ConnectedFactories project & pathways

Chris Decubber, EFFRA
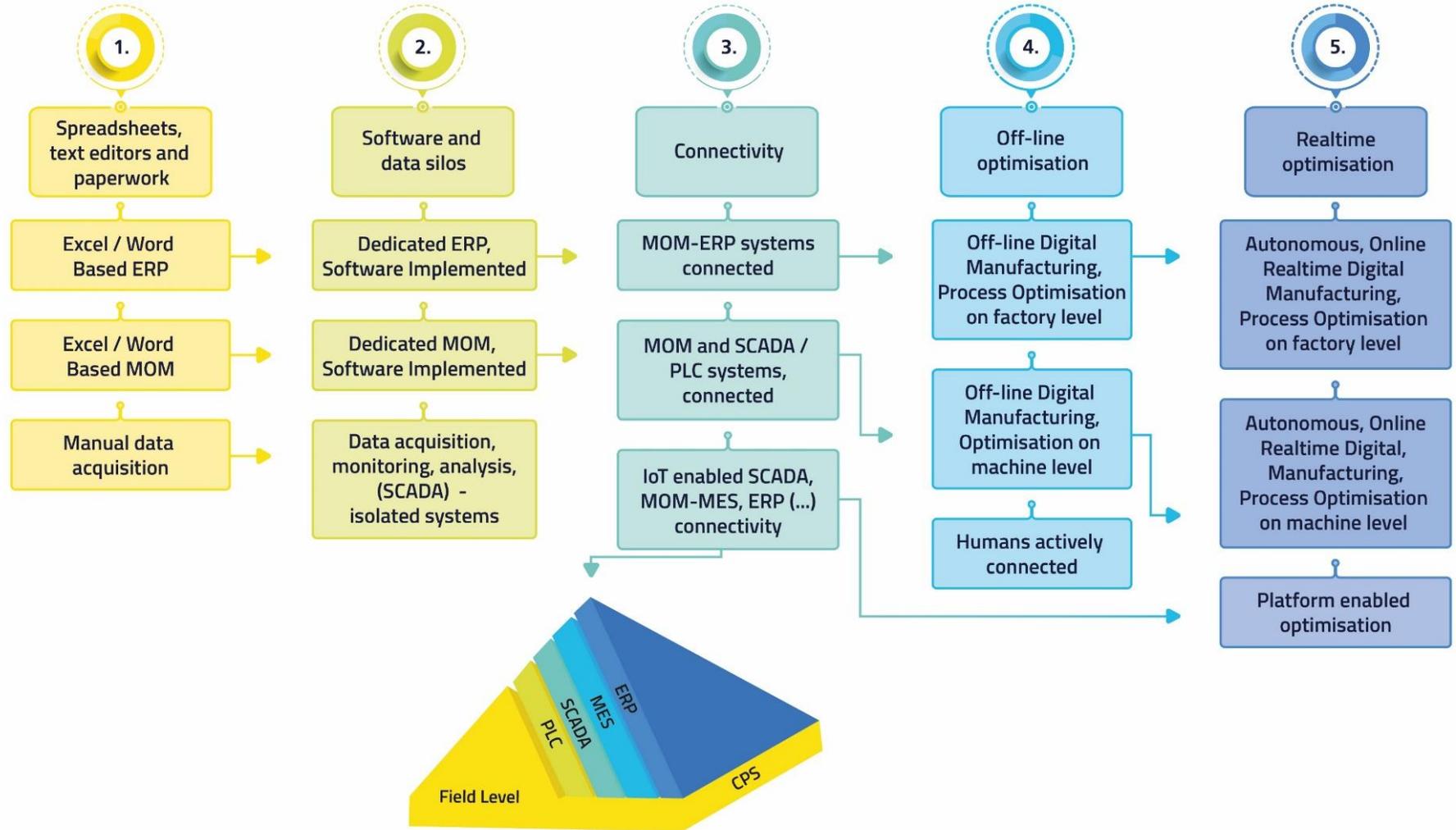
ConnectedFactories 2

CONNECTED FACTORIES

KEY ENABLERS AND CROSS-CUTTING FACTORS

- Skills and engineering tools
- Skills for operation of the technologies
- Added value / optimisation focus
- Business models / financial investment
- Interoperability / standards
- Security
- Technology – building blocks
- ...

