




WE MAKE THE INDUSTRY FIT FOR THE FUTURE



We show how artificial intelligence, multi-agent systems, data spaces, digital twins, and smarter safety features are shaping the future of production systems.



smartFactory^{KL}[®]



Foreword

Big challenges lie ahead. Our industries must solve pressing issues if they hope to remain competitive.

We must be better prepared to respond to supply disruptions. Conserving resources and reducing CO2 emissions are more important than ever before. The shortage of skilled labor is forcing optimization and automation of the factory floor.

At **SmartFactory**^{KL}, our innovative technologies are making sustainable and value creating production systems. Together with our corporate partners, we are building production systems to solve the urgent needs of industry. We provide answers and show you what manufacturing will look like in the near future.

Welcome to our stand and have fun trying things out!
If you have any questions, do not hesitate to contact us at any time!

Sincerely,
Martin Ruskowski

Prof. Dr.-Ing. Martin Ruskowski
Vorstandsvorsitzender
der **SmartFactory**^{KL}



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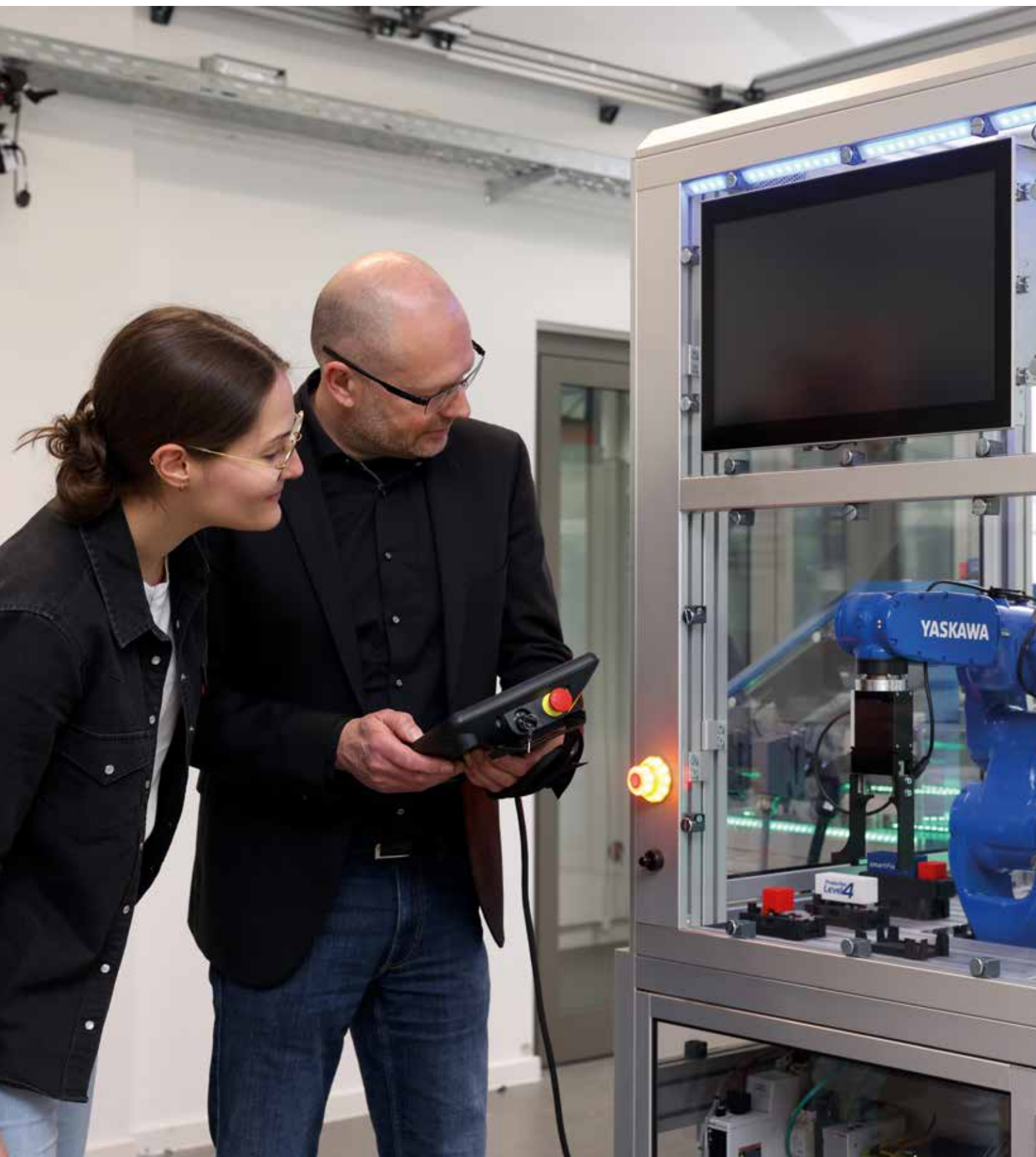
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FUTURE-PROOFING MANUFACTURING

