ARENA2036

Phase III

Well-defined

CARpulse

Connect4HCA

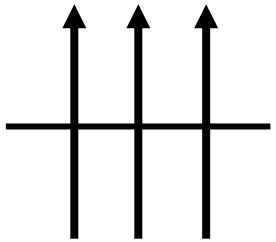
EcoFrame

Gefördert durch:
FORSCHUNGS CAMPUS
Öffentlich-private Partnerschaft für Innovationen
Bundesministerium für Forschung, Technologie und Raumfahrt
PTKA Projektträger Karlsruhe
Karlsruher Institut für Technologie

Research strategy

The innovation platform for **mobility** and **production** of the future.

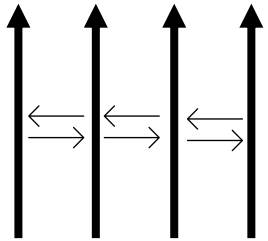
Vision2036



1. Funding period

(2013 – 2018)

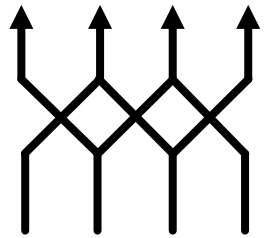
Collaborative projects to the largest extent self-sufficient, only observational accompanying research.



2. Funding period

(2018 – 2023)

Linking of projects by means of defined sprints.



3. Funding period

(2024 – 2028)

Joint research focuses and close interlinking, as well as orientation towards a **shared vision**.