PATHWAYS

1. Spreadsheets, text editors and paperwork
- Excel / Word Based ERP
- Excel / Word Based MOM
- Manual data acquisition

2. Software and data silos
- Dedicated ERP, Software Implemented
- Dedicated MOM, Software Implemented
- Data acquisition, monitoring, analysis, (SCADA) - isolated systems

3. Connectivity
- MOM-ERP systems connected
- MOM and SCADA / PLC systems, connected
- IoT enabled SCADA, MOM-MES, ERP (...) connectivity

4. Off-line optimisation
- Off-line Digital Manufacturing, Process Optimisation on factory level
- Off-line Digital Manufacturing, Optimisation on machine level
- Humans actively connected

5. Realtime optimisation
- Autonomous, Online Realtime Digital Manufacturing, Process Optimisation on factory level
- Autonomous, Online Realtime Digital, Manufacturing, Process Optimisation on machine level
- Platform enabled optimisation

Field Level · PLC · SCADA · MES · ERP · CPS

Industrial state of play in manufacturing
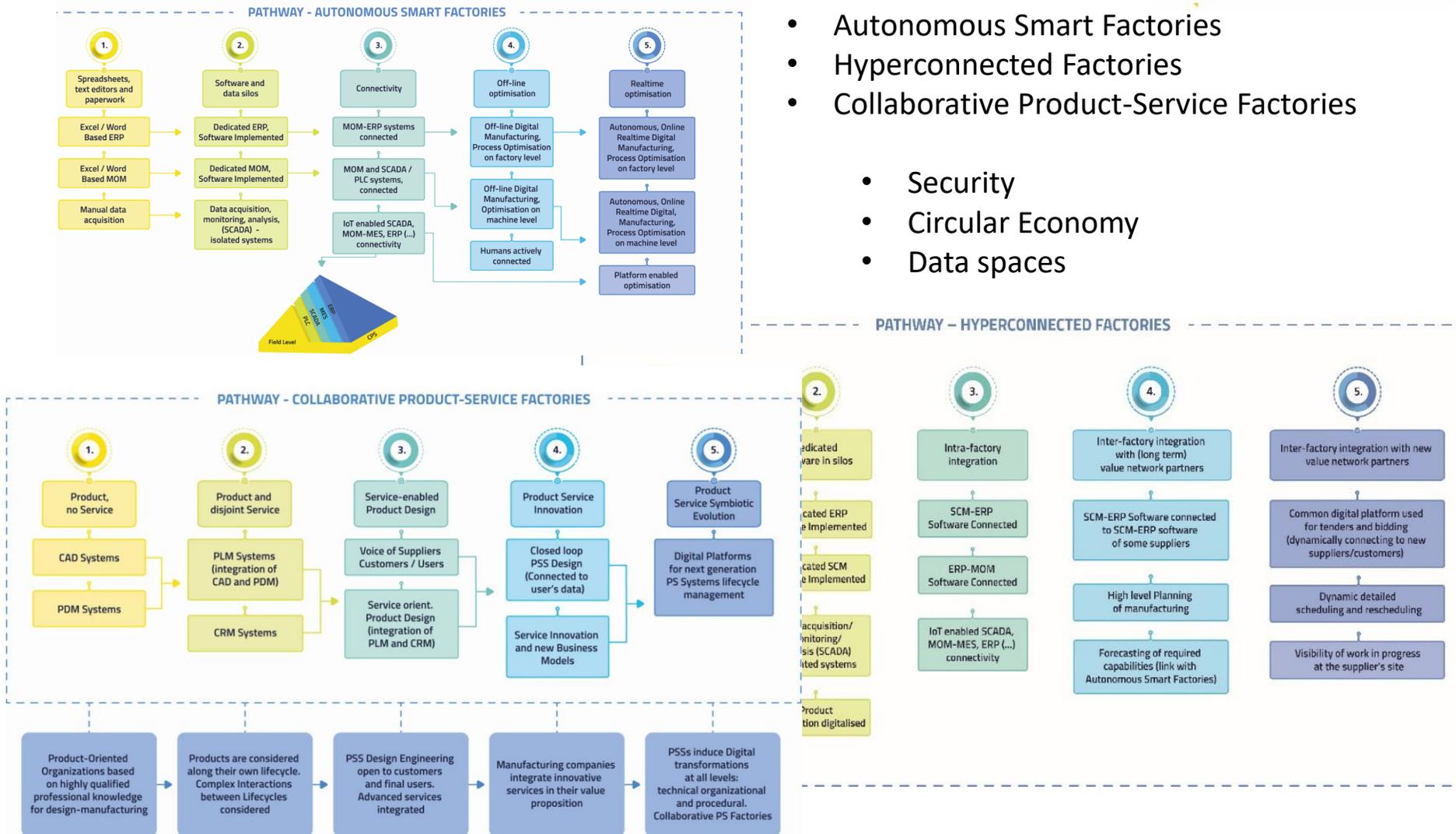
Cases that illustrate advanced state of the art