To better understand and test the manufacturing systems of the future, we built a complex, service-oriented production system in Kaiserslautern. It consists of production islands and modular components that represent industrial manufacturing companies. The facility shows what companies need to achieve to ensure that they and their industry are fit for the future.

The individual elements are networked in a data space and can be activated to perform the production of a model truck (as a sample product).

The model truck is a placeholder and stands in for a refrigerator, an engine, or an electric drill for example. We want to demonstrate today that production can already be more efficient, faster, and can add more value.

Our Shared Production ecosystem works with production islands and modules at several different locations. All are connected in the data space where they offer their skills and services by means of their asset administration shell.

The asset administration shell (AAS) is, in principle, the implementation of the digital twin. The AAS stores asset properties, skills, and IT services as well as the entire past manufacturing history. Additionally, it describes the communication options available between assets.



OBJECTIVES

- **Develop supply chains:** Software-agents (production Bots) implement the necessary steps quickly, flexibly, and effectively.
- **Improve interoperability:** Data spaces enable cooperation among various systems and companies.
- **Increase resilience:** Access to the many services offered in a data space eliminates dependencies in the event of a crisis. If a service fails at some point, another offer can be selected.
- **Minimize down times:** Offering and leasing machine skills or software services in a data space results in maximizing the utilization of your own production resources. Long term economic sustainability is supported as the need for new purchases can be avoided.
- **Optimize logistics:** Logistics is now part of the production infrastructure. Transport routes are taken into account during optimization by the production Bots.
- **Improve environmental sustainability:** Resource optimization results from the establishment of a circular economy. The administration shells promote energy and CO2-efficiency in the production processes.
- **Contribute to social and economic sustainability:** Automation of time-intensive work frees employees for more demanding tasks. In effect, it also saves jobs and mitigates the shortage of skilled labor, both of which ensure the long term viability of the company.

OUR STORY

Our scenario features a configurable model truck.

In addition to selecting the components, other selectable parameters can also be ordered such as the installation of used parts (circular economy, lower price), production speed, or energy consumption. Once the truck has been configured and the parameters selected, supply chain proposals are generated. These proposals provide information about price, time, CO2 footprint, etc. After selecting a supply chain, production begins. Depending on the final configuration, the respective production units are activated – all of which are networked in our data space. For example, the _MILOS production island located at RPTU Kaiserslautern-Landau, carries out the service Drill on the white truck trailer; the yellow driver's cab is printed in Stuttgart at ARENA2036, the module built by PILZ; and, at the *SmartFactory*^{KL} Lab in Kaiserslautern, a blue windshield is made by the Print4PAUL module. The undercarriages of the tractor and trailer are mounted at the manual work station. Final assembly of the tractor and trailer then takes place at the TSN marriage module and the truck is then ready for delivery.

The unique feature of our production example is the ability to dynamically assemble supply chains for a configurable product. Companies are protected against supply chain disruptions (resilient), while becoming more efficient (less time to establish supply chains), better for the environment (more CO2 and energy efficient, circular economy), and future proof (more value added and immunity to future labor shortages).

We demonstrate how shared production can work and the flexibility it provides through the use of data spaces – a concept that also enables interoperability.

ROLES AND FUNCTIONS OF PRODUCTION ISLANDS



**THE PRODUCTION ISLANDS
FORM THE HEART OF
OF OUR SHARED PRODUCTION.**



PRODUCTION ISLAND _JAVA

Introduced in 2020, _JAVA produces a configurable USB-stick that can be loaded with individual data. The _JAVA production island is now part of the Shared Production landscape and fills the role of supplier. _JAVA will be expanded to enable production and pre-assembly of truck parts in addition to the USB stick.

