

FRAUNHOFER AUSTRIA RESEARCH

Industry 4.0

State of the Art and Practical Examples

Riga, September the 6th, 2018



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Division Production and Logistics Management

Vienna University of Technology
Institute for Management Science
Department
Industrial and Systems Engineering



Agenda



■ Fraunhofer Austria

Short Introduction

■ Digital Transformation

Digitization, Industry 4.0 and Industrial Data Science

■ State of the Art

Research and Best Practice Examples

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Research and Best Practice Examples

Fraunhofer-Gesellschaft

The leading organisation for applied research in Europe

68 institutes, 80 research facilities

25 000 employees

€ 2.2 bn. EUR research budget

2/3 of Project Turnover from Industry-Projects

1/3 of Project Turnover from Public Research-Projects

Managing Director

Univ.-Prof. Dr.-techn.
Dieter W. Fellner

San José, CA

Washington, DC

Managing Director

Univ.-Prof. Prof. Dr.-Ing. Dr. h.c. Wi
Dr. Ingrid Isenhardt

Lisbon, Portugal

12.000 projects

(Industrial and public)

3.000 customers

Smart solutions in visual computing

■ = Research

● = Representative Office

72 institutes, 80 research facilities in Europe
~ 25 000 employees
€ 2,3 bn annual research budget
2/3 by Project Turnover of Industry-Projects
1/3 by Project Turnover of Public Research-Projects

Fraunhofer Austria Research GmbH

Non-Profit GmbH as a legal entity under the umbrella of Fraunhofer in Austria

Division: **Production and Logistics Management in Vienna**

Division: **Visual Computing in Graz**

Life Sciences
Microelectronics
Materials and Components
Surface Technology and Photonics
Information and Communication Technology

7 Alliances

- Microelectronics
- Production
- Information and Communication Technology (SPeCT)
- Materials and Components
- Life Sciences
- Surface Technology and Photonics
- Defence and Security

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Fraunhofer
PRODUKTION

4

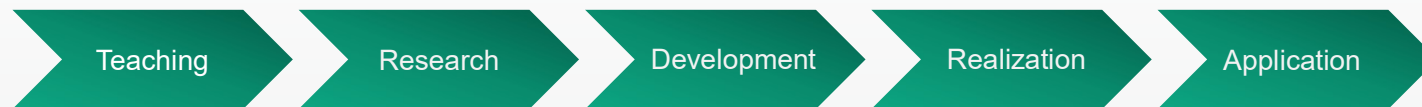
IMTS2018

TU WIEN
TECHNISCHE UNIVERSITÄT WIEN

Fraunhofer
AUSTRIA

Fraunhofer Austria Research GmbH

Connected with Science and Practice



Teaching

- Cooperation between Fraunhofer, TU Wien and TU Graz
- Involvement of Fraunhofer in Teaching / Involvement of Students in R&D and consulting projects via master thesis and employment

Applied Research

- Research for the benefit of businesses and as an advantage for society
- Development of innovative, industry oriented methods and technologies

Projects Financed by Industry

- Scientific findings translated in usable innovations
- Provider of Know-How for small and medium-sized enterprises without R&D departments on their own

TU Wien

Initiatives in Austria

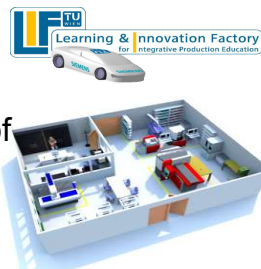
Plattform Industrie 4.0 Austria

- Industrie 4.0 Austria – the platform for intelligent production



Learning & Innovation Factory

- Display of a factory as a demonstration laboratory
- Learn environment for a hands on training of methods
- Industry-orientated and integrative education for industrial engineers



Pilot-Demonstration Plant

- Representation of a physical and virtual display of a best case factory
- Bundle of different competences of industry partners and research
- New prototypes, production technologies and systems as well as process technologies are tested together in a safe environment



Doctoral College

- Initiative of TU Wien
- Productivity- and Employment-oriented Working System Design in CPPS
- Virtual Engineering Design of CPPS
- Cell Controller Design for Robotized Manufacturing Cells in the Smart Factory



Endowment Professorship

- Financed by:
 - Funding by BMVIT (Austrian Federal Ministry of Traffic, Innovation and Technology)
 - Equity capital of university
 - Cash payment of co-financing partners
- Includes the development and establishment of new research topics in Austria
 - such as Human Centered Cyber Physical Production and Assembly Systems by Sebastian Schlund