Approaches & cases from research & innovation projects

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PATHWAYS

CONNECTED FACTORIES

- Autonomous Smart Factories
- Hyperconnected Factories
- Collaborative Product-Service Factories

- Security
- Circular Economy
- Data spaces

PATHWAY - AUTONOMOUS SMART FACTORIES

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PATHWAY – HYPERCONNECTED FACTORIES

2. Intra-factory integration
   - Dedicated software in silos
   - Dedicated ERP ... Implemented
   - Dedicated SCM ... Implemented
   - ... acquisition/ monitoring/ ...sis (SCADA) ...ated systems
   - Product ...ion digitalised
3. Intra-factory integration
   - SCM-ERP Software Connected
   - ERP-MOM Software Connected
   - IoT enabled SCADA, MOM-MES, ERP (…) connectivity
4. Inter-factory integration with (long term) value network partners
   - SCM-ERP Software connected to SCM-ERP software of some suppliers
   - High level Planning of manufacturing
   - Forecasting of required capabilities (link with Autonomous Smart Factories)
5. Inter-factory integration with new value network partners
   - Common digital platform used for tenders and bidding (dynamically connecting to new suppliers/customers)
   - Dynamic detailed scheduling and rescheduling
   - Visibility of work in progress at the supplier's site

PATHWAY - COLLABORATIVE PRODUCT-SERVICE FACTORIES

1. Product, no Service
   - CAD Systems
   - PDM Systems
2. Product and disjoint Service
   - PLM Systems (integration of CAD and PDM)
   - CRM Systems
3. Service-enabled Product Design
   - Voice of Suppliers Customers / Users
   - Service orient. Product Design (integration of PLM and CRM)
4. Product Service Innovation
   - Closed loop PSS Design (Connected to user's data)
   - Service Innovation and new Business Models
5. Product Service Symbiotic Evolution
   - Digital Platforms for next generation PS Systems lifecycle management

