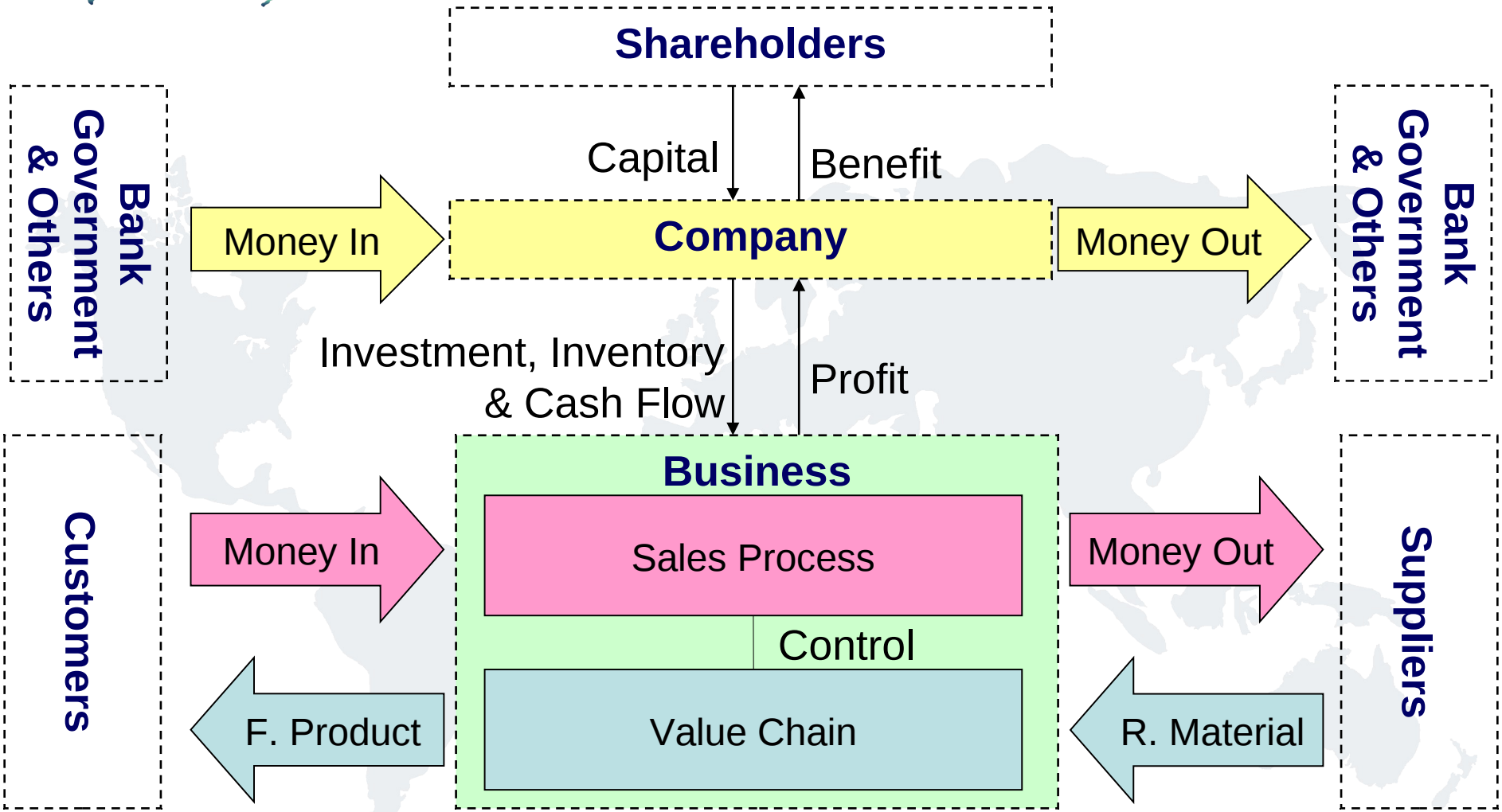
- **An industrial enterprise's purpose is to make money by selling physical, tangible entities :**
  - products, goods, energy
- **The Enterprise in 3 main entities:**
  - The Shareholders
    - who expect revenue from their investment
  - The Company
    - owned by the Shareholders, managing the shareholders capital and providing financial resources to the Business
  - The Business
    - owned by the Company, leveraging Company's capital

Enterprise main Business Processes

An industrial Business has 2 main processes

- **The Value Chain**
  - Creates Value that is perceived by the customers – in making requested products
  - Handles physical Flows and Transformation
- **The Sales Process**
  - Creates Value for the capital shareholders by connecting the Value Chain to the Market
  - Includes activities not related to physical F & T
  - Directs the Value Chain