Shared vision: Resilient, interconnected and sustainable mobility and production

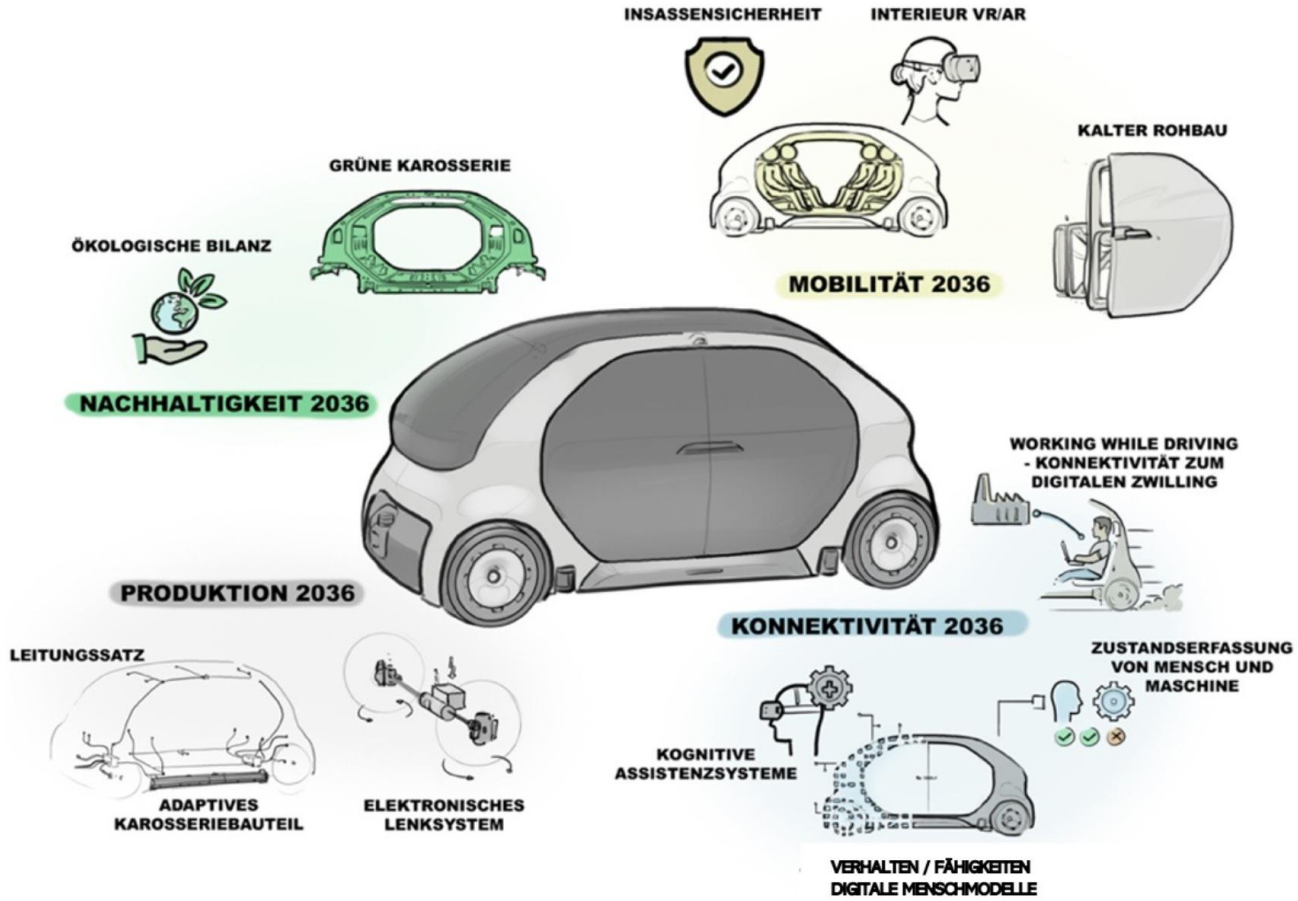
Linkage of the joint projects

Joint projects as strategic beacons of research focuses

- Mobility2036: CARpulse
- Sustainability2036: EcoFrame
- Production2036: Well-defined
- Connectivity2036: Connect4HCA

Goal and procedure in the interlinked framework

- Cyber-physical vehicle demonstrator as a product and its production system, which presents pioneering technologies in future automotive engineering
- Interlinkage of the joint projects through structural shared work packages



Demonstrator of the joint projects

Gefördert durch:
FORSCHUNGS CAMPUS
Bundesministerium für Forschung, Technologie und Raumfahrt
PTKA Projektträger Karlsruhe
Karlsruher Institut für Technologie

The four joint projects

Project duration: 01.01.2024 – 31.12.2028
Volume: 16,3 Mio € (10 Mio € Funding)

3. Funding period

01 Production2036
Well-defined

BÄR · BOSCH Technik fürs Leben · DXC TECHNOLOGY · Fraunhofer · PILZ THE SPIRIT OF SAFETY · TRUMPF · Universität Stuttgart

02 Mobility2036
CARpulse

BOSCH Technik fürs Leben · Constellium · Deutsches Zentrum für Luft- und Raumfahrt · DXC TECHNOLOGY · DYNAMORE · HOCHSCHULE DER MEDIEN · Universität Stuttgart · TRUMPF

03 Sustainability2036
EcoFrame

Constellium · Deutsches Zentrum für Luft- und Raumfahrt · DXC TECHNOLOGY · Fraunhofer · SCHAEFFLER · Universität Stuttgart

04 Connectivity2036
Connect4HCA

BALLUFF · DITF Deutsche Institute für Textil+Faserforschung · NAiSE · Fraunhofer · ISG · SIEMENS · Universität Stuttgart

