# TRAIN 2 - from Gare du MIDIH to Open Source Digital Manufacturing Platforms

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*MIDIH Final Event – Session 2*

*The MIDIH Project*

# Stability and Repeatability in Cutting Tools Manufacturing

Andoni Laskurain – NECO

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# NECO – Overview of the Company

**Spanish production plant of French** **TIVOLY** **Group**


- Industrial activities:
  - Manufacturing of taps
  - Manufacturing of cylindrical and flat rolling dies


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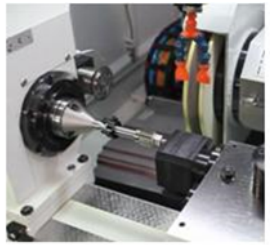
# Tap Manufacturing Process at NECO

Heat treatament



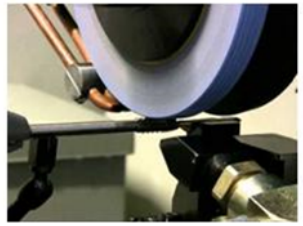
OD & square grinding

Flute grinding


MIDIH Pilot Machine

Turning, milling, first operations

**Tap production process**



Thread and chamfer grinding

Raw material bars

Finished tap

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# Why MIDIH?

## Ambition

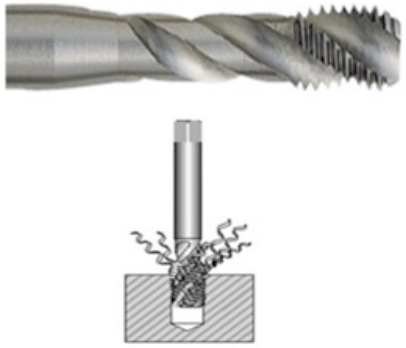
- Stability and repetitivity of the **tap's performance**.

## Objective

- To develop **cognitive manufacturing** abilities that can control the production to meet the quality requirements and performance.

# Use Case Description – Geometries of Study

1. Spiral pointed tap (to thread through holes)



2. Spiral tap (to thread blind holes)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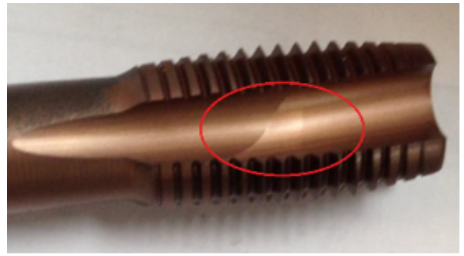
# Use Case Description – Most common Defects

