



## Project Results

# CREATE

## Optimum integration of automation systems for more flexible manufacturing

### Executive summary

The ITEA 2 CREATE project was a response to the increasing need for more dynamic production systems and the need for more precise and knowledge-based manufacturing so that costs, time, errors and reprogramming efforts could be reduced and the integration of innovative technologies with legacy components facilitated. CREATE defined a novel architecture for industrial automation systems, implemented it in demonstrators and showed the benefits of its application in three use cases in the industrial automation domain.

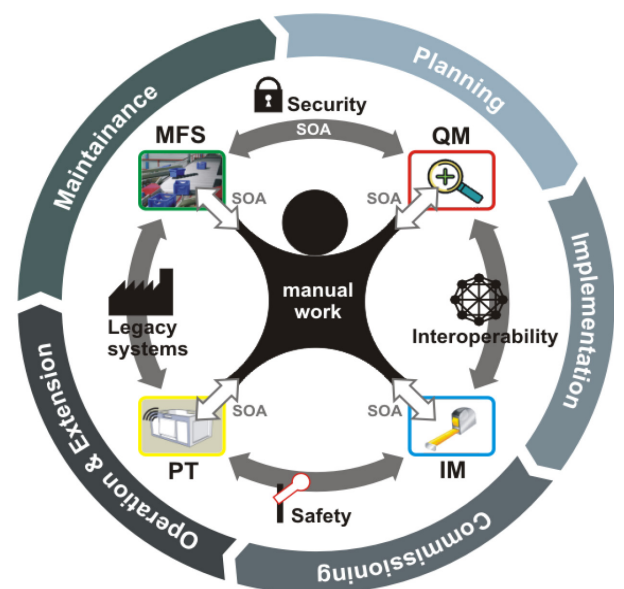
### Project origins

Automotive body assembly is a very complex, multi-phase process in which dimensional accuracy is a key quality factor. The manual process of intervention in the assembly process slows production rates and increases costs. The need to optimise of productivity through the integration of automation systems in the human operators' workflow, and decouple the production processes from extensive personal human experience, lay at the heart of a new software architecture and methodology for industrial automation developed by the CREATE project and based on modular solutions that communicate with each other. This new architecture lays the foundations not only for more flexible manufacturing but also for factories to meet changing customer demands and enhance customer satisfaction.

### Technology applied

CREATE proposed the adoption of Service Oriented Architecture (SOA) in industrial automation systems as well as the introduction and utilisation of (production) data generation and fusion devices, artificial intelligence applications and knowledge bases, showcasing the potential value through its use case prototypes. In the Flexible

Material Flow use case the demonstrator shows increased control over and monitoring of production lines but also reduces time, costs and reprogramming efforts while Industrial Metrology reveals the benefits of using high-precision 3D models of mechanical parts for knowledge-based manufacturing. The CREATE Integrator Module (CMI) allows the integration and communication of different robots and sensors, enabling the communication and management of data and operation from a single platform and automatically applying the measurement plan depending on the type of object that is manufactured, generating a customised report. Interaction between the metrology module and the production line allows the generation of automatic decisions, e.g. removing the object from the line when a defect is discovered. The Monitoring and Quality Control and Diagnostics (MQD) module underlines how the data fusion from production components and the use of



CREATE approach

artificial intelligence applications for decision support can lead to cost reduction and improved production quality. When applied to a car production line, such as the Volvo C.C. cross-member assembly process, the CREATE MQD module provides decision support for fast and correct adjustments with annual savings estimated at €0.3 million. Finally, the Cross-Domain Demonstrator demonstrated

hybrid case-based reasoning, the integration of sensor readings and operator corrective actions. The potential of these technical innovations in saving costs, improving quality and increasing flexibility is significant.

### Making the difference

The performance enhancements and added value of the CREATE approach were highlighted in a variety of use cases and demonstrators while various publications – in conferences, workshops and journals – disseminate the CREATE approach and its potential for optimising manufacturing quality. The project has spun off several products such as the TIE SmartBridge 3.0 that includes additional features developed through research in CREATE (product released by TIE Kinetix) while the TIE Smart Integrator, TSI extended within CREATE to support ontology schemas in OWL and RDF, is planned for product launch in 2015. INTERCEPTOR 16PRO, developed as a Smart Neighbourhood Module integrated in future flexible, intelligent and dynamic manufacturing solutions, is to be released as a product in 2015 as well. Among the in-house applications are Generic Substrate Carrier (GSC) based Production Lines (CCM)

provided with a highly portable interface for control and monitoring as well as a Proof of Concept for the reconfiguration of the production line support. Additionally, MQD in the manufacturing of gores was improved and is the main topic of a new two-year FFI Vinnova project led by Volvo Car that uses the CREATE results as input. The MQD in the manufacturing of transmissions for wheel loaders was also improved by the CREATE project and continues to be researched by a PhD at MDU, partly funded by Volvo Construction Equipment. The patenting of learning and self-improving algorithms are subjects of ongoing research at MDU.

### Future prospects

MDU is planning to develop a framework for case-based diagnostic systems as an open-source platform to enable the further development of the algorithms for applications in industry, the health care sector and business applications, which signifies a strengthening of the position of MDU in this research area. All partners in the consortium will be invited to be co-owners of a spin-off company intended to deliver beyond-state-of-the-art solutions to the manufacturing industry.

## Major project outcomes

### Dissemination

- 9 publications of academic papers (conference and scientific journal publications)
- 7 public deliverables
- 9 participations in dissemination events (e.g. ITEA Co-summits 2012, 2013, Control Fair, Stuttgart 2013)

### Exploitation (so far)

- 4 evaluated prototypes: Monitoring, Quality control and Diagnostics (Volvo CC and Volvo CE), Industrial Metrology (Trimek and DataPixel), Flexible Material Flow (CCM) and Cross-Domain Demonstrator (Volvo CC)
- 12 new or improved products, e.g: TIE Smart Bridge, TIE Smart Integrator, SEMA-TEC Interceptor 16PRO, CCM Generic Substrate Carrier, Improved Monitoring, Quality control & Diagnostics and Framework for case-based diagnostic systems

### Standardisation

- 2 new standards (1 ISO standard - Running, and Swedish Standard SS 728000 Published)

### Patents

- Hybrid case-based reasoning solutions developed in CREATE project are in initial state of patenting at Mälardalen University

### Spin-offs

- A spin-off company is planned to be established intended to deliver the CREATE results and continue to improve them even further, and to continue the legacy of CREATE project.

ITEA is the EUREKA Cluster programme supporting innovative, industry-driven, pre-competitive R&D projects in the area of Software-intensive Systems & Services (SiSS). ITEA stimulates projects in an open community of large industry, SMEs, universities, research institutes and user organisations. As ITEA is a EUREKA Cluster, the community is founded in Europe based on the EUREKA principles and is open to participants worldwide.

## CREATE

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### Partners

*Netherlands*

CCM

TIE Kinetix

*Spain*

Asociación de empresas tecnológicas

Innovalia

CBT

CEESA

DATAPIXEL

EPC

Software Quality Systems

Stäubli Group Spain

Trimek

*Sweden*

SEMA-TEC

Mälardalen University

Volvo Car Corporation

Volvo Construction Equipment

### Project start

September 2011

### Project end

December 2014

### Project leader

Peter Funk, Mälardalen University

### Project email

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### Project website

<https://itea3.org/project/create.html>