



Knowledge-based Factory of the Future

**Engelbert Westkämper
Fraunhofer Alliance Production**

MANUFUTURE



Factories are Products



MANUFUTURE

**European Platform for High Adding Value
in Manufacturing Industries**





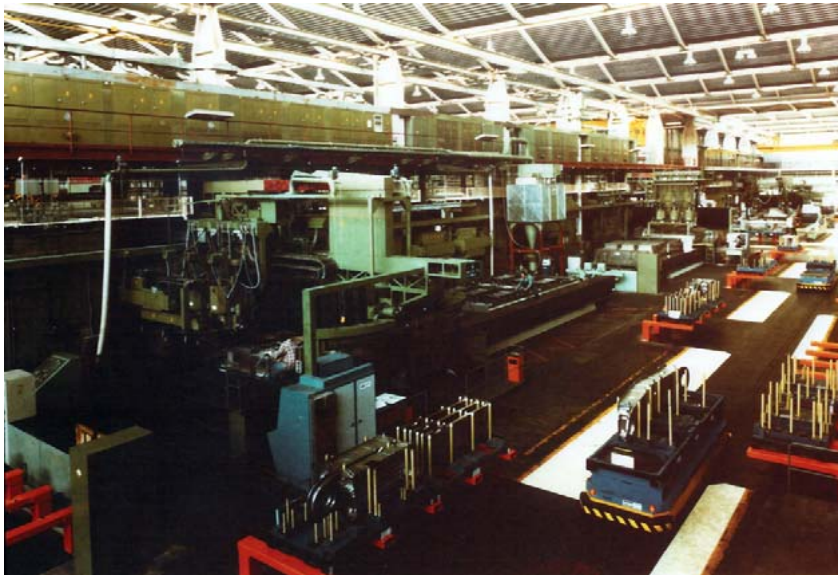
The Vision of MANUFUTURE



The World Champion in Manufacturing: all Resources for Manufacturing

Factories made in Europe....

- Engineering
- Engineering Tools
- Planning
- Planning Tools
- Machines
- Automation
- Systems
- Equipment (Tools...)
- Control systems
- Methods
- Process Models
- Management
- Services: Training, Finance..



Source: CIAM-MBB Augsburg 1980

....the R&D Focus on

- Adaptive
- Digital
- Networked
- Knowledge-based
- High Performance
- New Taylorism

... with R&D Networks

- Virtual Research Labs
- Basic Research
- Application-oriented Research
- Regional Centers

....over the Life Cycle

...enable Platforms for Manufacturing

Factories made in Europe with European Manufacturing Standards

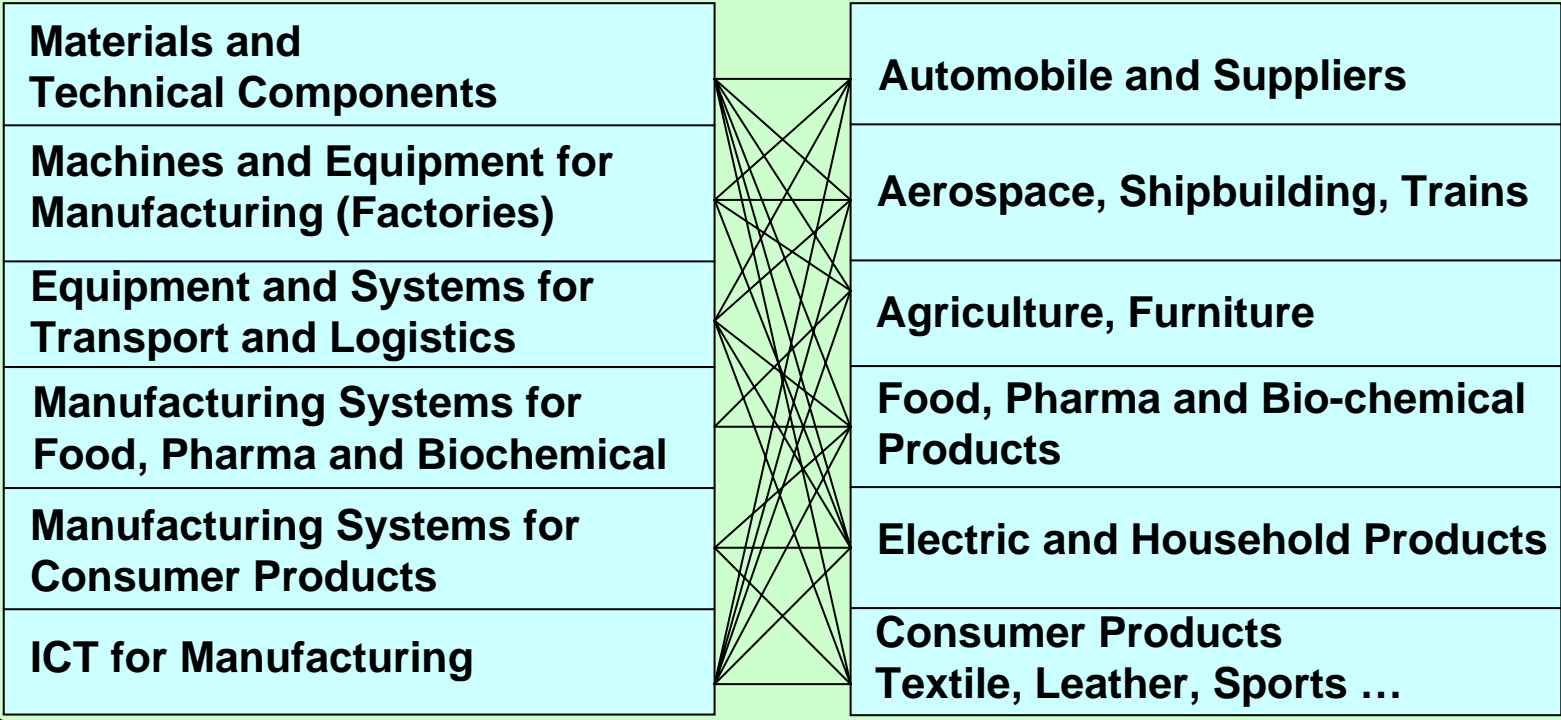


Manufacturing Sectors

Collaborative Research (Virtual Sector)			
New Business Models	Industrial Engineering	Emergent Technologies	ICT for Manufacturing