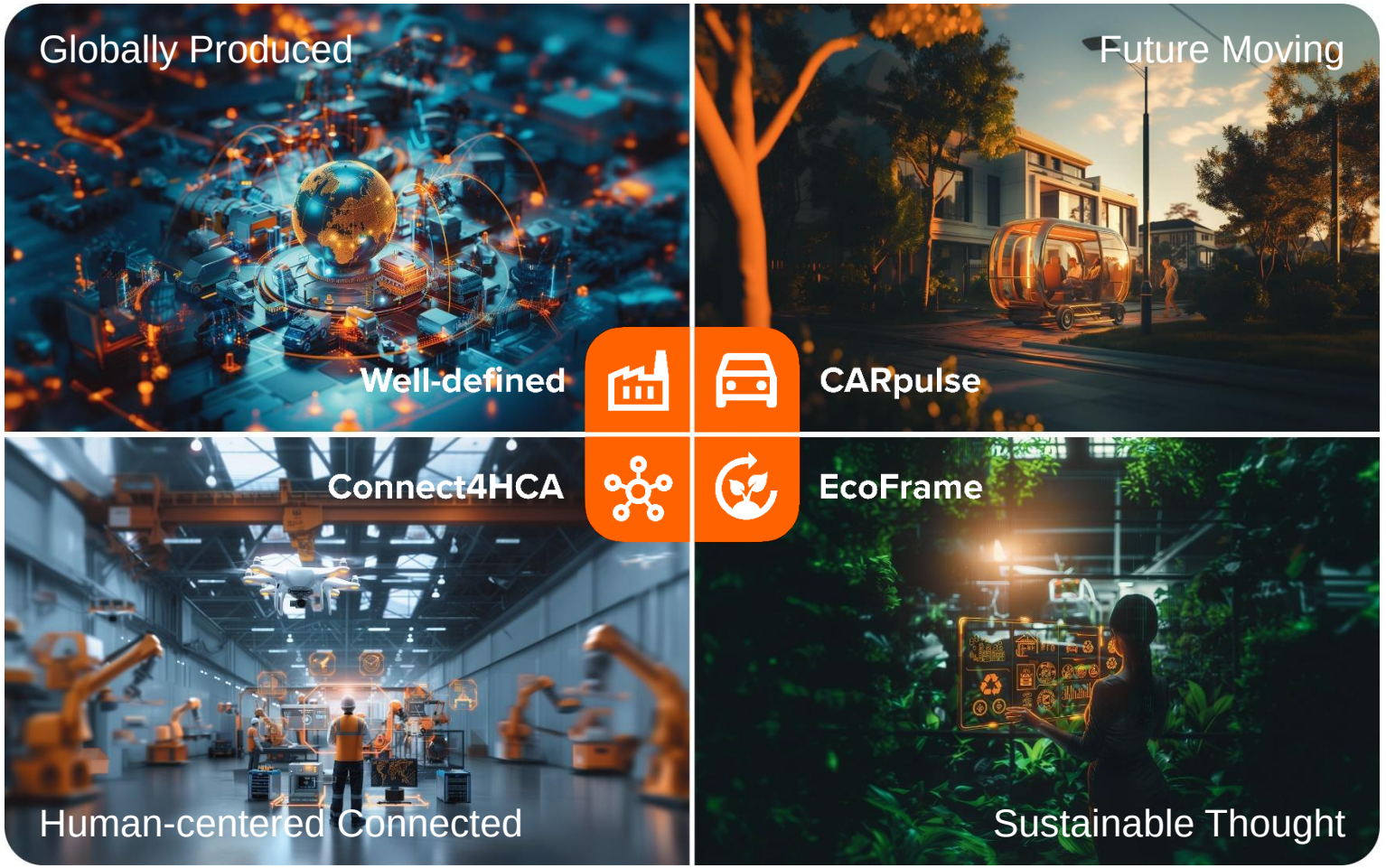
Assoziierte Partner: BALLUFF · SCHAEFFLER · NOKIA · BALLUFF · SIEMENS · TRUMPF

FORSCHUNGS CAMPUS · Gefördert durch: Bundesministerium für Forschung, Technologie und Raumfahrt · PTKA Projektträger Karlsruhe Karlsruher Institut für Technologie

Project management

David Dietrich
ISW, University of Stuttgart

Matthias Lück
Fraunhofer IAO



Gundolf Kopp
DLR Institute of vehicle concepts

Ann-Kathrin Briem
Fraunhofer IBP

Gefördert durch:
FORSCHUNGS CAMPUS
Bundesministerium für Forschung, Technologie und Raumfahrt
PTKA Projektträger Karlsruhe
Karlsruher Institut für Technologie

