Creating value by AI and Big Data: Industrial Applications, Challenges and Outlooks

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Industry 4.0 Big Data & AI Transformation

AI for Factories 4.0 – G20

- AI is a key enabler for the next generation of smart manufacturing.

- It can lead to a **disruption** in
  - traditional workflows,
  - supply chains,
  - value creation, and
  - business models in manufacturing

and works towards empowering and expanding workforce expertise.

- AI for internet services to manufacturing will pave the way to the synergietic collaboration between humans and robots in urban autonomos factories for mass customization.

Boost 4.0
BIG DATA FOR FACTORIES

Big Data Value Spaces
for CO**mpetitiveness of European
CO**nnected **S**mart Fac**T**ories 4.0

Project No:780732

Duration: 36 months

Start date: January 1st 2018

Partnership: 50 partners, 16 countries

Strategic Objective: ICT-15-2016-2017 (Big Data Lighthouse)

Total Eligible Cost: 18,925,990.00 €

EC Contribution: 14,983,566.26 €

Project Web Site: www.boost40.eu

Coordination

innovalia ASSOCIATION

Scientific Management & Digital Transformation

Leibniz Universität Hannover   **iti** Information Technologies Institute   **CARSA**   **INTRASOFT** INTERNATIONAL

Big Data Infrastructure

TTTech Ensuring Reliable Networks   **Telefónica** |epcc| **i2cat**   Institut Mines-Télécom

Factory 4.0 Big Data Expertise

ATB   **RISC** Software GmbH   **UNINOVA**   ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE   POLITECNICO MILANO 1863   **imec**   CHALMERS UNIVERSITY OF TECHNOLOGY   **Fraunhofer** IEM

Big Data Tools & Smart Machines

SIEMENS   **VISUAL COMPONENTS**   **esi** get it right®   **IBM**   **§.SAS**   **capvidia**   **ATLANTIS**   UNPARALLEL   **asti**   **TRIMEK** METROLOGICAL ENGINEERING   **PRIMA INDUSTRIE**

Lighthouse Factories 4.0

VW   **Fill** YOUR FUTURE   **+GF+**   **FCA** FIAT CHRYSLER AUTOMOBILES / Jeep   **PHILIPS**   **Gestamp**   **VOLVO**   **Whirlpool** CORPORATION   **BENTELER**

Replication Factories 4.0

United Technologies   PIACENZA   VISTA ALEGRE Atlantis PORTUGAL

Open Communities

universität bonn   **redborder**   INDUSTRIAL DATA SPACE ASSOCIATION   **FIWARE** FOUNDATION   it's owl