Capital Intensive Goods for Manufacturing Consumer Goods

27 Sectoral Road Maps and ETPs

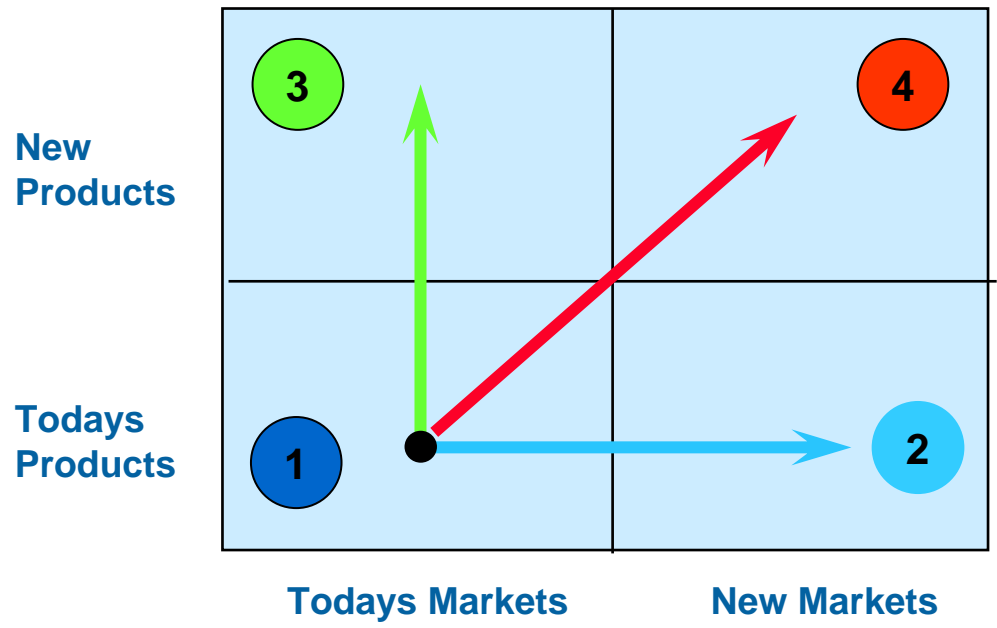




MANUFUTURE Vision RTD for High Adding Value

Assuring the Future of Manufacturing in Europe by High Adding Value

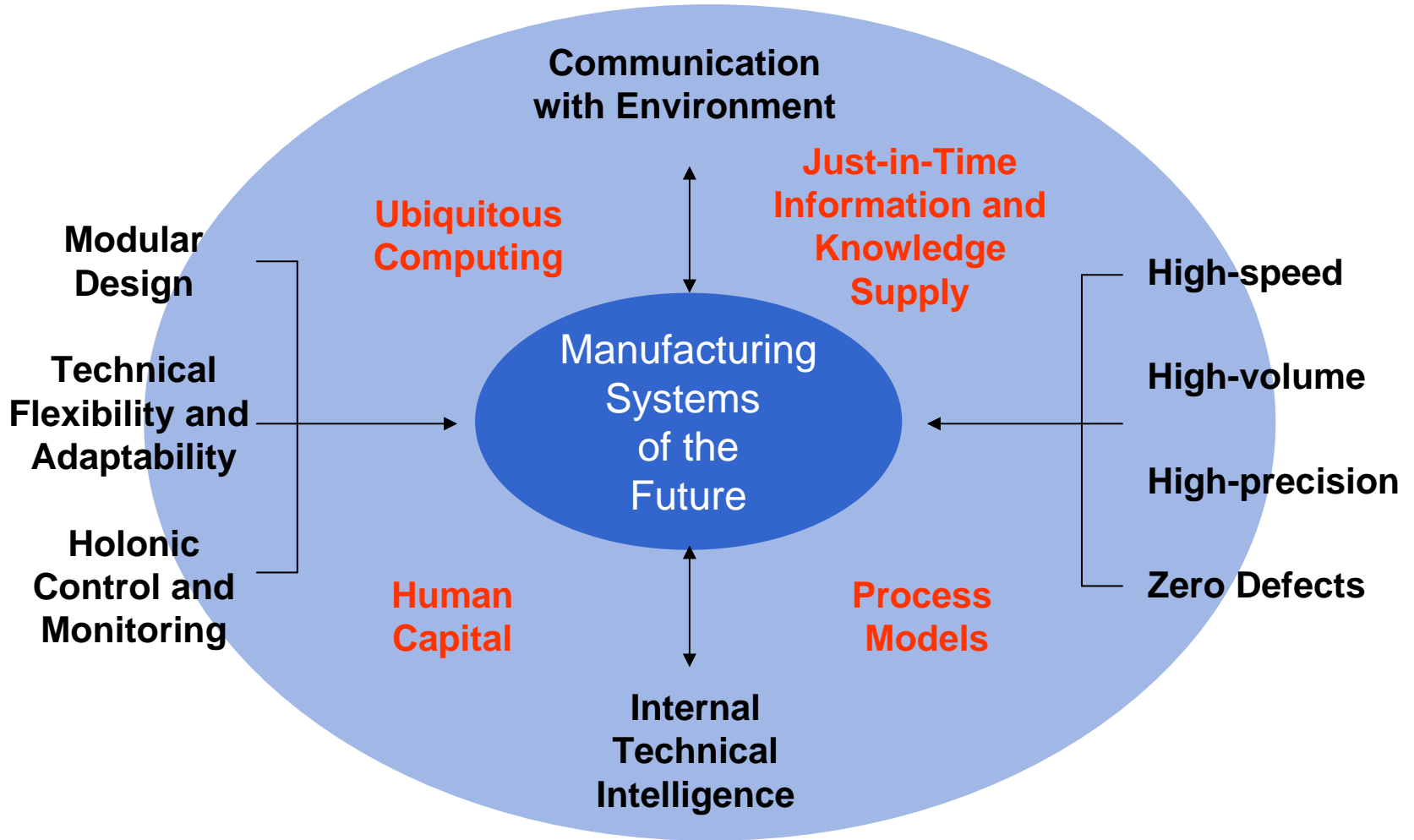
- 1** Customisation
Quality, Cost, Time
- 2** Global Production
- 3** Leadership in Technologies
- 4** New Technologies for Emerging Sectors



- Knowledge-based Manufacturing for Competition
- Leadership in Technologies
- Environment-friendly and European Culture of Manufacturing

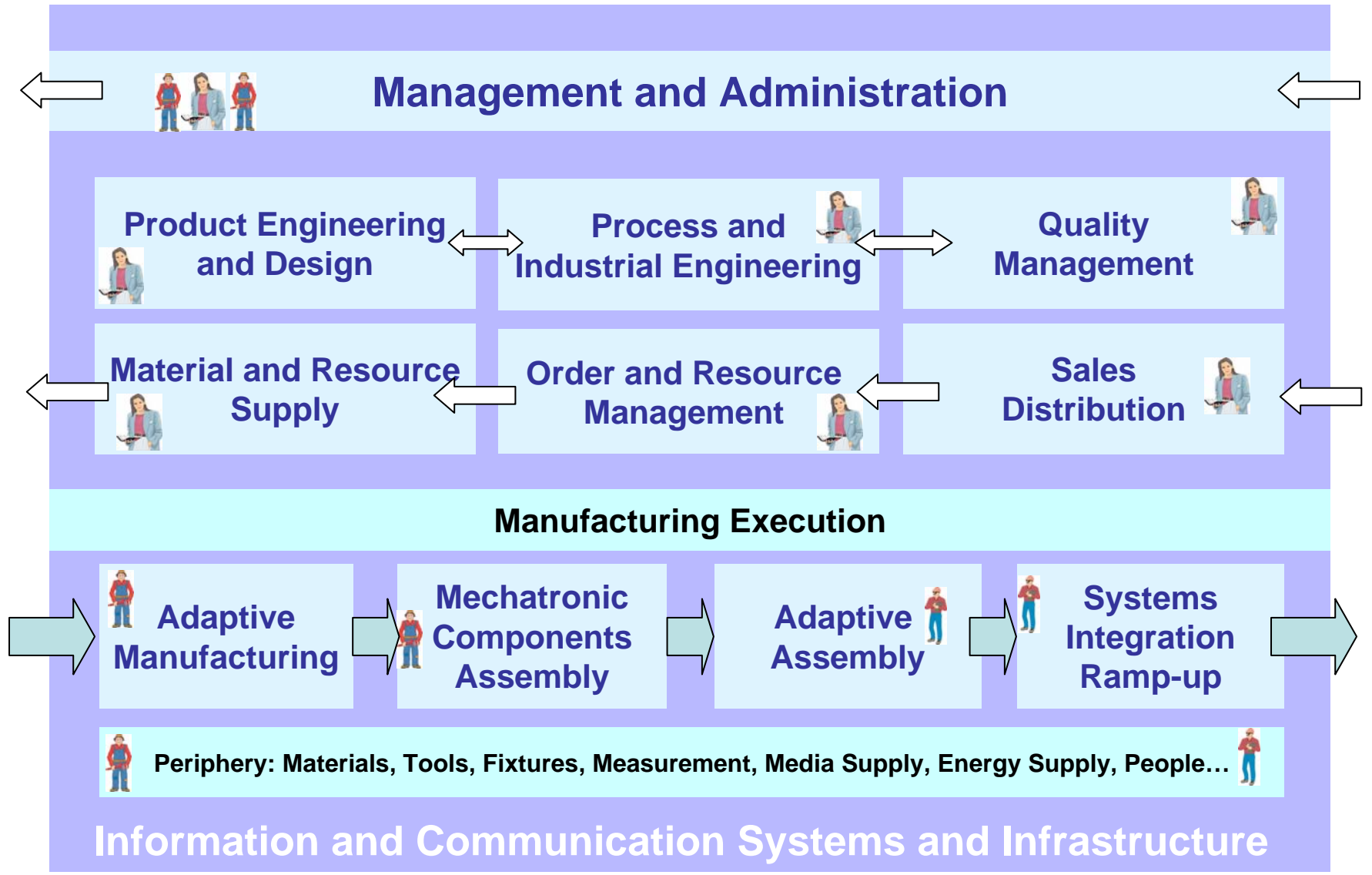


Manufacturing of the Future Objectives





Knowledge Integration by ICT Factory Functionalities





ICT for Intelligent Manufacturing



Innovative ICT Infrastructure and Systems

- Vision Systems
- Wireless Communication
- Grid Computing
- Embedded Electronics
- Cognition-based ICT
- Self-organising Systems
- Human Interfaces