Well-defined

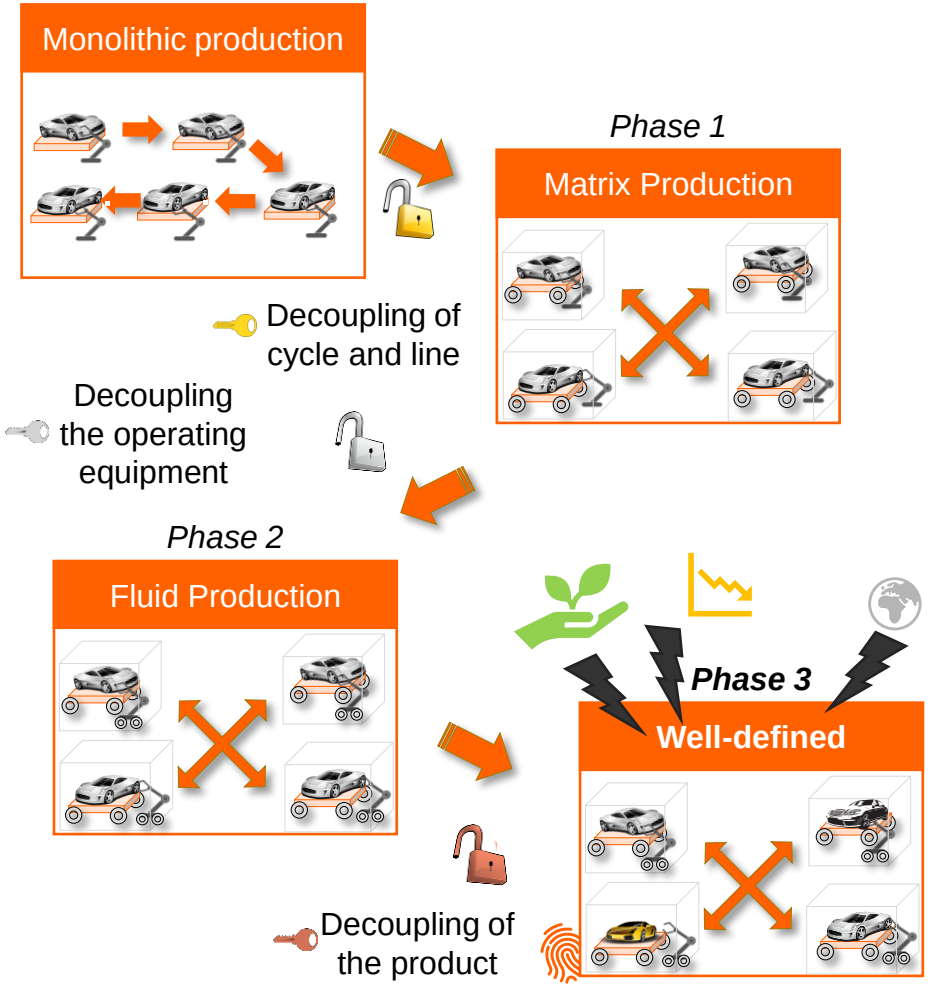
Value network modelling for the software-defined resilient production of the future

Project Leader: David Dietrich
Mail david.dietrich@isw.uni-stuttgart.de

Gefördert durch:
FORSCHUNGS CAMPUS
Bundesministerium für Forschung, Technologie und Raumfahrt
PTKA Projektträger Karlsruhe
Karlsruher Institut für Technologie