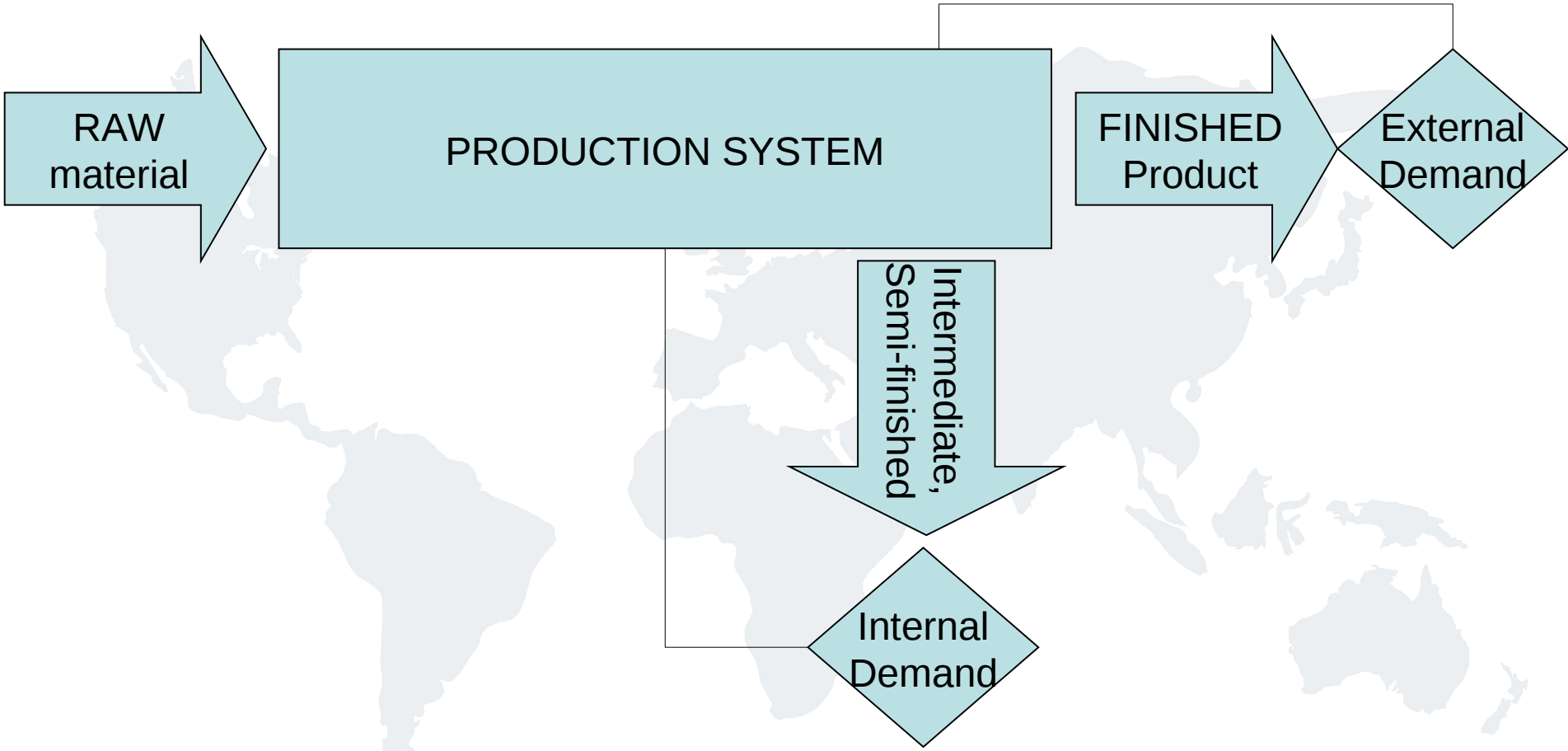
Enterprise global model



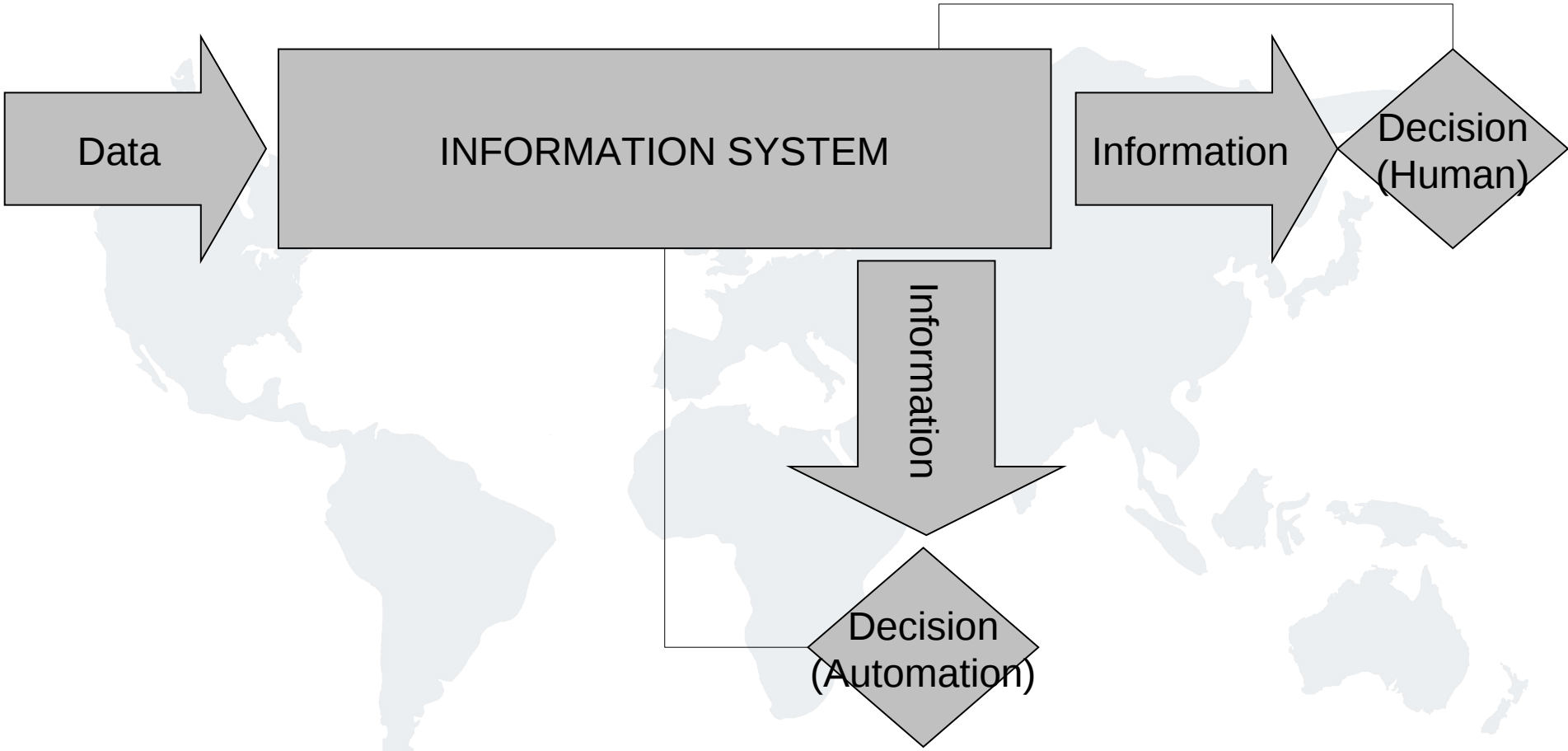
Agenda

- Industrial Enterprise
- The Information Factory
- Combining Industrial & Information Systems
- IIS lifecycle management
- ISA88/95 Functional framework