European Platforms for:

- Management
- Engineering
- Execution

European Production System

- High Adding Value
- Customisation
- Networking
- Knowledge-based
- Emergent Techn.
- Intelligent
- High Efficiency

Implementation and Customisation of Factories Made in Europe for....

- Consumer Goods
- Capital Intensive Goods

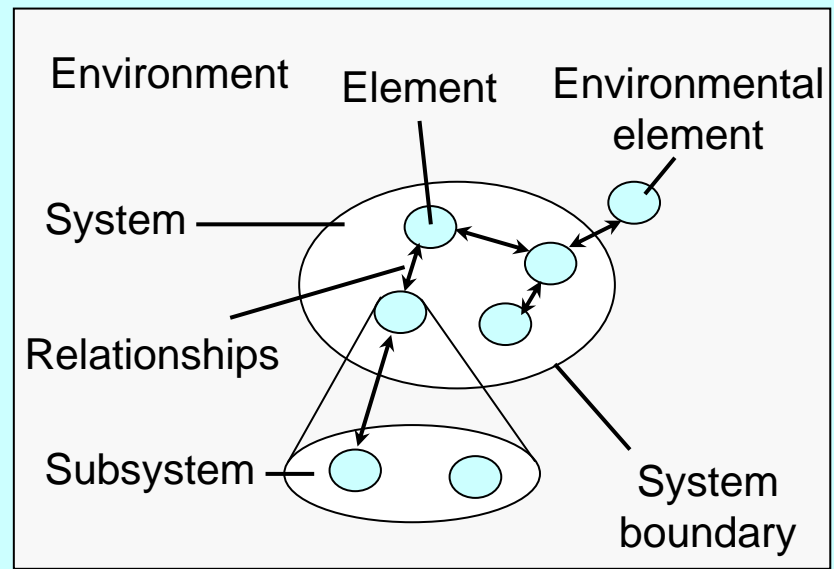


RTD Key Challenges

**Product-Integrated Knowledge (Intelligent Products)
Product-oriented Services
Life Cycle Orientation**



- **Adaptive**
- **Digital and Virtual**
- **Integrated Networks**
- **Knowledge-based**
- **High Performance**
- **New Taylorism**

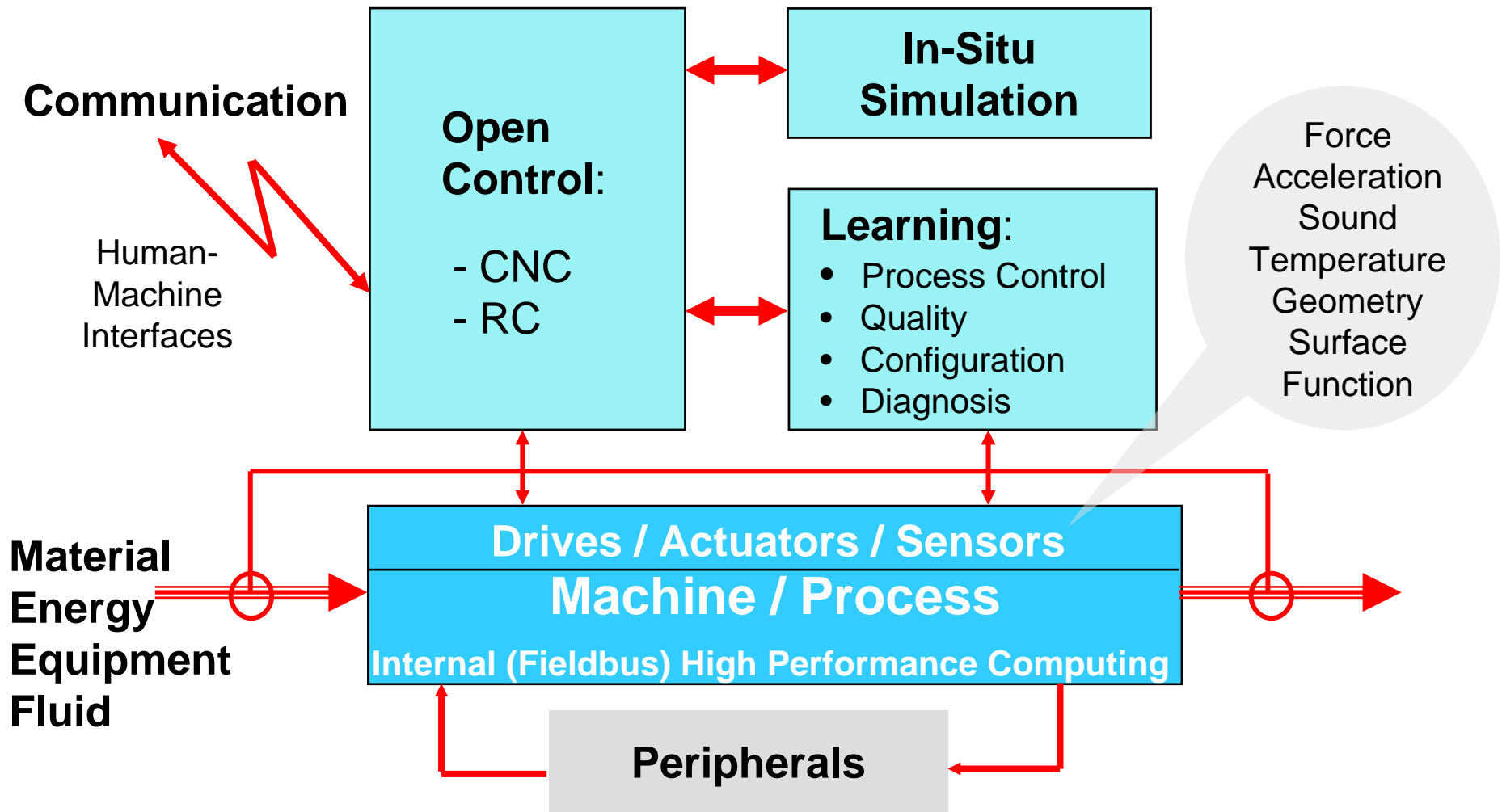




- Intelligent / Learning Machines and Systems
- Adaptive Manufacturing Systems
- Integration of Knowledge by Simulation
- Real Time Networking in Engineering and Management (Grid Manufacturing)
- Digital Factory and Real-Time Factory
- Life Cycle Management Systems
- Manufacturing Execution Systems
- Smart Factories



Intelligent (Learning) Machines and Systems





Adaptive Manufacturing Systems



Enablers for Adaptive Manufacturing:

Sensors-Actuators Systems
High Performance
Real-Time Control

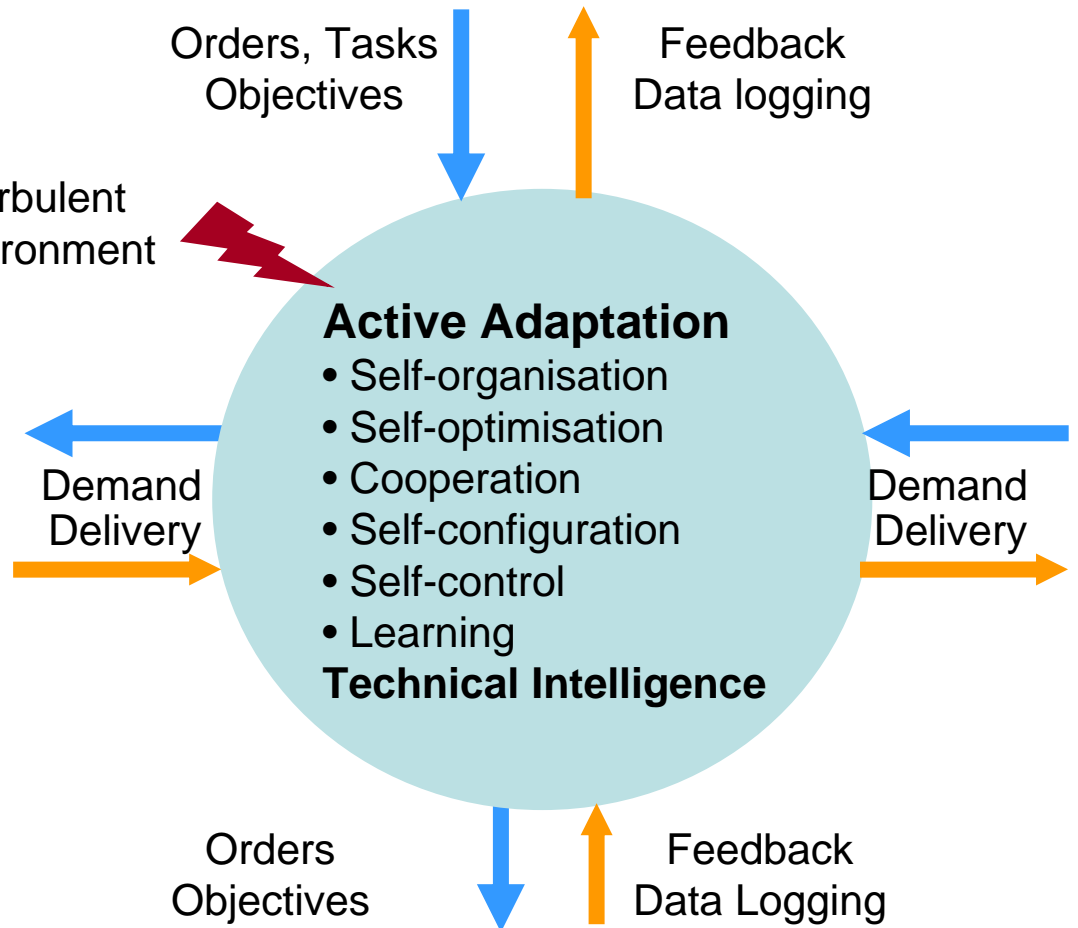
Sensors' Signal Analysis

Modular Structure:

- Embedded Electronics
- Mechatronic Components

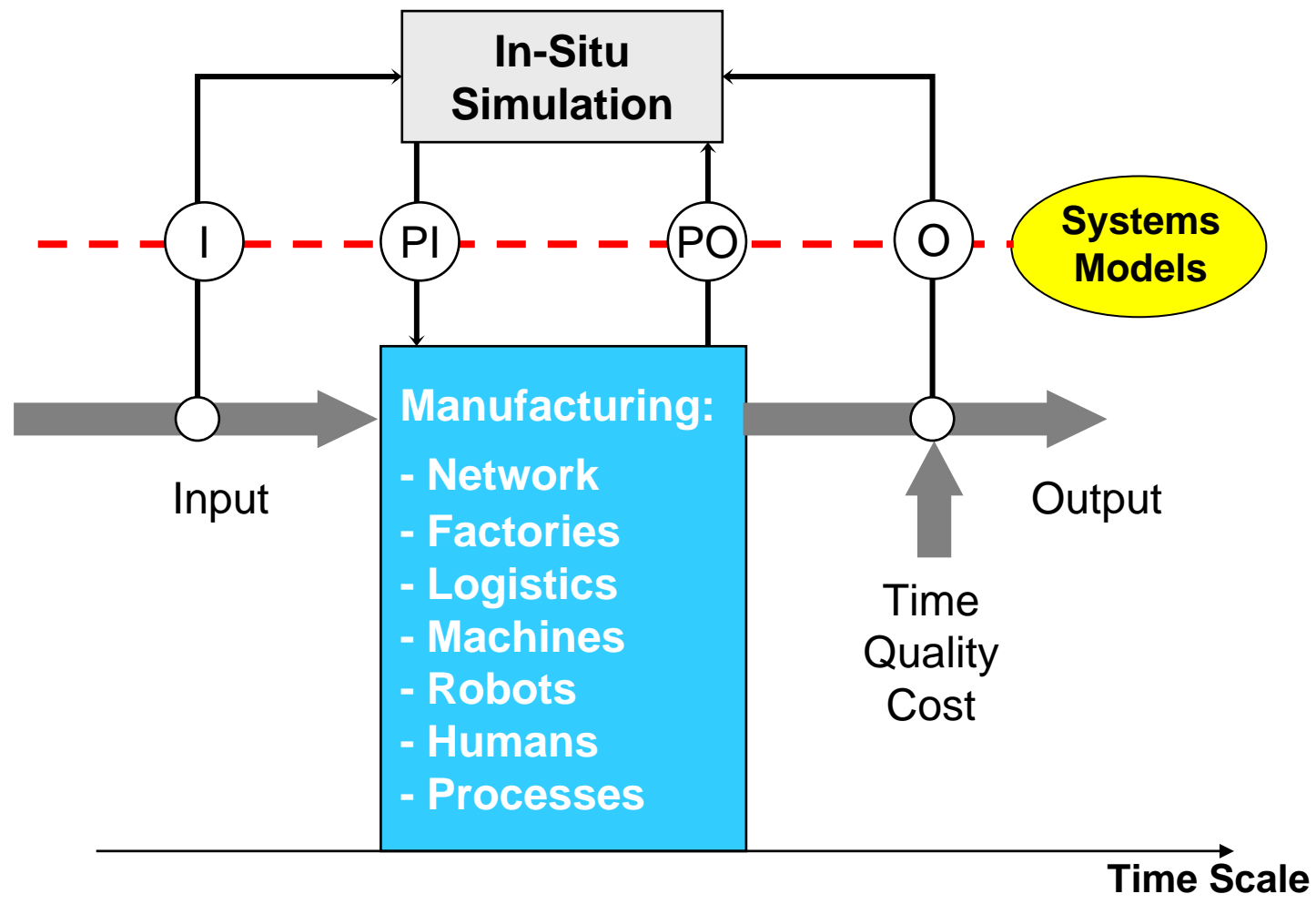
Standardised Interfaces:

- Mechanical
- Electric / Electronic
- Software and Data





Multi-Scale Simulation Knowledge Integration

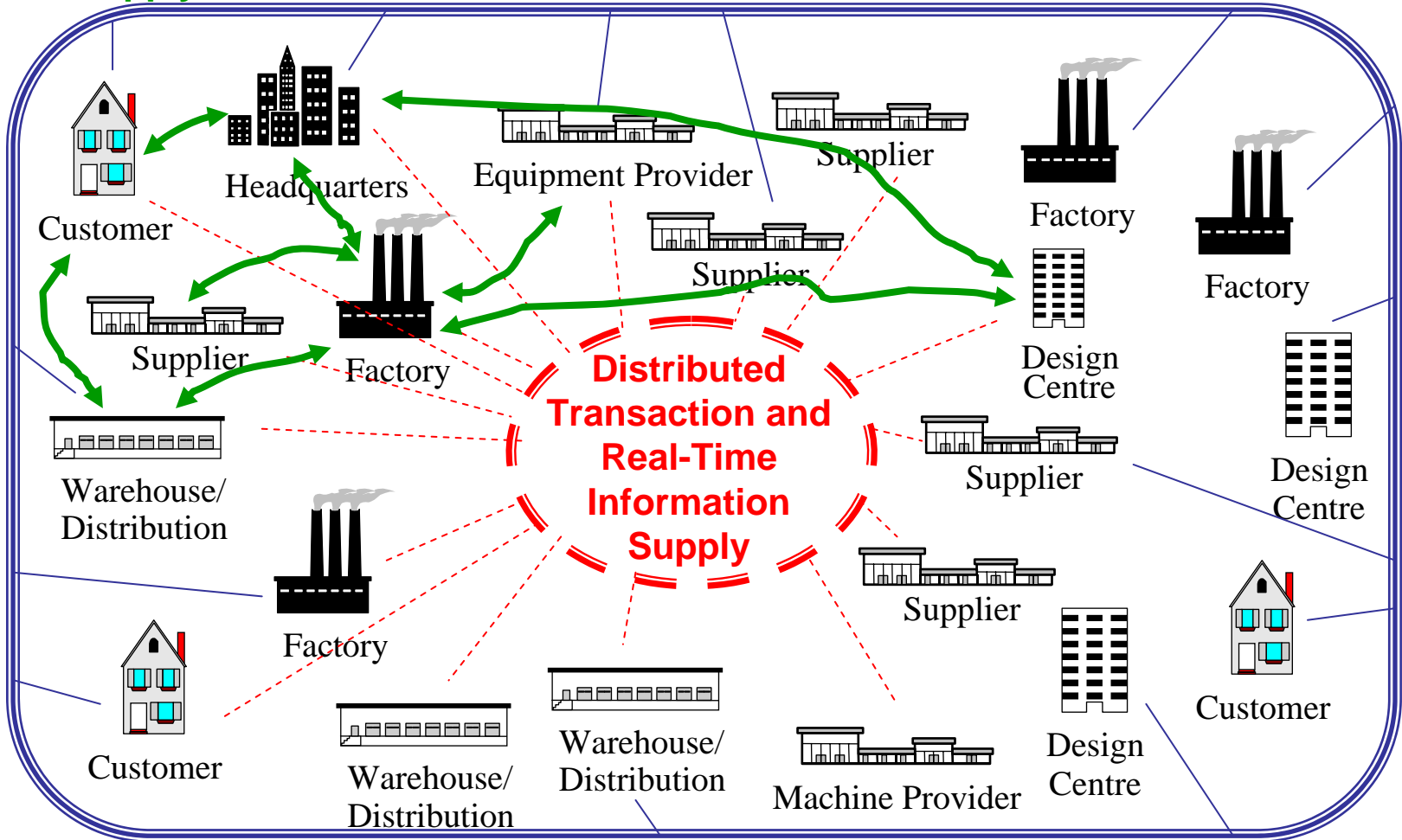




Grid Manufacturing



Effective Supply Network



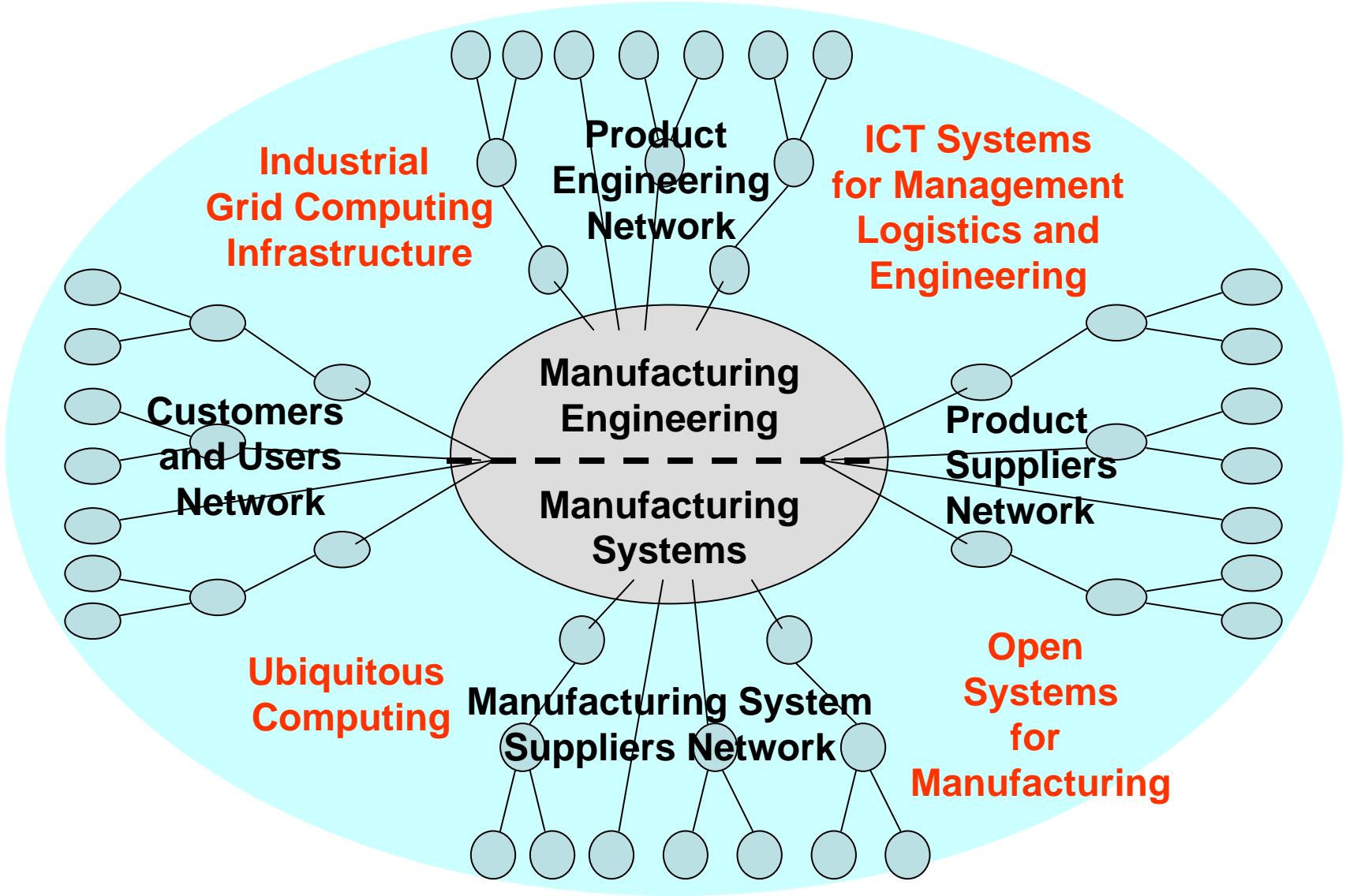
Source: IMRC Univ. Cambridge

Material Flow Main Pipeline