Certification & Standards

sqs   **W3C**

BOOST 4.0 Big Data & AI Industrial Applications
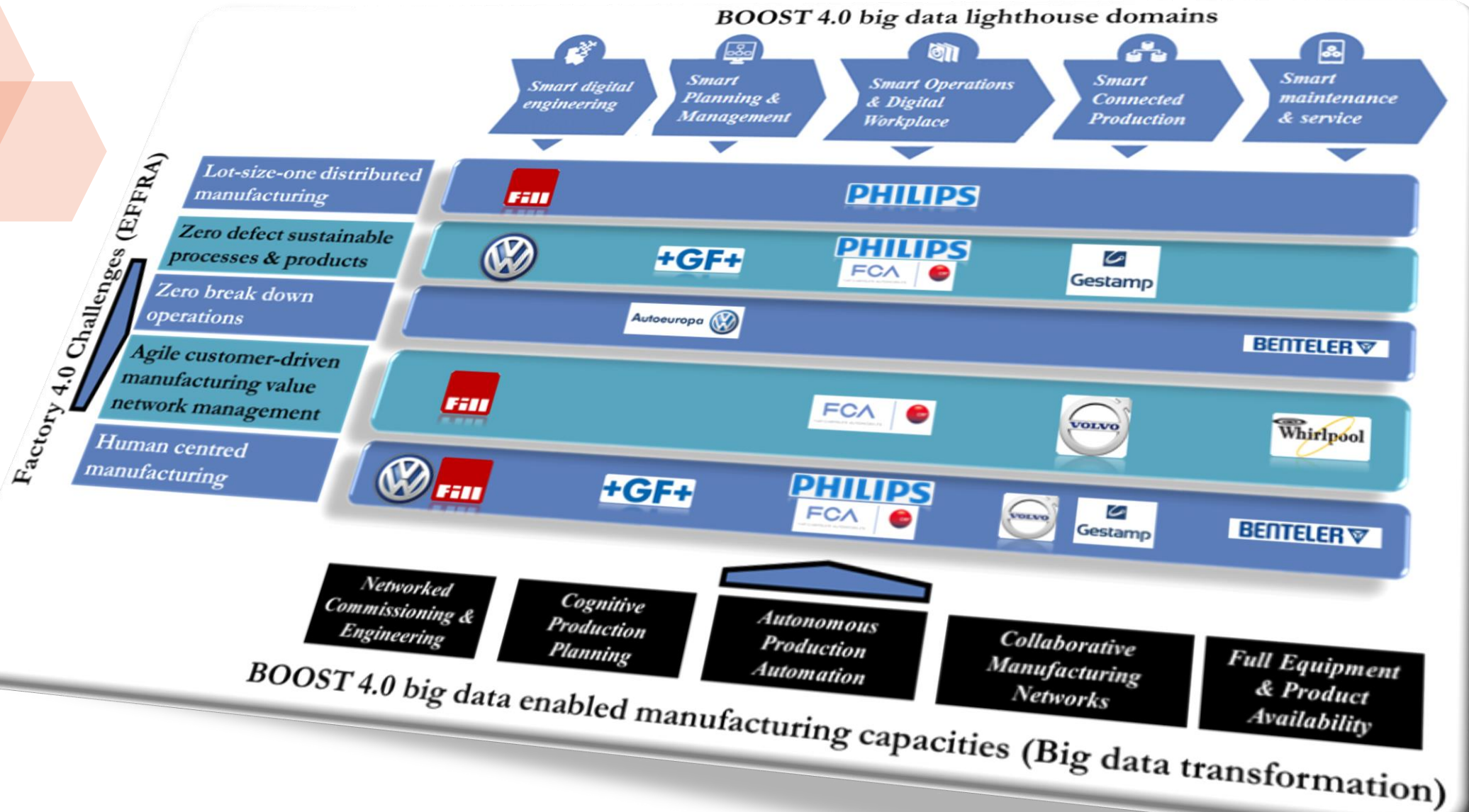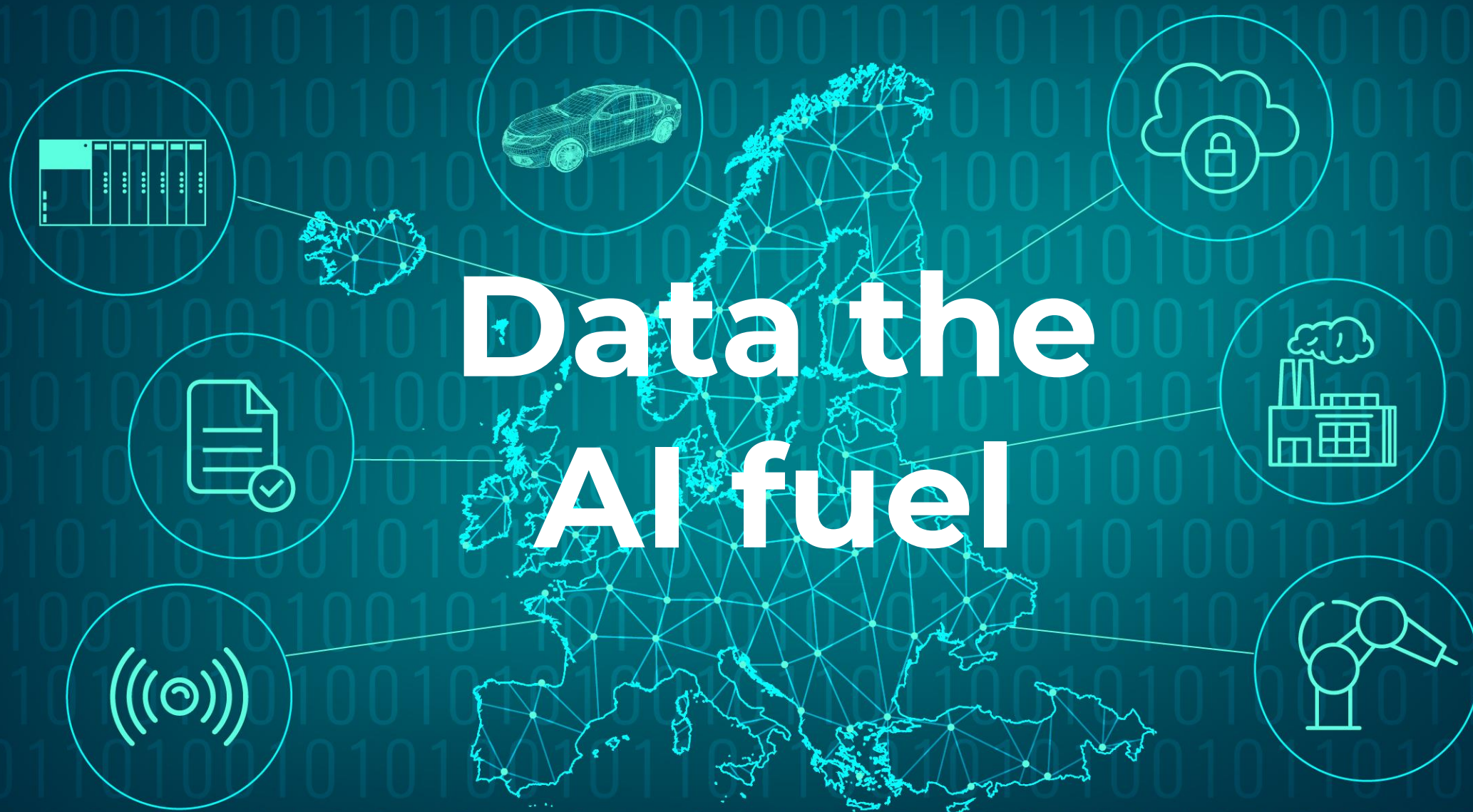
FACTORIES 4.0

