IOT in Manufacturing
Factories of the Future meets Industrial IoT

AITOR ALZAGA
Industry 4.0 Coordinator
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SRA presented at the **Manufuture Conference** (2006)

**Factories of the Future** PPP strategic multi-annual roadmap (2010-2013)

Multi annual roadmap for the contractual PPP under **Horizon 2020** (2013)

**Factories 4.0 and Beyond**
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**Total**

- **25** PROJECTS
- **61** PROJECTS
- **98** PROJECTS
- **151** PROJECTS
- **180** PROJECTS
- **208** PROJECTS
- **245** PROJECTS
- **268** PROJECTS
### ICT CONTRIBUTION TO THE FACTORIES OF THE FUTURE

#### THREE WAVES

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<tr>
<th>Year</th>
<th>Nr Proj</th>
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<td>2017</td>
<td>23</td>
<td>268</td>
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</tbody>
</table>

**Projects:**
- **M2M Platform:** 37 Projects
- **CPS Platform:** 37 Projects
- **Platform:** 23 Projects
KEY WORDS

Predictive maintenance of production equipment

Innovative strategies for renovation and repair

Re-use of modular equipment

Intelligent production machines and 'plug-and-produce’
### FIRST WAVE (2012-2015)

<table>
<thead>
<tr>
<th>EMBEDDED INTELLIGENCE - CBM</th>
<th>M2M, CLOUD DATA STORAGE</th>
<th>COMMUNICATION, INTEROPERABILITY</th>
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<tr>
<td><strong>CbM:</strong></td>
<td><strong>eMaintenance</strong></td>
<td><strong>OSA-CbM</strong></td>
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<tr>
<td>• Machine tools</td>
<td>• Remote Services</td>
<td><strong>OPC-UA</strong></td>
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<tr>
<td>• Press machines</td>
<td></td>
<td><strong>Component’s interfaces</strong></td>
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<tr>
<td>• Robots</td>
<td></td>
<td><strong>ISO/TC 108/SC5</strong></td>
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<tr>
<td>• Lift trucks</td>
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<td>«Condition monitoring and</td>
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<tr>
<td></td>
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<td>diagnostics of machines»</td>
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<td><strong>Self-Description, Auto-Diagnostic:</strong></td>
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<tr>
<td>• Ctes</td>
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<tr>
<td>• Machines</td>
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<tr>
<td>• Lines</td>
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</table>
KEY WORDS

Monitoring, Control and Optimization

Digital Twins

Cyber-Physical Systems

Industrial IoT

SECOND WAVE (2015-2018)
PREDICTIVE SYSTEM TO RECOMMEND INJECTION MOULD SETUP WITH PROCESS OPTIMISATION IN WIRELESS SENSOR NETWORKS
TWIN-MODEL BASED VIRTUAL MANUFACTURING FOR MACHINE TOOL PROCESS SIMULATION AND CONTROL

Machine Tool as a CPS
Digital Manufacturing Platforms

Operating system that integrates different technologies and various applications and services

Ecosystems

Standards
Vf-OS  Virtual Factory Open Operating System

External Service Providers (Hosting, Computation..)

Kernel
Application Services & Middleware (Runtime)
  Middleware
  Process Execution, PubSub, and Messaging
  Control Security, System Dashboard
  Data Management
  Analysis, Storage and Transformation
  I/O Toolkit
  Gateways to Sensors, APIs, ERP..., External Service Provision, Enablers (Framework)

Application Development (Design)
OAK Toolkit
  Process Designer, Data Mapping, SDK, Frontend Environment, Studio
Engagement
  Hub, Training

vf-OS Platform Providers
Application Deployment (Use)
  Marketplace Services
  vf-OS Assets
    vApps, Services, Enablers (Applications), 3rd Party Services

Software Developers

Manufacturing and Logistics Users (From Factories to Sensors)

Manufacturing and Logistics Solutions Providers
Wireless autonomous, reliable and resilient production operation architecture for Cognitive Manufacturing
Distributed control and simulation platform to support an Ecosystem of digital automation developers

Vertical integration with asynchronous Digital Applications to extend modularity CPS functionalities

Horizontal integration with other shop-floor automation platforms (DDS, OPC-UA, etc.)
DIGITISING EUROPEAN INDUSTRY

European platform of national initiatives on digitising industry

- Horizon 2020 €100 M/year
- Building Blocks (PPPs)
- Security
- Value Creation
- Widening EU13
- Full Digital Single Market
- Free Flow of Data
- Cybersecurity
- Digital Skills & Jobs Coalition
- EIT-KIC
- Digital Opportunity Scheme
- Platforms & Pilots
- Horizon 2020 €3+ bn (2018-20)
- Partnerships & Platforms

European Commission > Strategy > Digital Single Market > Policies

Digitising European Industry
FROM FoF 2020 ROADMAP TO FACTORIES 4.0 & BEYOND

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

Vision of the factories of the future: the challenge perspective

Key priorities for FoF 18-19-20

Agile value networks: Lot-size one-distributed manufacturing

Excellence in manufacturing: Advanced manufacturing processes and services for zero-defect processes and products

The human factor: Human competences in synergy with technological assets

Sustainable value networks: Manufacturing in a circular economy

Interoperable digital manufacturing platforms: connecting manufacturing services
KEY WORDS

Interoperable Digital Manufacturing Platforms
• CPS: integration with physical legacy machines in factories
• Platform inter-connectivity

Agile value networks:
• Integration of CPS (from M2M/IoT) and ERP
• Industrial data space architectures and standards

Zero-defect manufacturing – Quality Assurance – Self learning systems
Plug-and-inspect data gathering systems, based on IoT solutions

Sustainable Value Networks
ICT technologies and models for energy monitoring and assessment

THIRD WAVE + (2019-2022)
How many years will it take to develop the following technology to full market readiness (TRL9)?

FINDINGS FROM DOMAIN EXPERTS OPINIONS
FINDINGS FROM DOMAIN EXPERTS OPINIONS

Main barriers for the development and introduction of smart components
CONCLUSIONS

IoT is one of the key enabling technologies for FoF

Growing gap between exponentially changing technology and implementation by organisations

Inmaturity of the Manufacturing Platform concepts and implementation

OT is conservative

“Digital part” is taking too much relevance (some opinion)

Open software vs proprietary software