The Industrial Factory



The Information Factory

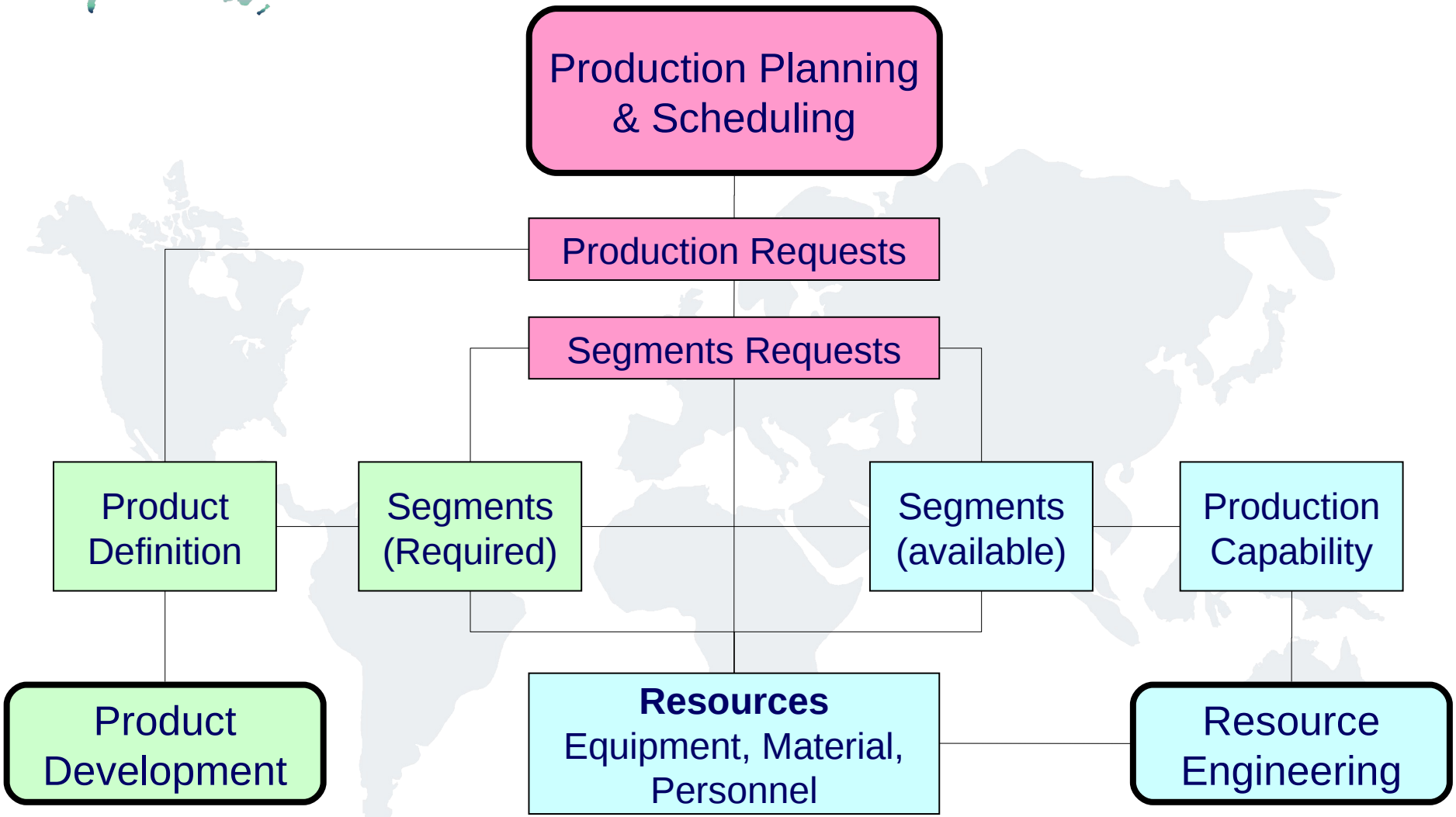


IIS as an Information factory

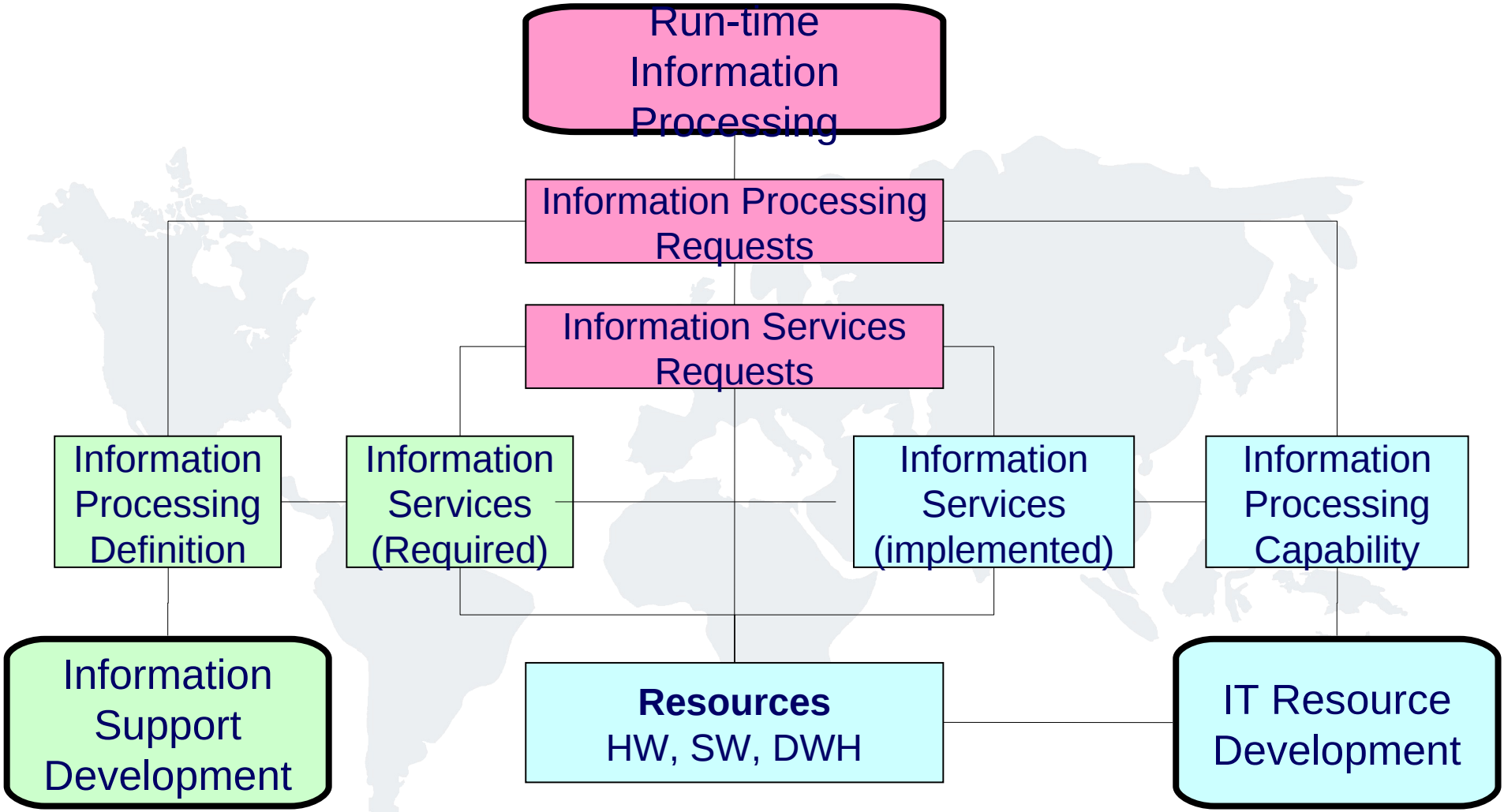
Industrial facility's 3 main processes become:

- **Product Development =**
  - Definition of the information processing requirements
- **Resources Engineering =**
  - HW/SW + information processing capabilities
- **Production Planning & Scheduling =**
  - Run time usage of information processing services

Value Chain Main Processes



Information System Main Processes



Agenda

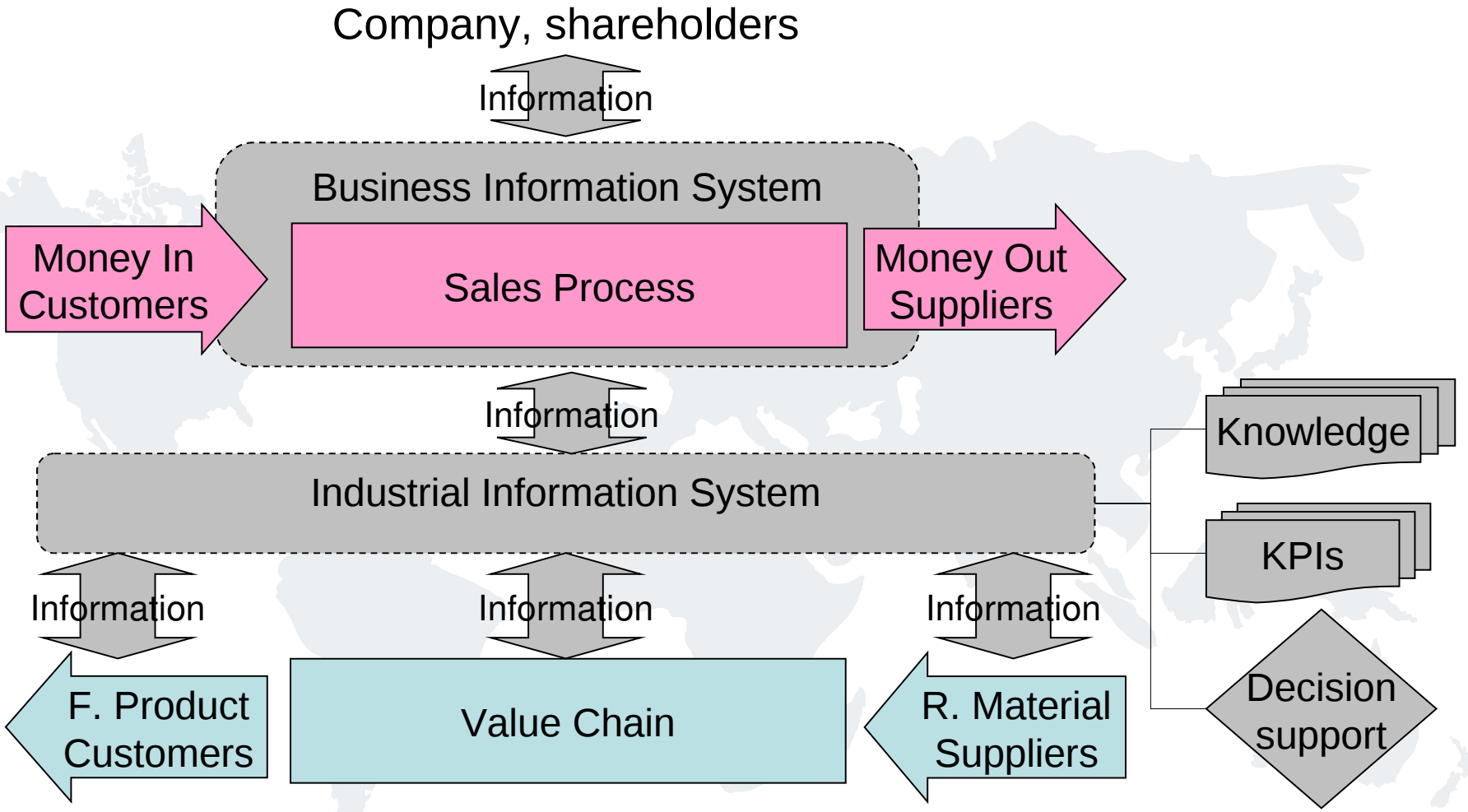
- Industrial Enterprise
- The Information Factory
- Combining Industrial & Information Systems
- IIS lifecycle management
- ISA88/95 Functional framework

Business vs Industrial IS

IIS vs BIS

- **Business Information System**
  - supports the Sales Process
  - Informational in essence – BIS is part of the process
- **Industrial Information System**
  - supports the Value Chain Process
  - Physical in essence

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
  - Each 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 supporting the physical system, it does not lead it!
- **Any part of the production system might need IIS support**
  - Or can live without it