- Product-Oriented Organizations based on highly qualified professional knowledge for design-manufacturing
- Products are considered along their own lifecycle. Complex Interactions between Lifecycles considered
- PSS Design Engineering open to customers and final users. Advanced services integrated
- Manufacturing companies integrate innovative services in their value proposition
- PSSs induce Digital transformations at all levels: technical organizational and procedural. Collaborative PS Factories
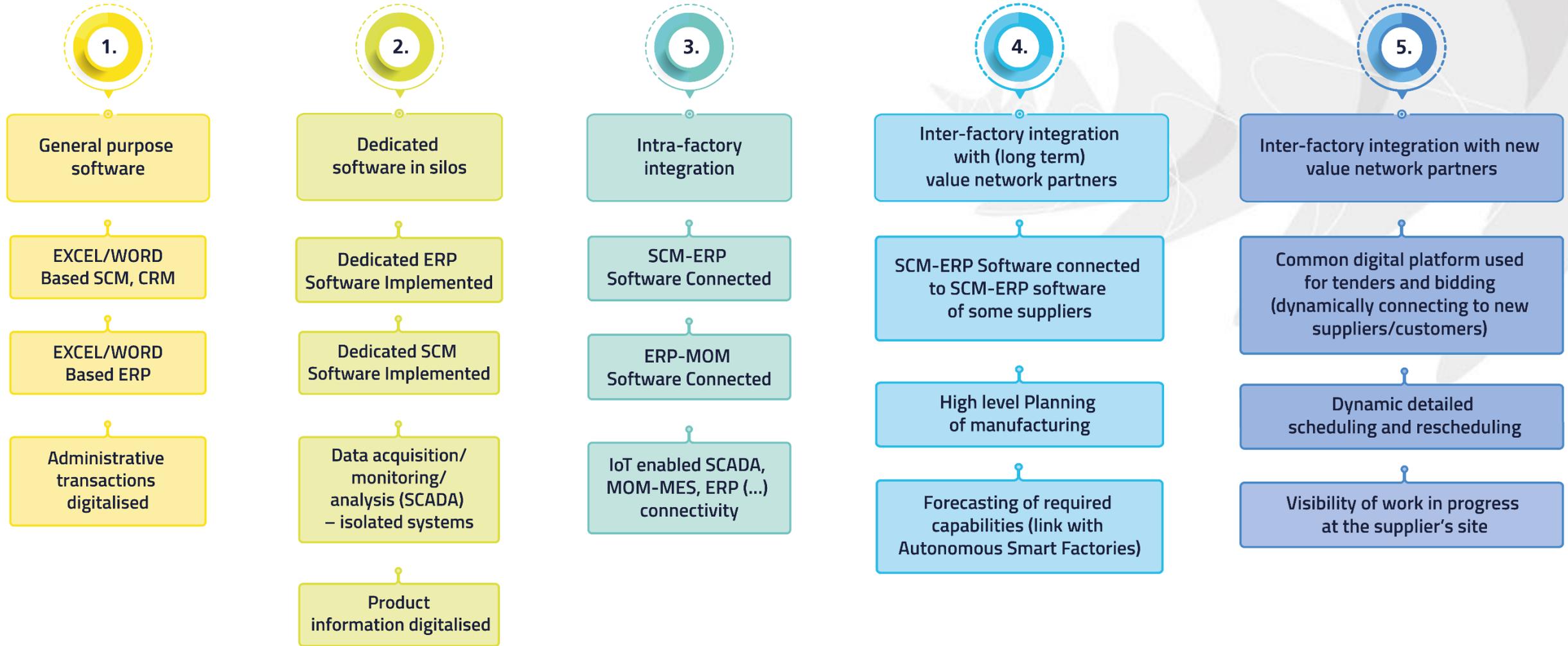
Industrial state of play in manufacturing

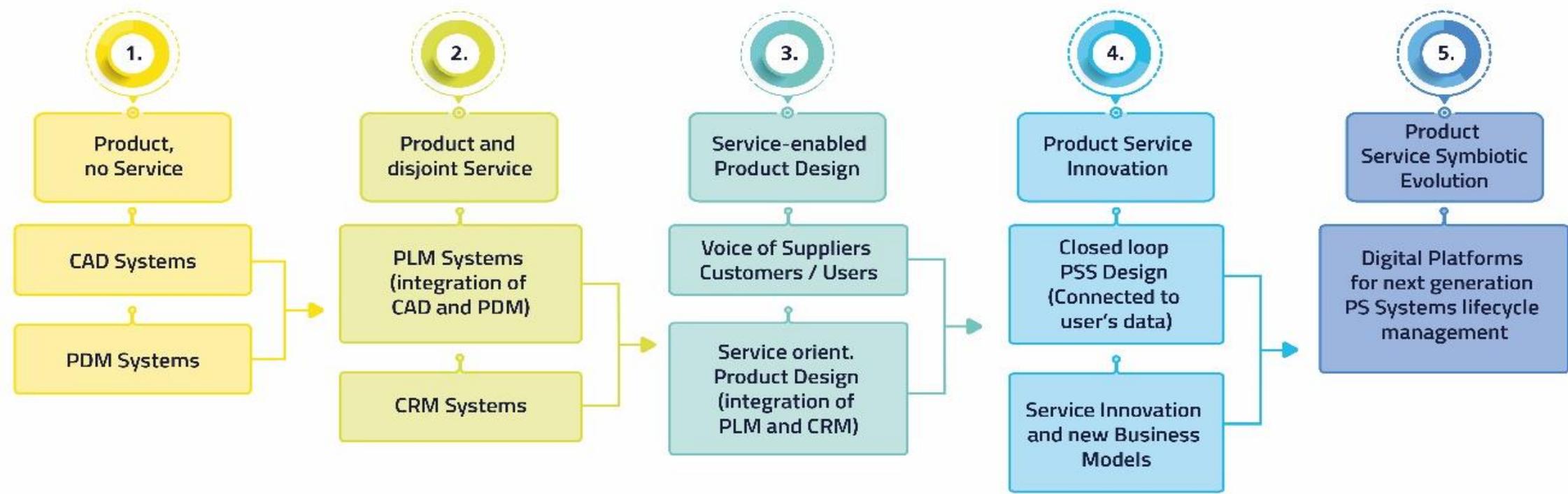**Cases that illustrate advanced state of the art**