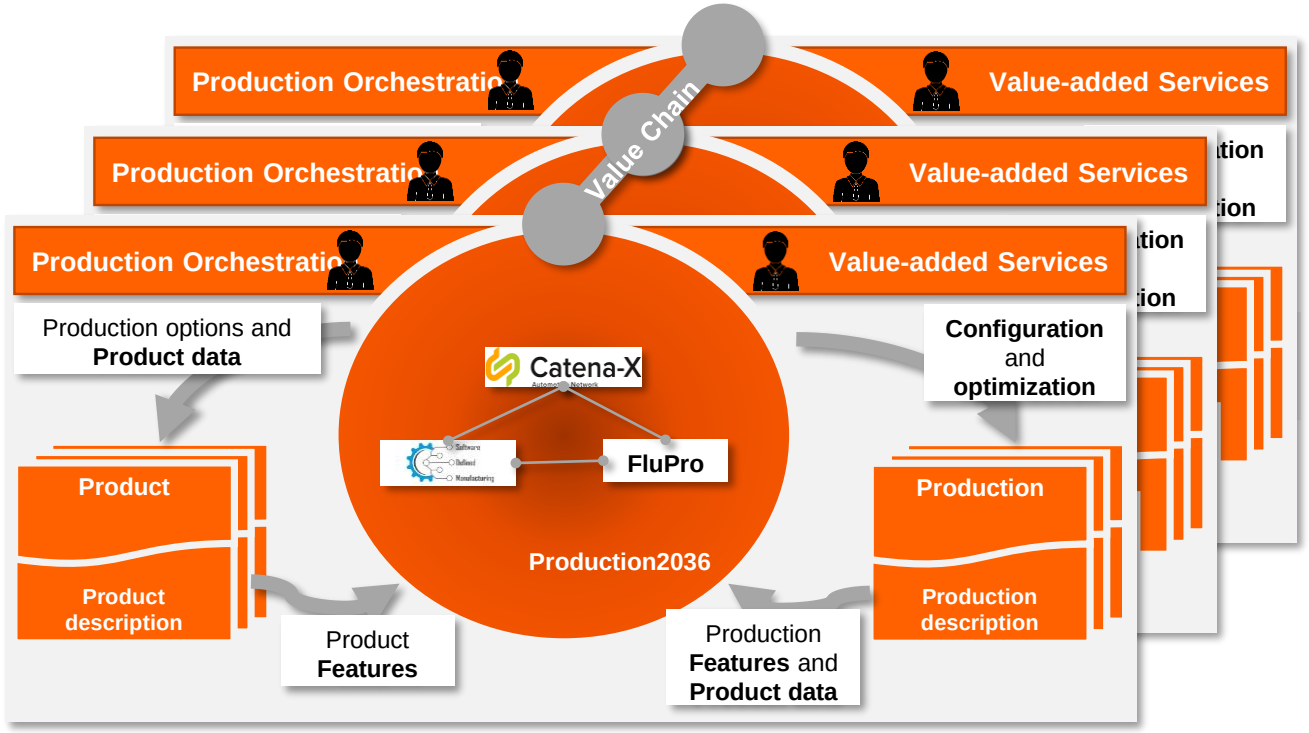
Motivation and Research Focus

- Motivation
  - Static supply chains, static product models
    - Non-resilient supply chains – Market Shock
    - Conflicting Objectives (z.B. manufacturing process) are chosen once and forever
    - No tech push possible
  - Proprietary, sometimes manual interfaces between organisations
    - Low reusability
    - Consistency problems due to different models
    - Limited flexibility
- Research Focus
  - Platform for controlling a value chain (Value Chain Execution System)
  - Associated modelling of the semantics and validation on demonstrators



Vision and project objective

- Vision
  - Sustainable, cost-effective and self-optimized production
  - Creation of resilient value networks to minimize delivery failures
  - Resilience on the shop floor by increasing the security and availability of resources
  - Humans as central decision-makers in the distributed, highly complex value creation network
- Project objective
  - Establishment of a value network with a Value Chain Execution System (VCES) consisting of three interconnected individual physical demonstrators
  - Comprehensive communication of the individual demonstrators via the VCES with secure communication between the demonstrators using Catena-X



Consortium and sub-project structure

TP0: Project Leader

David Dietrich (ISW)

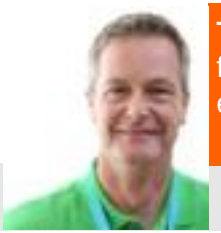
Mercedes-Benz TRUMPF Fraunhofer IPA BOSCH ISW DXC TECHNOLOGY PILZ THE SPIRIT OF SAFETY BÄR

TP 1: Data model and specification requirements for Industry 4.0 as a Service and products

David Dietrich (ISW)

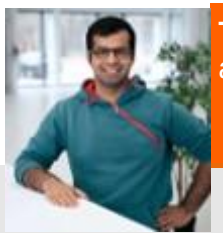
TP 2: Adaptive Value Chain Execution System for flexible Industry 4.0-as-a-Service orchestration

Werner Lober (DXC)



TP 3: Construction of a model factory for the assembly of an electric steering system

Oliver Romoser (Bosch)