Manufacturing Networks

ICT for Manufacturing and European ICT Environment

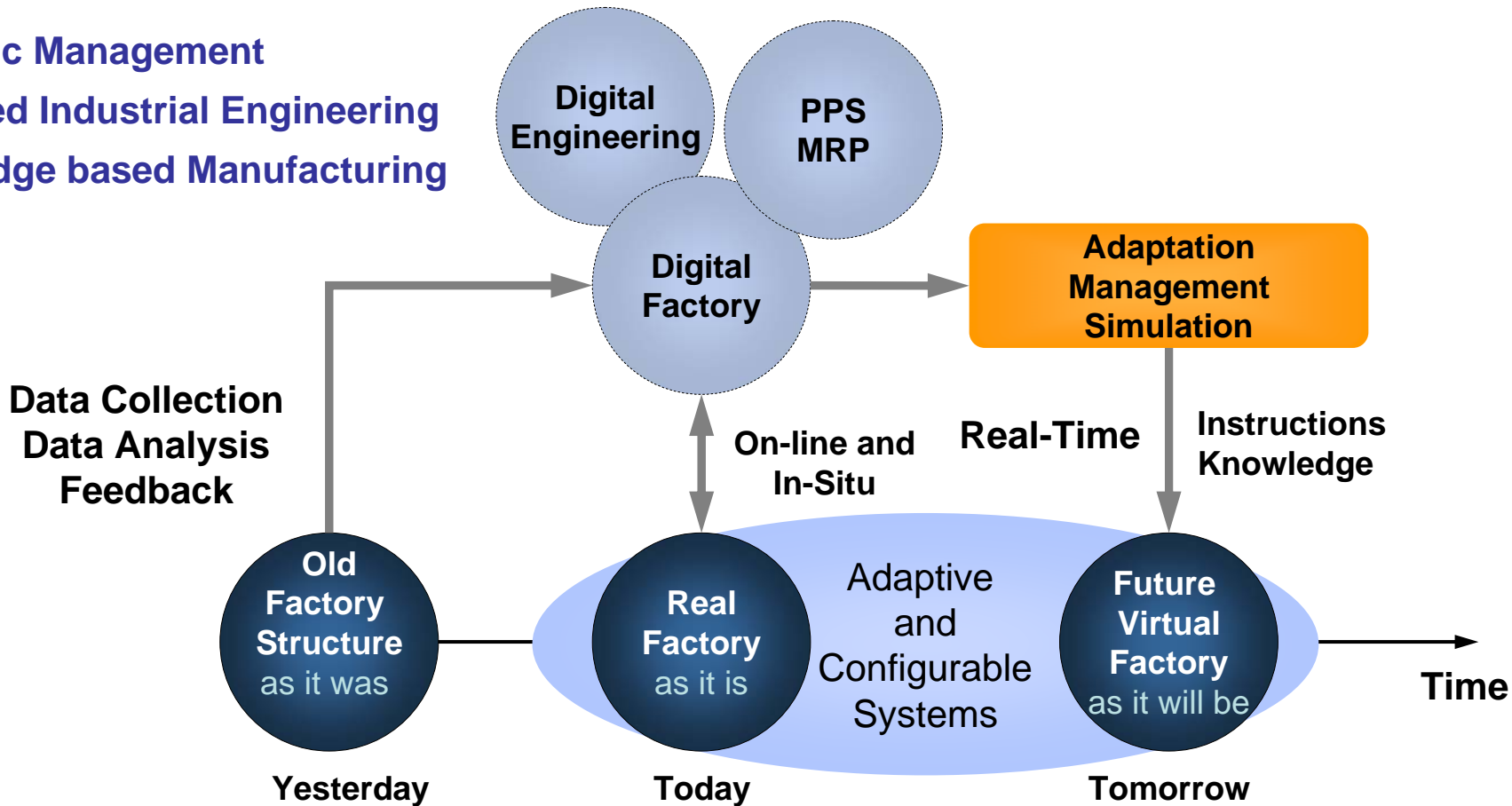




Digital Factory: Near Reality and Real-Time

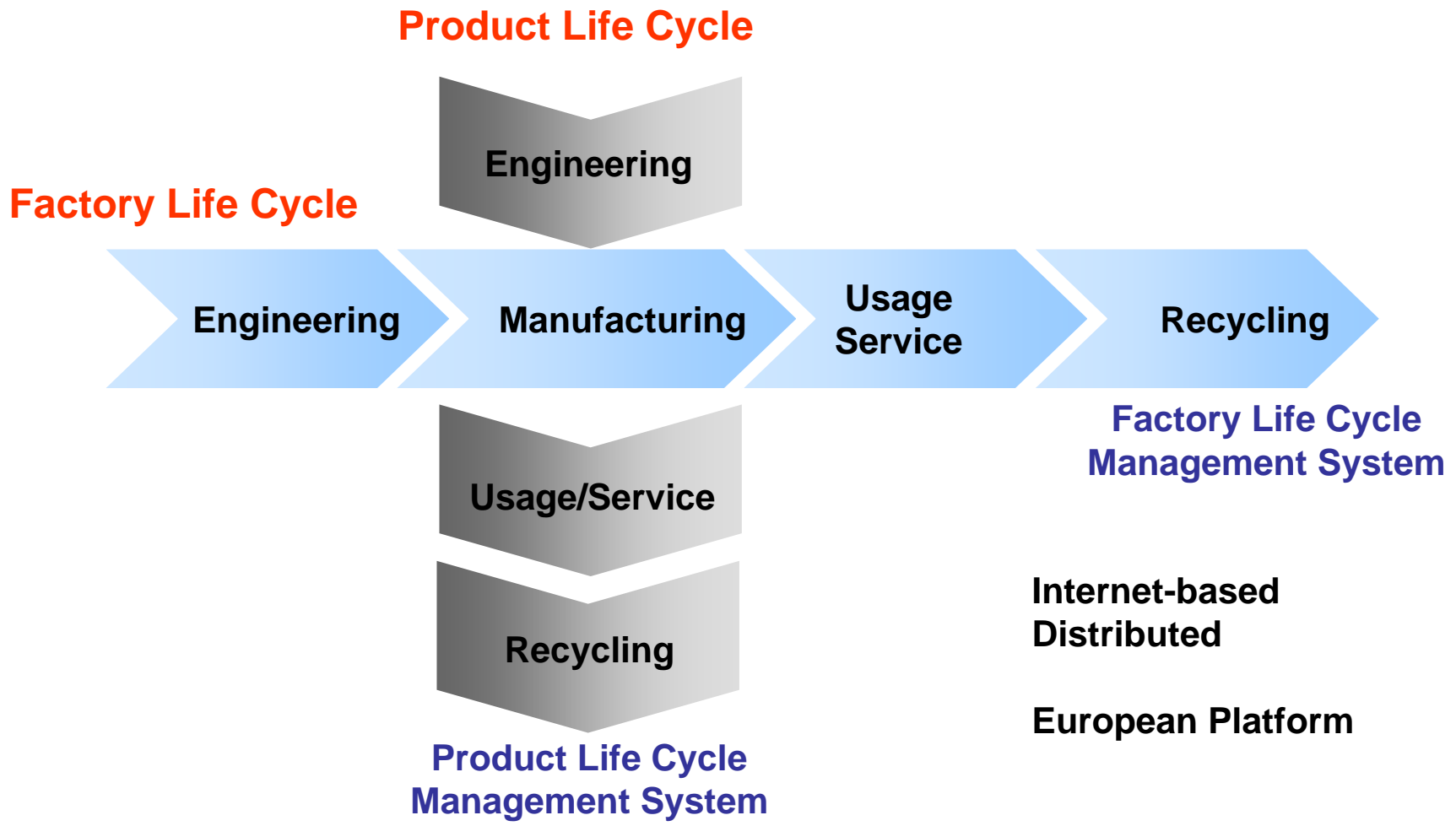


Scientific Management
advanced Industrial Engineering
Knowledge based Manufacturing