**Approaches & cases from research & innovation projects**

PATHWAY - AUTONOMOUS SMART FACTORIES

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Spreadsheets, text editors and paperwork

Excel / Word Based ERP

Excel / Word Based MOM

Manual data acquisition

2.

Software and data silos

Dedicated ERP, Software Implemented

Dedicated MOM, Software Implemented

Data acquisition, monitoring, analysis, (SCADA) - isolated systems

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Connectivity

MOM-ERP systems connected

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Platform enabled optimisation

Field Level

PLC

SCADA

MES

ERP

CPS

Industrial state of play in manufacturing

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PATHWAY – HYPERCONNECTED FACTORIES

CONNECTED FACTORIES

1.

General purpose software

EXCEL/WORD Based SCM, CRM

EXCEL/WORD Based ERP

Administrative transactions digitalised

2.

Dedicated software in silos

Dedicated ERP Software Implemented

Dedicated SCM Software Implemented

Data acquisition/ monitoring/ analysis (SCADA) – isolated systems

Product information digitalised

3.

Intra-factory integration

SCM-ERP Software Connected

ERP-MOM Software Connected

IoT enabled SCADA, MOM-MES, ERP (…) connectivity

4.

Inter-factory integration with (long term) value network partners

SCM-ERP Software connected to SCM-ERP software of some suppliers

High level Planning of manufacturing

Forecasting of required capabilities (link with Autonomous Smart Factories)

5.

Inter-factory integration with new value network partners

Common digital platform used for tenders and bidding (dynamically connecting to new suppliers/customers)

Dynamic detailed scheduling and rescheduling

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Animated pictures illustrating digitalisation in manufacturing