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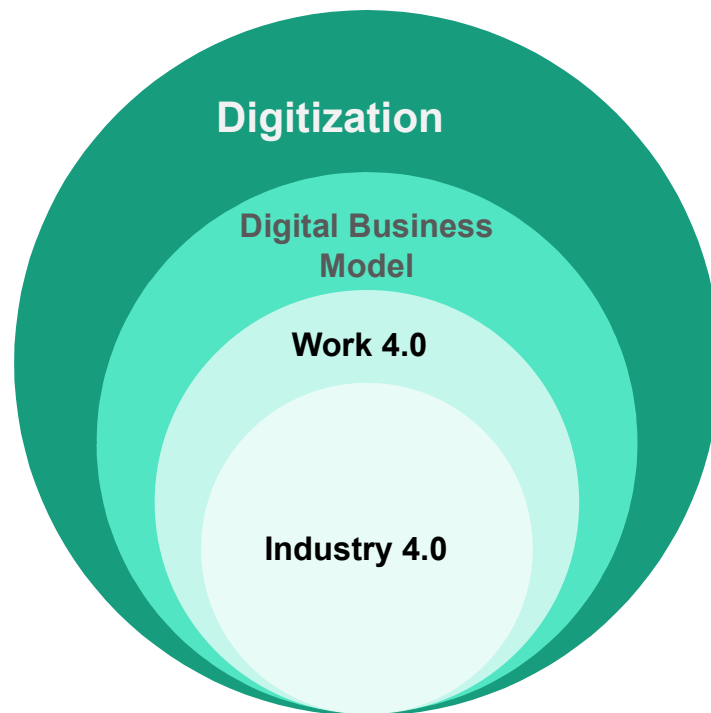
Digitization, Industry 4.0 and Industrial Data Science

■ State of the Art

Research and Best Practice Examples

Classification of Terms

Digitization, Digital Business Models, Work 4.0, Industry 4.0



- **Digitization:** Conversion of analogue Information into digital, binary signals
- **Digital Business Model:** Innovation of business models driven by digitization
- **Work 4.0:** Impact of digital technologies and business models on the working environment
- **Industry 4.0:** Connecting humans, machines, products etc. in real time