TP 4: Production of an adaptable car body component

Anwar Al Assadi (IPA)

TP 5: Shared safety for autonomous and self-sufficient AGVs in flexible environments with changeable safety zones

Florenz Graf (Bär)

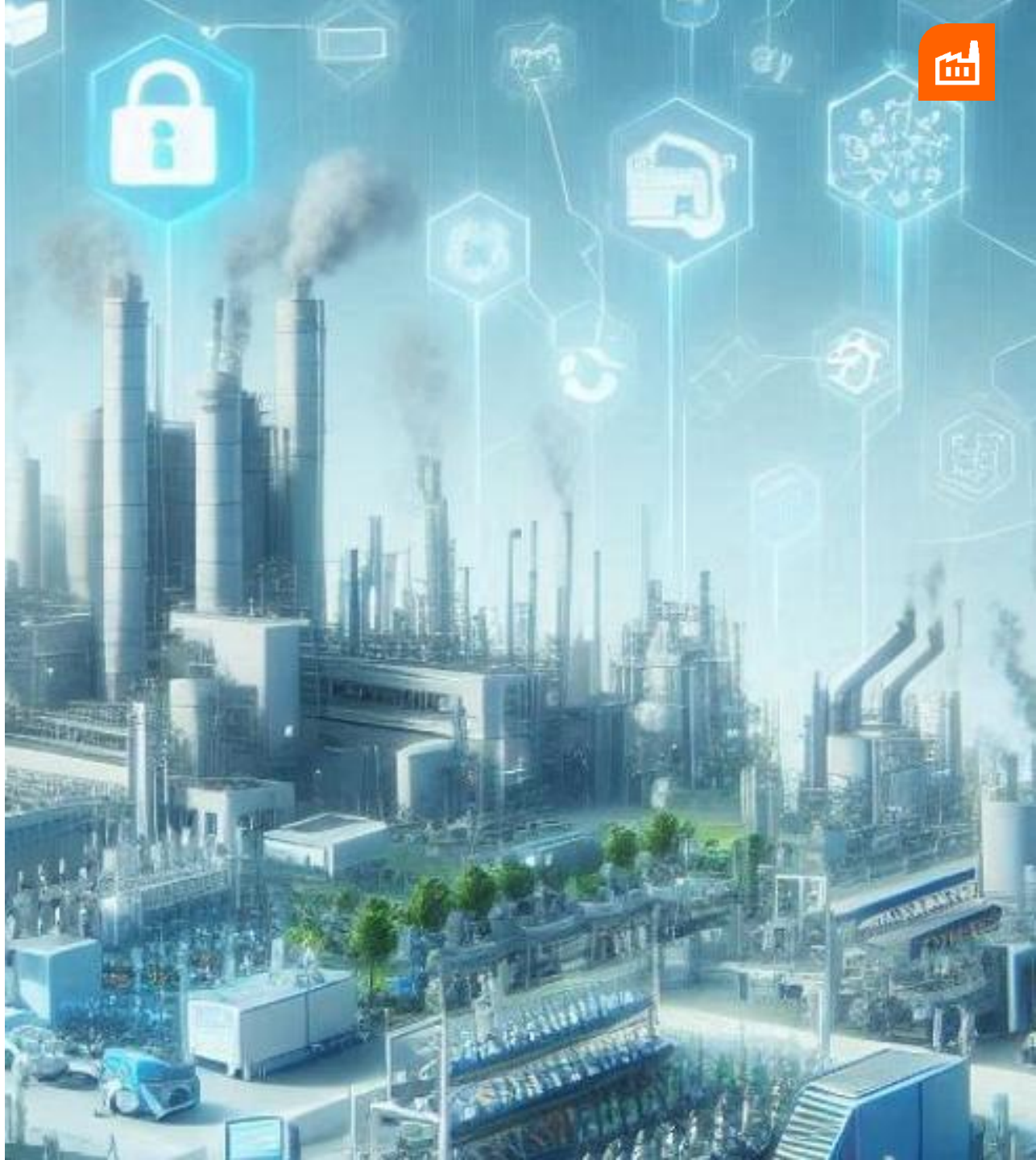
Assoziierte Partner

BALLUFF SCHAEFFLER

Gefördert durch: FORSCHUNGS CAMPUS; Bundesministerium für Forschung, Technologie und Raumfahrt; PTKA Projektträger Karlsruhe Karlsruher Institut für Technologie