Produced by the ConnectedFactories 1 project
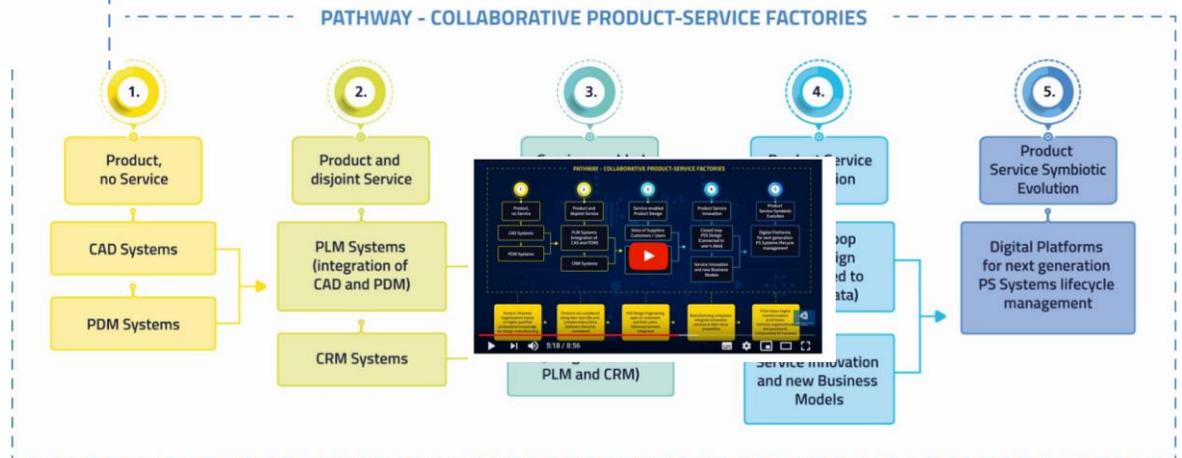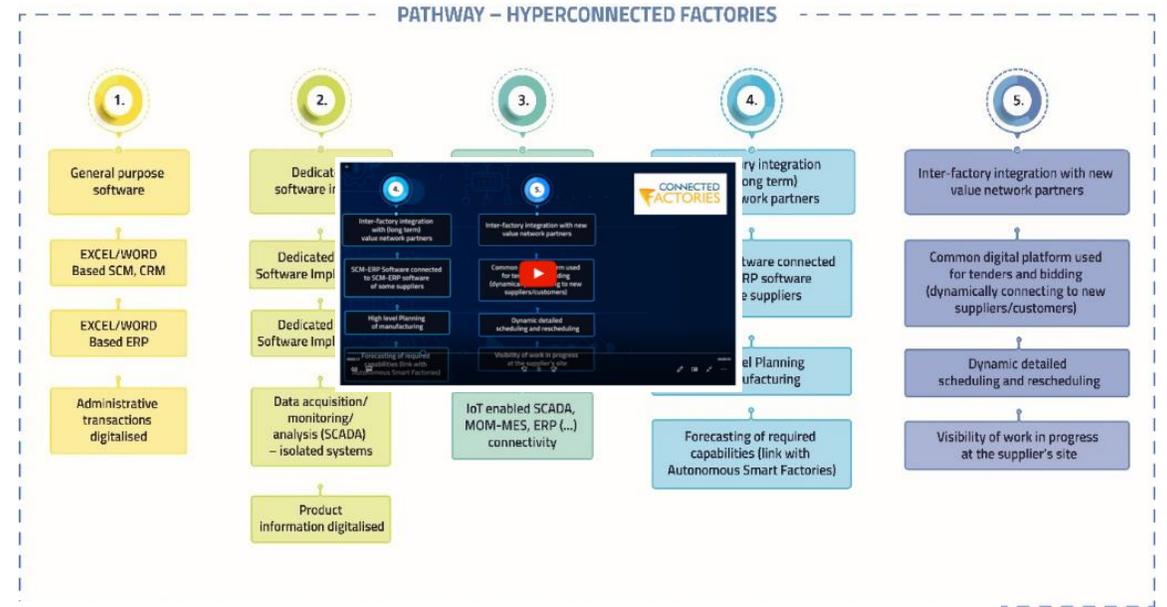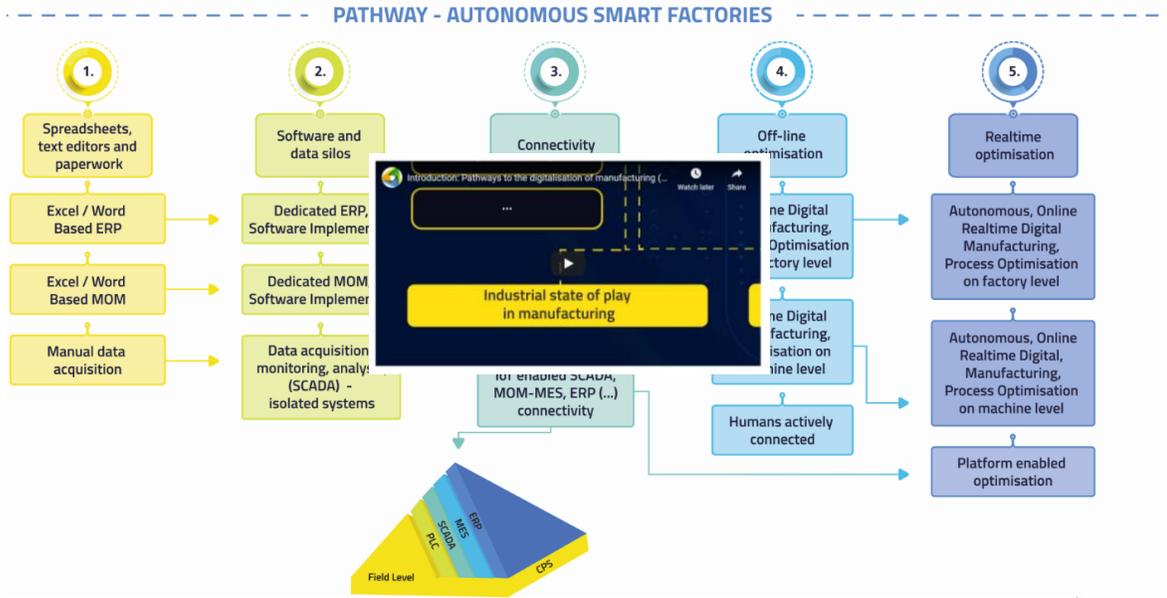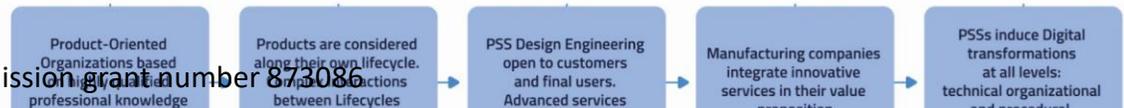
https://www.connectedfactories.eu/pathways-digitalisation-manufacturing