Physical & Decisional hierarchy

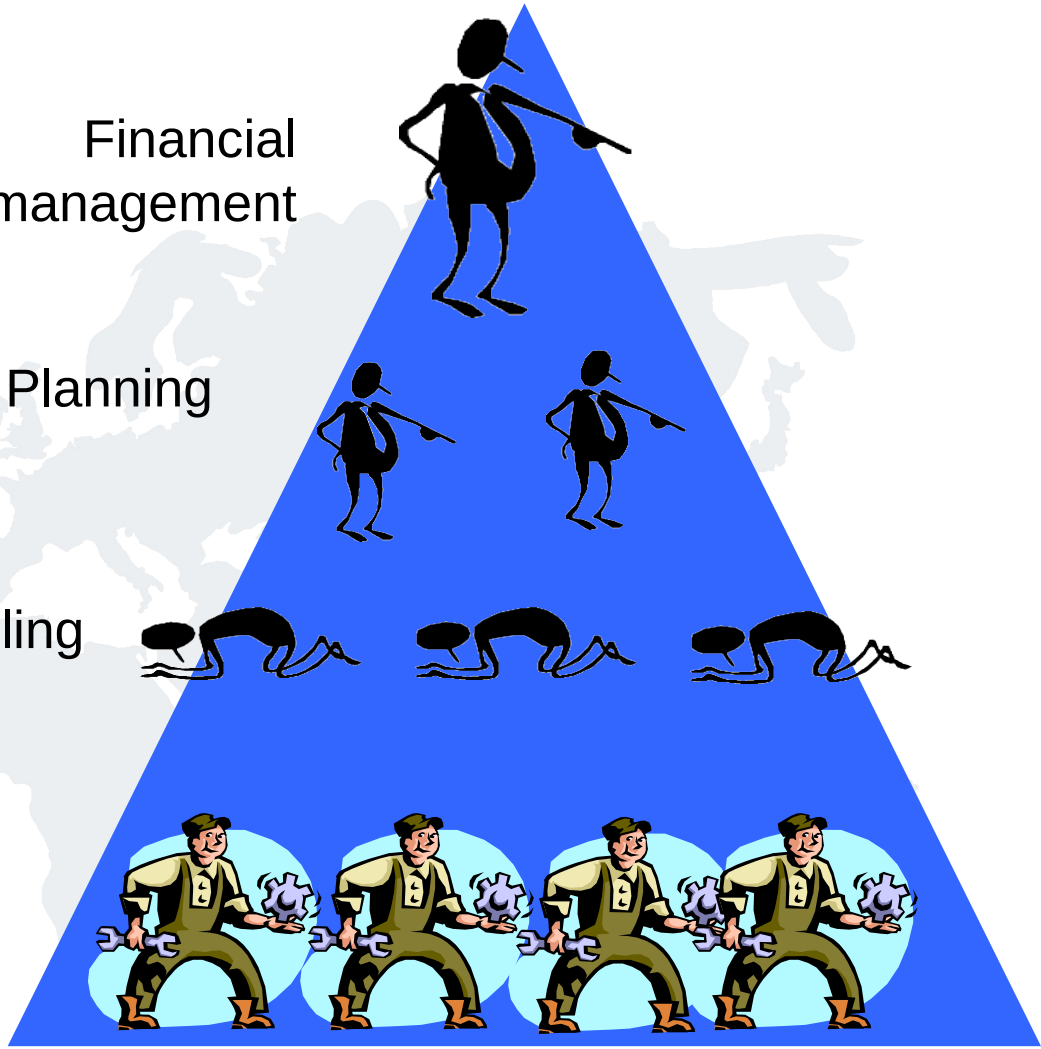
- Shareholders
- Company
- Enterprise
- Site
- Area
- Work Center
- Work Unit
- Equipment Module
- Control Module