The central orchestrator offers services in the data space and executes them via various module skills. Depending on the product, the required modules are activated and begin their contribution to the production process.

Research aim: _JAVA shows how the interplay of OT and IT enables rapid reconfiguration of a production plant with a focus on energy-efficient processes in a dynamic edge-cloud continuum. Future plans include the concept of a digital thread to provide decision support for the worker based on semantic technologies and information stored in the administration shells (e.g., Digital Product Pass). The concept links the information in the asset administration shells (AAS) and provides cross-divisional information, such as when a certain product from logistics will arrive at the production worker's location.

Participating companies and projects: Yaskawa, B&R, PILZ, Harting, Siemens, Rexroth, Hirschmann, Perinet, Empolis, IBM, EASY, TWIN4TRUCKS, smartMA-X



PRODUCTION ISLAND _KUBA

The core task of the _KUBA production island is to assemble the model truck and deliver it to the customer. A major element of _KUBA is the ACOPOStrak transport system, around which the different modules can be positioned in any desired arrangement.

The most important production steps for the model truck take place at _KUBA: Quality control, assembly (manual task) as well as infeed and output. Controls are managed by a multi-agent system (MAS).

The _KUBA production island offers services in the data space depending on the connected modules.

These modules can establish peer-to-peer links and jointly solve complex tasks. Analog to hardware, the software of the transport systems also relies on modularity. The various transport shuttles can dynamically change their movement routes to ensure a smooth production flow.

The model truck undergoes final assembly at the manual workstation of the TSN module.

_JAVA and _KUBA are designed in such a way that modules are interchangeable at any time (interoperability). This is the essence of Plug & Produce, because with new skills, new products are made possible. This unique flexibility is a decisive milestone on the way to the production of the future.

Research aims: Design software architecture (operating system) as a multi-agent system (MAS), test federated learning, container-based controls, security systems for production plants, 5G for safety, and manufacturer-independent real-time communication. Develop encapsulated units at different layers with embedded controls and skill-based interfaces. Test human machine cooperation at the manual work station.

Participating companies and projects: B&R, Rexroth, PILZ, Huawei, Yaskawa, Harting, Fujitsu, MiniTec, Siemens, Rexroth, PILZ, Harting, smartMA-X, Transfer4Production

Use Case: Dynamic Safety

Dynamic safety is designed to be able to respond to dangerous situations in a flexible manner and keep the production speed as fast as possible. In our Safety use case, the undocking of a module creates a potentially critical situation while a radar sensor analyzes the environment. AI implemented "above" the traditional functional safety layer reacts only to human presence, while it classifies AMR/AGV as non-critical. If a person approaches, the Safety Tool registers the direction of motion and the distance. This information places it in a position to react in graduated stages, for example, by slowing down production or in more critical situations, bringing it to a standstill.

Research aim: Productivity improvement through reduced downtime.

Participating companies: B&R, PILZ, TÜV SÜD

Use Case: Hazardous materials in production

The aim is the safe and effective transport of hazardous materials in the production process, and the choice of individual responses to defects or critical product states. Optical quality controls use AI to distinguish defective from intact batteries (example product). These controls slow down the transport and bring the items to a transfer point where they are handed over to an appropriately trained safety worker. To enable a use case demonstration at an industry trade fair, we simulate the defective battery by a visual inspection instead of relying on actual control measurements. In actual production, such battery defects are detected by continuous condition monitoring systems.

Research aim: Productivity improvement and increased safety through individual handling of hazardous goods in various product stages.

Participating companies: B&R, TÜV SÜD, Fujitsu, Radiflow



PRODUCTION ISLAND_MILOS

The _MILOS production island resides in the Department of Machine Tools and System Controls (WSKL) at RPTU in Kaiserslautern.

As part of the shared production system at Kaiserslautern, it takes on the role of an external supplier offering services (machining) in the data space. If machining is required for certain configurations of the truck, _MILOS is integrated into the production plan. We see how the skill-based structure is making CAM or G-code programming a thing of the past. Information about holes and pockets and other properties is exported directly from a CAD model and automatically converted into skills and parameters. Production takes place in a robot cell we use as a milling and drilling machine. Thanks to the smart machine i.e., the skills, all necessary decisions regarding to tool path, approach strategy, tool selection, machining parameters, etc. are encapsulated behind a defined interface.