10 Lighthouse

Automotive (6)
Machine Tool (2)
White Goods & Appliances (2)

3 Replication

Textile
Ceramics
Elevation / AERO

VOLVO

PHILIPS

+GF+

Otis
A United Technologies Company

RIA STONE

Gestamp

Volkswagen

VW

BENTELER

Fill YOUR FUTURE

PIACENZA

CRF

Whirlpool
CORPORATION

📍 Lighthouse Factory 4.0
📍 Replication Factory 4.0

AI for Factories 4.0 – G20 Industrial Applications

What is AI intended for in Factories 4.0?

1. Hybrid Teams of Human Workers and Collaborative Robots in Smart Factories
2. Deep Learning for State-based and Predictive Maintenance of Networked Production Machines and for Understanding Human Behaviors of Shop Floor Workers
3. Semantic Technologies for Worldwide Interoperability of Machine-to-Machine Communication in Smart Factories and Logistics
4. Human-Aware and Real-Time Production Planning & Scheduling for Multiagent Systems and Dynamic Plan Revision
5. Intelligent Industrial Assistance Systems for Human Workers: Proactive and Situation-Aware On-line Help and Training on the Shop Floor
6. Trusted Industrial Data Exchange Hubs and Machine Learning for Industrial Process Mining
7. Active Digital Product Memories and Digital Twins for Intelligent Asset Tracking and Production Cockpits
8. Security Technologies for Intelligent Intrusion Detection and Penetration Testing for Smart factories
9. Long-Term Autonomy and Self-Learning as well as Self-Healing Capabilities of Industrial Components