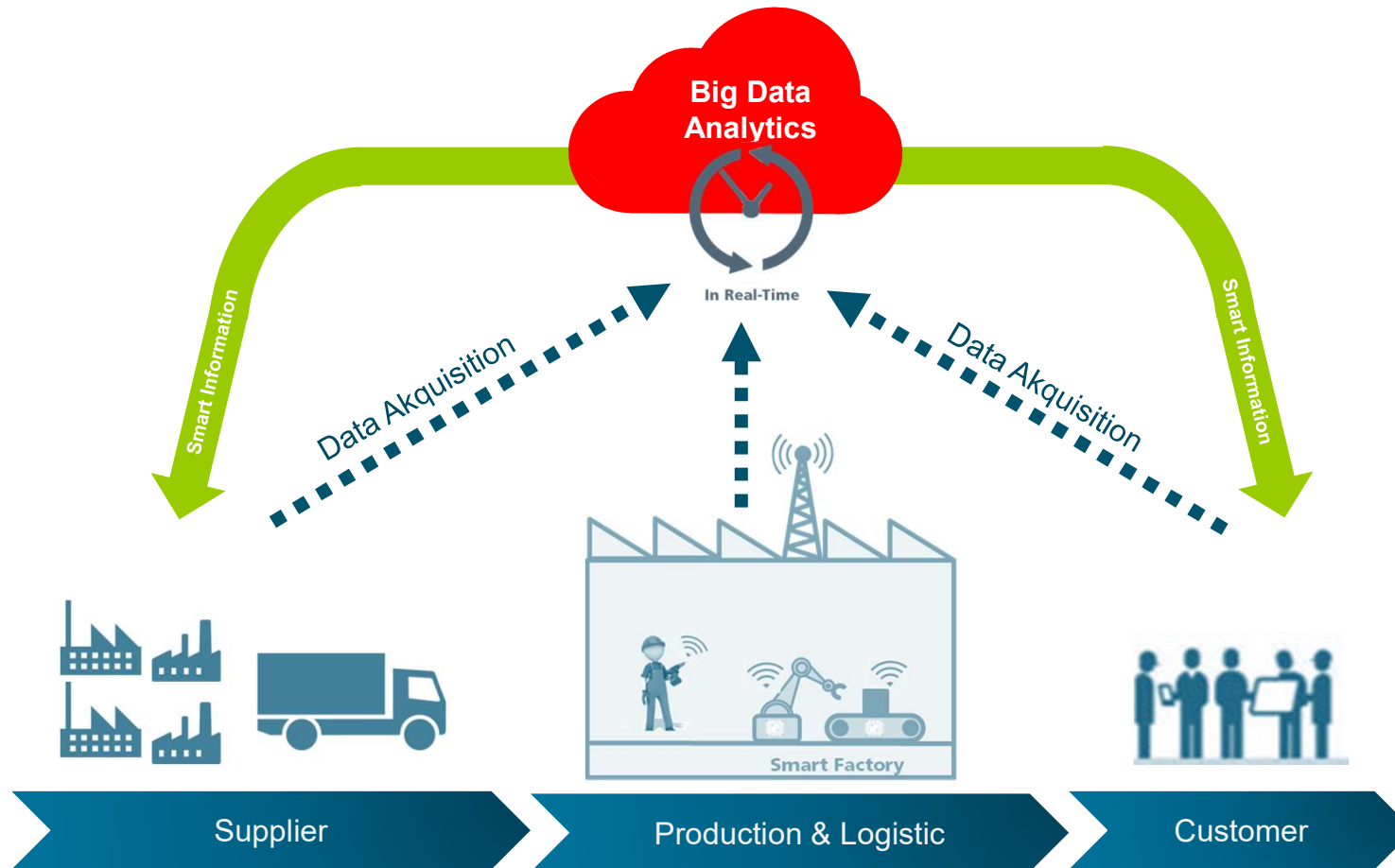
Industry 4.0

The Importance of Data

**„Data is the Oil
of the Future“**

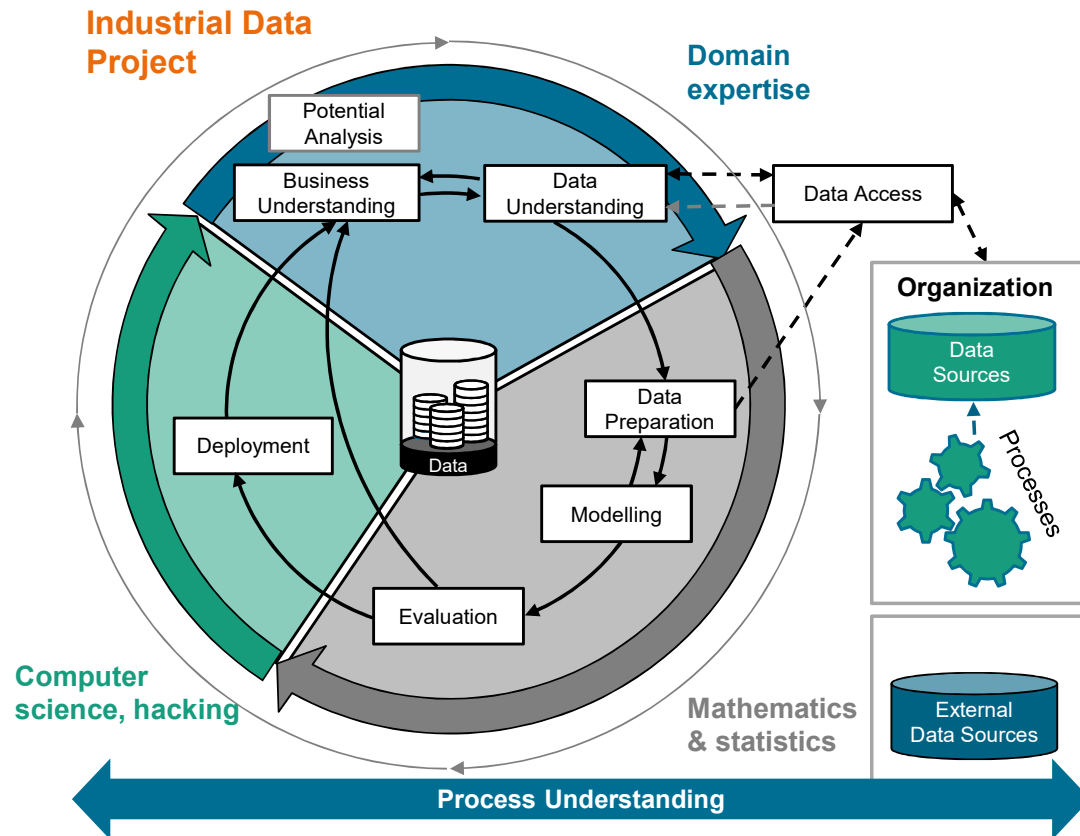
Industry 4.0

From Big-Data to Smart-Information

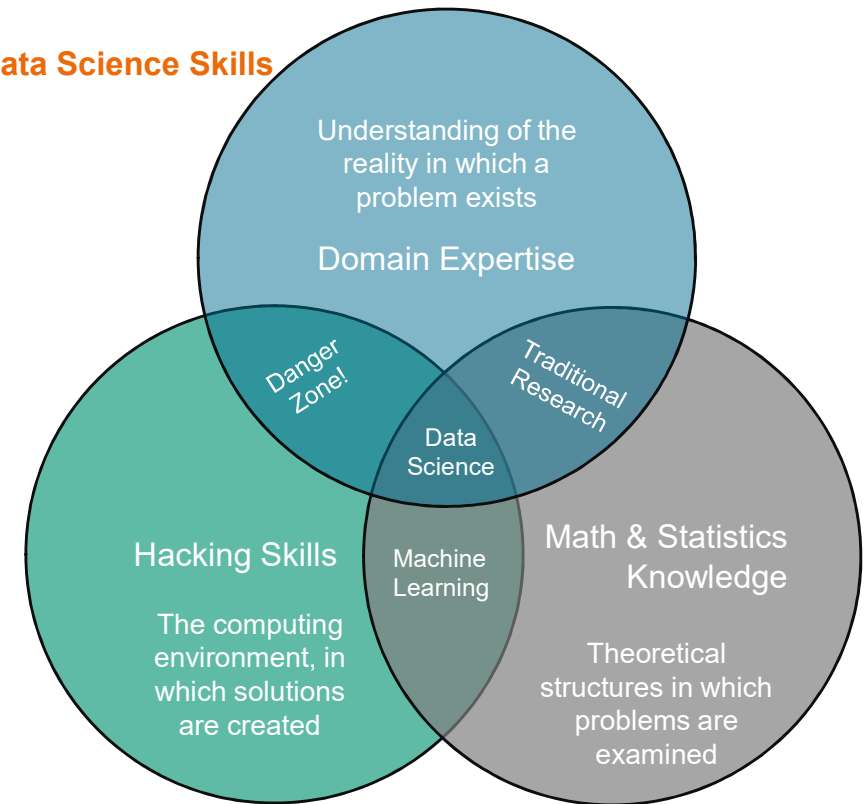


Industrial Data Science

Cross-industrial standard process for Data Mining (CRISP)



Data Science Skills



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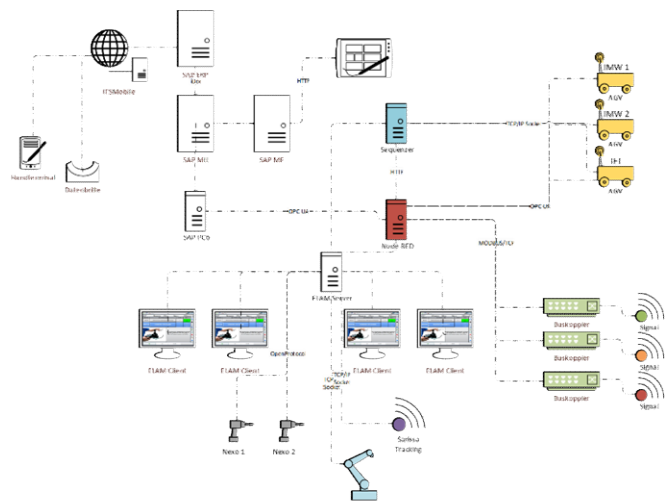
Research and Best Practice Examples

Vertical and horizontal data integration