Financial management

Planning

Scheduling

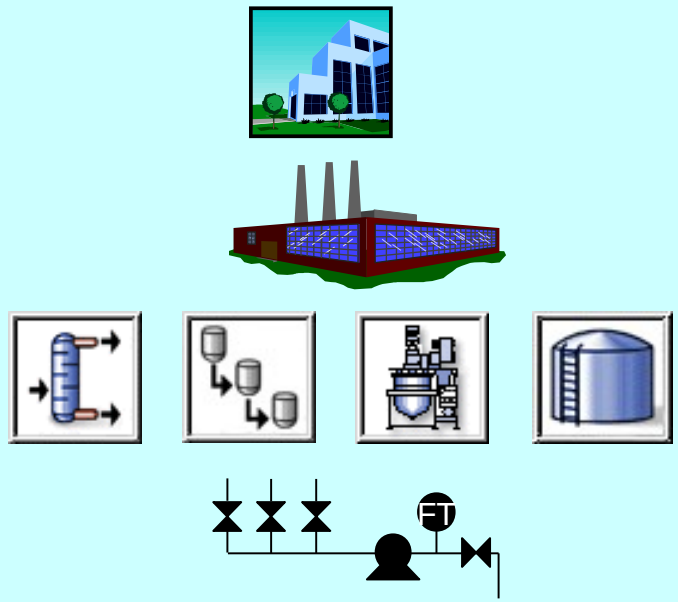
Operations



Equipment Entity - Principle

Enterprise
Site
Area
Work Center
Work Unit
Equipment Module
Control Module

Physical
Equipment



Equipment Entity

Information
Processing

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

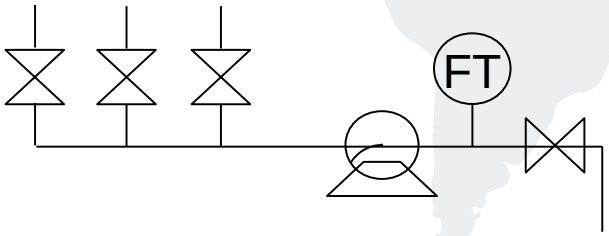
Equipment Entity - Example

Command
Run pump at rate X

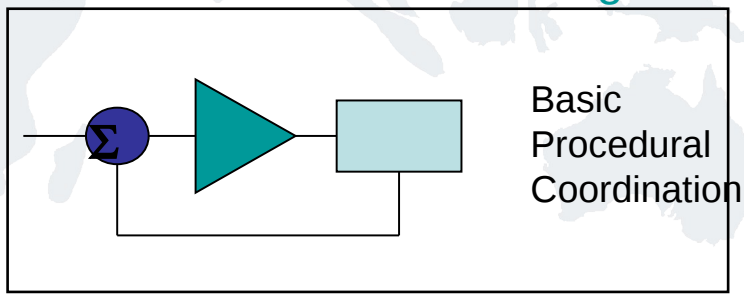
Status
Pump running At rate X

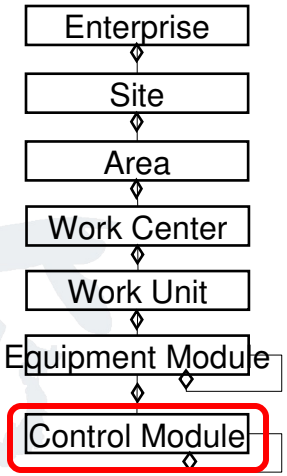
Equipment Entity

Physical Equipment



Information Processing

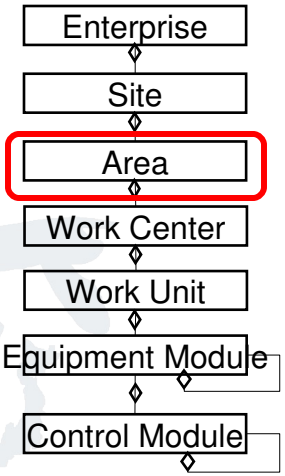




Equipment Entities - Example

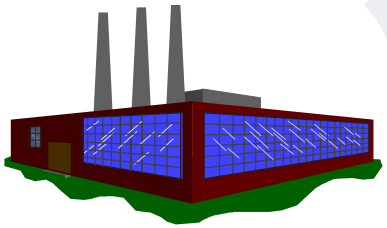
Command
Optimize Orders'
Scheduling

Status / Response
Optimized
Orders' schedule



Equipment Entity

Physical Equipment

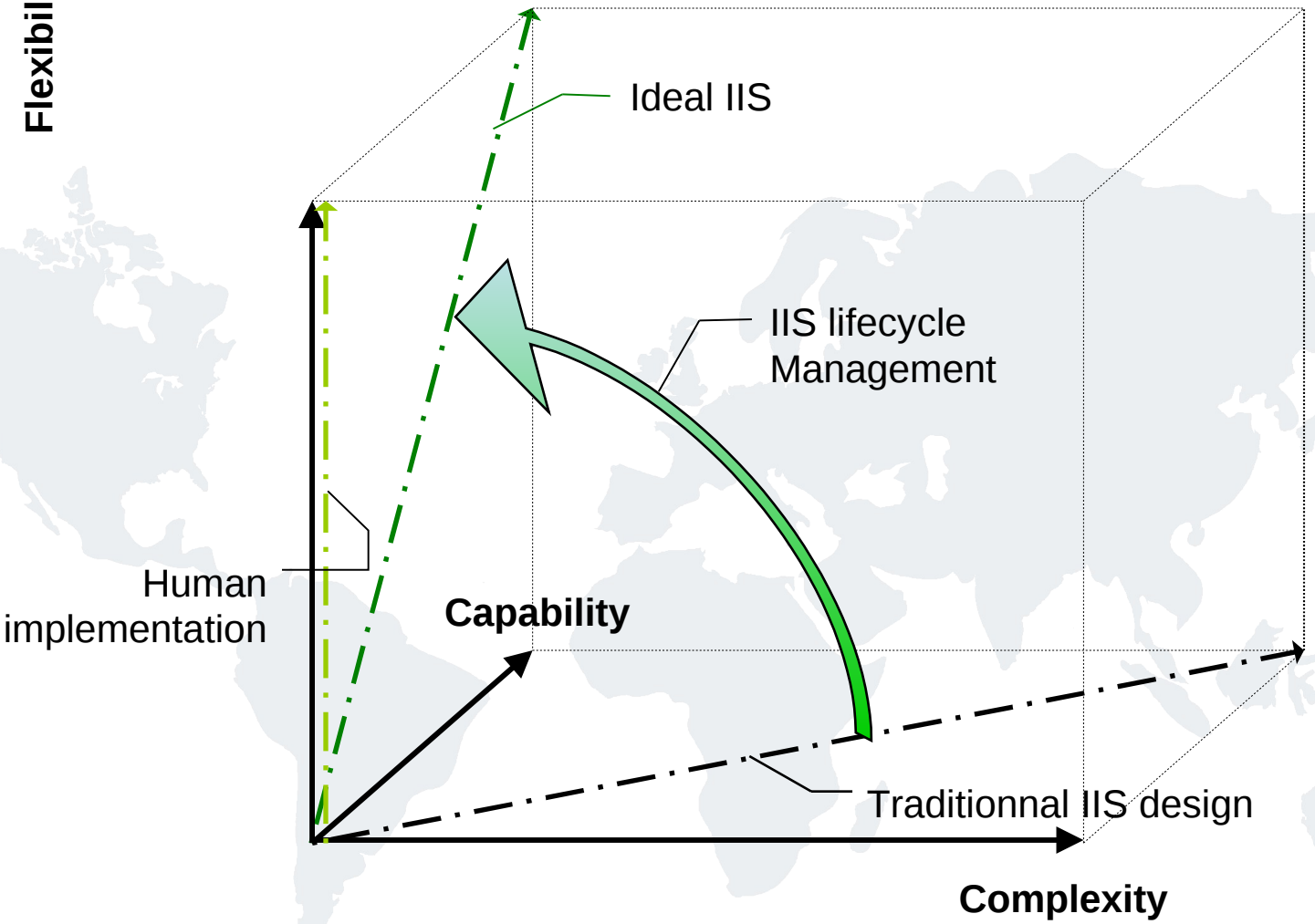


Information Processing
Schedule Orders

Agenda

- Industrial Enterprise
- The Information Factory
- Combining Industrial & Information Systems
- IIS lifecycle management
- ISA88/95 Functional framework

Information system goal



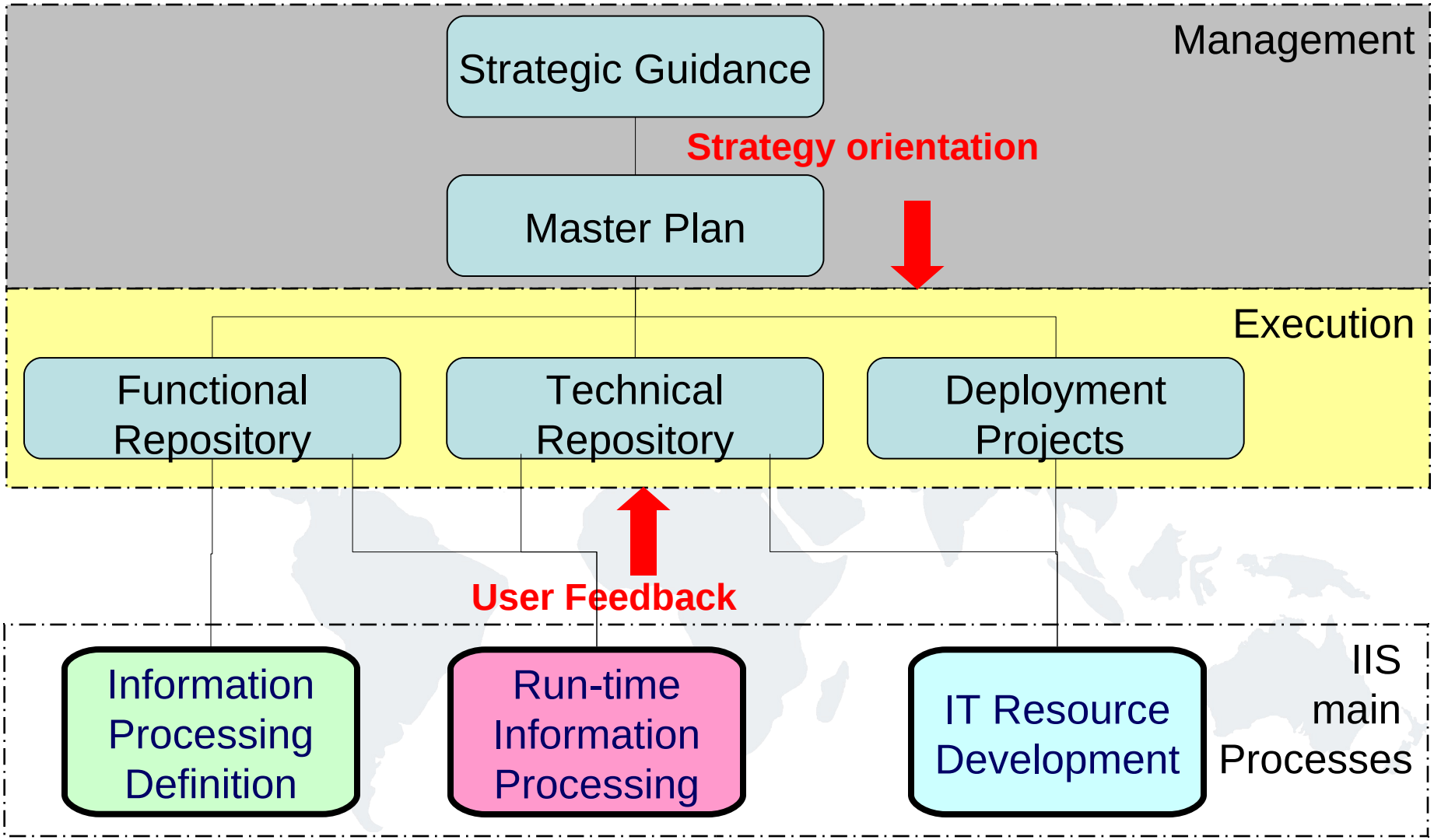
An ISA88 goal generalization Inspired by Lou Pillai and Darin Flemming

IIS lifecycle management

IIS lifecycle management:

- Defines and designs the information processing requirements
- Aligns Enterprise Strategy and User Requirements
- Plans the IIS development and deployment
- Builds, Maintains, and Improves the IIS

