ProcessIT.EU Roadmap
Industrial process automation.

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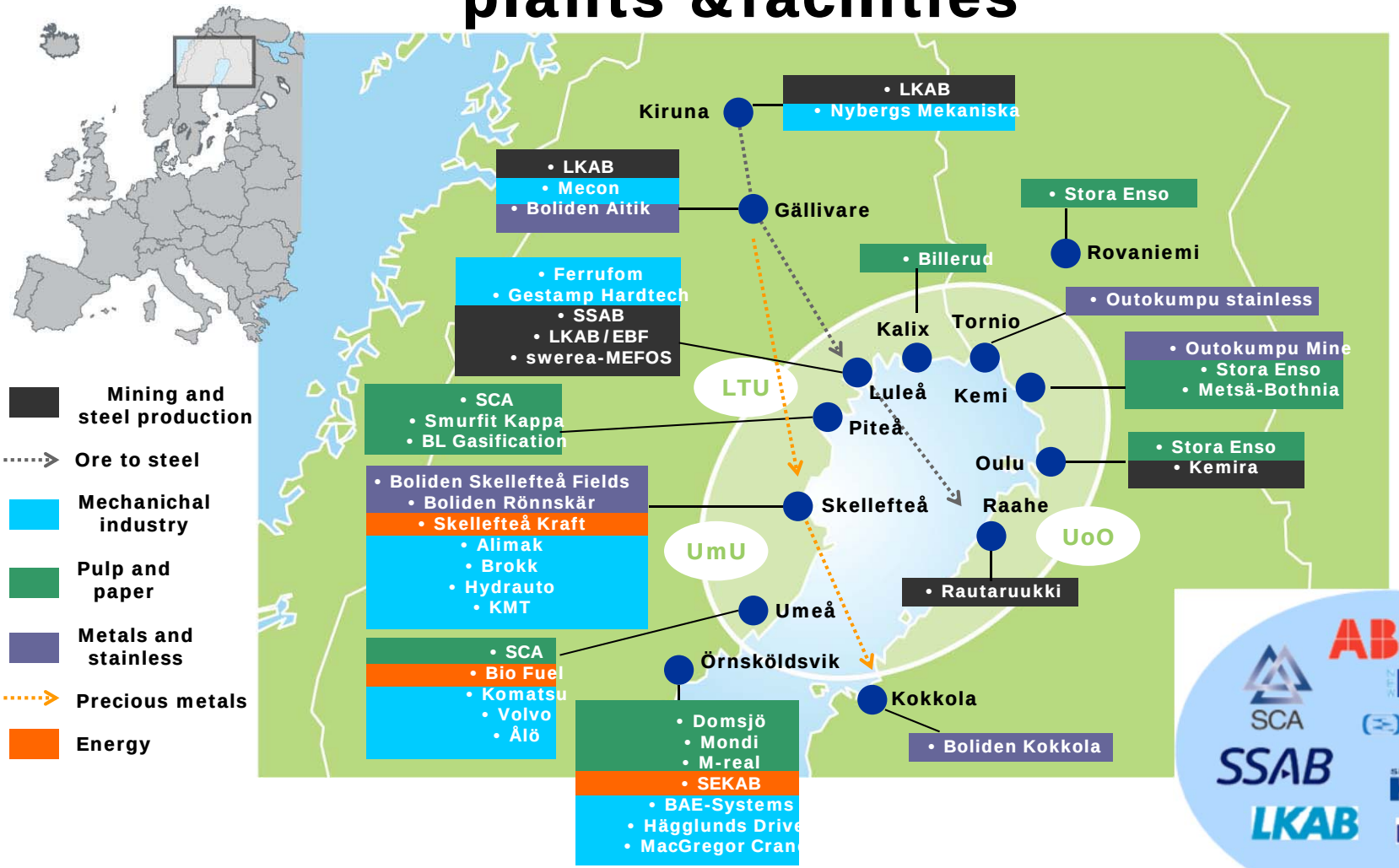
Bothnia Bay Area

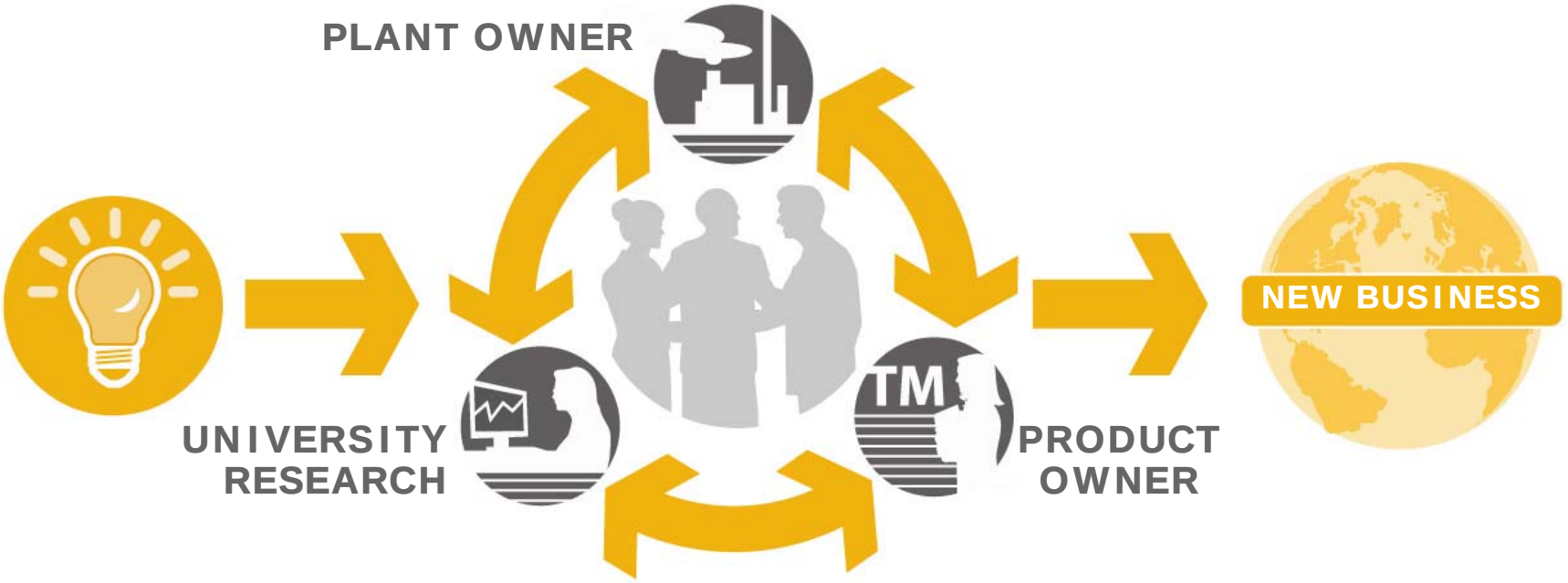
plants &facilities



Regional

From Idea to International Product

the strategic idea



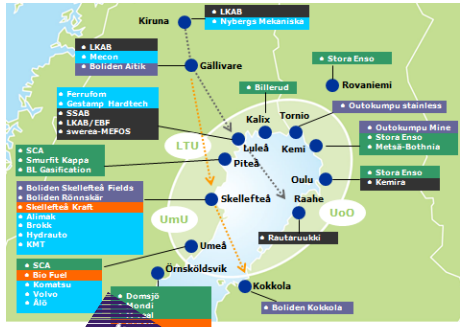
IDEA
- Needs
- Big potential
- Risk

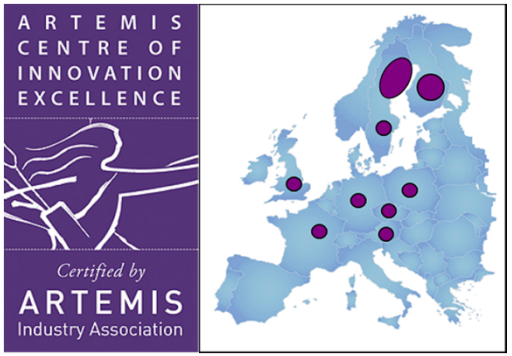
Meetings – PROJECTS
- Studies
- R&D Projects
- Commercialization

RESULT
- Regional growth
- Stronger SMEs
- Regional partners

Regional – National – European /International

- Regional
  - RDI-projects (in different stages - Pre-studies, pre-projects, projects and need finding activities)
  - Project portfolios (SCOPE, GRAM, …..)
  - Technology clusters (Optical, Interaction, simulation)
- National (Swe - Finland)
  - National strategic agenda ”Industrial Process Automation”
  - Project portfolios. Competence provision.
  - Collaboration. Automation region, PPI, PIC, FindIT etc.
- European / International
  - ProcessIT.EU
  - Projects. Arrowhead.
  - Roadmap





NATIONAL POOLING OF RESOURCES FOR INDUSTRIAL PROCESS AUTOMATION

– an agenda for leadership, innovation and skills development

More effective and broader corporate partnerships:

1. Establish an Industrial national leadership and a national collaboration platform for the area.

Stronger integration with the university and college world:

2. Coordinate projects and networking activities with university and college based RDI environments that are identified as particularly strong and relevant to the area.
3. Coordinate and implement combined skills development initiatives with both business community, university and college partners.