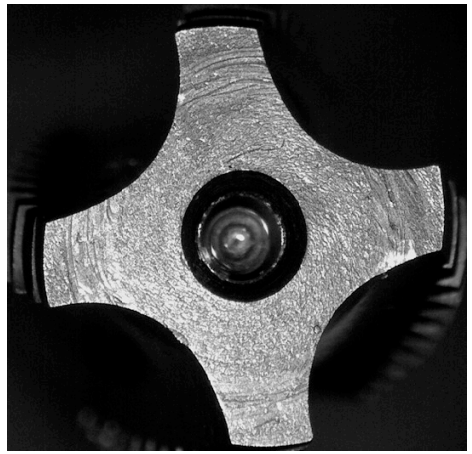
1. Wrong Cutting Angle

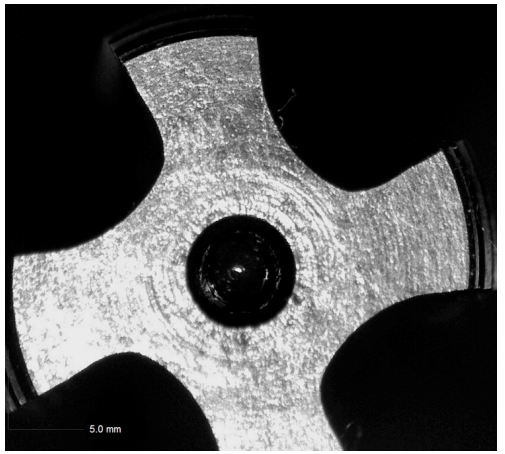


NO OK

OK

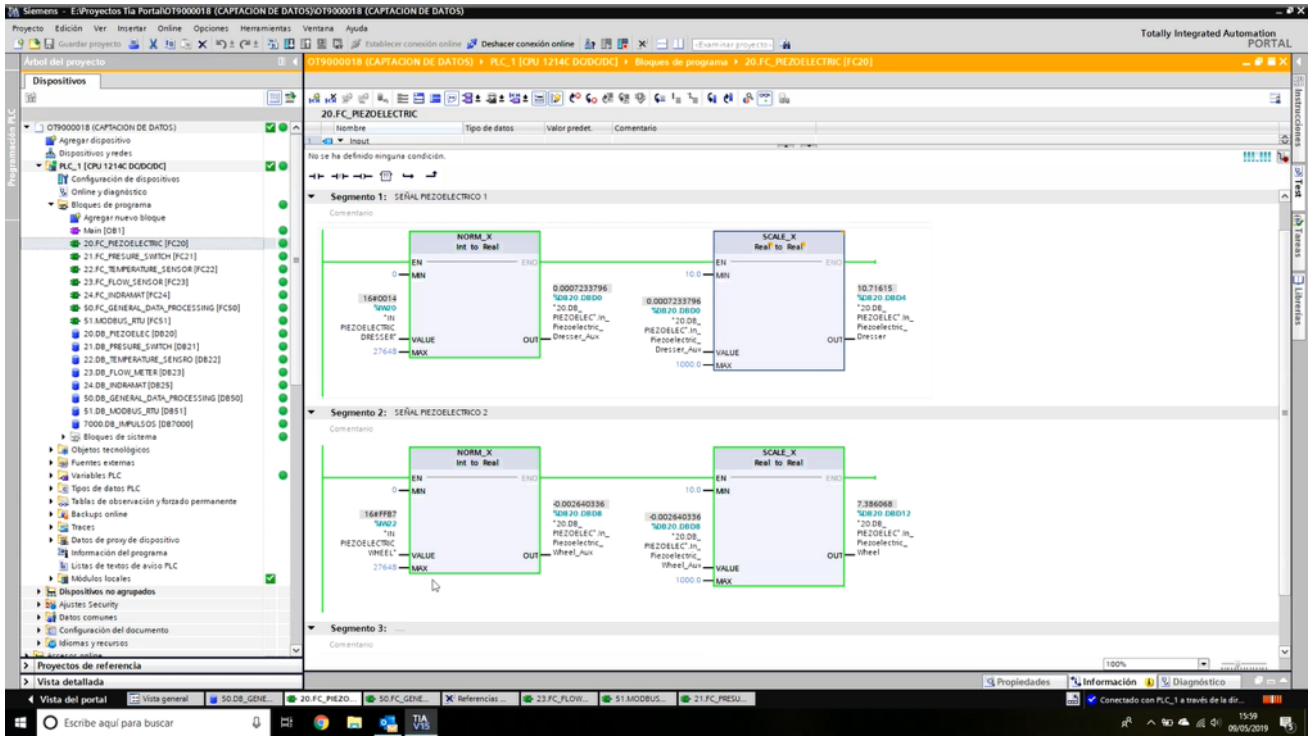
2. Wrong Flute Form





# Smart Factory – Process Digital Twin


Monitoring of the Operational Conditions at the grinding machine




| | Nombre | Tipo de datos | Offset | Valor de arranq... | Valor de observación | Remanen... | Accesible d... | Escrib... | Visible en ... | Valor de a... |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Static | | | | | | | | | |
| 2 | Out_Piezoelectric_Dresser | Real | 0.0 | 0.0 | 10.60872 | ☑ | ☑ | ☑ | ☑ | ☐ |
| 3 | Out_Piezoelectric_Wheel | Real | 4.0 | 0.0 | 7.027995 | ☑ | ☑ | ☑ | ☑ | ☐ |
| 4 | Out_Pneumatic_Presure_Switch | Real | 8.0 | 0.0 | -0.0354456 | ☑ | ☑ | ☑ | ☑ | ☐ |
| 5 | Out_Coolant_Presure_Switch | Real | 12.0 | 0.0 | 0.08246528 | ☑ | ☑ | ☑ | ☑ | ☐ |
| 6 | Out_Temperature_Sensor | Real | 16.0 | 0.0 | 22.09925 | ☑ | ☑ | ☑ | ☑ | ☐ |
| 7 | Out_Flow_Meter | Real | 20.0 | 0.0 | 15.10308 | ☑ | ☑ | ☑ | ☑ | ☐ |
| 8 | Out_Indramat_Speed | Real | 24.0 | 0.0 | -14.93604 | ☑ | ☑ | ☑ | ☑ | ☐ |
| 9 | Out_Indramat_Torque | Real | 28.0 | 0.0 | -0.4340363 | ☑ | ☑ | ☑ | ☑ | ☐ |
| 10 | Out_Cooling_On | Real | 32.0 | 0.0 | 0.0 | ☑ | ☑ | ☑ | ☑ | ☐ |

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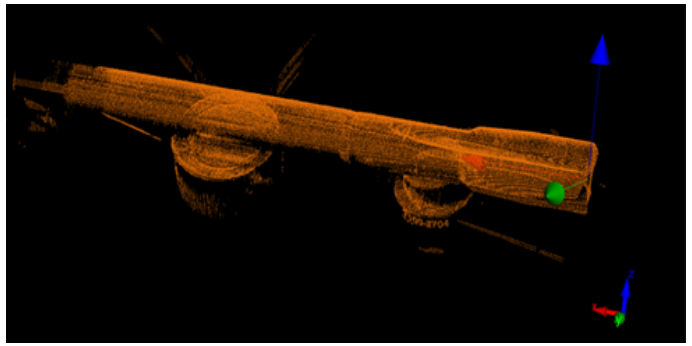
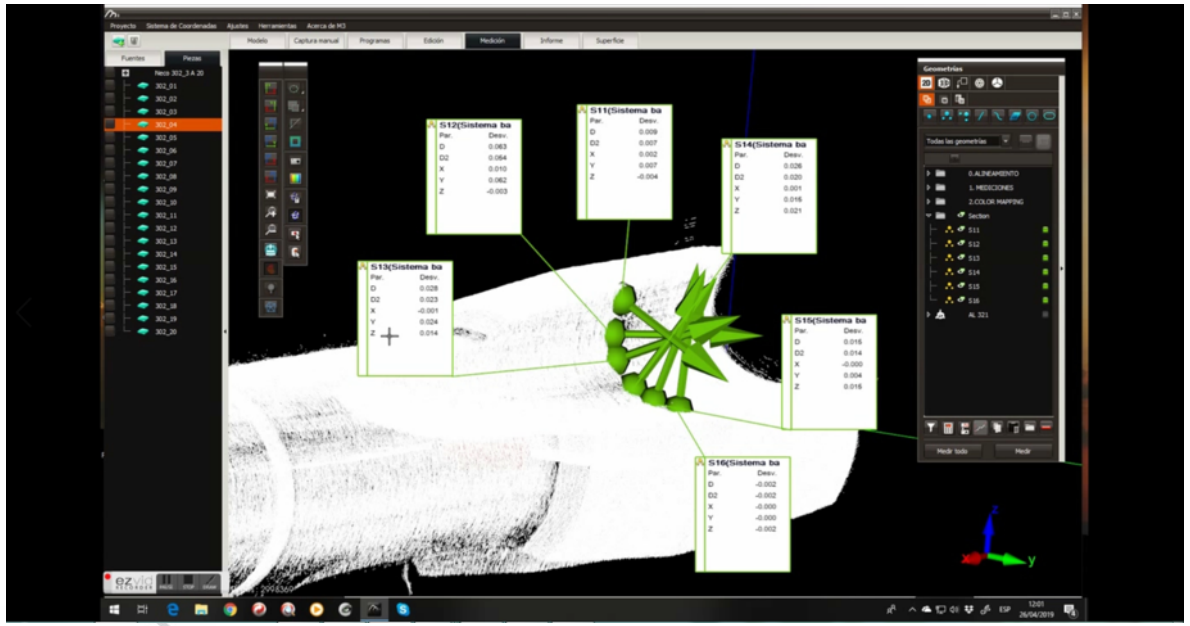
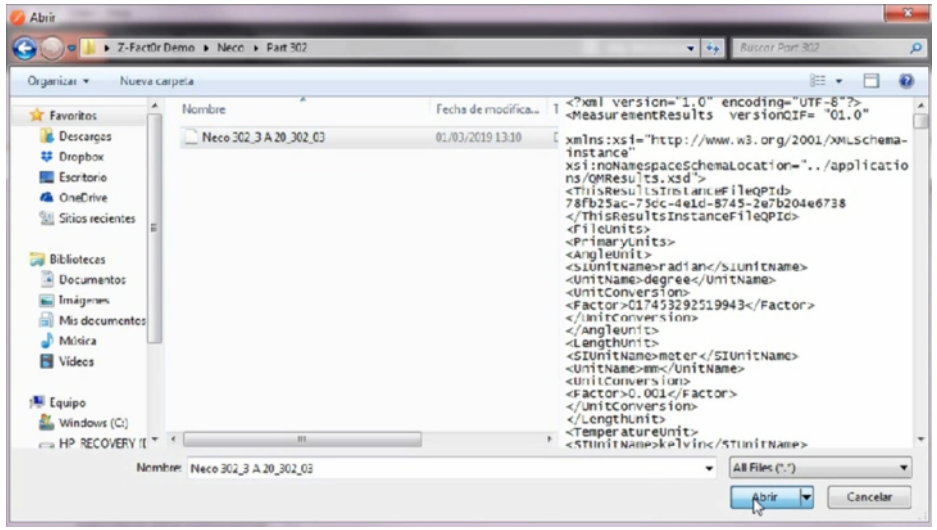
# Smart Factory – Product Digital Twin