It is possible to execute the operation simply by specifying the geometric and material properties of the product. We have installed a self-developed plug-in in the CAD program, which supports the extraction of product features and properties. Whenever an order is received – whether from an internal design desk or an external source via the data space – feature extraction takes place. The plug-in first queries the individual machines in the machine park, to see if they can manufacture a product with the given properties. The machines, for their part, check the request and report the results back to the CAD plug-in. If the product can be manufactured on at least one of the machines according to the specifications, the operator can select the corresponding machine and start the job order.

Research aims: In addition to testing the described skill-based machine tools and the production data consistency, the research also extends to considering the automated guided vehicle transport systems (AGV), the remote plant monitoring, and the use of 5G in flexible production systems.

Project participation: smartMA-X



PRODUCTION ISLAND_CAPRI

The _CAPRI production island represents parts of the supply chain for the model truck. The cab assembly can be manufactured and supplied via various production modules.

The Print4Paul module makes the 3D printed variants of the driver's cab and the windshield. Print4Paul has a 3D printer park with various 3D printers and independently checks which machines are available to produce the requested product. The color, geometry, and accuracy required for the component are taken into account, while this information is being obtained from the product's administration shell. When printing, the energy consumption by the various printers can be predicted as it is being recorded by intelligent energy monitors. Print4Paul assumes the role of a first-tier supplier in our scenario, producing and providing serial parts.

The module SE4Paul (Shared Economy 4 Paul) illustrates how small and medium sized manufacturers (SMEs) can participate in shared production. SE4Paul has a worker assistance system to support workers as they assemble the configurable cabs made from plastic building blocks. Step-by-step assembly instructions are projected into the worker's field of vision using AR glasses or displayed on a tablet or smartphone. A pick-by-light warehouse system illuminates the compartment that contains the next part.

The _CAPRI modules are integrated into our service-based production landscape. They were built as training demonstrators for the Mittelstand-Digital Zentrums Kaiserslautern to show SMEs how to digitize and automate their production processes. The 3D printer park features comprehensive web-based controls.

Research aims: To experience and understand AI & digital transformation at SME manufacturing companies as well as the transfer of complex content and technologies to the training demonstrators. To implement worker assistance via tablet, smartphone, or AR glasses.

Project participation: Mittelstand-Digital Zentrum Kaiserslautern



PRODUCTION ISLAND_SKYE

_SKYE enables the return of used truck parts (re-use) to the value chain in keeping with the circular economy. Using AI tools, used components are checked for visual defects and a quality assessment is carried out with regard to re-use. The checked components are integrated into the shared production ecosystem via a data space and a Digital Product Pass in the form of the administration shell. This means that products as well as services can be offered in the value network. The reuse of components is one of the greatest ways to conserve valuable resources. In addition to reducing the CO2 footprint, re-use also reduces costs. By returning used parts to the shared production, we demonstrate a practical way to implement the circular economy through the use of AI algorithms and the standardized provision of information.

Research aims: To test a circular economy concept in which used parts reenter the value chain in order to incorporate multiple life cycle stages into the production systems and the economy.

Participating companies and projects: Green AI Hub, Greenable



APPLIED TECHNOLOGIES



SmartFactory^{KL} develops and tests the manufacturing technologies of tomorrow in research projects and joint working groups involving member companies. In addition, we maintain relationships with scientific institutions and networks to collaborate on useful findings that we build into practical applications. The Shared Production setup created in Kaiserslautern serves as a testbed, for example, for digital twins, safety-tools, AI methods, 5G, or data spaces.

THE DIGITAL PRODUCT PASS (DPP)

In the future, it will be possible to access information about a certain product digitally. The Digital Product Pass (DPP) accompanies the product throughout its entire lifecycle and serves as a technological tool to support the transformation from the linear economic system towards a circular economy. In our case, the DPP is implemented through the product's administration shell. Standardized access to the product data enables various reuse strategies and makes sustainability indicators transparent. In the manufacturing phase of the truck model, material and energy data are collected, which then allows the product carbon footprint (PCF) to be calculated. The CO₂ balance serves here as a measure of resource use and also as a benchmark for competing products. Individual parts of the truck can be offered for re-use on the marketplace with the help of the DPP, which includes disassembly instructions and information on the quality and useful life. In comparison, the PCF of a truck with used parts is lower than that of a completely new production model.