Strengthen the area's role and position in national and international innovation systems:

4. Substantial investments in National RDI programs in this area.

NATIONAL POOLING OF RESOURCES FOR INDUSTRIAL PROCESS AUTOMATION

– an agenda for leadership, innovation and skills development

FOCUS AREAS

1. Efficient use of resources
2. Flexible production
3. Facility availability
4. Integrated tools for design, configuration, operation and maintenance
5. Process control, modelling and simulation
6. Future technologies

ACTIVITY TYPES

1. Business and operations development
2. Skills development Reception ability
3. Test, pilot and demonstration
4. Innovation development and research
5. Strategic research

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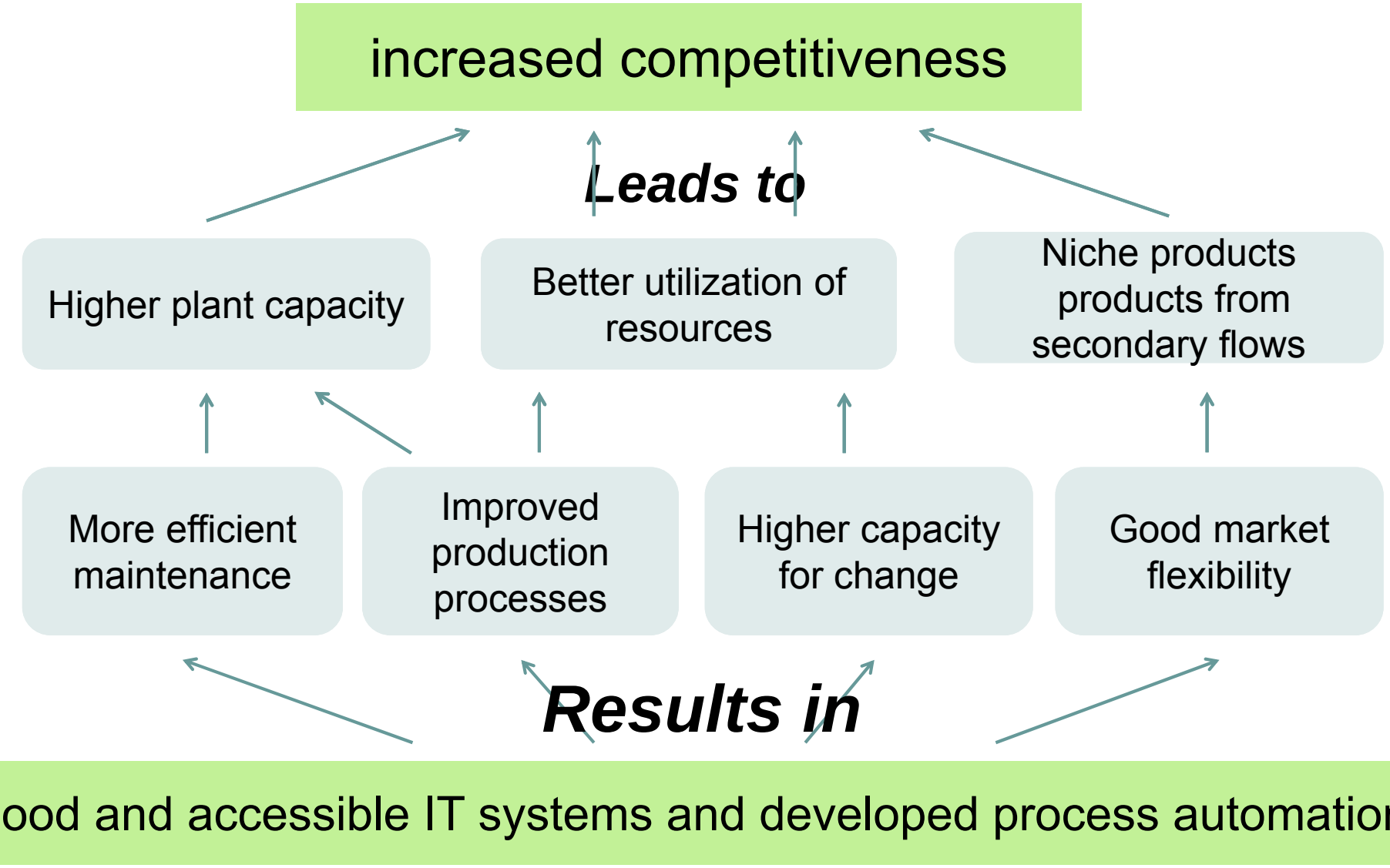
Automation for process industries

- Roadmap inom Processindustriell automation.

Industrial process automation projects



Accelerating IT development continues ... examples

- **Artificial Intelligence:** High-frequency trading, Software agents, Natural language interpretation, Machine translation, Procedural storytelling, VR-only lifeforms, Machine-augmented cognition
- **Internet:** Cloud computing, Cyber-warfare, 4G, Mesh networking, Internet of things,Virtual currencies, 5G, Reputation economy, Interplanetary internet, Remote presence, Exocortex
- **Interfaces:** Multitouch, Gesture recognition, Speech recognition, Augmented reality, 4K, Haptics, Holography, Telepresence, Immersive virtual reality
- **Sensors:** Depth imaging, Near-field communication, Pervasive video capture, Biometric sensors, Smart power meters, Biomarkers, Machine vision, Computational photography, Optogenetics, Neuroinformatics
- **Ubicomp:** Tablets, Volumetric (3D) screens, Flexible screens, Boards, Picoprojectors, Eyewear-embedded screens, Context-aware computing, Fabric-embedded screens, Reprogrammable chips, Skin-embedded screens, Retinal screens
- **Robotics:** Appliance robots, Smart toys, Robotic surgery, Self-driving vehicles, Powered exoskeleton, Commercial Unmanned aerial vehicles, Domestic robots, Swarm robotics, Embodied avatars, Utility fog

http://envisioningtech.com/envisioning2012/?ncid=edlinkusaolp00000008

Source: Envisioning Technology

Risks with increased complexity in IT and automation systems

Increased supplier dependency.
Worse internal automation expertise.
Lower internal purchasing expertise.

More difficult to see the potential in new solutions.
Harder assess skill needs.
More functionality can not be utilized

Increased high competence and skills competition.
Worse holistic approach to systems support.

Leads to

More short-term automation solutions

Unstable system environment, increased system maintenance

Reduced internal control system support

Reduced adaptability to new customer and market requirements

More downtime, lower availability, reduced customer flexibility, etc.