IIS lifecycle management



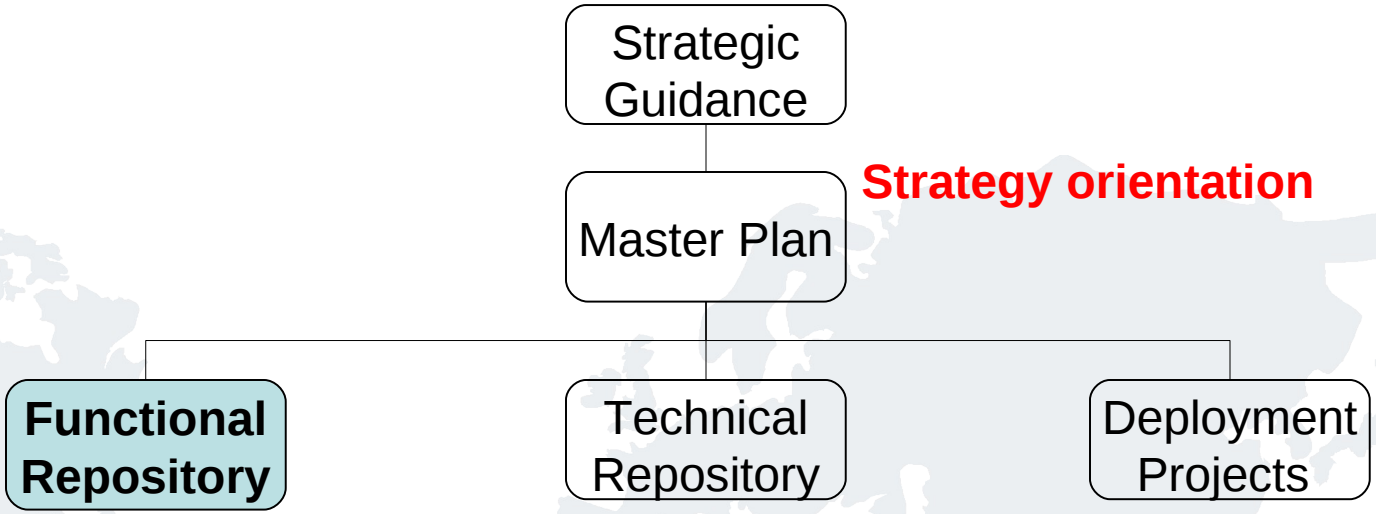
Improvement Areas

- **IIS as an Information Factory**
  - Information Processing Definition
  - IT Resources Development
  - Run-Time Information Processing
- **IIS lifecycle as a process**
  - How Industrial IT performs within the Enterprise
- **Industrial Management methods apply to both IIS and its lifecycle process**
  - Namely Theory of Constraints, Lean Management, Six Sigma

Agenda

- Industrial Enterprise
- The Information Factory
- Combining Industrial & Information Systems
- IIS lifecycle management
- ISA88/95 Functional framework

Functional Repository Sub-Process

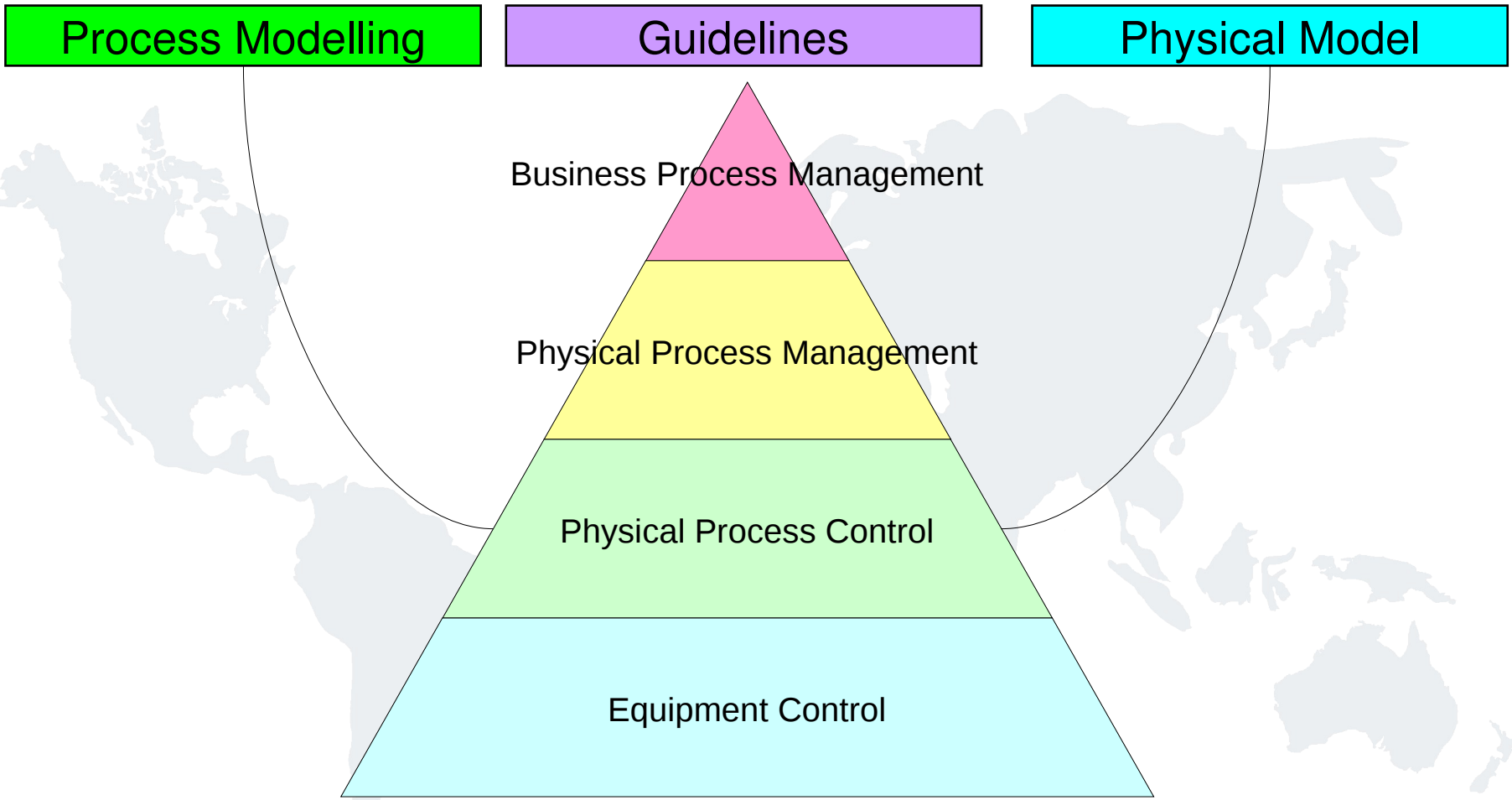


- **The Functional Repository deals with Information Processing Knowledge / Requirements**
- **Scope**
  - The entire manufacturing related information processing knowledge
  - Global for the whole Enterprise

