## Results from ITEA international customer and end-user workshop on Smart Manufacturing

*On 21-22 June 2017, the third ITEA customer and end-user workshop took place and this year's theme was Smart Manufacturing. AIRBUS kindly hosted this event at its premises in Toulouse.*
*37 participants from 9 countries, coming from large industry, SMEs and public authorities took part in the workshop.*

| Customer | Industry | SME |
|---|---|---|
| **Airbus** | Koçsistem | Algoryx Simulation |
| **Alstom** | Siemens | Convergent Manufacturing Technologies Inc |
| **Daimler** | | EKS InTec |
| **Eczacibasi Group | Vitra** | | Enforma Bilisim A.S |
| **Fokker** | | Evolution Energie |
| **Ford Otosan** | | ICC Elektronik Ltd |
| **Kordsa** | | Innovalia Metrology |
| **Philips Lighting** | | Jotne |
| **National Research Council Canada** | | Nextel |
| **Safran** | | Ometa |
| **Valeo** | | Seclab |
| | | SGS Control Systems Ltd |
| | | Sigfox |

The target of the ITEA international customer and end-user workshops is to get important topics for future projects directly from the customers and end users along with their actual pain points. We observed in ITEA success stories that the projects starting from actual user' demands are more successful than the ones starting from promising technologies.

We invite you to check this report carefully if you intend to push a new ITEA project on Smart Manufacturing. You will find a set of pain points to be solved, which interest many top brands struggling with these challenges today.

If you have an innovative idea to solve any (or part) of these challenges, use the ITEA Project Idea Tool (https://itea3.org/getting-started.html) to show your interest and participate in the ITEA Project Outline (PO) Preparation Days, taking place on 12-13 September 2017 in Berlin, to define your project and gather the suitable consortium.

## 1. Topic: End-to-end digital integration

### a. Pain points to be solved:

- Many data are still on paper. Digitalisation must be more than paper digitalisation ➜ challenge to move from raw data to information and challenge on data format
- The challenge is to ensure data exchange between R&D, engineering, process, quality and maintenance teams. Data exchange from customer order to customer delivery including a fully integrated digital production flow. Data exchange including suppliers, partners and customers worldwide
- 3 levels of data are identified: Enterprise Resource Planning (ERP), Process definition, Real-Time (RT) line data. Product Lifecycle Management (PLM) and engineering data are rather static compared to the business data stored in the ERP, when the line data are actually real time
- Some data, like 3D representation, are complex and require some different filtering tools. A 3D model can be very complex with metadata like the material of the different pieces and attendant constraints, identification tags, … The usage of these data can require a different level of details (texture or just the structure, just visualisation or access to the metadata for interaction). In these different filtering processes, it is important when we interact on a simple terminal like a tablet to be able to go back to some details of the full data without losing the connection
- The production line design must remain dynamic enough to allow continuous Bill of Material refinement with impact on procurement strategy
- For a long time the plants have still been confronted by the reality of a system of system built from separated heterogeneous sub-systems (Customer requirements, 3D modelling, workshop data). A challenge is to build from this heterogeneity a global vision of the system (smart data translation, data collection for deep learning, global modelling).
- The system must remain flexible enough to take into account the new emerging technologies
- This E2E data integration will generate a huge quantity of data useful for deep learning but which data need to be acquired and stored? We must keep in mind the cost of data acquisition and storage in our big data strategies.
- The unique target of a plant manager is enhancement of the performance of the line. His challenge is to simulate evolution to confirm the potential of efficiency enhancement rather than to check the past. Our architecture must be future oriented
- Production engineering tools are indeed different from usual ERP, which generates another challenge to make them compatible

### b. Ideas for project proposals:

- We have to explore existing standards like: Automation Mark-up Language (Automation ML), Functional Mock-up Interface (FMI) and STEP
- We can explore the formal definition of the call for tender to generate automatically optimal workflow
- We want to explore detection of events to start a sub process
- We could define some generic hierarchical data and metadata translators keeping the path to the most detailed information when required with the specific case of visualisation

#### Interested companies:
Siemens, Ford Otosan, Enforma, Airbus, Kordsa, Jotne, National Research Council Canada, Fokker, Safran, Nextel, Ometa, Valeo, ICC Elektronik, SGS Control Systems, Innovalia, Convergent Manufacturing Technologies?