TP1: Data model and specification guideline

- Motivation & Objective
  - Standardized data models for products and services in value chains are required
  - Data model of a value network for mapping production systems and flexible products
  - Specification for Industry-4.0-services to describe a standardized application profile for orchestrating value networks
  - Joint concept for sustainability data and target criteria with EcoFrame
- Contribution to the overall project
  - Data models as the basis for the value chain execution system and the demonstrators in the form of administration shells and aspect models
  - Service-based model of the value network, taking into account products, production, logistics and engineering services



FORSCHUNGS CAMPUS
Gefördert durch: Bundesministerium für Forschung, Technologie und Raumfahrt
PTKA Projektträger Karlsruhe Karlsruher Institut für Technologie

TP2: Adaptive Value Chain Execution System

- Motivation & Objective
  - Increasing interconnection of participants on the market without overarching control
  - Distributed concepts of production require standardization of information structures and services
  - Setup of an adaptive value chain execution system as evaluation platform to control the entire value chain
  - Flexible combination of production services based on changing targets and criteria
- Contribution to the overall project
  - Transfer of the requirements, data models and specification rules into a software system for development and testing of the well-defined use cases
  - Networking of the partners' sub-projects and demonstrators via specific instances of the VCES with extensive use of Industry 4.0 components for adaptive and flexible production

FORSCHUNGS CAMPUS
Gefördert durch:
Bundesministerium für Forschung, Technologie und Raumfahrt
PTKA Projektträger Karlsruhe
Karlsruher Institut für Technologie

TP3: Model factory for automotive-components

- Motivation & Objective
  - Overall optimized control of a production facility that is part of an overarching value chain
  - Design and implementation of an existing assembly line as a model factory
  - Design and implementation of interfaces and data models
- Contribution to the overall project
  - Realistic evaluation of the technologies and concepts for their practical suitability in the model factory and overarching value chain
  - Demonstration and validation of the added value of the product model and the VCES based on use cases of the physical demonstrators