gives

Reduced competitiveness and lower profitability

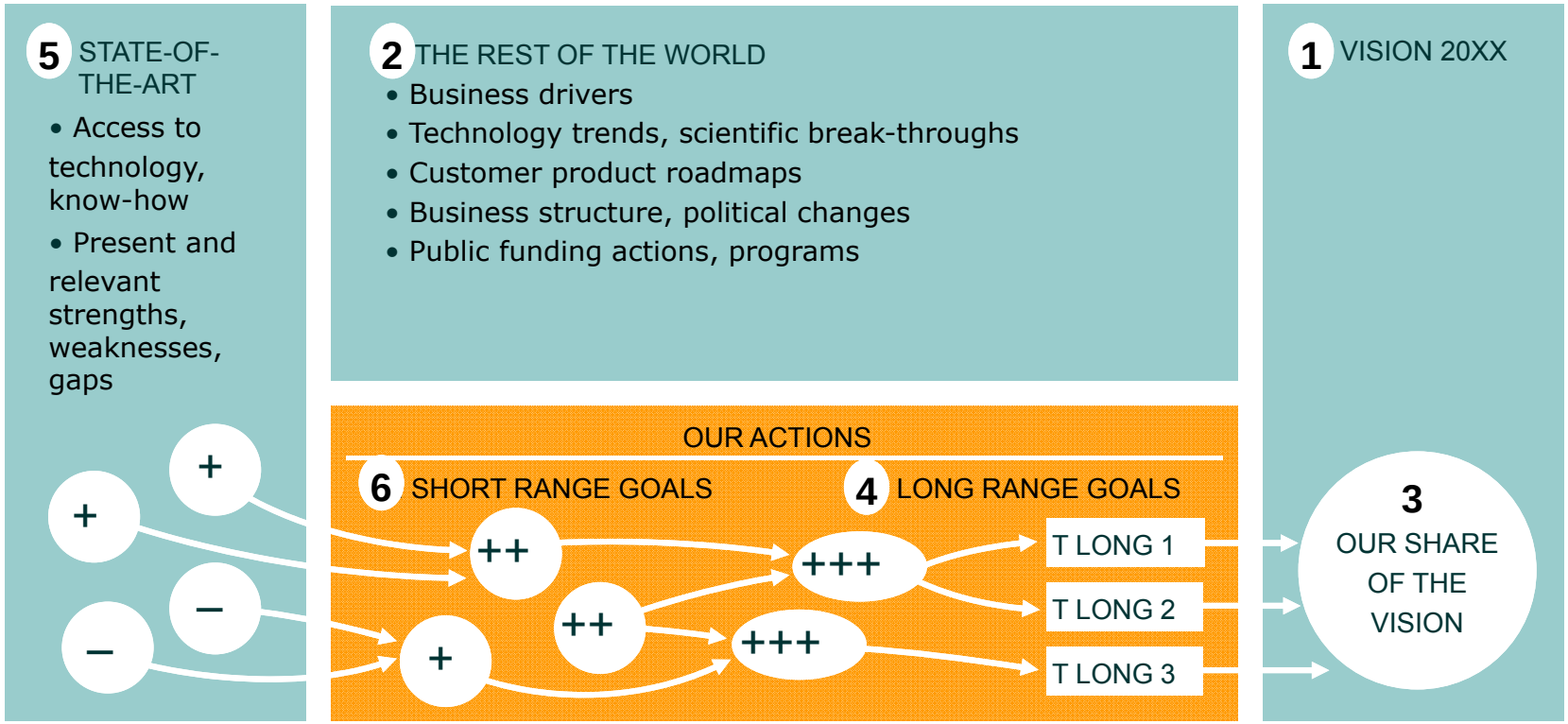
PURPOSE

Our ambition is to highlight industrial process automation as a key enabler for the future European process industry.

In the area

- Accelerate growth and technology development in Europe
- Innovations in ICT and automation technology.
- Incubation and implementation of strong R&D projects.
- European automation world class research thru access to highly challenging industry contexts.

Methodology



Sources of information

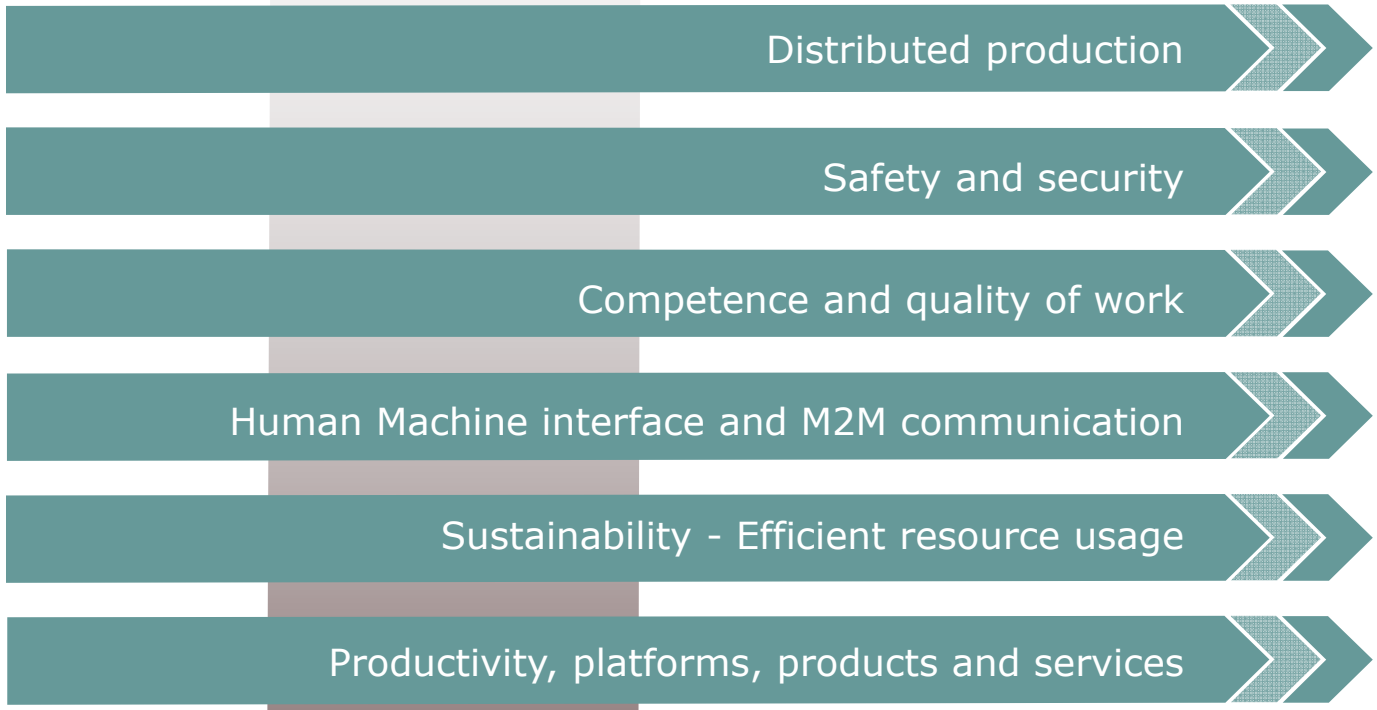
In addition to national agendas for SWE and FIN, RDI-project findings and industrial input we have mainly reviewed ETPs to form a starting point for trends and business environments.

Individual ETPs

Energy	ICT	Bio-based economy	Production and processes	Transport
Biofuels	ARTEMIS	FABRE TP	ECTP	ACARE
SmartGrids	ENIAC	Food	ESTEP	ERRAC
TPWind	ISI	GAH	ETP SMR	ERTRAC
Photovoltaics	Net!Works	NanoMedicine	Manufuture	Waterborne
ZEP	NEM	Plants	FTC	ESTP
SNETP	NESSI	Forestry	WSSTP	
RHC	EUROP		SusChem	
	EPoSS		EuMaT	
	Photonics21		IndustrialSafety	

Invest Last updated on: 2011-06-01

From top level needs to concrete goals



A SELECTION OF
TARGETED GOALS

- Orchestration of production systems
- Agility and scenario handling by prediction methods

- Certification process
- Risk management
- Encryption
- Information assurance

- Efficient automation engineering process
- Awareness of the automation profession
- Open RDI environments

- Integration in the ISA 95 pyramid
- IP convergence
- Service oriented architectures

- Smart city integration
- Urban mining
- IoT based recycling

- Well developed virtual factory
- Integration by plug and play
- Application distribution platform
- Distributing big data
- User friendliness

TOP LEVEL NEEDS

Competence management

Sustainable production

Improved OEE

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Automation for process industries

Ideal concepts describes the path towards long range goals considering ongoing trends and thereby making a contribution to the future business environment.

DESCRIBED WITH:

- Vision
- Description and examples
  - Trends supported by the ideal concept
  - Visions and long range goals supported by the ideal concept
- State-of-the-art
- Proposed actions
- Business potential

AND ALSO:

- Reachable within 2020
- An inspiration to new RD&I projects

Ideal concepts.