Automatic quality inspection thanks to INNOVALIA software: measurement of parameters which are critical for the eventual tap performance






QIF (ISO 23952:2020) as framework for Data Storing and Interoperability throughout the product lifecycle, also allowing Traceability

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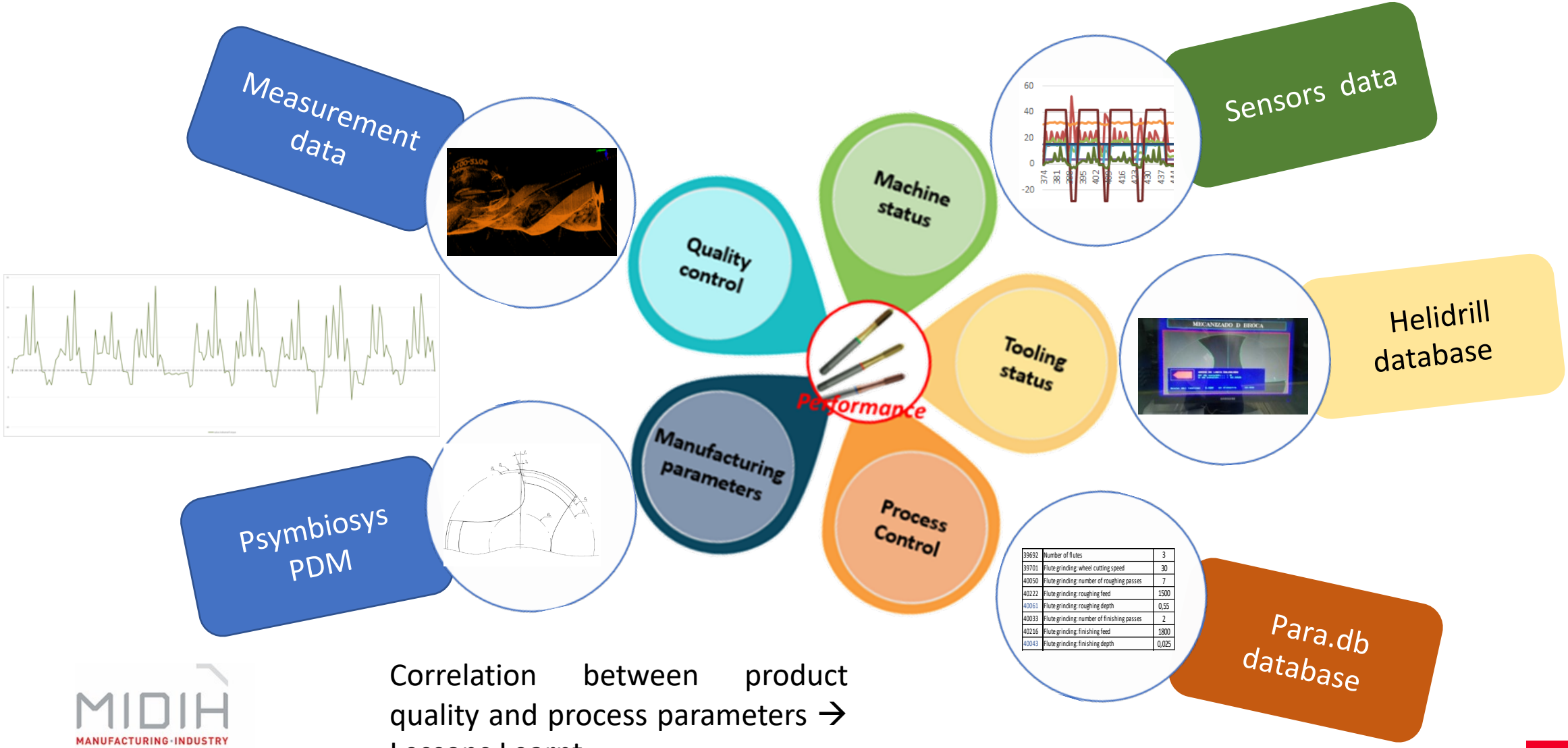
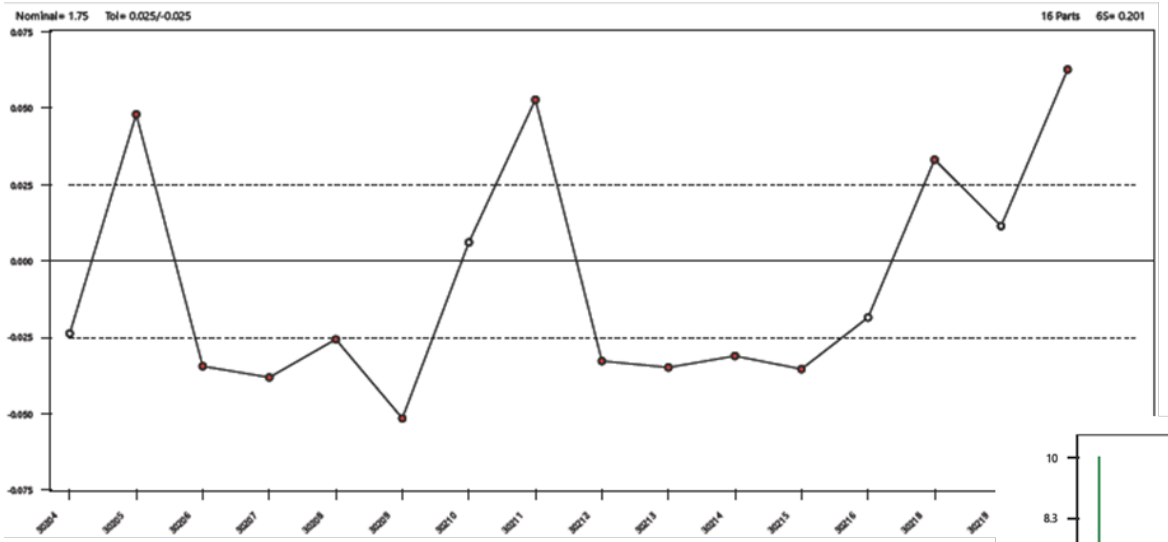
# Smart Factory – Smart Production Analysis