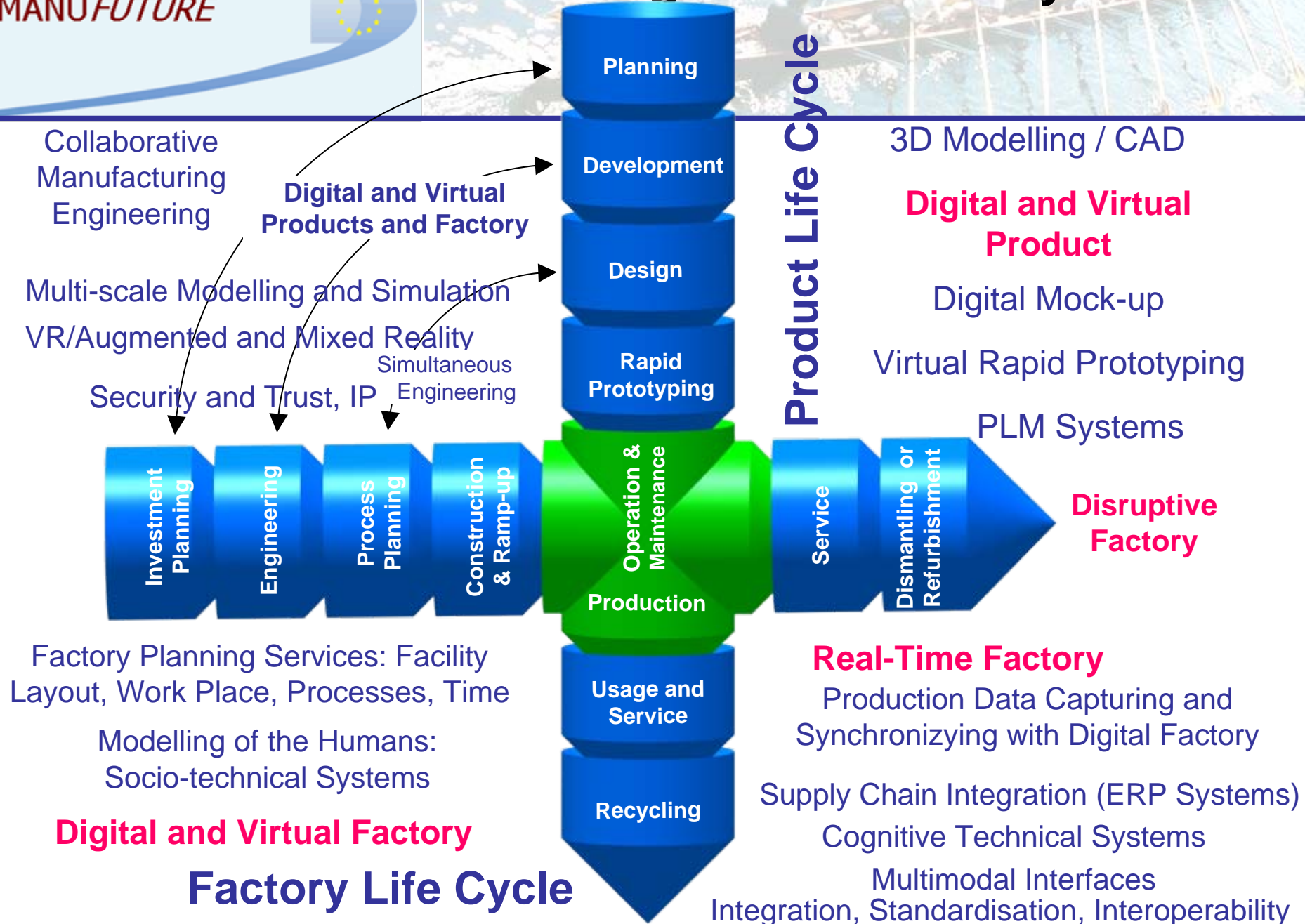


Life Cycle „Data Management“ The Backbone of Manufacturing



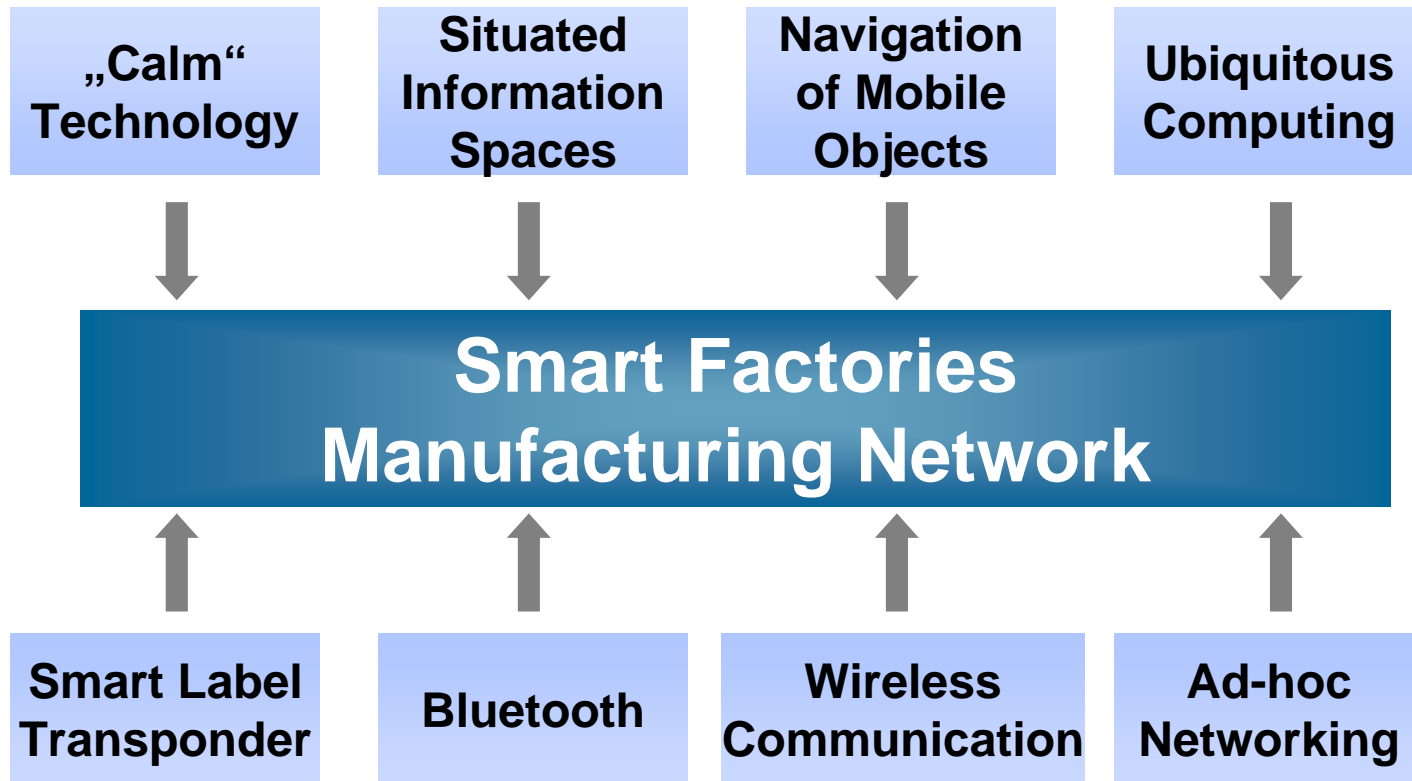


Integration of ICT Systems





Innovative ICT for Manufacturing Management Systems

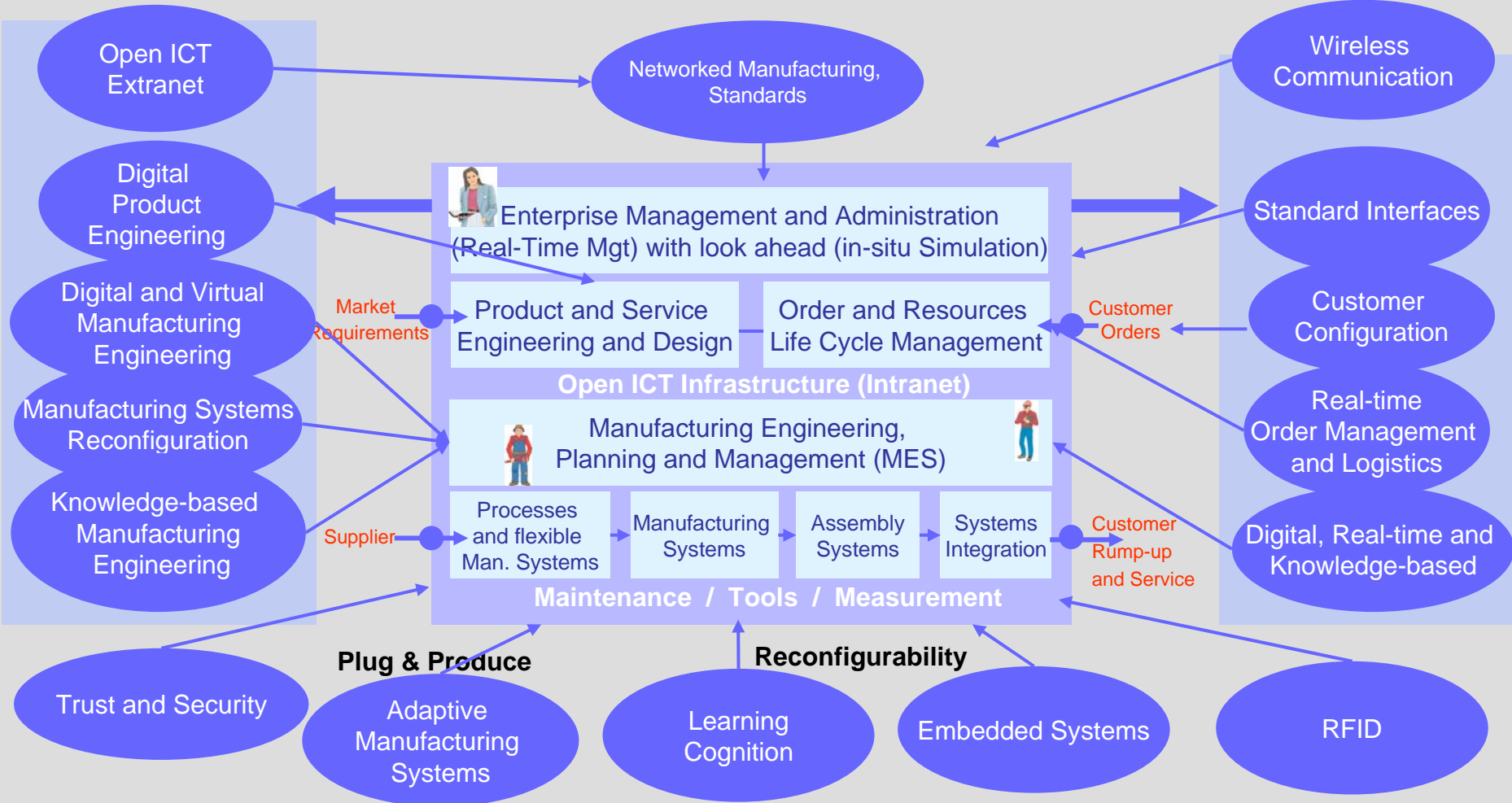




The knowledge-based Factory ICT for Manufacturing: Enabler of the European Production System

ICT for MANUFACTURING,

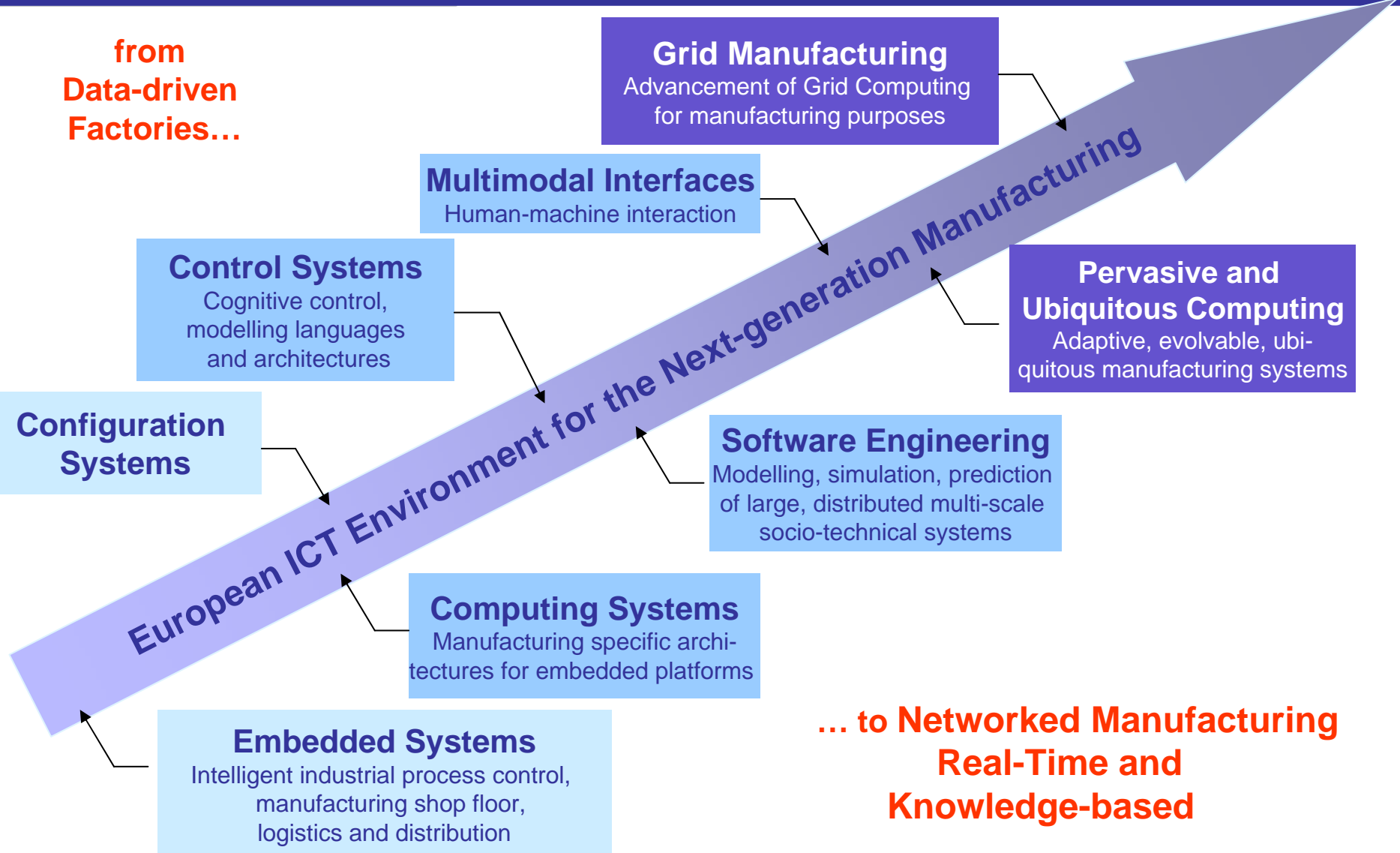
on the way from Data-driven Factories to Knowledge-based, Real-Time and Networked Manufacturing





Road Map: „ICT for Manufacturing“

from
**Data-driven
Factories...**



**... to Networked Manufacturing
Real-Time and
Knowledge-based**



Trans-sectoral Road Map



New Business Models		Beyond Lean... Life Cycle Services Survival Strategies	European Production System Knowledge & Service	Real-Time Enterprises New Taylorism	Invest in R&D Entrepreneurship
adv. Industrial Engineering	Adaptive Manufacturing	Adaptive Automation Modular Products Configurable Systems	Adaptive Factories Real-Time Adaptation Adaptive Systems	Real-Time Factories Disruptive Factories	Knowledge-based Factories
	Networking in Manufacturing	Network Engineering Interoperable Networks Customisation	Manufacturing on Demand Networking Standards	Supply Chain Mgt.: - Real-Time - Global	Knowledge-based Order Management
	Digital Engineering	3D PLM and Tools Fast Engineering Digital Prototyping	Multi-Scale Simulation Digital Factory Material Engineering	Process standards Smart Factory Cognitive Simulation	Knowledge-based Engineering
Emergent Technologies		Intelligent Products High Performance Energy Saving	Gen. Technologies Adaptive Materials Micro & Nanotechn.	Reliability Process Models and Simulation	In-Situ Process Control beyond Borders
ICT for Manufacturing		Configuration Systems Embedded Systems	Multimodal Interfacing Software Engineering	Grid Manufacturing Ubiq. Computing	ICT Environment Manufacturing



Potential of Competition in Manufacturing