G20 GERMANY 2017
HAMBURG

Big Data Factory 4.0 Competitive Advantages

(1) VW zero defect factory 4.0 virtual **commissioning**

(2) FILL lot-size-one machine tool **circular** engineering factory 4.0

Smart Digital Engineering

(3) VWAE real-time **self-learning** virtual factory 4.0

(4) +GF+ machine tool **optimum** production factory 4.0

Smart Planning

(5) FIAT **autonomous** assembly line factory 4.0

(6) Philips **mass customised** consumer electronics manufacturing line

Smart operations & digital workplace

(7) Volvo truck **digital** assembly factory 4.0

(8) GESTAMP automotive part **resource efficient** factory 4.0

Smart connected production

(9) Benteler **predictive** factory 4.0

(10) Whirlpool whitegoods spare part **sensing customer** service factory 4.0

Smart maintenance & service

Big Data Factory 4.0 Processes

Smart Digital Engineering

Smart Planning

Smart Operations & Digital Workplace

Smart Connected Production

Smart Maintenance & Service

Big Data/AI Factory 4.0 - Opportunities

Smart Digital Engineering

Pilot Area 1	Smart digital engineering	VW	Fill
BOOST 4.0 Transformation Value	Networked Commissioning and Engineering		
	Description: Short time-to-market of innovative customised products is a key success factor for industrial companies. Integrating big data feedback information from operation and maintenance phases into the engineering phases will shorten the time for real plant or factory commissioning in lot-size-1 production facilities		

Smart Planning

Pilot Area 2	Smart Planning & Management	Autoeuropa VW	+GF+
BOOST 4.0 Transformation Value	Cognitive Production Planning		
	Description: Allow system wide visibility and data flow and analysis from the shop-floor to the top floor to the global value chain will allow manufacturing companies to trade on their production capacity, manufacturing planning schedules and production costs to perform dynamic end-to-end production planning across flexible value networks.		

Smart Operations & Digital Workplace

Pilot Area 3	Smart operations and digital workplace	FCA	PHILIPS
BOOST 4.0 Transformation Value	Autonomous Production Automation.		
	Description: Multi-source high-speed production data processing in workplace-process-human-machine context evaluation is critical for shop-floor productivity and safety concerns. Machine learning based high-performance production data analysis is key for system autonomy-automation and augmented human competences.		

Big Data/AI Factory 4.0 - Opportunities

Smart Connected Production

| Pilot Area 4	Smart Connected Production	Gestamp	VOLVO
BOOST 4.0 Transformation Value	Collaborative Manufacturing Networks.		
	Description: Hundreds of thousands of parts, provided by multiple supplier facilities across the globe, go into large complex product such as automotive or smart home appliances. Big data connects physical production world with the digital twin. Big data transparency means continuous process coordination and enables quality control within and across the complete value chain		

Smart Maintenance & Service

Pilot Area 5	Smart maintenance & service	BENTELER	Whirlpool
BOOST 4.0 Transformation Value	Full Equipment and Product Availability.		
	Description: Continuous product or machine data means continuous analysis, risk assessment, and process coordination resulting in better customer experience, fewer field service calls, optimum spare part distribution and prescriptive maintenance.		

The Algorithm

Challenges for AI in manufacturing

Common standards and a free flow of industrial data in a secure and safe (trusted) environment in Europe are a prerequisite for AI applications in Factories 4.0.

Complexity of machine learning may reduce the justification for consequential decisions to "the algorithm made me do it". Not acceptable in a healthy & safe Factory 4.0 (human centered).