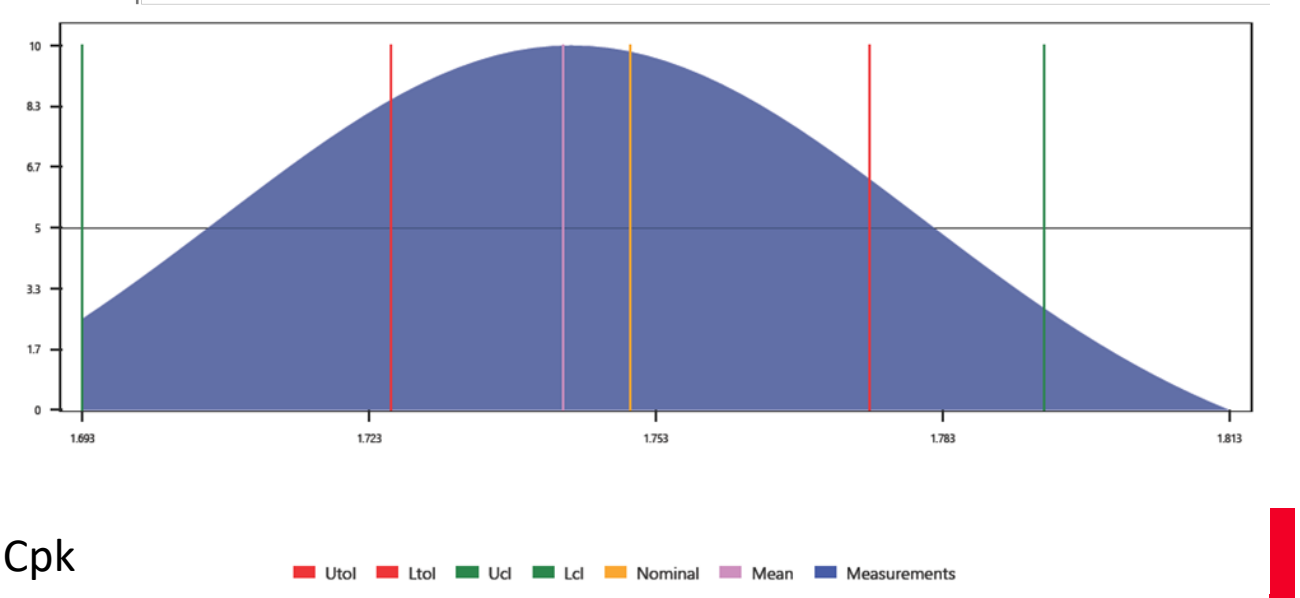



Correlation between product quality and process parameters → Lessons Learnt

# Smart Factory – Smart Production Analysis




Narrowing tolerances to observe the repeatability




SPC and Estimation of the Cp and Cpk

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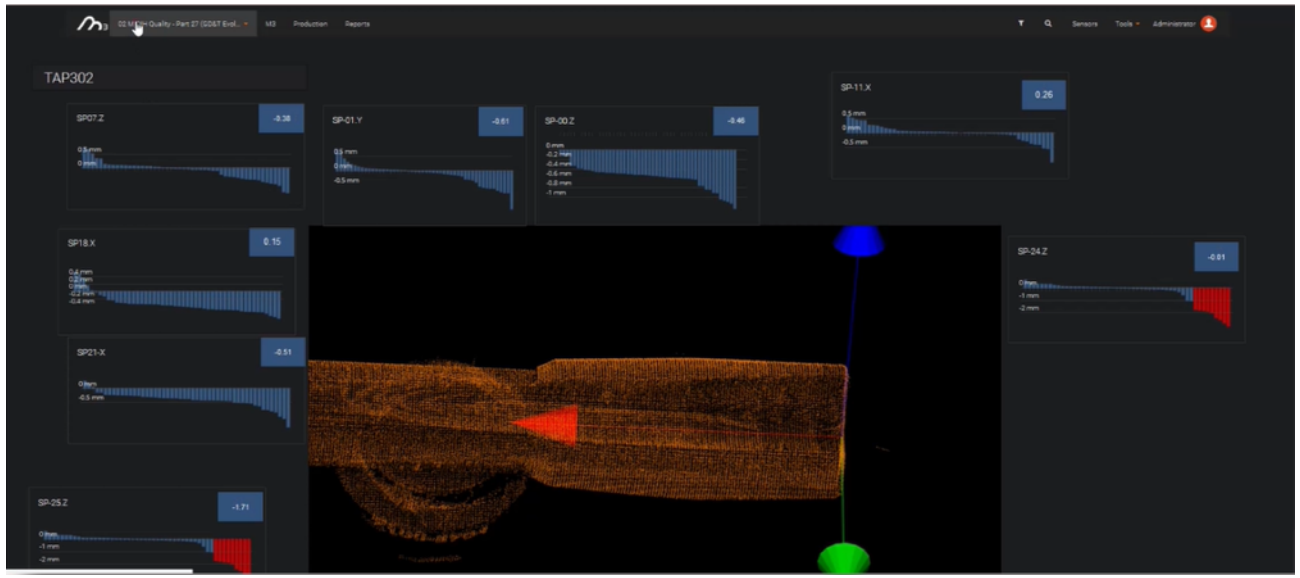
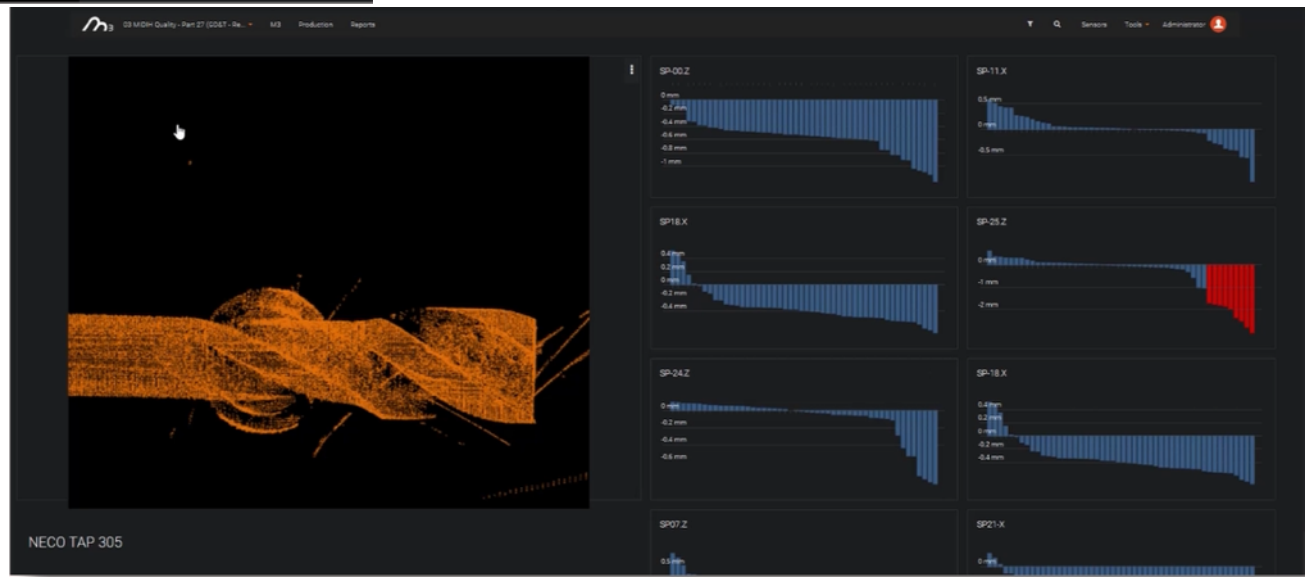
# Smart Product




Ability to share production data and tool usage with OEMs through trusted industrial data spaces

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# Key Process Indicators for the Experiment

| Level | Indicator | Change |
|---|---|---|
| Tactical | Tap reworking | 25% reduction |
| Operational | Defective product manufacturing | 10% reduction |
| Operational | Lead time to the customer | 15% reduction |