DATA SPACES

Today's manufacturing industry is experiencing a paradigm shift that is moving the importance of data to center stage. Companies face the challenge of optimizing the generation and use of data to remain competitive and meet legal requirements. Previous approaches to data exchange have been fragmented, hindering efficient collaboration and access for new participants. The data space is a new networked, transparent, and efficient communication solution. Data spaces not only promote collaboration between companies, but also the development of new business models and innovative products. In contrast to closed platforms, data spaces guarantee the data sovereignty of the user and provide flexibility and interoperability. The Shared Production setup in Kaiserslautern shows how a data space works and that it is already scalable and uncomplicated today.

Production Level 4

TRUSTWORTHINESS - SAFETY MEETS SECURITY

The goal of the “Connect & Control” working group at **SmartFactory^{KL}** is to develop dynamic safety architectures that include both operational safety intelligence and IT/OT security. Operational safety intelligence is a term that refers to the dynamic extension of functional safety at runtime that monitors and protects machines, processes, and the production environment in addition to protecting people. This extension can be seen as an additional layer that leaves classic functional safety untouched. An integrated approach is essential for a highly networked production environment such as the Industrie 4.0 ecosystem. The Trustworthiness Task Force was established to bring together all aspects of safety & security and is dedicated to the shared vision of safety, security, reliability, privacy, and resilience. This combination used in manufacturing is intended to counteract the high productivity losses caused by conventional methods and predictively prevent errors. The expected result is higher plant availability, which leads to higher productivity and sustainability of production systems. Digital tools such as knowledge graphs, anomaly detection, digital twins, and multi-agent systems are used in a targeted manner to create and implement dynamic situation assessments and generate the corresponding recommendations for action.

ARTIFICIAL INTELLIGENCE (AI)

Artificial Intelligence (AI) operations are used in various tasks at Shared Production Kaiserslautern. We use AI to assist humans as they go about their activities. AI is often more powerful and more accurate, especially, for the repetitive work associated with large databases. However, it is limited when it comes to optimizing workflows, developing new processes, or detecting structural faults. We work on the interaction of AI operations with human capabilities to make the best use of both.

An example of the many uses of AI in our shared production setup is its use at the _SKYE production island: The first step is an optical quality check to detect potential defects on the model truck. In our case, this image data is then examined by the AI system to detect and classify defects. In the next step, a detected defect is evaluated by another AI algorithm. A transparent and deterministic AI decision support model evaluates the risks associated with each defect and sorts the part into a quality class according to the known risks. Another AI model, trained with empirical knowledge then makes the resale decision (price and target market) based on the quality status evaluation and historical data from the digital product passport.



Production Level 4 (PL4) is the dynamic update of the Industrie 4.0 (I40) concept. PL4 adheres to the concept of subsidiarity in manufacturing, aiming for production automation level 4, while taking into account AI methods, the latest technologies, and people. The goal is a resilient, sustainable, and future-oriented production system. This is being realized, for example, in the service-based shared production environment that we have set up in Kaiserslautern. There, we use digital twins, data spaces, production Bots, multi-agent systems, and AGV. We believe that the convergence of IT and OT will lead to completely new production efficiencies. Transparency towards employees is a major factor in making the right decisions.



RESEARCH AND INDUSTRY

For many years, *SmartFactory*^{KL} Kaiserslautern (*SmartFactory*^{KL}) has performed the role of research and transfer organization, one that builds and transfers the production systems of the future. SmartFactory-KL is constantly driven by the desire to help shape the manufacturing environment of tomorrow and to have its „eyes the horizon.“ The transfer of cutting-edge research into practice is always associated with major challenges. The organizational structure of *SmartFactory*^{KL} is ideally suited to meet these challenges. The participation of the Department of Machine Tools and Control Systems (WSKL) of RPTU Kaiserslautern-Landau and the German Research Center for Artificial Intelligence (DFKI) combined with the practical relevance of the Technology Initiative *SmartFactory*^{KL} with its industry membership facilitates the appropriate handling of these challenges. This structure results in a high level of understanding of the issues facing industry and, with the aid of the latest technologies and research findings, allows *SmartFactory*^{KL} to contribute to the solutions. The cooperation within the association always focuses on pre-competitive topics. Industrial projects detached from the association's work, can address the individual challenges of companies on a bilateral economic and competitive basis within the framework of DFKI Industrials and individual challenges to DFKI from companies. Such cooperation is completely decoupled from the work of the *SmartFactory*^{KL}, with a clear separation between IP and proprietary know-how in all matters. In the context of the SmartFactory Kaiserslautern's own understanding, the implementation of a custom solution in industry places the highest possible demand on the excellence of its own work. The desire to help shape the production of tomorrow and to use future technologies to solve current and future problems, finds its culmination in individual collaboration with industrial companies.