- **vertical** across all levels of the automation pyramid

- ### ■ Fully integrated module management (lot size 1)

■ Paperless order processing

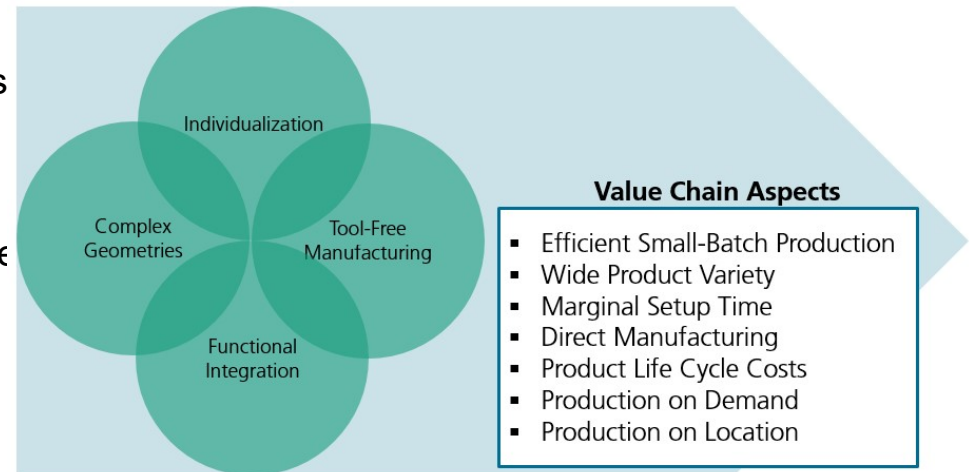


Selected Research Topics

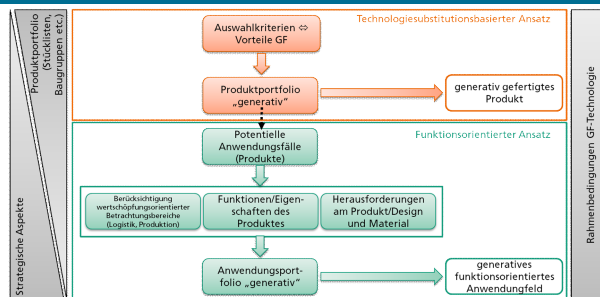
Value Creation Systems and Business Model Development in Additive Manufacturing

Generative production technologies will **disrupt** the industry. They can be used as supplements to conventional technologies but to reach full potential, **business models** and **value chains** have to be **rethought**.