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# The Lighthouse Experiment in Automotive

Julien Mascolo- CRF

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# MIDIH in the Automotive sector

## Objectives

1. Enable the quality assessment and predictive maintenance
2. Supply chain efficiency improvement
3. Creation of a network of maintenance services and components supplier

## Impact

- Plant productivity increase
- Reduction of the environmental impact
- Reduction of total cost for each vehicle produced

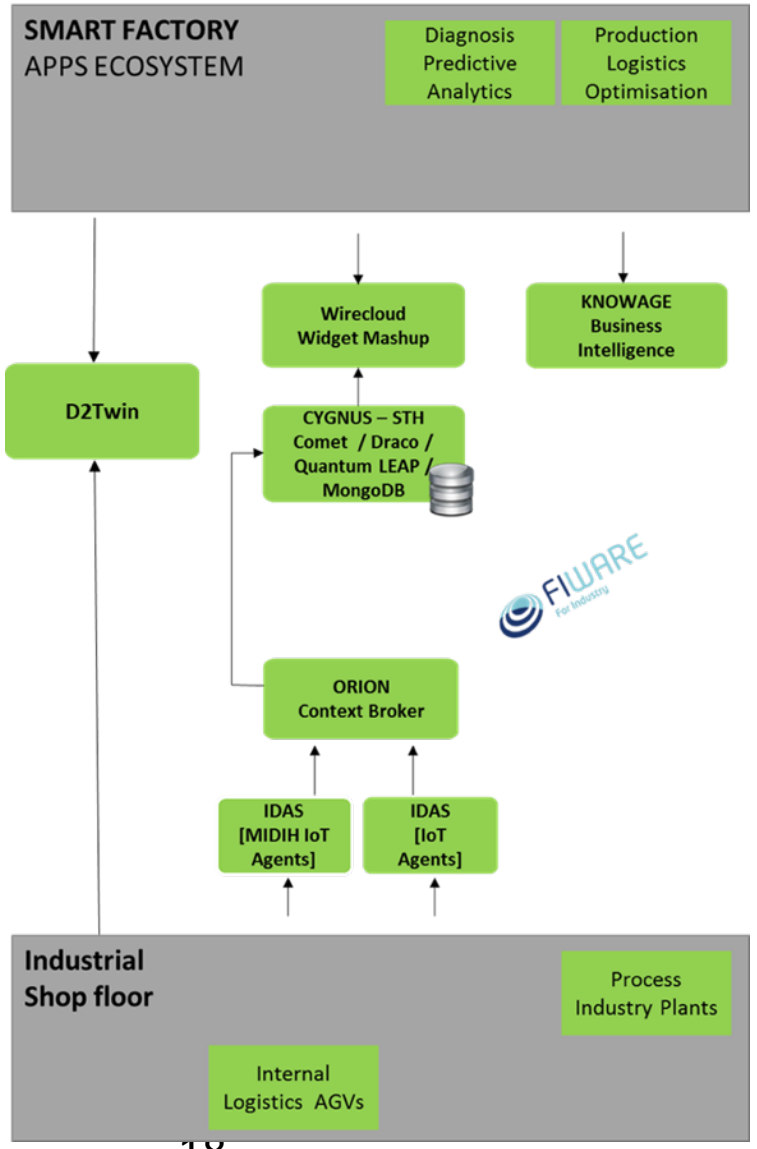
# Smart Factory scenario

## MAIN OBJECTIVE:

Enable the predictive maintenance of welding cells located in FCA plants in Italy, in order to improve the quality of the final product and avoid unexpected events (i.e. line stops).