DEMONSTRATOR PARTNERS 2024



B&R INDUSTRIAL AUTOMATION GMBH

Brief description

B&R Industrial Automation manufactures industrial automation systems and is ABB's global center for machine and plant automation. B&R was established Erwin Bernecker and Josef Rainer in 1979 with headquarters in Eggelsberg, Austria. Today, B&R is a leading supplier of automation solutions for machines and factories and is responsible for ABB's robotics and production automation division. Steady innovation and strong partnerships have been the hallmarks of B&R's success for over 40 years.

Contribution to the demonstrator

ACOPOStrak from B&R is the highly flexible transport system at the heart of the _KUBA production island. The integrated "high speed switches" in ACOPOStrak enable separating and merging of product flows at full speed production. Individual products can take individual routes through the production system. The modular architecture of the ACOPOStrak system means it can grow with production requirements and adapt to changes in the production process at any time during operation. Setup times are for the most part eliminated! Thanks to its flexibility and modularity, ACOPOStrak is perfectly adapted to the requirements of shared production and the production of very small batch sizes. The *SmartFactory^{KL}* demonstrator landscape includes B&R industrial PCs and control panels as edge devices and HMI systems. In addition, our functional safety technology and vision technology are in use as part of the further development of *SmartFactory^{KL}*'s modular safety concepts, up to and including "operational safety intelligence."

More information at

www.br-automation.com



BOSCH REXROTH

Brief description

Economical, precise, secure, and energy efficient: Power and control systems from Bosch Rexroth move machines and plant systems of all sizes. The company combines worldwide experience in the market segments of mobile applications, plant engineering and construction, with factory automation in its development of innovative components, customized system solutions, and services. Bosch Rexroth is the single source for customers seeking hydraulics, electric drives and controls, gear technology as well as linear and assembly systems. In 2021, with more than 31,000 associates in 80 countries, the company generated sales of around 6.2 billion euros.

Contribution to the demonstrator

Implementation of the ctrlX AUTOMATION module at the _KUBA production island. The ctrlX CORE serves as a communication interface and takes over the control and description of each module. At _MILOS, implement the centralized control of the retrofitting milling skill with the aim of automating the production of milled parts in batch size 1 sent via CAD to the shared production network. Active member of WG 1 (Cyber-physical production modules) & WG 2 (Connect & Control). Collaboration on various edge and edge-cloud concepts (GAIA-X), together with IBM, German Edge Cloud, B&R, Siemens, Perinet, DFKI, TÜV SÜD, PFALZKOM, Telekom, Huawei, and Weidmüller.

More information at

www.boschrexroth.de



EMPOLIS

DFKI GMBH

Brief description

DFKI has been performing human-centric AI research for over 35 years in the major pioneering areas of AI research and applications and is oriented towards socially relevant issues and scientific excellence. The German Research Center for Artificial Intelligence (DFKI) was established in 1988 as non-profit, public-private partnership. It maintains facilities in Kaiserslautern, Saarbrücken, Bremen, and Niedersachsen, with labs in Berlin, Darmstadt, and Lubbeck and one branch office in Trier. Based on application-oriented basic research, DFKI develops product functions, prototypes, and patentable solutions in the field of Information and Communications Technology. Projects are ongoing in 27 research departments, ten competence centers, and eight living labs. Funding is received from government agencies and R&D contracts with industry. Project results and milestones are periodically reviewed institutionally and audited by an international panel of experts (Scientific Advisory Board). Apart from the state governments of Rhineland-Palatinate, Saarland, and Bremen, numerous renowned German and international high-tech companies from a wide range of industrial sectors are represented on the DFKI supervisory board.