European Industrial Data Space
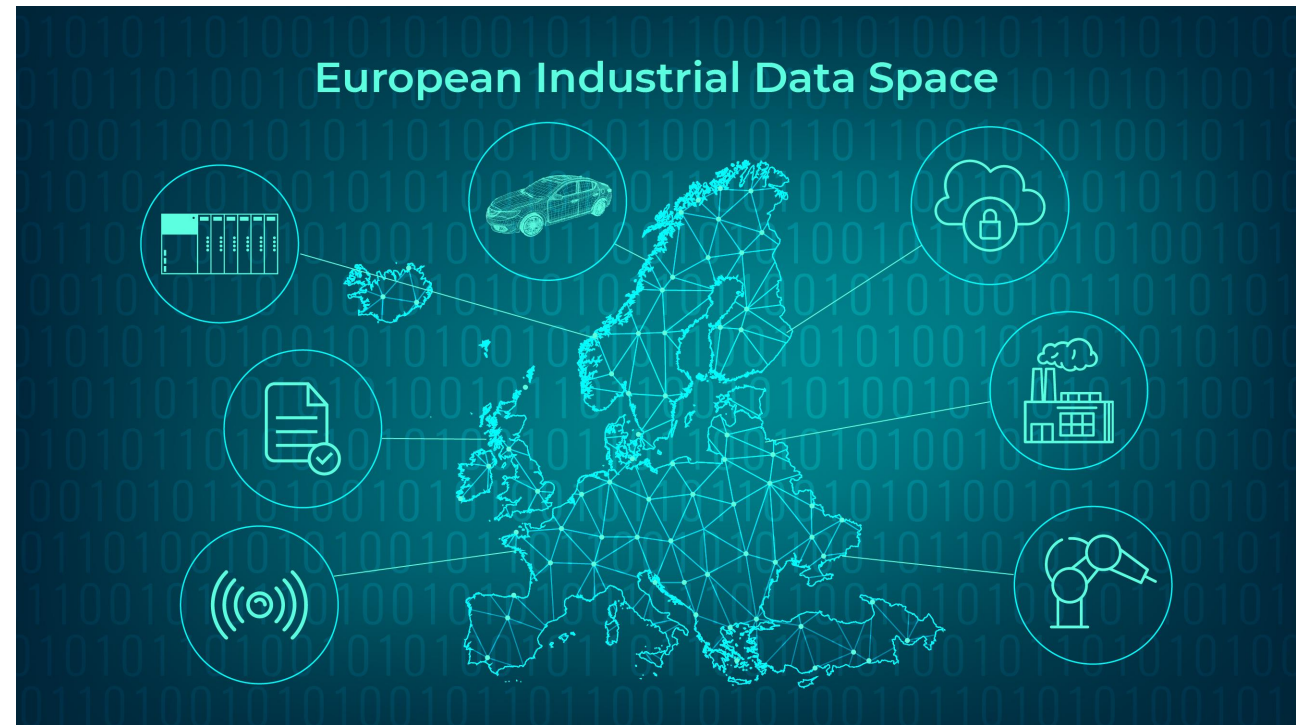
Challenges for AI in manufacturing

- **Transparency and trust** of such Algorithmic Systems (data & algorithms) becoming competitiveness factors for Data-driven economy ;

- Importance of **remedying the information asymmetry** between the producer of the digital service and its consumer, be it citizen or professional

- **Dominant platforms** on the market play a role of "prescriber" – rank

Descriptive Analytics	Predictive Analytics	Prescriptive Analytics
100 mid-size customers bought product X last year	10% of our cusomters will grow to mid-size next year and be eligible for up-sell to product X	Customer A is up for renewal in 30 days and just reported higher earnings. Up-sell to product X and pair with complimentary product Y

Challenges for AI in manufacturing

- Transparent-by-design, auditable-by-design, fairness & non-discrimination-by-design.
  - Fact checking & information flow monitoring & Viz.
  - Causal discovery & digital evidences.
  - Deep model & architecture interpretability
  - AI reproducibility
  - Data provenance & usage monitoring

Thanks!

Any questions?

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🌐 www.boost40.eu
🐦 boost4_0
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