## AS-IS SITUATION:

- Need to maximize the **machine saturation**;
- Machine **unplanned maintenance**, causing delays in production , need for rescheduling and then additional costs;
- No **prediction of events**, in order to have a proactive approach and prevent possible issues;
- **Data analysis not performed in real time**, making it difficult to detect and handle potential issues in time;
- **Wastes** in terms of materials and time, because of reparation and rework operations due to low quality products, with consequent environmental impact and additional costs.



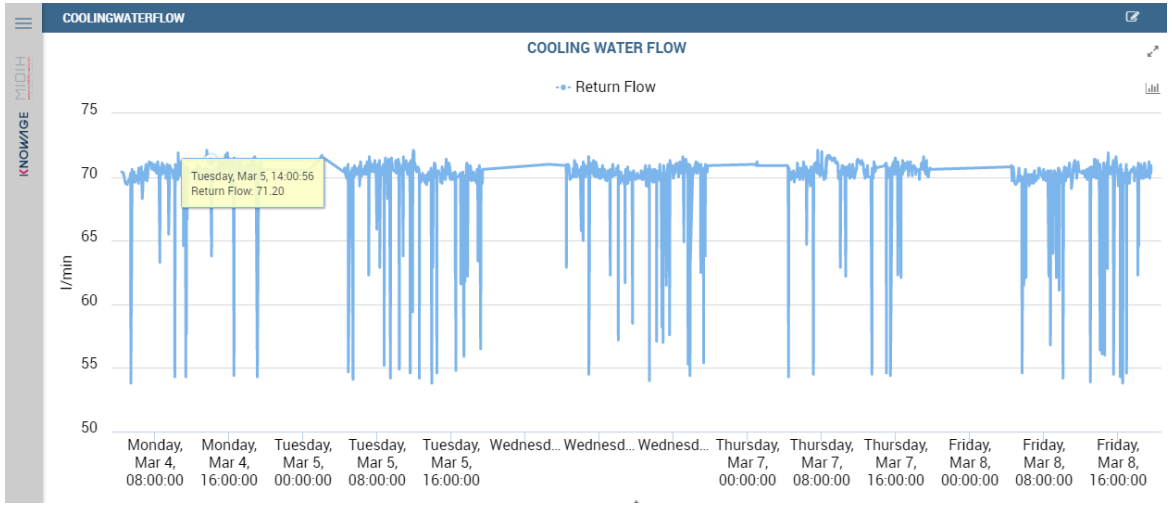
# Smart Factory scenario

**TO-BE SITUATION:**

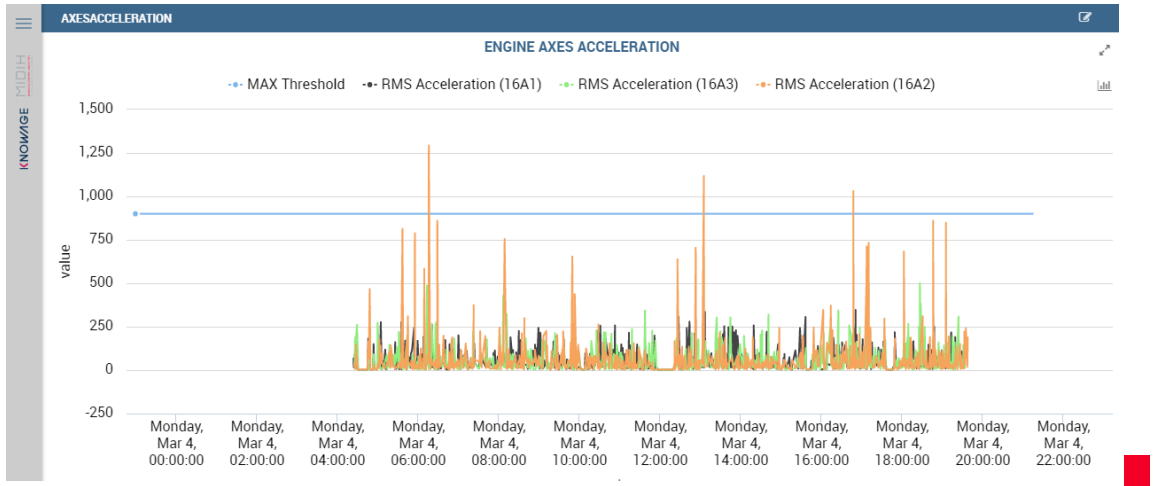
The solution implemented has allowed:

- The possibility to **monitor** the behavior of parameters related to the welding process;
- To receive **notification** in case the values are out of the expected range.
- I**dentification and prediction of events** thanks to the Data Analytics tool included in the Open Source platform
- Reduction of scraps and improvement of the **OEE** (Overall Equipment Efficiency)