**A special focus on 3D data management**

- It covers the product inspection, dimensional control, surface control
- STEP / IGES data exchange
- 3D data for tooling
- 3D Scanning
- Optimal loading of components on the production line
- It includes also the previous generic hierarchical data and metadata translators

**Interested companies:**
**Jotne**, Vitra, Innovalia, SGS Control Systems, Enforma, Airbus, Ford Otosan, Safran, Koçsistem

## 2. Topic: middleware for digital manufacturing

### a. Pain points to be solved:

- It covers the data acquisition, big data, data analysis, machine learning
- It requires the defining of which data to acquire (machine data, environment data), the adequate real-time, and work on the data fusion
- We need to work on the data analytics for industrial robots
- A challenge is the data analysis for quality prediction
- Virtualisation is also covered by the digital twins projects
- There is the special case of visualisation covered in the E2E data integration
- This middleware must allow easy the introduction of new machines, defining proper parameters, more proactive alerts
- A challenge is to be able to work with (the legacy of) older machines
- Connectivity, security and wireless interoperability also need to be considered

**Interested companies:**

KoçSistem, Airbus, Siemens, Ford Otosan, Safran, Kordsa, Enforma, Valeo, Philips Lighting, Vitra, EKS InTec, Innovalia, SGS Control Systems, ICC Elektronik

## 3. Topic: Production line flexibility

### a. Pain points to be solved:

- The challenge is to allow different type of products on the same production line, to allow personalisation of the products on the same line
- The target is to reduce response time to customer delivery and to calls for tenders
- The flexibility is intrinsically limited by the machine we use
- Some businesses require this flexibility because more or less each product is personalised
- We want the freedom to offer late customisation on the production line itself
- Quality remains a key issue in this flexibility

### b. Ideas for project proposals:

- We need to set up a product configuration tracking but also a takt time management for continuous process to allow synchronisation
- We must define the different variants of the products and the level of variance required
- We must explore an automatic configuration of the line to the product specifications based on a modular production line design
- It appears the Digital Twin could be a unique tool to ensure the command & control of the production line to ensure this flexibility
- The required variance must be defined and taken into account in the engineering phase before the deployment of the line to define all the flexibility options
- It requires high-end simulation to design the line (at both the engineering and production stages)
- We need to capture workers' knowledge to feed back into the engineering stage

### Interested companies:

**Fokker,** Ford Otosan, Algoryx, Sigfox, Innovalia, EKS InTec, Vitra, Valeo, Siemens

## 4. Topic: Predictive maintenance

### a. Pain points to be solved:
- The target is predictive maintenance both for the final product and for the production line
- Which type of data we need and how can these be optimised?
- For the moment we have one solution per machine
- We have to overcome the challenge that many machines are not providing open data
- This topic is very important as it can change some business models and create some potential extra business

### b. Ideas for project proposals:
- We must explore how to monitor the machines, analyse the products characteristics which are produced by the machine to forecast some required maintenance actions
- Digital twin for each machine will help to support this predictive maintenance allowing continuous comparison between the reality and the forecasted behaviour
- We can explore some standards to describe the virtual model of the machine. The machine manufacturers will need convincing to deliver these kinds of models with their actual machines
- Deep learning, big data analysis will be key tools for this target
- Three kinds of solutions deserve to be explored: digital twin, statistical approach based on all available data, analysis of the required data

### Interested companies:
**KoçSistem**, Ford Otosan, Airbus, Sigfox, Alstom, Evolution Energie, Nextel, Jotne, Ometa, National Research Council Canada, Innovalia, Kordsa, Safran, Enforma, ICC Elektronik, EKS InTec, Vitra, Siemens?