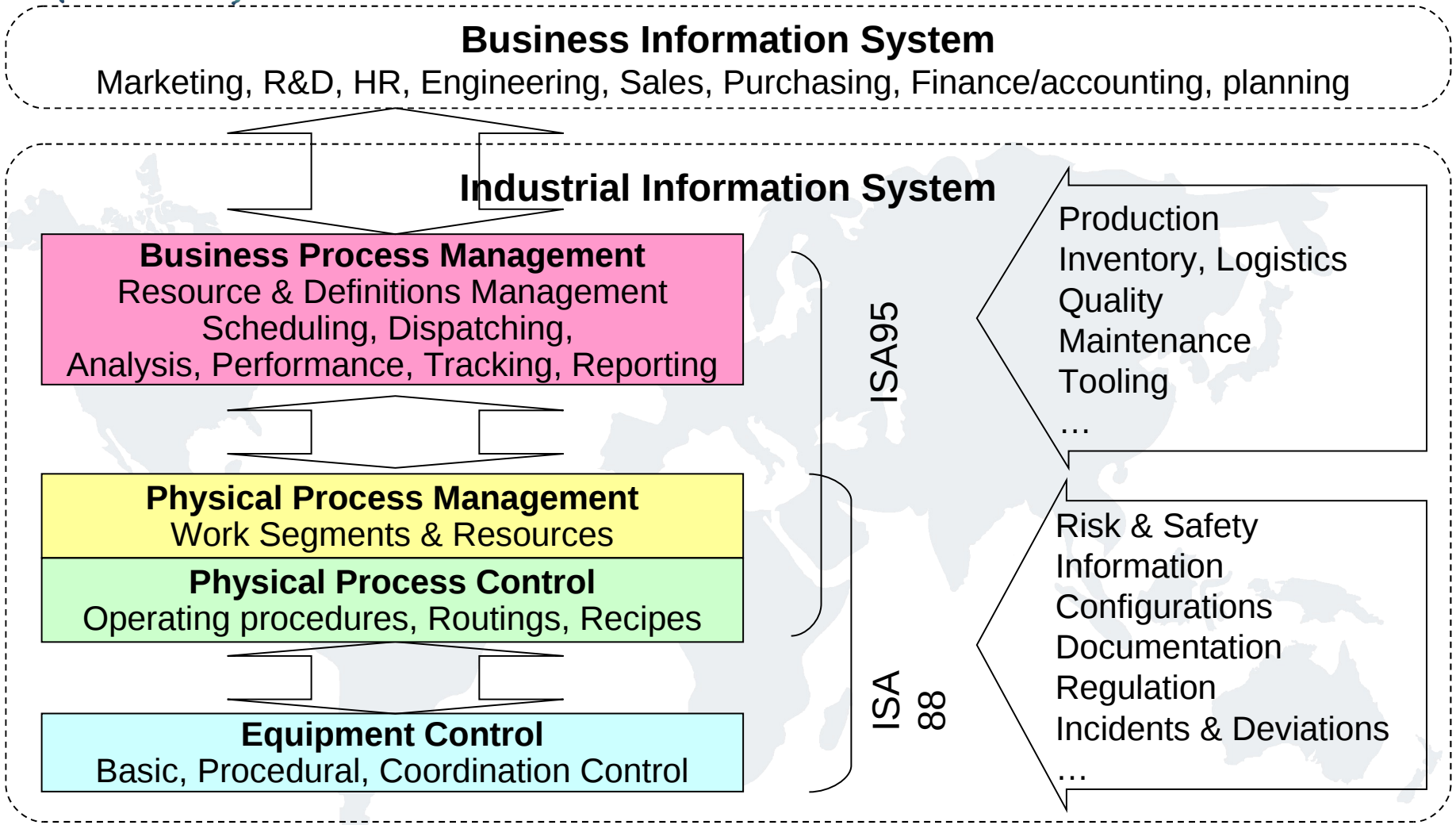
Functional Repository Sub-Process

- **FRP separated from actual deployment**
  - Delivers and captures global knowledge to and from actual IIS development/projects
- **FRP is the framework**
  - For structuring the knowledge
  - For mastering development planning

IIS domains



IIS Scope



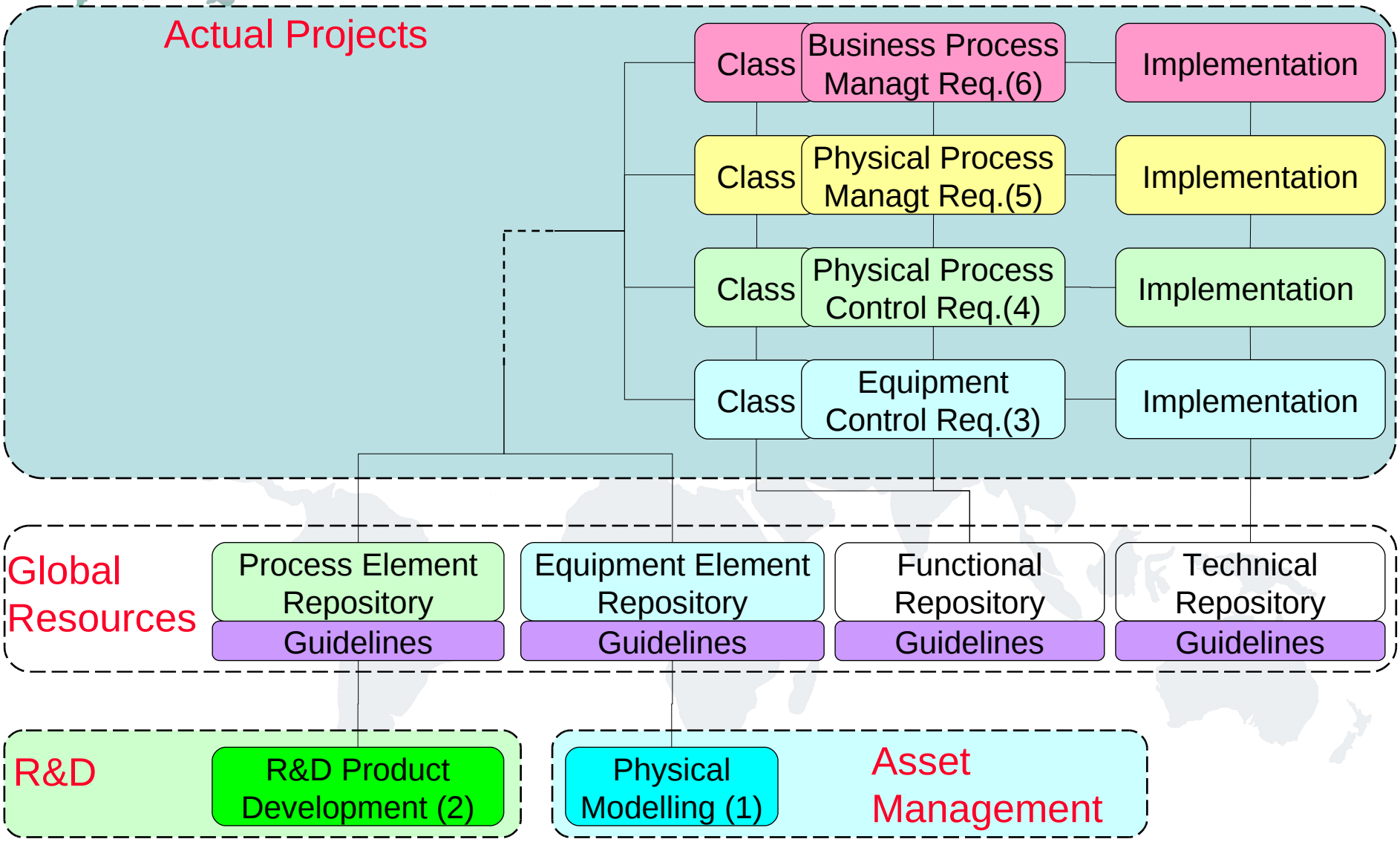
Objects Classes

Domain	Model	Std	Objects classes	Owner
Asset Management	Physical	ISA88-1 ISA95-1	Equipment	Asset Management
Product Development Management	Process	ISA88-3	Process Elements Material Equipment Constraint	Product Research
Equipment Control	Procedural	ISA88-1	Equipment Procedural Elements	Automation Engineering
Physical Process Control	Procedural	ISA88-1	Process *(Recipe)* Procedural Element	Product Development
Physical Process Management	Work Segment	ISA95-1	MOC Work Process Work Segments Personnel	Planning, Cost Accounting & HR
Business Process Management	Operation Activity	ISA95-3	Business Process Tasks	Production Management

