CREATE the Next Generation IoT eXperience for the Future
European Industry Partnership Collaborative Event
Strategic Directions and Research Priorities. Amsterdam, April 17th 11:20

EFFRA Roadmap and Connected Factories 2025 pathways materialization

Sergio Gusmeroli
sergio.gusmeroli@polimi.it

EFFRA
EUROPEAN FACTORIES OF THE FUTURE RESEARCH ASSOCIATION
POLITECNICO MILANO 1863
SCHOOL OF MANAGEMENT
Manufacturing Group
Who We Are

- **Industry-led association** representing private side in the ‘Factories of the Future’ Public-Private Partnership with European Commission

- 170+ members from across Europe (a network of experts)

- Members include **large, small & medium** industrial enterprises, research organisations, universities, industrial associations and clusters

- **Full time secretariat**: Connecting with members, coordinating research agenda & liaising with the European Union

- Support wider Factories of the Future community
### The Factories of the Future PPP - Some figures…

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<th>FoF-2010</th>
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<th>FoF-2012</th>
<th>FoF-2013</th>
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<table>
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<th>Nr of projects</th>
<th>Cumulative total</th>
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<td>23</td>
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</table>

- **283** Projects to date.
- **> 2,000** organisations participating
- High involvement of SMEs: **>30% of funding**
- Projects feature **demo activities**
- **>1000** results have been reported on EFFRA Innovation Portal ([portal.effra.eu](portal.effra.eu))
From FoF 2020 roadmap to Factories 4.0 & Beyond

Building on the vision of the FoF 2020 roadmap and public consultation in 2016

Key priorities for FoF 18-19-20

1. Agile value networks: Lot-size one-distributed manufacturing
2. Excellence in manufacturing: Advanced manufacturing processes and services for zero-defect processes and products
3. The human factor: Human competences in synergy with technological assets
4. Sustainable value networks: Manufacturing in a circular economy
5. Interoperable digital manufacturing platforms: connecting manufacturing services

Open DEI: Aligning Reference Architectures, Open Platforms and Large-Scale Pilots in Digitising European Industry

Connected Factories
I4MS Programme: ICT Innovation for Manufacturing SMEs

**Phase II** BEinCPPS, Success Stories, Industrial Cases

**Phase III** MIDIH, DIHs Networks, Reference Architecture, Open Calls

**Phase IV** DT-ICT-03-2020 Uptake digital game changers
Smart Moulds in Plastic Industry

**Sensor data**
- T1 (°C) 122.5
- T2 (°C) 125
- P1 (bar) 860

**Motor following**
- I1 (A) 3.4
- I2 (A) 2.7
- C1 (mm) 17
- C2 (mm) 67

**Injection machine data**
- Top closing mold A6
- Pull out ejection B4
- Pull in ejection B3

**Alerts**

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Alert</th>
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<td>A1</td>
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<td>25/04/16</td>
<td>08h45</td>
<td>A1</td>
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<tr>
<td>26/04/16</td>
<td>15h12</td>
<td>A2</td>
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**Motor Command**

**EUROMAP67**

**Smart Mold**

**Factory Gateway**

**Local Fiware Components**

**Data visualization**

**Data storage**

**Data analysis**

http://www.beincpps.eu/
On-field Experimentation

- Encoder
- Stepper
- Current Sensor
- Thermal Sensor x 2
- Local WireCloud server
- NGSI / OPC-UA
- Orchestrate
- Controller
- Serial Bus
- Socket
- SPI
- ADC
- Pressure Sensor

24V -> 5V (Opto Couplers)
5v -> 24V (Transistors)
NPE 2018: Orlando OCCC
White Goods Zero Defect Quality process

- Q-Box 2
  - OPC UA Server
  - Box Handler
  - Executor
  - Advantech Interface

- M10-5271

- WH Network
  - Operator Intelligence Dashboard
  - Test Plan Configurator

- A-Box2
  - Actuator/Sensors

- Advantech
  - Adam 6017
  - Adam 6018
  - Adam 6051
  - Adam 6052
  - EKI 3728

- EKI 6332

- WH Network
  - 4 DI & 4 DO
  - 4 AI & 2 Counters
  - Temperature Measure
  - Power Measure
• Appliances Under Test
• Type Built-in
• Testing Time duration from 20 to 120 minutes in according with the model and the specific procedures

• Appliances in preparation for testing
• 4 Temperatures in cooling areas
• 2 Temperatures in warm areas
• Electrical Parameters
Cloud Computing (Hybrid Clouds)

- Data-at-Rest
- Cloud Computing
- Data Semantic Models
- Analytics Middleware
- Edge Computing (Local Clouds)

Industrial Analytics
- Analytics Middleware
- Data-at-Rest
- Cloud Computing
- Data Semantic Models
- DiM Security