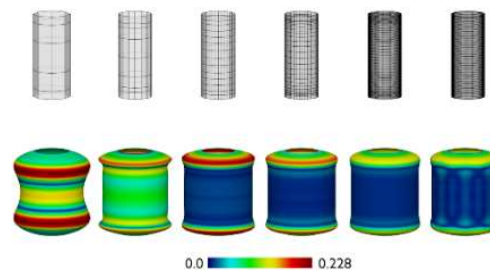
The research objectives of TU Wien and Fraunhofer in this project are investigations from a product and value creation process perspective as well as business model development in additive manufacturing:



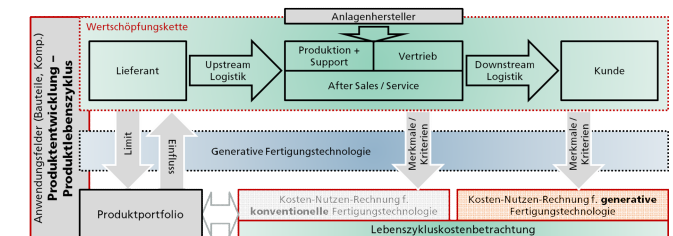
Identification of fields of application



Digital model creation and optimization



Implementation of generative value chain



Selected Research Topics

Digital and Visual Assistance-Systems in Maintenance

Development of an Augmented Reality Worker Guidance | Workers are guided step-by-step through the process of changing the grab jaws via virtual information directly projected to the object, using voice and gesture control.