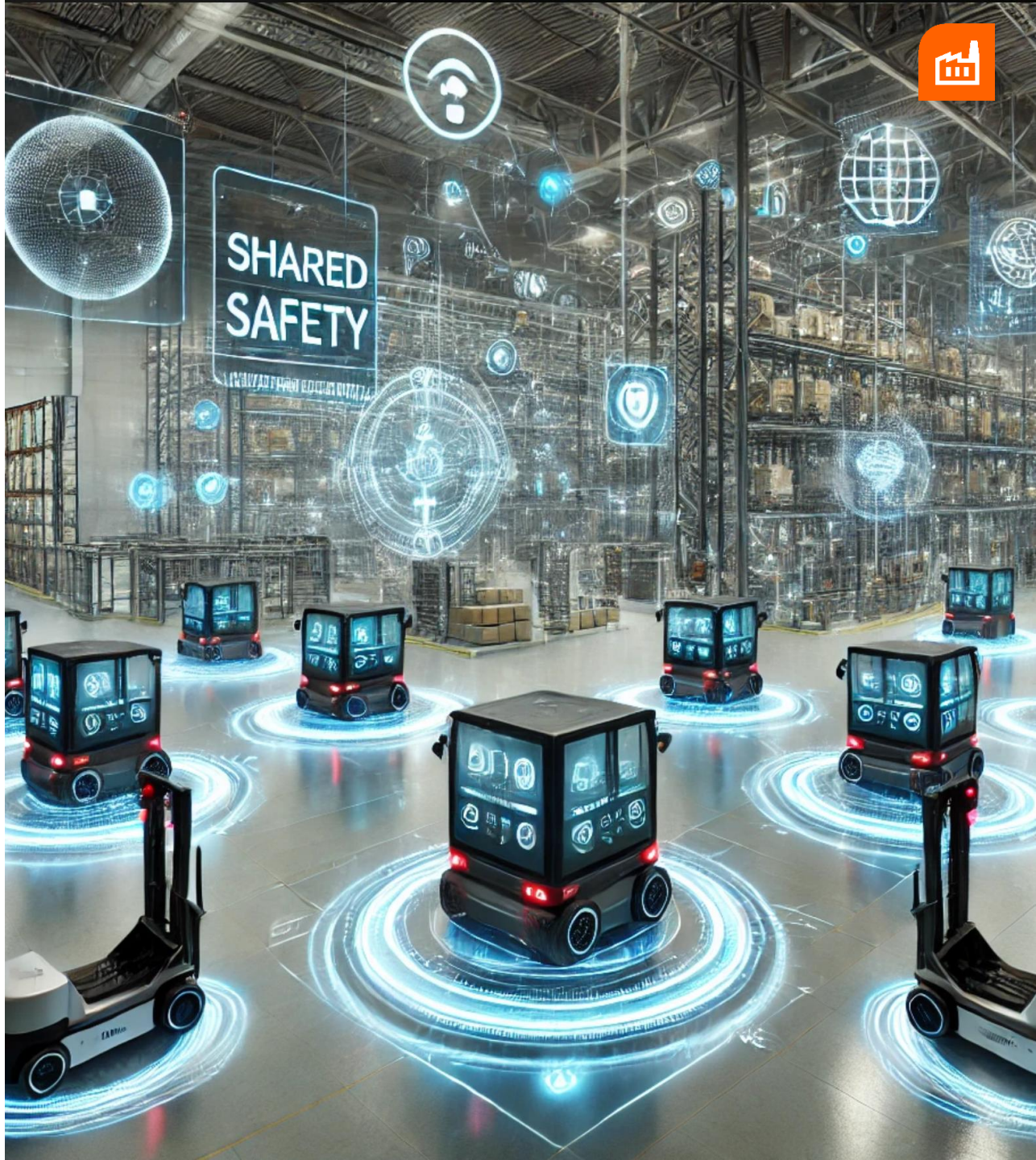
FORSCHUNGS CAMPUS
Gefördert durch: Bundesministerium für Forschung, Technologie und Raumfahrt
PTKA Projektträger Karlsruhe
Karlsruher Institut für Technologie

TP4: Manufacture of a car body component

- Motivation & Objective
  - Component changes and model maintenance measures cause effort in robot programming
  - Information gap between the CAD-CAM process chain and robot programming (assembly)
  - Provision of component design and integration of change management
  - Development of an adaptive CAD-CAM process chain including robot programming
  - Learning robot programs in the simulation
- Contribution to the overall project
  - Development of a system that enables production to be made more flexible
  - Integration of CAD-CAM interfaces and AI-supported simulation (using reinforcement learning) to create robot programs for assembly

TP5: Shared Safety for AGVs in changeable zones

- Motivation & Objective
  - Security measures must be configured manually on an individual basis
  - Inflexible docking options to systems
  - Situation-dependent safety aspects of a mobile system in a changing production environment
  - Simplification and flexibilization of docking processes to production facilities
  - Software and hardware interface development for AGV orchestration
- Contribution to the overall project
  - Manufacturer-independent solution for safe communication across multiple assets
  - Plug & Play Integration of shared safety functions into the value chain by using existing standards such as VDA5050 and AAS



Gefördert durch:
FORSCHUNGS CAMPUS
Bundesministerium für Forschung, Technologie und Raumfahrt
PTKA Projektträger Karlsruhe
Karlsruher Institut für Technologie

Thank you!

Gefördert durch:

FORSCHUNGS CAMPUS
öffentlich-private Partnerschaft für Innovationen

Bundesministerium für Forschung, Technologie und Raumfahrt

PTKA
Projektträger Karlsruhe
Karlsruher Institut für Technologie

ARENA2036

ARENA2036 e.V.
Pfaffenwaldring 19
70569 Stuttgart

www.arena2036.de

Stay in touch!

Follow & subscribe ARENA2036

Follow ARENA2036 on Linkedin

Follow ARENA2036 on Instagram

ARENA2036-Newletter subscription

www.arena2036.de