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Industrial state of play in manufacturing

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- Presentations – here
- Recording - here

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- Recordings - [here](#)

Data Space Pathway (draft)

Digital Transformation - Industry 4.0

Dimensions / Levels	Level I No Data Control	Level II Data Silos	Level III Data Bridges	Level IV Data Interoperability	Level V Data Valorization
Data Management					
Data Protection			Data Engineering & Security Privacy	Data Sovereignty and GDPR	Data-driven Business Models
Data Processing	Data are generated, processed and visualized by CPPS and I4.0 systems	Enterprise Applications (ERP, SCM, PLM, CRM) collect, store and visualize Data	Complex applications require data from different sources	AI-driven applications; Digital Assistants; VR/AR	Data Economy and Industrial Data Platforms
Data Analytics					
Data Visualization					
Data Sharing			Cross-domain Data Spaces	Data Sharing Spaces	Dynamic Data Marketplaces

Circular Economy Pathway (draft)

CONNECTED FACTORIES

Circularity (5°)

Circular Economy Thinking (4°)

Systemic Material Management (3°)

Industrial CE Piloting (2°)

Linearity (1°)

	1	2	3	4	5
Products	Any toxic substances should not be used to create products	Material used to should be the minimum amount required to respect product functionalities and design (resource sufficiency)	Systematical identification of possibilities to reuse, refurbish and remanufacture	Ecodesign of products (must be easy to be disassembled,repaired, remanufactured and its components should berecyclable)	Changing business model towards product-service-systems and X as service approaches at ecosystem level
Process	Quality monitoring to avoidunnecessary scraps	Production processes must require limited amount of energy	Transportations modes (reverse logistics), internal recycling of materials	Building industrial synergies/closed loop models	Circular systems and process at value network/ecosystemlevel
Platform	Information technologies to gather processes data	Company systems integration (e.g. ERP, MRP, PDM, PLM…)	Disassembly and Remanufacturing enabling technologiesintroduced onthe shop-floor	Digital platform integrationenabling the interaction among valuechain actors	Collaborative business processes and workflows are used over the product life cycle
People	Ad-hoc engagement of individuals, not comprehensive engagement	Engagement and awareness raising, systemic empoweringthrough champions	Cultural transformation and qualified people (skills)	Circular suppliers selection and value network level indicators	Sustainable government'requirements and European Green Deal?
Partnershi	Contractual	Code of conduct	Circularityobjectiv	Capabilities to	Digital

Cybersecurity Webinar, 20 January 2021

Thank you!

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