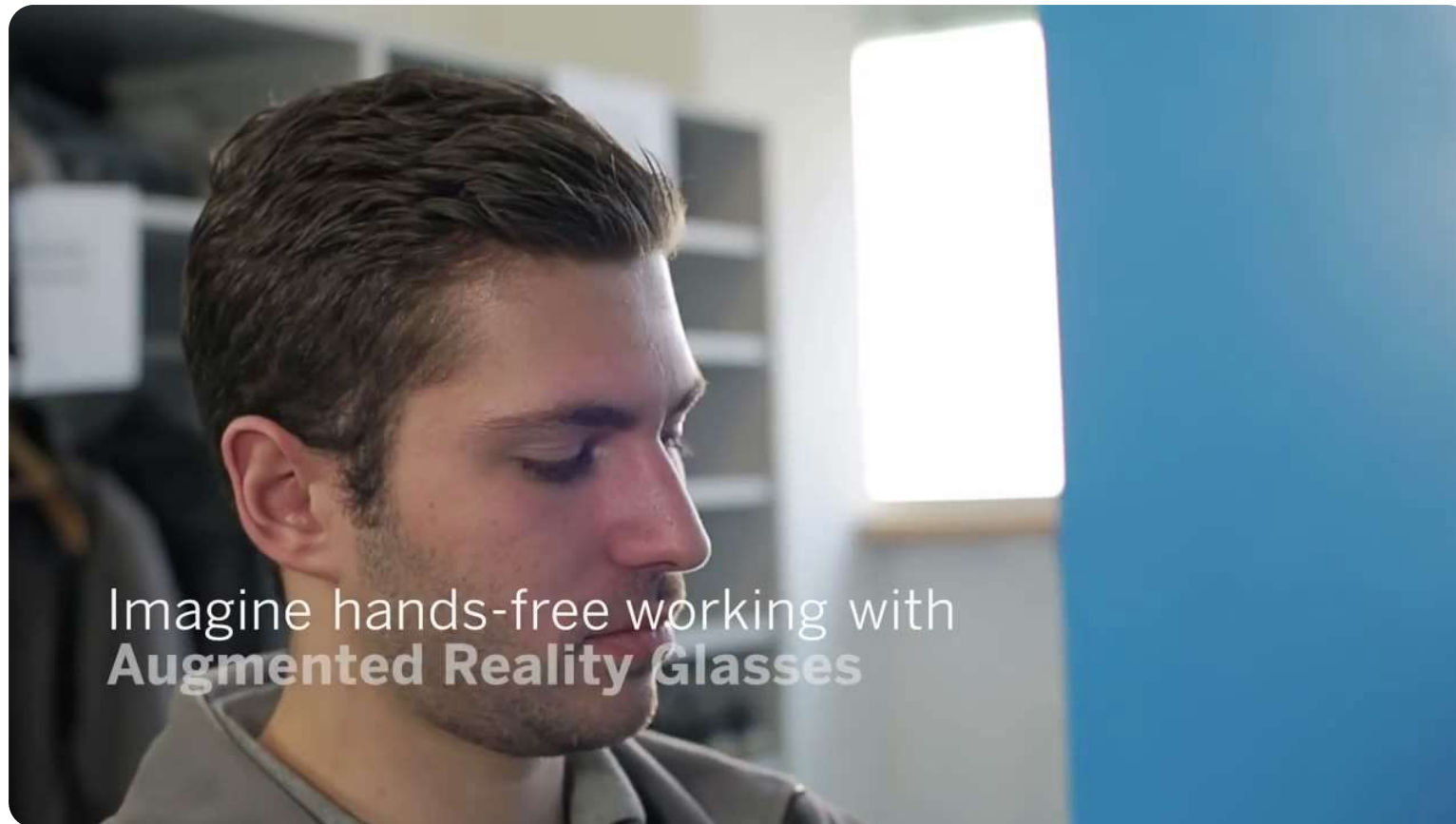
Approach

- Identification of potential assistance services
- Definition of technical and organizational interfaces
- Development and implementation of a demonstrator in the Pilot Demonstration Plant Industry 4.0
- Formulation of the worker information



Selected Research Topics

Digital and Visual Assistance-Systems in Maintenance



Source: https://www.youtube.com/watch?v=9Wv9k_ssLcl

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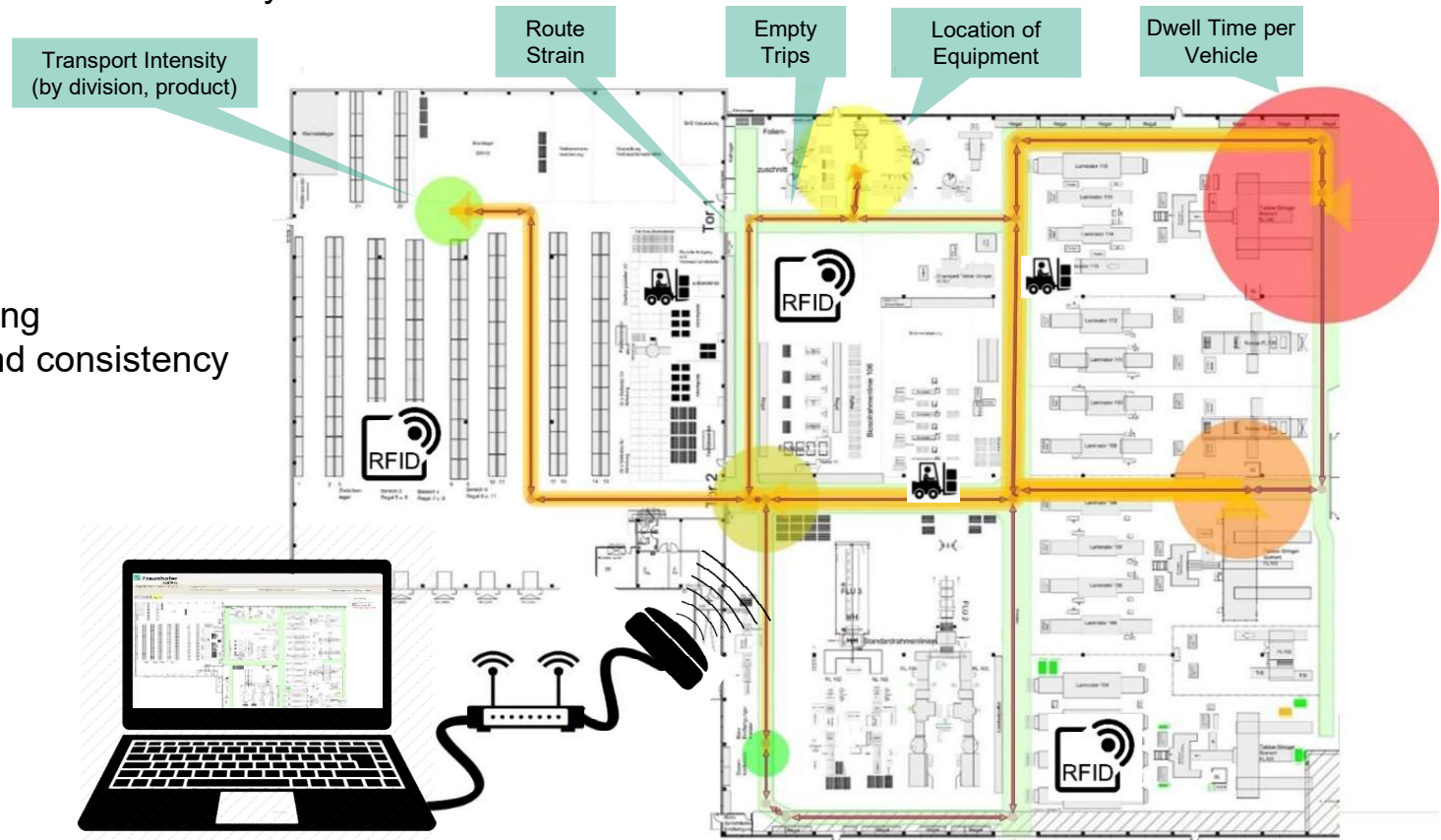