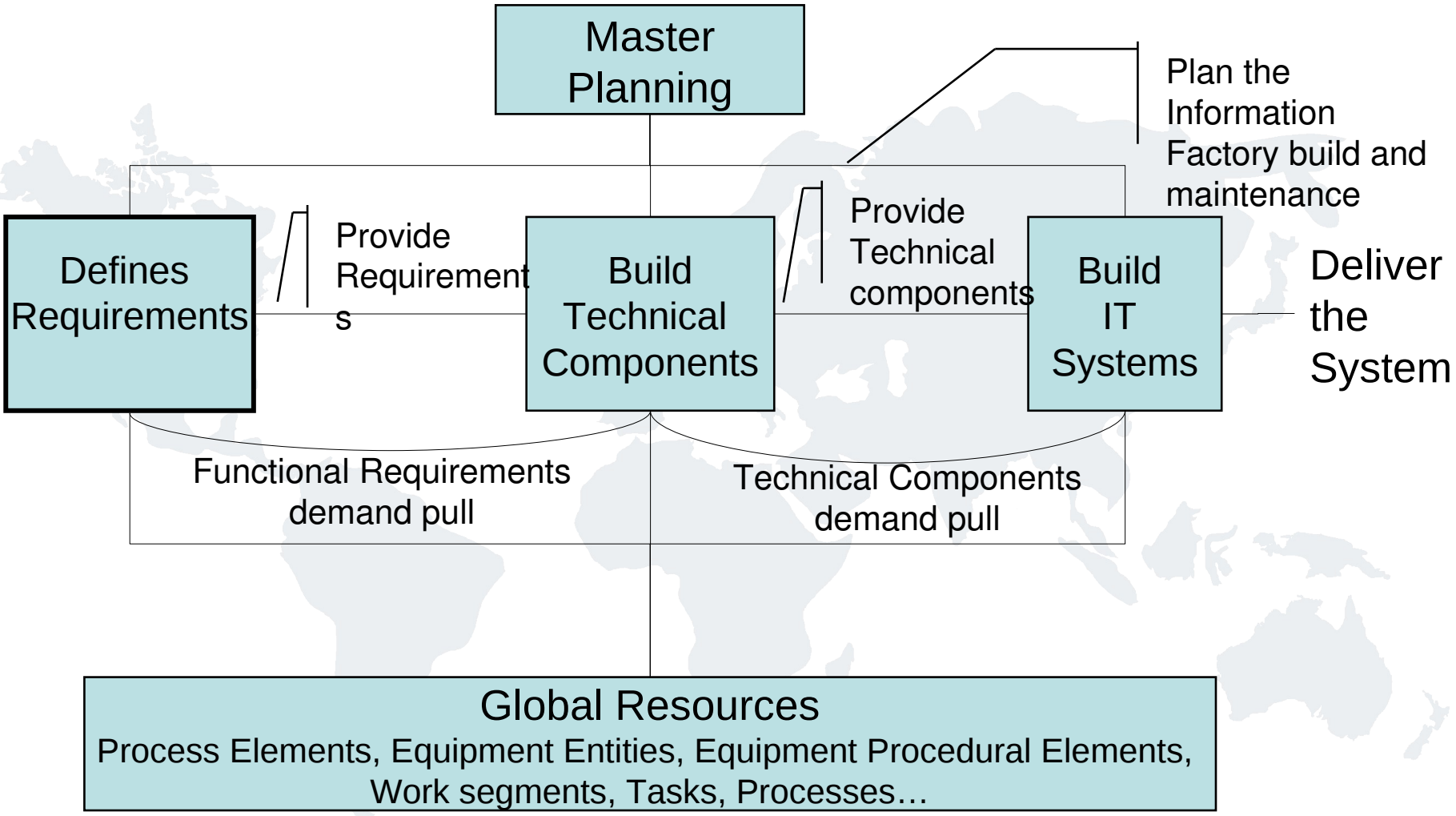
Objects Instances

Domain	Model	Std	Objects Instances	Owner
Asset Management	Physical	ISA88-1 ISA95-1	Equipment	Asset Management
Product Development Management	Process	ISA88-3	Product Requirement Process Element Material Definition Equipment Constraint	Product Research
Equipment Control	Procedural	ISA88-1	Equipment Procedural Element	Automation Engineering
Physical Process *(Recipe)* Control	Procedural	ISA88-1 ISA88-3	Physical Process *(Recipe)* Physical Process *(Recipe)* Transform Components Process *(Recipe)* Procedural Element	Product Development
Physical Process Management	Work Segment Work Definition	ISA95-1	MOC Work Process *(Process segment/Product Definition)* Work *(Process)* Segment Personnel	Planning, Cost Accounting & HR
Business Process Management	Operation Activity	ISA95-3	Business Process Tasks	Production Management

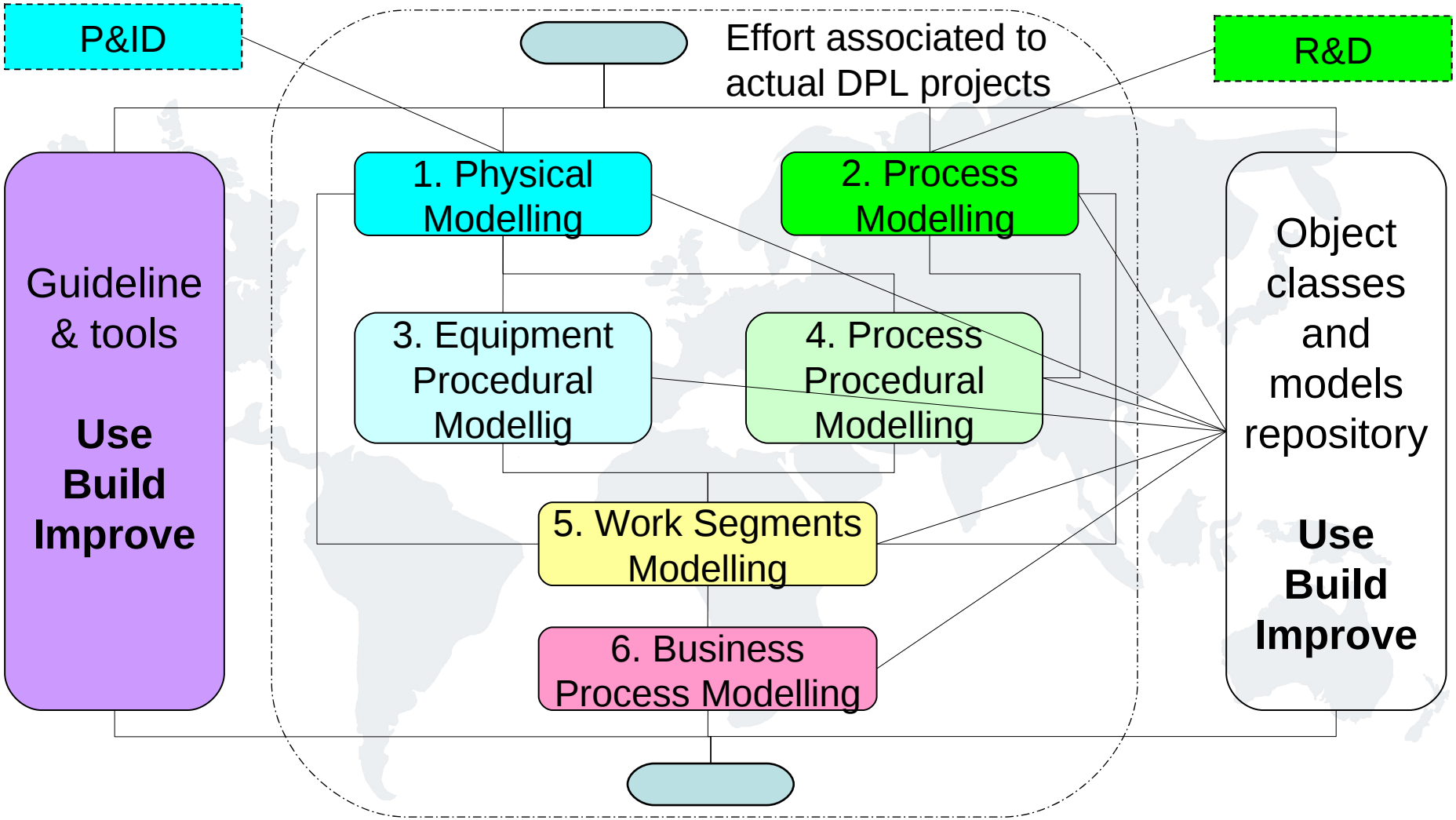
relationship



Demand driven IIS construction process



Functional definition framework overview



Conclusion

- **IT is maturing, but Industry is still behind.**
  - The IIS **Information Factory** must concentrate on supporting the Industrial Factory performance
- **The whole IIS must adopt a flexible design**
  - Using the proven ISA88 **Equipment Entity** concept and SOA/ISA88 service/orchestration split
- **Functional Requirement sub-process provides the global IIS framework**
  - **ISA88/95 models** only need slight changes / *interpretation* to cover consistently the full scope of IIS functional framework

Thank You

Questions?