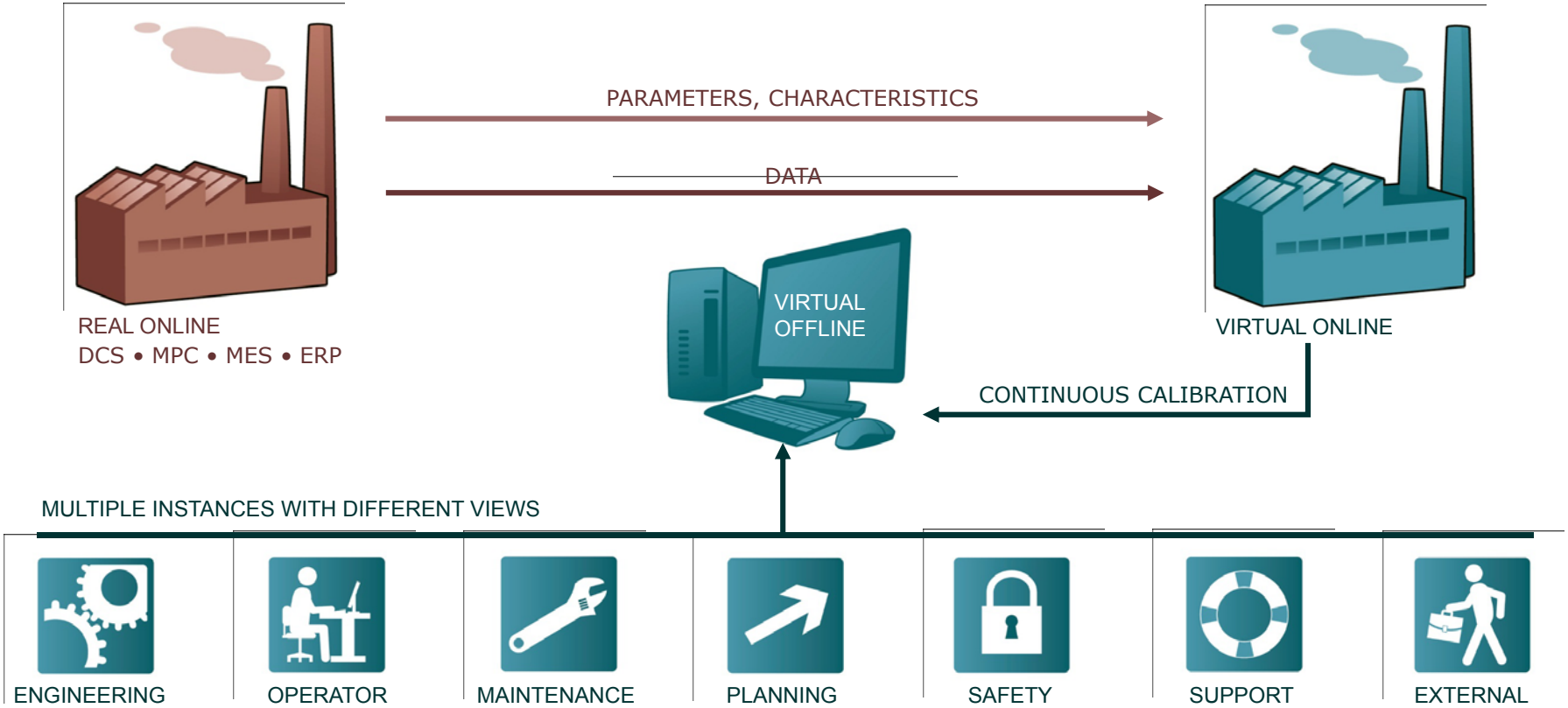
Identified “white areas” that require further development

ROADMAP IDEAL CONCEPTS ARE:

1. Instant access to virtual dynamic factory
2. Increased information transparency between field devices and ERP
3. Real-time Sensing & Networking in Challenging Environments
4. Process industry as an agile part of the energy system
5. Management of Critical Knowledge to support Maintenance Decision Making
6. Automation service and function engineering
7. Open simulator platform
8. Automation system for flexible distributed production
9. System wide balancing of safety, security and production flexibility

1. Instant access to virtual dynamic factory

VISION: To have instant, organization wide, and inter-organization wide access to the virtual real-time plant in order to provide the right service to the right persons in the right time.



1. Instant access to virtual dynamic factory

EXAMPLES

BUSINESS POTENTIAL:

- Real-time access to training. Preferably in a consumer-oriented game inspired environment.
- Model-based reasoning by providing prediction and back-tracking possibilities.
- Usage of soft-sensors, where real sensing is impossible.
- Providing first-line rather than back-office simulation services.
- Enabling agile production by efficient support due to prediction possibilities.
- Enabling remote service providers (global).
- Meet the challenges of fast process adaptation

STATE-OF-THE-ART:

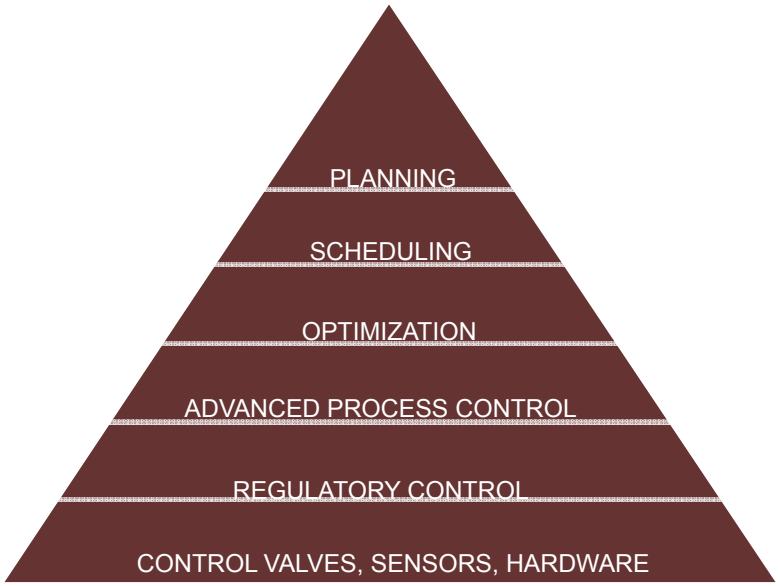
- Not much found in the literature on online simulators
- Metso article from 2012 on tracking simulator. Points out potential to generate new services by models online
- Yokogawa electric corporation has a series of papers 2006-2010 on prediction based plant operations

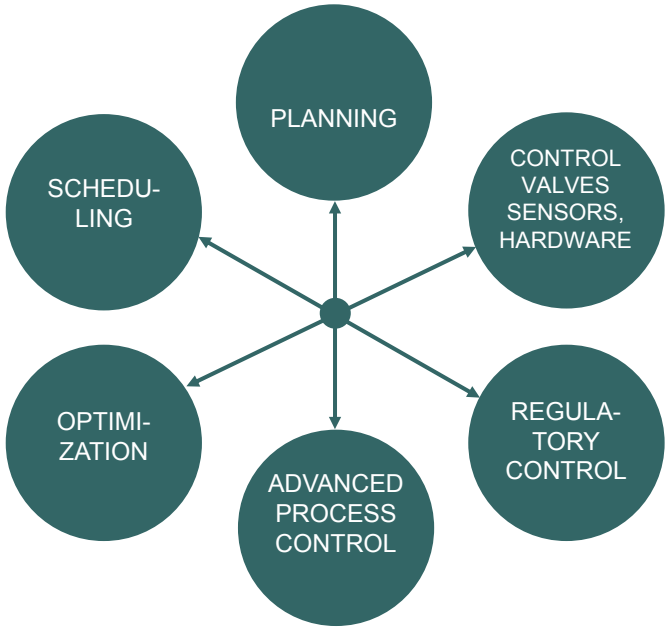
FUTURE ENABLERS:

- Method to update the virtual on-line model and control system.
- Robust and fast numerical methods for simulation and updates.
- Computational issues regarding simultaneous instances of virtual factories.
- Tool interoperability

2. Increased information transparency between field devices and enterprise wide systems

VISION: To enable full interoperability and configurability with zero configuration characteristics between computational devices from different organizational levels using open network and communication technologies.





2. Increased information transparency between field devices and enterprise wide systems

EXAMPLES

BUSINESS POTENTIAL:

- Reduced cost for maintaining parallel systems, with different vendors/protocols
- Redundancy in system -> reduce downtime
- Interoperability -> Not bound to one single vendor (avoid vendor lock-in)
- Reduction of data-converting tools
- Wireless systems removes (or reduces) the need for cables.
- Installation of new sensors is cheaper (installation and configuration)
- IP convergence will increase the number of available programmers. It increases the eco system of developers.