Industrial IoT
- IoT Middleware
- Data-in-Motion
- Edge Computing
- DiM Services

Data Persistence Middleware
- Streaming and Batch Analytics (Data Management & Integration)

Data at Rest
- Flume
- Sqoop
- Hadoop
- Zeppelin
- Mahout
- SPARK
- Flink
- Hive

Data in Motion
- KAFKA
- NiFi
- Edgent
- STORM
- SPARK
- Flink
- Samza

Data Management & Integration
- Apache Implementation
- MidiH Analytics Framework
MIDIH Analytics Framework - FIWARE Implementation

MIDIH Second Wave OPEN CALLS: from May 6th 2019
Digital Manufacturing Platforms in DT-ICT-07-18/19

Roles of digital industrial platforms:

- **Network/Marketplace/Community**
  - Explicit connections between users
  - Network is key value

- **Technology infrastructure**
  - Complementary applications
  - Development platforms
  - Unlock data
  - Integration

- **Data**

Examples of how different platforms fill in roles in different ways and to varying degrees:

- **eFactory** is the Marketplace for Agile Value Networks in Lot Size 1 Production

- **ZDMP** is the Operating System for developing ZDM systems of systems

- **QU4LITY** is the cross-platforms Middleware for operating ZDM systems of systems

Adapted from http://platformed.info/platform-stack/
OPEN DEI CSA in DT-ICT-13

Open DEI
Aligning Reference Architectures, Open Platforms and Large-Scale Pilots in Digitising European Industry

European platform of national initiatives on digitising industry
Pathways to digital manufacturing + enablers and critical success factors

Video on https://www.connectedfactories.eu/pathways-digitalisation-manufacturing
Three major pathways towards Digital Manufacturing

**Collaborative Product-Service Factories**: Interoperability of Personal and Industrial IoT Data Spaces along the Product / Material lifecycle for Sustainable Value Networks (Circular Economy)

**Autonomous Smart Factories**: Collaborative Intelligence between humans and IoT-driven Autonomous Systems (Collaborative Robots, Humans in the Loop) considering Human Factors and Skills gaps

**Hyper-connected Factories**: Interoperability between IoT Open Platforms and Proprietary Systems through pan-EU Data-Service Marketplaces (IoT Catalogue)
The FoF background is materialised by its validation business scenarios of **Smart Factory**, **Smart Product** and **Smart Supply Chains** as projected to 2025 by the pathways:

- Autonomous Smart Factories,
- Collaborative Product-Service Factories, and
- Hyperconnected factories.

FoF is also providing its **reference architectures**, originated e.g. from **RAMI 4.0 Plattform Industrie 4.0** and the **Industrial Internet Consortium**, and data-driven implementation guidelines such as the **layered data-buses architecture** of **IIRA 1.8**.
## SMI Reference Framework

Grand Scenarios

<table>
<thead>
<tr>
<th>BDVA Data Priority</th>
<th>Data Management and Lifecycle</th>
<th>Data Processing Architectures</th>
<th>Data Analytics</th>
<th>Data Protection</th>
<th>Data Visualization and User Interaction</th>
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</thead>
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<table>
<thead>
<tr>
<th>Smart Factory</th>
<th>Smart Product</th>
<th>Smart Supply Chain</th>
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<tbody>
<tr>
<td><em>(data is generated inside production lines)</em></td>
<td><em>(data is generated by product-service itself along its lifecycle)</em></td>
<td><em>(data is generated by ecosystems of suppliers, providers, distributors, retailers, etc.)</em></td>
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**56 big data research and innovation challenges related to Smart Manufacturing**
Towards a Manufacturing Partnership under Horizon Europe (2021 – 2027)

**Impact**
- People
- Planet
- Competitiveness
- Products of the Future

**Co-creation through Manufacturing Eco-systems**
- **Excellent, responsive and smart factories**
  Scalable first-time right manufacturing
  Agile and robust optimal manufacturing
- **Low environmental footprint, customer-driven value networks**
  Demand and consumer driven manufacturing networks
  Circular economy (symbiotic manufacturing networks)
- **Parallel product and manufacturing engineering**
  Concurrent, holistic and collaborative product-service engineering
  Virtual end-to-end life-cycle engineering from product to production lines, factories and networks
  Manufacturing smart and complex products
- **Human-driven innovation**
  Co-creation in European knowledge networks
  Managing constant change
  Human & technology complementarity

**Enabling Technologies & Approaches**
- Advanced and smart material processing technologies and process chains
- Smart mechatronic systems, devices and components
- Intelligents and autonomous hand and robotics, assembly and logistic technologies
- De-manufacturing and recycling technologies
- Energy and power supply technologies
- Simulation and modelling (digital twins)
- Robust and secure industrial communication technologies, distributed control architectures
- Data analytics, artificial intelligence and deployment of digital platforms
- New business and new organisational approaches
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