Selected Research Topics

Position finding based material flow in Real-Time

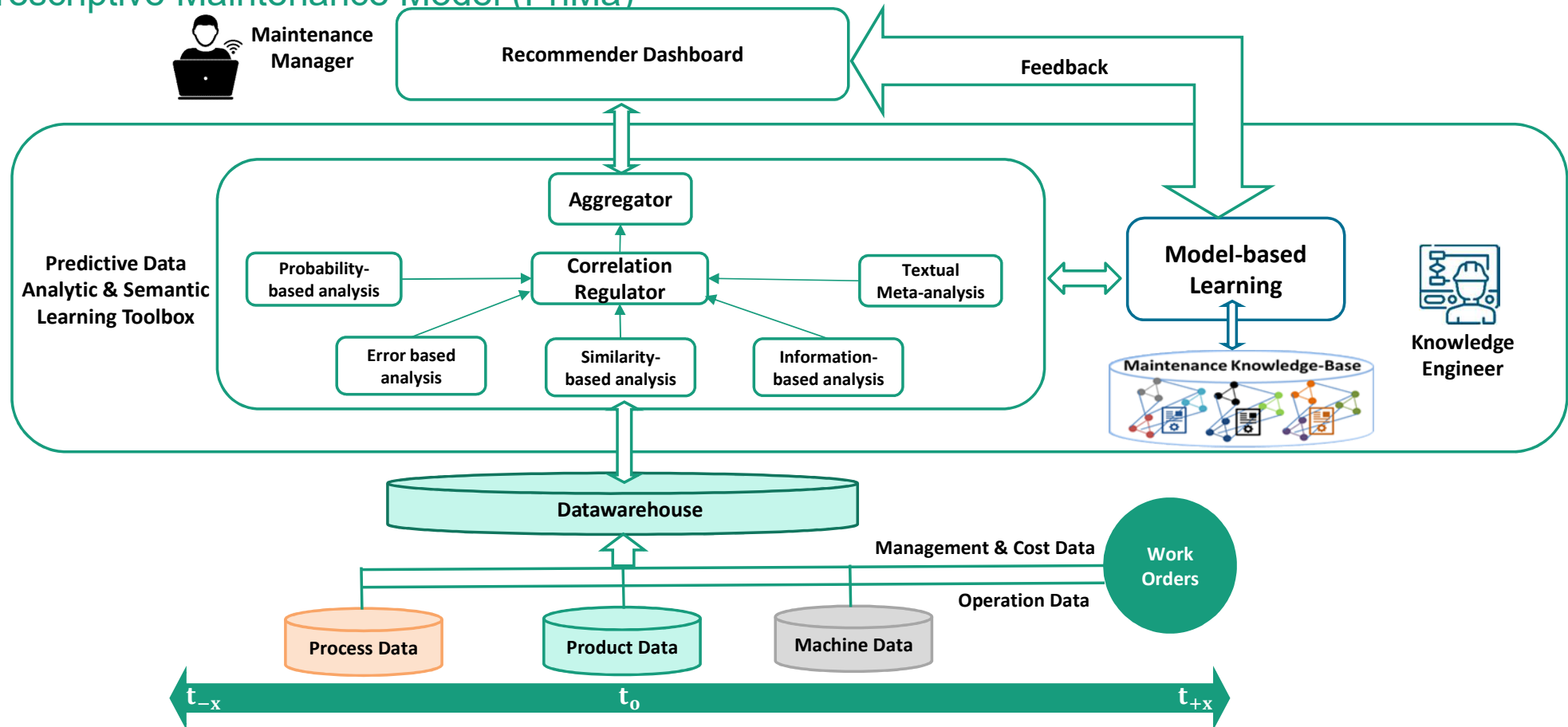
■ Automated data generation, acquisition and analysis in Real-Time

- Transportation
 - Material
 - (Empty) truss
 - Equipment (e.g. devices)
- Addition of historic, manual booking details to increase data quality and consistency



Selected Research Topics

Prescriptive Maintenance Model (PriMa)



In: F. Ansari, R. Glawar, & W. Sihn, Prescriptive Maintenance of CPPS by Integrating Multimodal Data with Dynamic Bayesian Networks, Machine Learning for Cyber Physical Systems, Springer, 2017