Welding cell




Water flow capacity data visualization




Robot axes acceleration values and related threshold

# Smart Supply Chain scenario

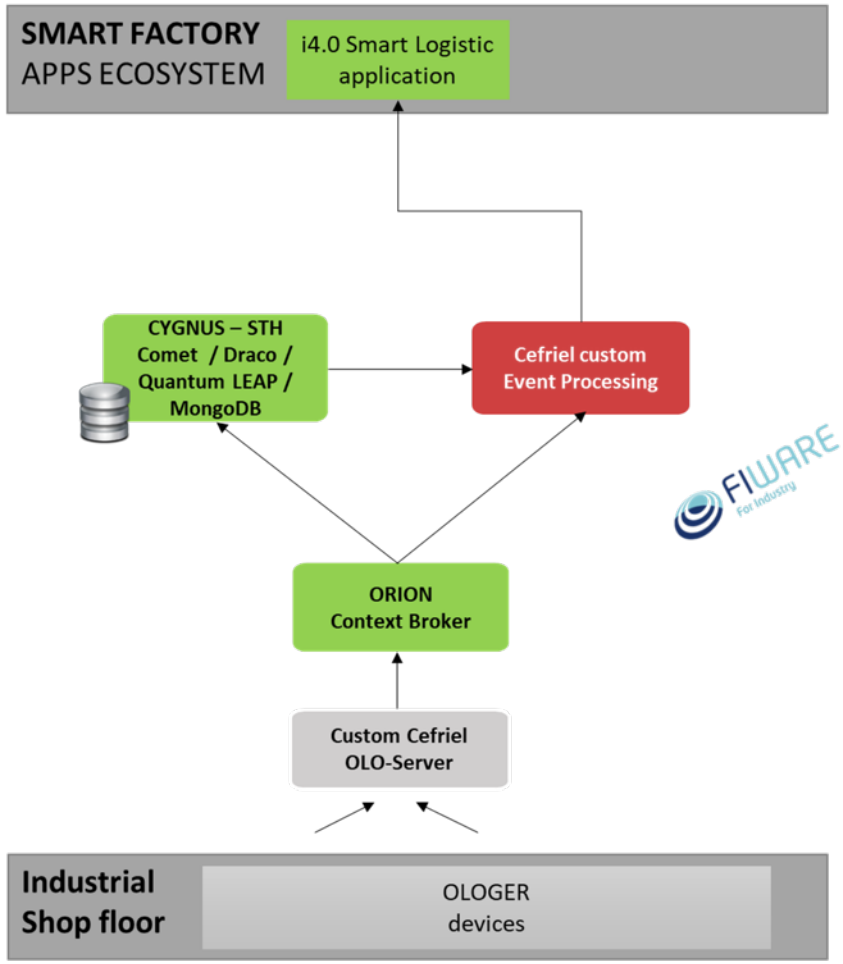
**MAIN OBJECTIVE:**

Improvement of the **efficiency of the supply chain**, by implementing and using solution that, by mean of both **FIWARE and custom components**, allows a **better knowledge and understanding** of the events that can happen during the shipment of components from the supplier plant to the production plant.

**AS-IS SITUATION:**

- **Data about supply status not detected and collected**, since only starting and arrival time was traced; no information about parameters related to the supplied components was detected during the transport, for example temperature, humidity, vibrations, that need to be traced during the shipment from the supplier plant to the production plant;
- **Events not identified and traced**, because there was no monitoring of parameters on transported components, in order to identify events and reduce delays that can cause rescheduling of the production;
- **No prediction of events**, since there weren't any devices and systems able to monitor parameters to predict damages and delays that can happen during the transportation of critical components;

# Architecture for the Smart Supply Chain scenario



# Video on the I4.0 Smart Logistic application

# I4.0 Smart Logistic application: Ologer installation


Ologer on Stabilizer bar container

# I4.0 Smart Logistic application: Ologer installation

Ologer on Airbag container

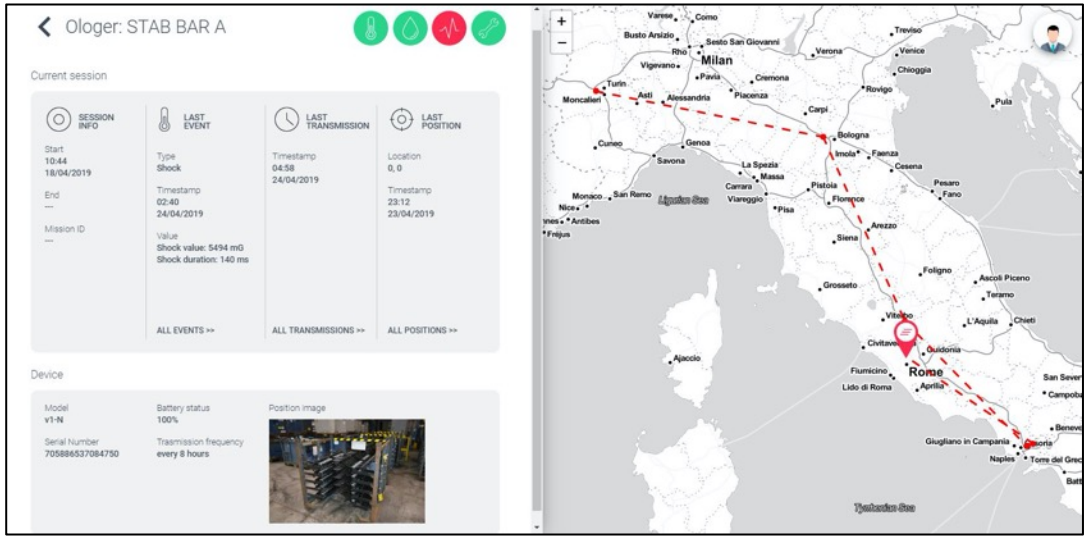
Ologer on Skydome roof container


Ologer on Automotive Lighting container

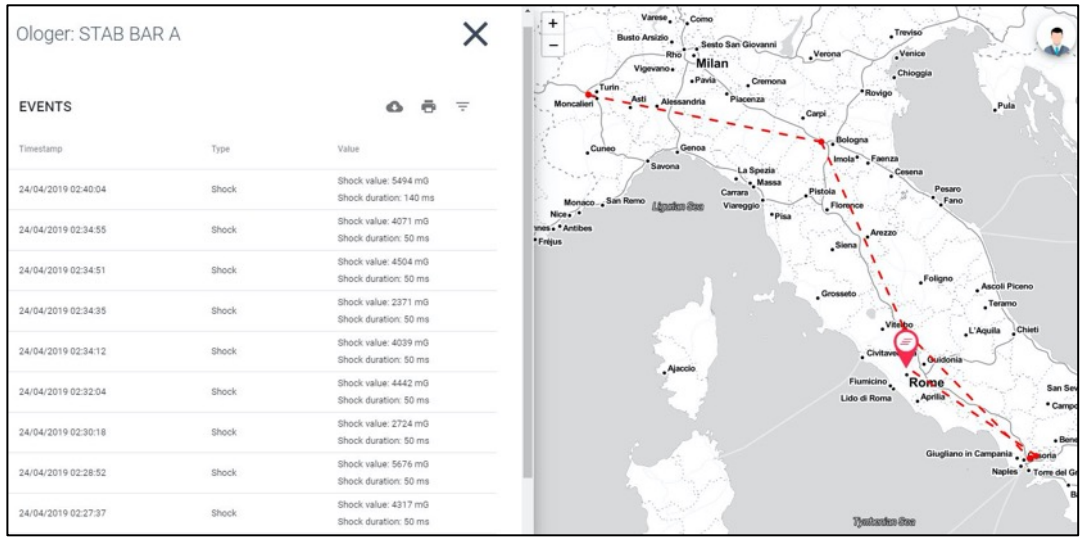
# I4.0 Smart Logistic application

Parameters monitored:

- GPS position
- Temperature
- Humidity
- Vibrations
- Shocks


Full view of the application




View of all the events

## TO-BE SITUATION:

- ✓ **Data Visualization**: enables the user to contextualize and understand parameters trends;
- ✓ **Data Monitoring**: gives to the user the possibility to have notification in case parameters are out of the predefined range, in order to understand in advance possible issues during the shipment. i.e. to know in advance delays and update the ETA.

# Overall benefits due to MIDIH Open Platform

- **Welding process efficiency improvement:**
  - ❑ Quality of the final product increase
  - ❑ Process costs decrease
  - ❑ Wastes reduction

- **Supply Chain efficiency improvement**:
  - ❑ Quality of the final product increase
  - ❑ Costs per vehicle produced decrease
  - ❑ Wastes reduction
  - ❑ Knowledge about components supply
- **Starting the creation of a network of services and components supplier**: the platform allows the collaboration between the company and its suppliers, thanks to the involvement of both services and components suppliers. The collaboration and sharing of knowledge and information is easier. Further step in the innovation related to Industry 4.0 are being done both for FCA and for the other companies in the ecosystem.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# Cross border experimentation in steel supply chain

Sebastian Steinbuss - IDSA

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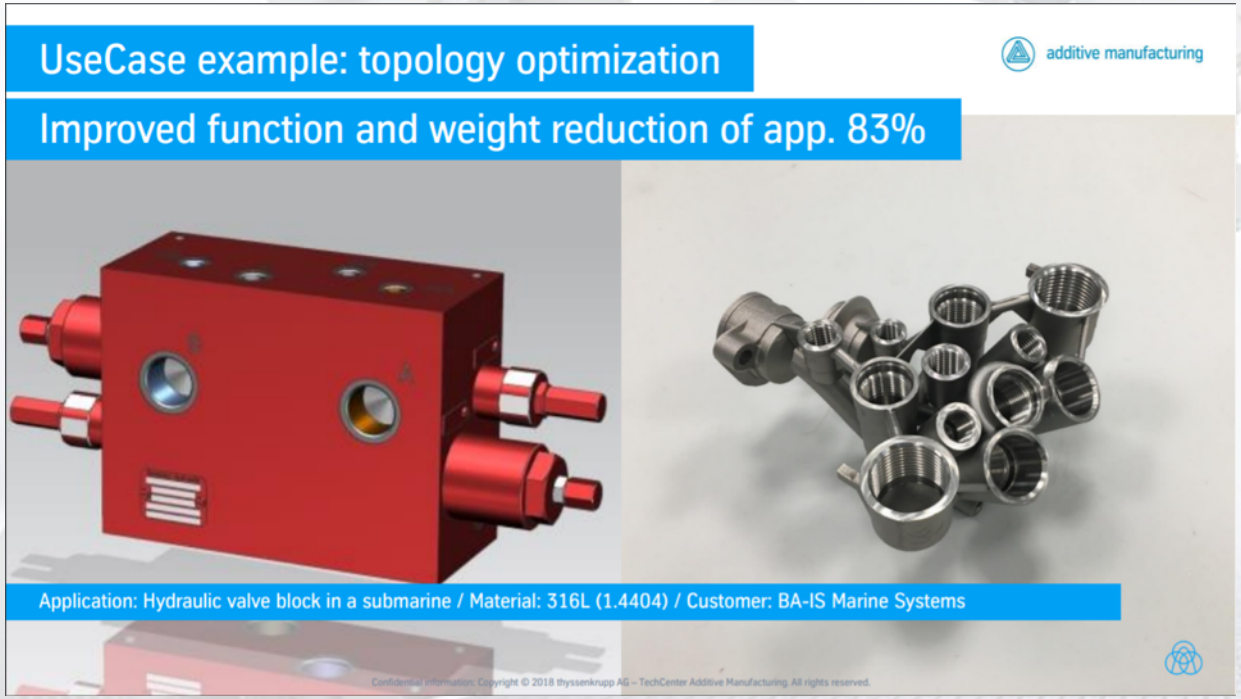
# Applied Additive Manufacturing in the MIDIH experimentation




Picture Source: www.defensenews.com

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# The Value Chain is breaking down hierarchical Structure and move towards Dynamic ecosystems

## Digital Twin

Distributed, access and usage controlled dataset with comprehensive insights into design and production aspects of parts. Will be further enriched with data from the lifecycle

## Engineering

Create a digital representation based on requirements

## Service Composition

Choose from service landscape/ marketplace a set of fitting services (iterative)

## Ecosystem Enabling

Enable Findability, Accessibility, Interoperability and Usability of data assets

Requirements

Information Flow

Material Flow

Logistics Service Provider


## Alignment of planning and execution

By providing access to planning data of all participants in the value chain and in the supply chain, the planning processes and the execution process become better aligned. This leads to more flexibility, robustness and transparency.

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# Open data driven manufacturing ecosystem need Open Source

## Interoperability

- Standards drive interoperability cross the borders of companies and security domains.
- Open Source drives this from paper to source code.

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## Increase development speed

- Supply chains and value chains are getting more flexible and agile.
- All participants need to adapt to new needs more frequently.

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## From competition to coopetion

- This leads to costs for every participant to leverage the benefits.
- Joint efforts can decrease costs and increase benefits.
- But a shift in the mindset is required: **from competition to coopetition**

DIH

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# THANK YOU!

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