STATE-OF-THE-ART:

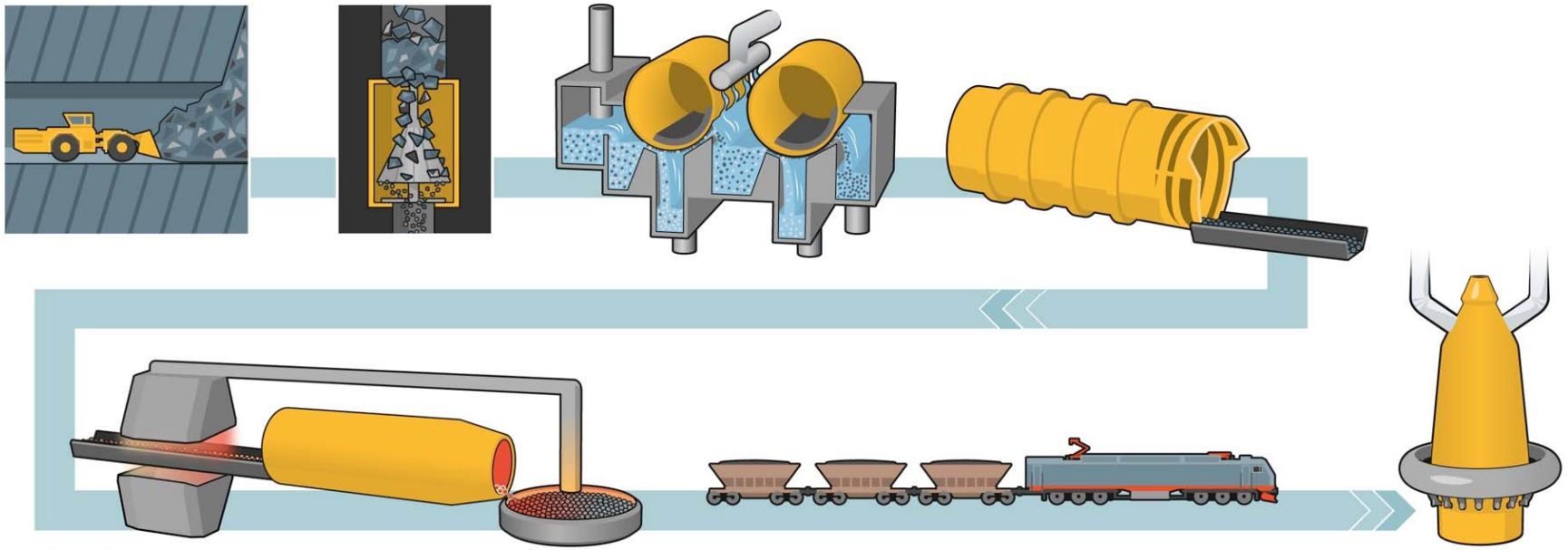
- Proprietary field bus is today dominating on lower levels
- SOA exists on enterprise level
  Too extensive for resource constrained embedded devices
- Efficient SOA for embedded systems exists on lab/demo-level

FUTURE ENABLERS:

- IP protocols, Open standards, enable vendor compatibility
- IoT technology, utilize established technology in the industry
- SOA for lightweight devices, loosely coupled devices
- System of systems technologies

3. Real-time Sensing & Networking in Challenging Environments

VISION: In real-time measure any parameter of interest, anywhere in an operating industrial process to increase process knowledge and improve automation performance.



3. Real-time Sensing & Networking in Challenging Environments

EXAMPLES

BUSINESS POTENTIAL:

- Will increase Process knowledge
- Better material tracking and use of disposable sensors
- Validated process
- Growing market for new sensing and energy harvesting and storage technology
- Great support to the maintenance system
- Improved calibration of control systems and improved operation of the automation process.

STATE-OF-THE-ART:

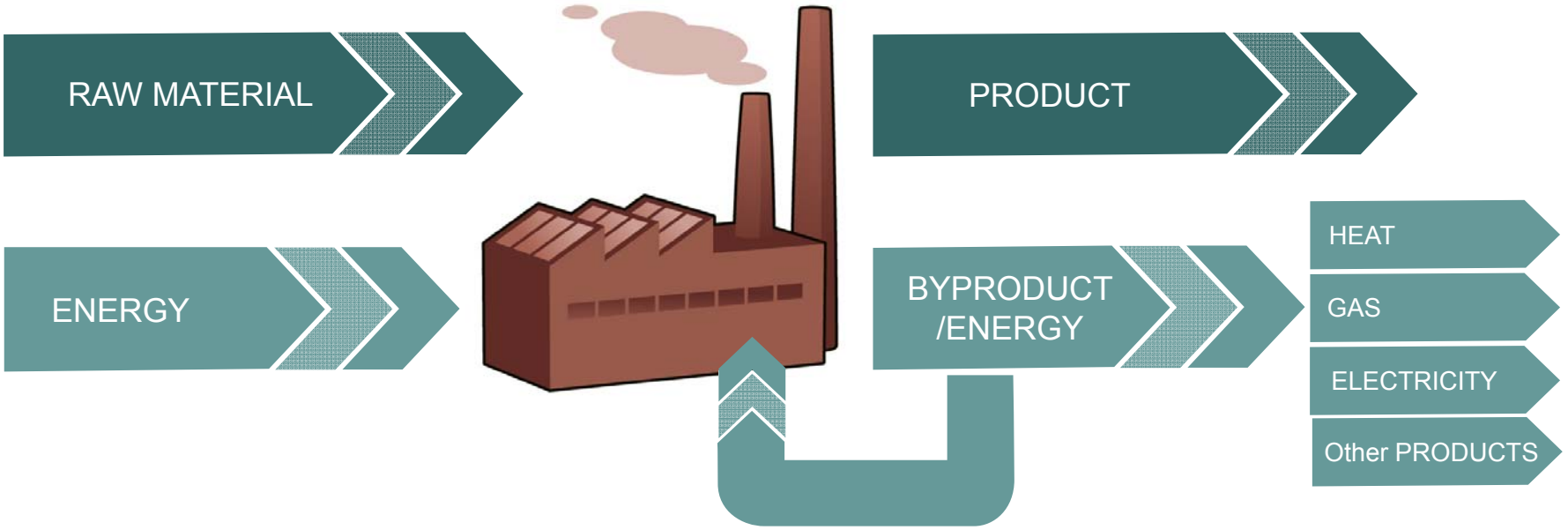
- Process measurements are today often made offline and in batches.
- Online measurement primarily on conventional static field-bus technologies needing converters & mediators
- Technology expensive and limits the potential of real-time online measurement

FUTURE ENABLERS:

- Interoperable WSN solutions, using cloud-computing approach
- Open standards and security mechanisms for the low-power wireless devices.
- Industrial-purpose sensor equipment and adaption of low cost technologies
- Energy management
- Disposable sensors

4. Process industry as an agile part of the energy system

VISION: To make process industries a natural part of the energy grids to maximize utilization of energy resources and reduce environmental impact.



4. Process industry as an agile part of the energy system

EXAMPLES

BUSINESS POTENTIAL:

- Excess heat produced at process industries
- Optimization due to energy market price on hour/minute based level
- But, must also consider side effects

STATE-OF-THE-ART:

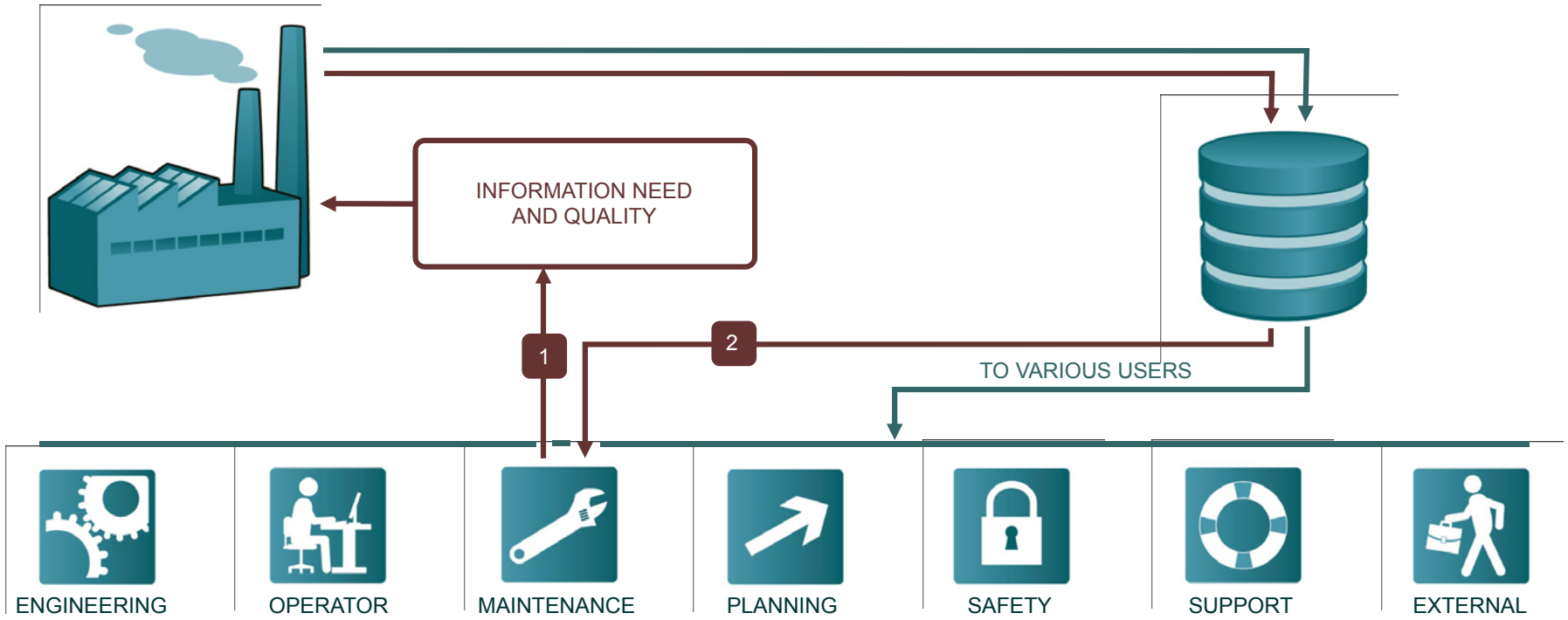
- process industries in some countries are today often connected to district heating systems
- industrial production plant start reconsidering production schedules due to e g energy prices.
- Investments in wind power
- Too low-tempered waste heat