## 5. Topic: Security

### a. Pain points to be solved:
- Security is everywhere. It can be added in all projects and/or it can be taken as a project by itself
- All sensors can be hacked especially with wireless network
- Could sensors have their own security?
- Could we disconnect the industrial network from internet and keep the flexibility?
- All the data need to be accessible to allow optimal production line management but it opens new gates to attack
- Digital attack is safer for counterfeiters than physical attack
- We must face a combination of physical and digital attack to counterfeit the physical world or the digital world
- We must solve the basics of security which exist to block the process (e.g. defining access per group) in different risky situations. The result is that the business-oriented persons manage to overcome these limits to safeguard the business, sharing the data (e.g. by USB-key exchange) Organisations are more flexible and require secured flexible data exchange
- Digital attacks put the business in danger

### b. Ideas for project proposals:
- We need to set up a new model of security compliant with flexibility. Basically data are open and sharable except when specific unsecure conditions are detected dynamically through the trace analysis
- We need to explore a concept of risk of non-sharing data as return on investment (cf. ATAC project approach)
- It will require generalised traceability on data exchange
- New kind of people training is required to master security of data

### Interested companies:
Nextel, Fokker, Ometa, Jotne, Sigfox, Alstom, Innovalia, Kordsa, Enforma, Ford Otosan

## 6. Topic: Geolocalisation

### a. Pain points to be solved:
- The target of geolocalisation is optimisation of product and assets logistics, but also asset and product tracking
- Such a topic requires some kind of standards
- We must tackle different temporal resolutions
- A challenge is the counterfeit detection
- This is a part of the IOT. Which device to use?
- A common challenge is on power consumption and autonomy

### Interested companies:
Nextel, Sigfox, Algoryx, Enforma, Philips Lighting, Kordsa, Airbus

## 7. Topic: Augmented reality

### a. Pain points to be solved:
- The main usages are around:
  - Troubleshooting, training, maintenance
  - Process verification and optimisation
  - Marketing
  - Factory smart desktop
- One issue is the availability of consistent data
- We need to rethink the usage, we scan the paper data, next should be digitisation from raw data to information and usage

### b. Ideas for project proposals:
- We need to work on wearable devices, size, resolution
- But also on software tools for VR/AR
- We intend to work on the safety aspects of using Augmented Reality, e.g. collisions, alerts

**Interested companies:**

Kordsa, Ford Otosan, Vitra, EKS InTec, Safran, Innovalia, Airbus, Valeo, Philips Lighting, KoçSistem

## 8. Topic: Robots, Cobots

### a. Pain points to be solved:
- A challenge is to increase robot efficiency based on collision prevention
- The situations of human / robot cooperation are more and more frequent and pertinent
- We must ensure human safety
- There is a demand of in-line robotic non-destructive inspection for quality control
- There is the special use case of aeroplane painting / lining robot

### b. Ideas for project proposals:
- We would like to develop some robot station design and some robot programming tools based on the Programming Logic Controllers.
- We will work on robot dynamic task management.
- We will develop new collaborative robot applications for assembly and body-shop.

### Interested companies:
Ford Otosan, Airbus, Kordsa, Safran, EKS InTec, Vitra

## 9. Topic: 3D Printing

### a. Pain points to be solved:
- We have to ensure the management of the 3D models for printing
- We need to create a formal expertise on which technology for which application
- We need to work on the different materials for 3D printing of tools and spare parts
- A challenging topic is the control / verification of dimensional, roughness, porosity of the printed parts
- In the production chain, we have regularly to reverse engineer existing parts to copy them
- There is a specific challenge to build 3D printing farm

### Interested companies:
Valeo, Kordsa, Ford Otosan, Innovalia, Philips Lighting, Jotne

## 10. Topic: Miscellaneous

### a. Pain points to be solved:

- We have a challenge to monitor the consistency of production and planning and to define dynamically the planning of manual operations. We feel the digital twins approach is the key solution
  Interested companies: Daimler
- The large industrials are confronted by some worldwide ramp-up. We are convinced that to automate this ramp-up, the E2E digital integration has to be solved
  Interested companies: Daimler, Alstom
- The different departments involved in the full production chain must collaborate when significant speed discrepancies occur between the real time of the production line and the design, e.g. we need to define some new collaborative business process and tools. The E2E digital integration must be solved
- Quality control (video, 3D, sensors) is an R&D direction
  Interested companies: Vitra, SGS Control Systems, Innovalia, KoçSistem, Safran
- The industrials have to manage a real-time, non-stock supply chain.
  Interested companies: Enforma, Kordsa
- Innovation methodology and education training are more general challenges