Selected Research Topics

Smart Maintenance with Artificial Intelligence by IBM Watson



Source: <https://www.youtube.com/watch?v=QE70SNyyY9g>

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Selected Research Topic

Overview and Project Goals

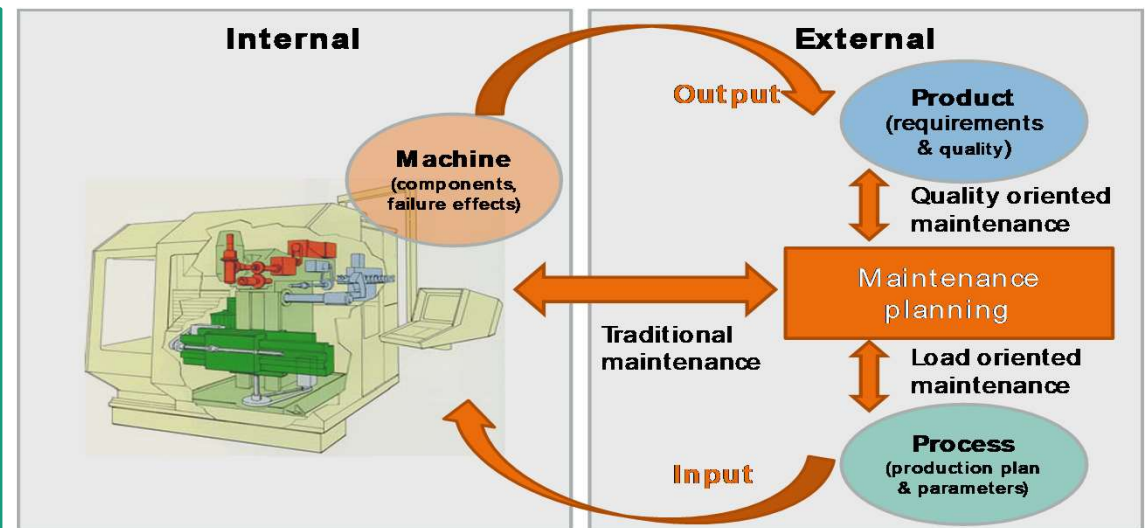
Maintenance 4.0 | Improving product quality and machine availability through a prescriptive maintenance control center

Development of a **holistic maintenance planning approach** to anticipate critical events through a **maintenance control center** and a mobile **maintenance app**.

Results:

- Maintenance Control Center & Mobile Maintenance App
- **Reduction of downtime of 12-25%** is demonstrated
- **Improvement** in the relationship between **unplanned / planned** downtime of **8-13%**

→ Proactive and anticipative measures to prevent failures!



Partners & Funding



Selected Research Topics

Digital Twin

Initial Situation

Precise planning and controlling not possible due to:

- Insufficient data basis
- Discontinuous IT-system
- Interface losses between disparate planning level

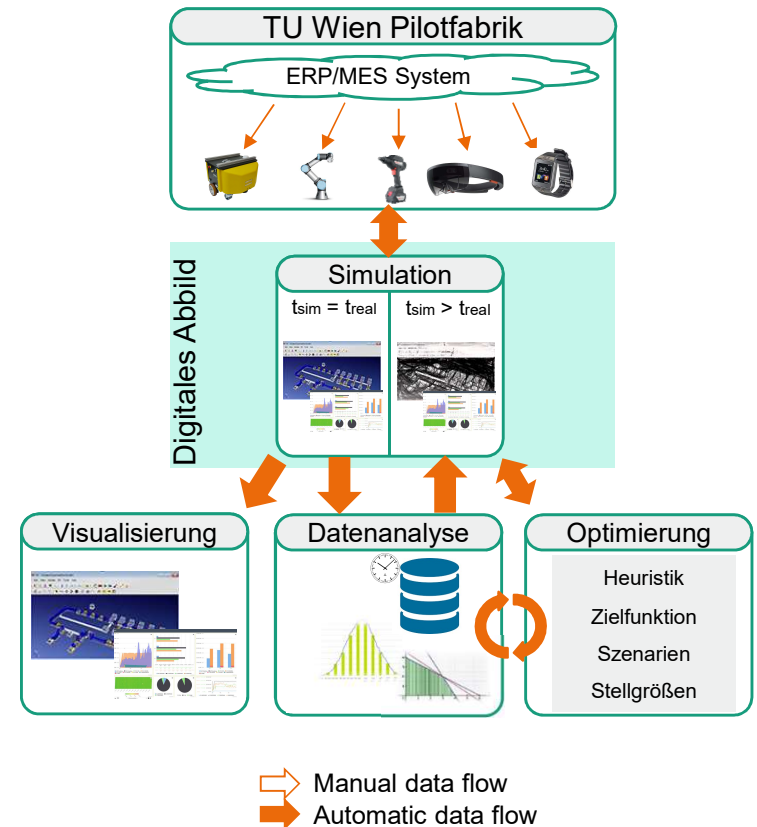
Simulation based planning and controlling tool rooted in a Real-Time, holistic and digital image of the production system.

Objective and Use

Tool using a Digital Twin for:

- Flexible production planning
- Dynamic and autonomous production controlling
- Multi-criteria production optimization
- Visualizing of Live-Dashboards

Tools





We are looking forward to accompanying
you in innovative projects...



„Fraunhofer Austria – on behalf of the future“



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