FUTURE ENABLERS:

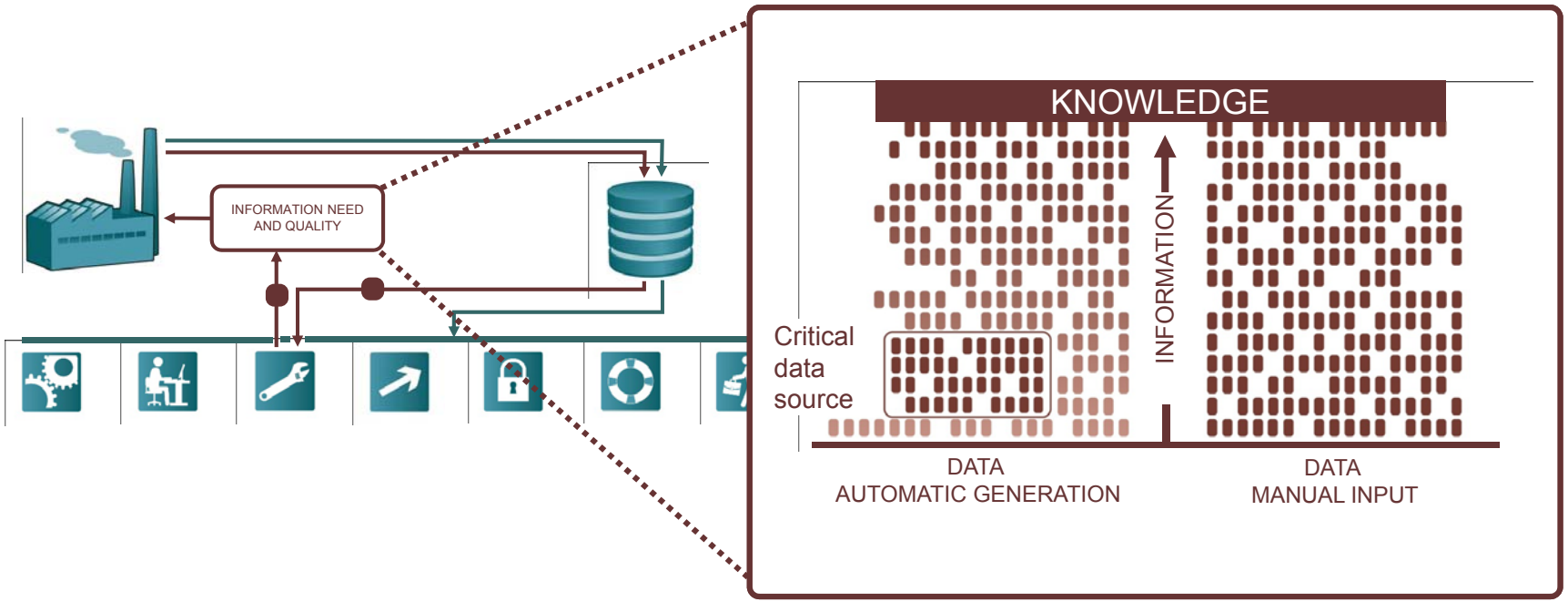
- Infrastructure to support the trade of excess energy
- Agile integration with energy systems as energy prices rise and fluctuate
- Probability analysis for process industries due to smart cities
- Dynamical model of plant that includes energy I/O.

5. Management of Critical Knowledge to support Maintenance Decision Making

VISION: Right and correct information in right form to right persons in right time in right place to support maintenance related decision making on different organizational levels & reliable KPIs for sub-processes.



5. Management of Critical Knowledge to support Maintenance Decision Making



5. Management of Critical Knowledge to support Maintenance Decision Making

EXAMPLES

BUSINESS POTENTIAL:

- Products, services and systems for several business sectors: ICT, ES, devices, services etc
- Tools, simulators support the integration of data and information
- Industrial maintenance will be a growing market for specialized, often remote services.
- Increased availability with a staff that has correct information

STATE-OF-THE-ART:

- Quite a lot of research but few practical solutions taking advantage from research.
- International projects like DYMAMATE and a number of EU FP7 but not implemented in industry
- Evaluation of the information and data quality is mainly based on tacit knowledge
- Integration of data and information is limited by the compatibility issues.
- Personalization of information is not widely used

FUTURE ENABLERS:

- Methodology for analyzing and integrating data / information from various sources
- Ubiquitous self-diagnostic methods and technologies
- Technology for context awareness
- Transformation of tacit to explicit knowledge
- Maintenance service business models

6. Automation service and function engineering

VISION: Industrial process automation service and function engineering that is capable of meeting the challenges from globalization and technology trends.

6. Automation service and function engineering

EXAMPLES

BUSINESS POTENTIAL:

- To have engineering processes and tools that fulfil the requirements originating from technology trends will become an enabler for successful product development and generation of new business
- Tool and process interoperability will make it possible to always choose the best possible suppliers in a much easier and less time consuming way than currently supported

STATE-OF-THE-ART:

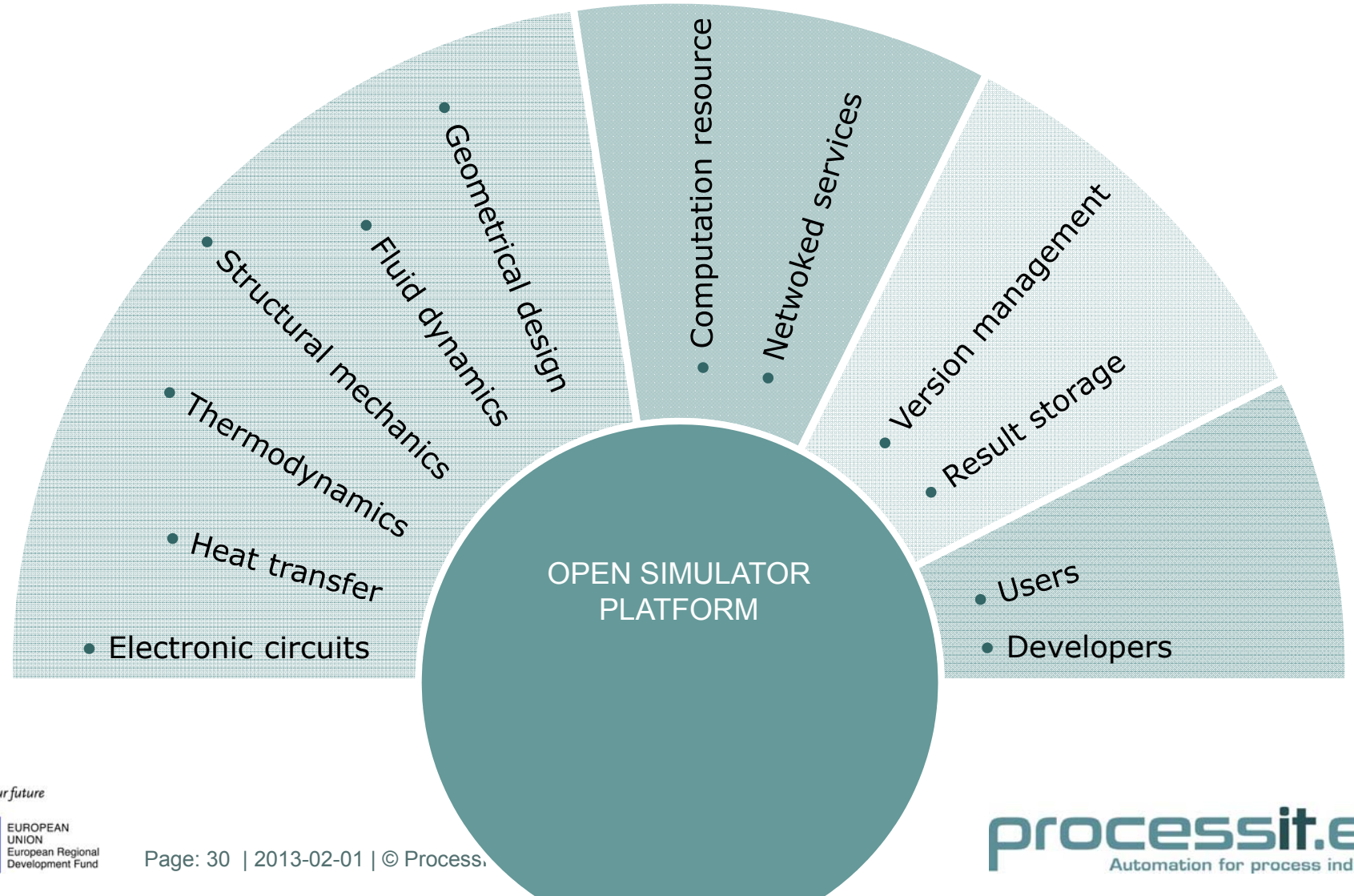
- relying on a model based design principle developed for many years. Well developed and implemented for geometrical design (CAD,PDM) but clear lack regarding the function and service development process
- new functionality is designed specifically for one HW platform rather than being generic
- lack of good virtual plants often the numerical optimization is restricted to model based supervisory control like MPC or LQ control

FUTURE ENABLERS:

- engineering tools that support the whole engineering process
- Development of engineering tools and process should strive for open source architecture to promote and enabler new innovative products
- Interoperability of the virtual plant and component models at all development stages:

7. Open simulator platform

VISION: To optimize the efficiency of simulation based development by full interoperability between simulation tools over the complete development process.



7. Open simulator platform

EXAMPLES

BUSINESS POTENTIAL:

- Tool interoperability will integrate, speed-up, and quality assure the different stages of the development process.
- Possibility to always choose the best available simulation tool .
- Meeting the increasing need for calibration and verification of data is continuously increasing.

STATE-OF-THE-ART:

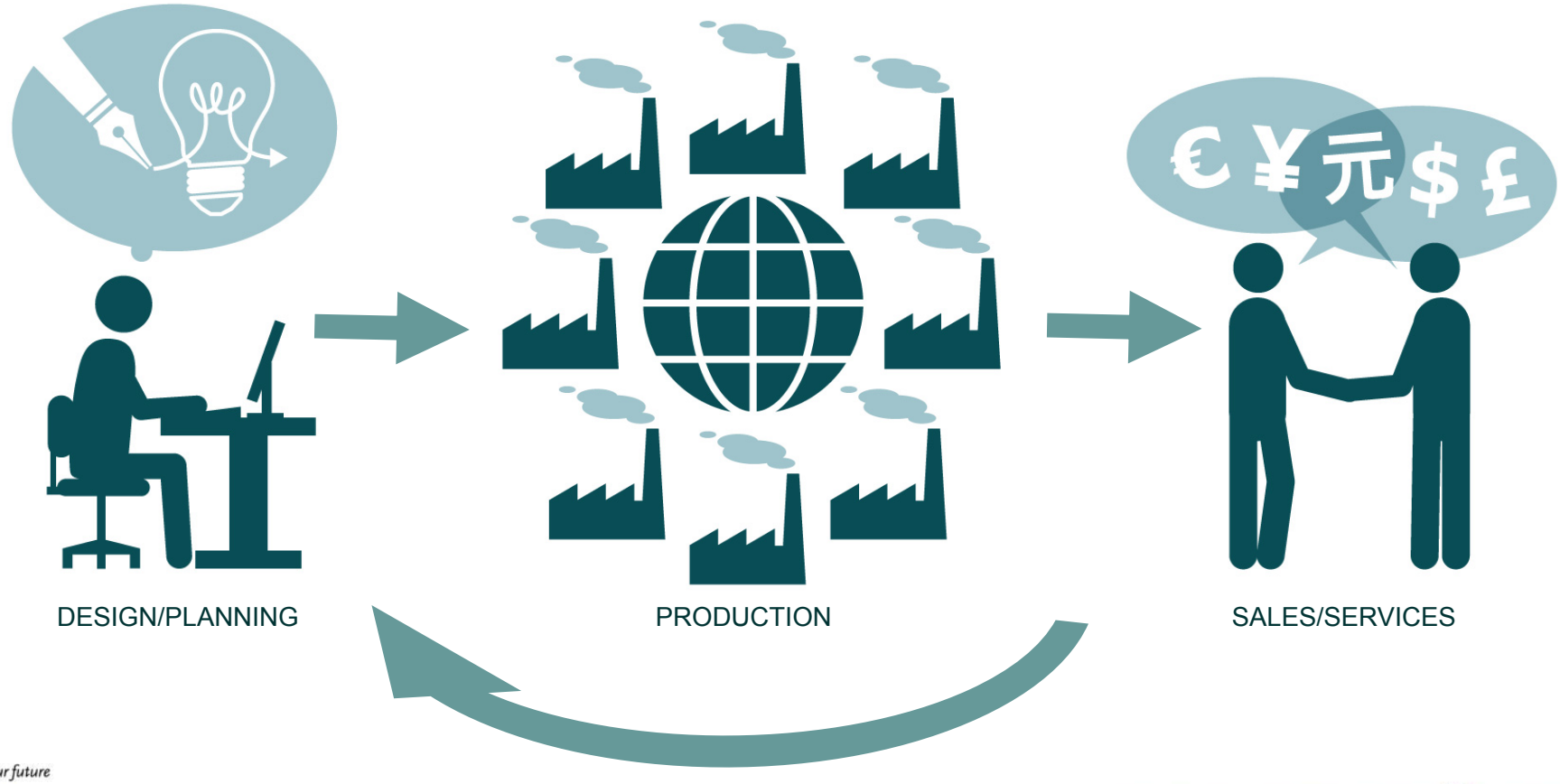
- Simulator interoperability requires large amounts of manual work with static and low quality parameterization
- Different models are used at different stages of the development process
- Projects like Simantics, Salome, CAPEOPEN
- Usage of open simulator platforms rather low and much development effort is still needed

FUTURE ENABLERS:

- Seamless support for simulation at different levels and Seamless exchange of model and simulation results
- Simulation data visualisation using modern methods
- Links from simulators to different engineering applications or tools
- Runtime adaptive tools forhigh-level component modelling, meshing, model topology editing, and simulation management
- Multi-domain and multi-physics simulation

8. Automation system for flexible distributed production

VISION: To have production capacity anywhere for anything. The production capacity scales up (and down) timely. Production start-up costs are low.



8. Automation system for flexible distributed production

EXAMPLES

BUSINESS POTENTIAL:

- Decrease time-to-market using decision supporting tools
- Optimize production cost with maximized efficiency.
- Providing common platform for sales and production
- Tools for service providers to monitor, manage, audit, and approve plans and operations

STATE-OF-THE-ART:

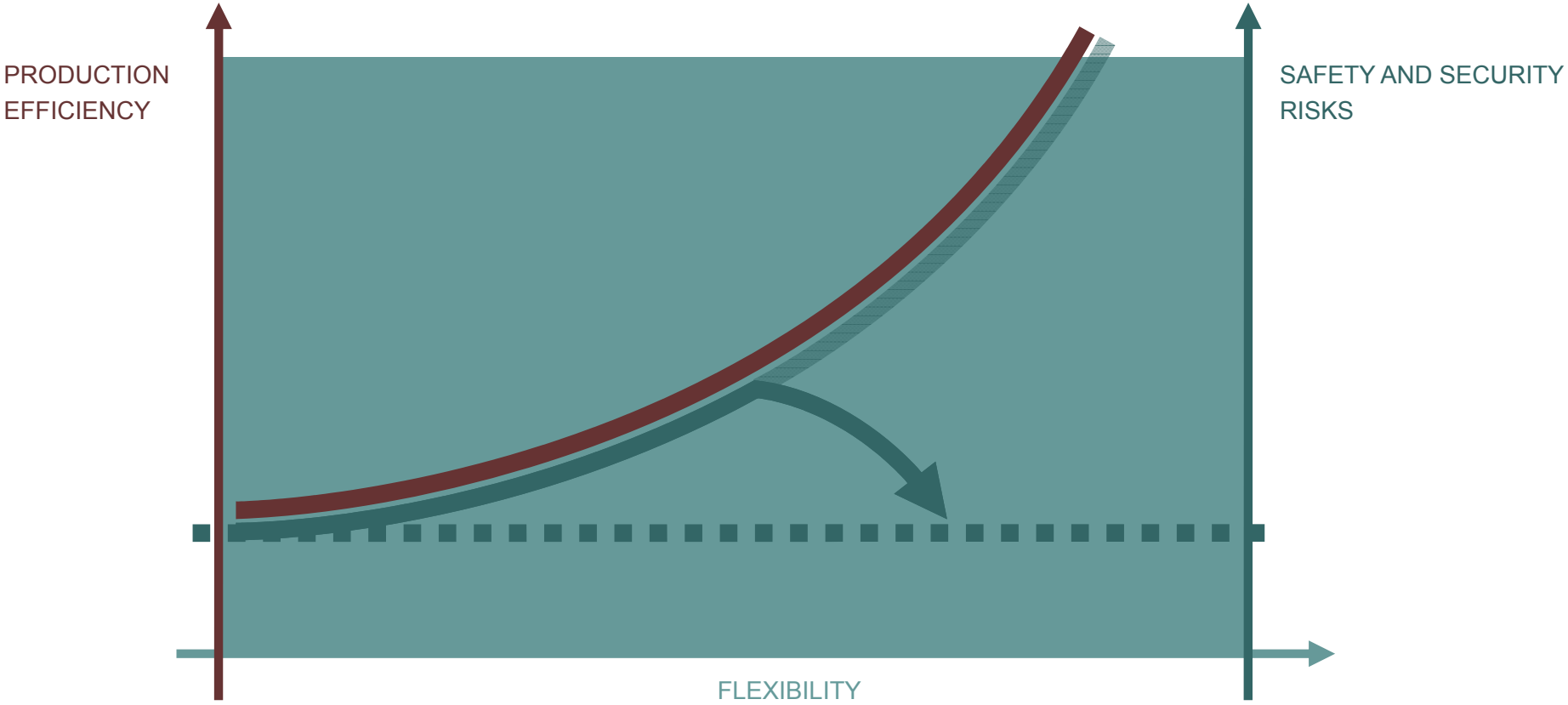
- Provide automation implementations that once generated can and should remain unchanged.
- Recent development have been in integration of digital control, production management systems and planning systems
- Current methods are not flexible enough to provide cost effective automation solutions for rapidly change in production.

FUTURE ENABLERS:

- Tools, methods and systems for production control, more skilled people, and shorter set-up times
- Automatic reconfiguration
- Remote direct access to vital system components.
- Methods to automatically generate cost/income effective production plans

9. System wide balancing of safety, security and production flexibility

VISION: To ensure production availability and plant safety through system wide information assurance and data validation.



9. System wide balancing of safety, security and production flexibility

EXAMPLES

BUSINESS POTENTIAL:

- Systems that prove that they are secure and supports safety standards required by legislation and company policy
- Internet of Things, Collaborative Automation, System of Systems and Service Oriented Architecture that are demonstrated and proved to be secure, safe and reliable.

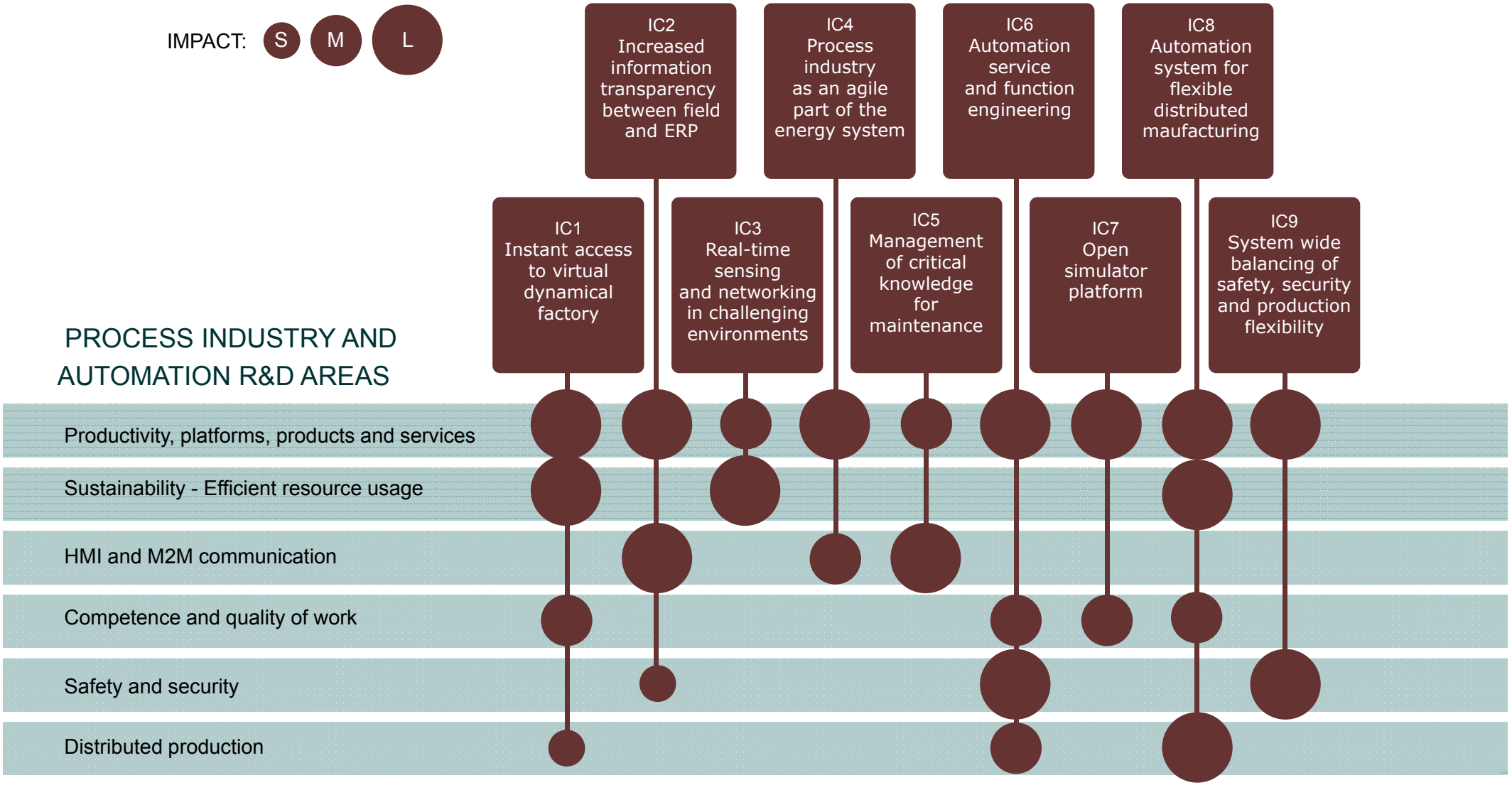
STATE-OF-THE-ART:

- New communication and infrastructure concepts (including IoT and SOA) provides higher flexibility, but ……
- Plants are considered secure but lacking possibilities with new technology.
- Use of traditional firewall, virus, intrusion detection technologies.

FUTURE ENABLERS:

- Provide tools and methods for emerging technical approaches within process automation, to prove system reliability, security and safety
- Online hazard analysis tools
- Systems that detect and prevent attacks, financial losses and severe accidents.

Contribution to trends



Short time goal → Target and goals in new projects

1. ***Instant access to virtual dynamic factory***
   Automatic model life cycle management, computational resources, business service development. Data to information. Training of staff and model based reasoning.
2. ***Increased info. transparency between field devices and ERP***
   IP everywhere, middleware nowhere, seamless integration, industry requirements.
3. ***Real-time Sensing & Networking in Challenging Environments***
   Robustness, calibration, energy harvesting, IoT, in situ sensors, cyber physical systems,M2M
4. ***Process industry as an agile part of the energy system***
   Agile Integration, production flexibility. Automation for short and long term variations. Collaborative automation. Technologies for “look up, loosely coupling and late binding”,.
5. ***Management of Critical Knowledge to support Maintenance Decisions***
   Quality assurance, context awareness, targeting and timing of information, business models
6. ***Automation service and function engineering***
   Functionality for systems of systems, configuration and requirement management, model based development,
7. ***Automation system for flexible distributed production***
   Faster product changes, faster ramp-up/down. Scheduling. Material tracking.
8. ***Open simulator platform***
   Interoperability, numeric's, reusability, development tools.
9. ***System wide balancing of safety, security and production flexibility***
   Risk management. Cryptography and intrusion detection & prevention. System architecture

Thanks for listening

Roadmap Workgroup

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