Contribution to the demonstrator

Production island _SKYE – For a circular economy in a shared production ecosystem. Artificial Intelligence can make a huge contribution to the re-use of product components. The prerequisite being a digital twin of the product that is as complete as possible with comprehensive component data that can be identified and accessed via administration shells. The _SKYE production island demonstrates the AI-based quality check of a used truck model, resulting in a decision concerning re-use of the part. With AI-support and the help of the product self-description from the administration shell, the manufacturer is able to make a qualified decision as to whether the use of a used or a new component is more cost-effective, sustainable, and operationally efficient. _SKYE simulates new product ordering with used or new components. Each recyclable component contains a product passport, which includes information on the current condition, previous use history, and carbon footprint. This allows the person ordering a truck to choose to install re-use components with a documented product history while saving materials, energy, and CO₂.

More information at

www.dfki.de

EMPOLIS INFORMATION MANAGEMENT GMBH

Brief description

Empolis, a proALPHA Group company, bundles Artificial Intelligence systems for CRM and service applications in the Cloud. These enable a completely new quality of service, customer approach, and digital „as a service“ and platform business models – from signal to action. Innovative service products can be developed and marketed quickly using real-time analysis of machine, product, and service related data and the latest human-machine interfaces. Future service technicians will have personal service assistants using voice controls to guide them through the repair, maintenance, and diagnostic tasks. AI continuously processes data and information automatically and provides it to the worker, if requested. AI technologies and digital assistants represent the next logical step in the fourth industrial revolution; Human and Artificial Intelligence will work hand in hand in the future. Around 500 Empolis installations exist around the world and nearly 700,000 professional users rely on Empolis solutions on a daily basis to serve approximately 40 million end customers.

Contribution to the demonstrator

Empolis support is based on the use of Artificial Intelligence. Several workgroups use AI from Empolis for anomaly detection, error analysis and understanding, guided worker assistance as well as in the areas of safety and security in worker activities. This facilitates the implementation of shared production concepts and resilient production. For example, knowledge graphs, natural language processing, semantic search, decision trees, and also machine learning methods are used to analyze machine data, which revolutionizes Human-Machine Interaction in the context of *Production Level 4*.

More information at

www.empolis.com



EPLAN SOFTWARE & SERVICE GMBH & CO. KG

Brief description

EPLAN develops CAx, configuration and mechatronic engineering solutions and provides consulting services to companies as they optimize their engineering processes. Customers benefit from improved efficiency in product development with standard operations, automated processes, and integrated workflows. EPLAN delivers customized concepts for system introduction, setup, and precise integration into the IT and PLM system landscape – based on standard engineering solutions. The service portfolio includes customizing, consulting, and training. The development of customized and standard interfaces to ERP, and PLM/PDM systems ensure data consistency in product development, order processing, and manufacturing. Consistent customer orientation, global support, innovative development, and interface competence are engineering success factors. EPLAN was founded in 1984 and the company is part of the Friedhelm Loh Group.

Contribution to the demonstrator

The new *SmartFactory^{KL}* demonstrator is 100% planned with EPLAN. Several EPLAN products are used: EPLAN Electric P8 (ECAD), EPLAN Fluid (Fluid-Engineering), EPLAN Pro Panel (controller and switchboard design). The entire plant was designed with EPLAN and stored after completion in the cloud via EPLAN eVIEW. Project data is then shared and exchanged with value-adding partners.

More information at

www.eplan.de



FUJITSU TECHNOLOGY SOLUTIONS GMBH

Brief description

Fujitsu is a global partner in the digital transformation and has the aim of making the world more sustainable by building trust in society through innovation. Fujitsu has approximately 124,000 employees supporting business customers in more than 100 countries. The service and solutions portfolio for sustainable transformation is based on five cutting-edge technologies: Computing, Networks, AI, Data & Security, and Converging Technologies. In the fiscal year 2022 (ended March 31, 2022), Fujitsu Limited (TSE:6702) headquartered in Tokyo, Japan, reported consolidated annual revenues of 3.7 trillion Yen (28 billion USD) and remains the leading digital services company in Japan in terms of market share.

Contribution to the demonstrator

The need for more sustainable manufacturing in the future is closely tied to the topic of resilience and potential shared production solution. The three fields of action: self-determined data exchange via data spaces, integrated use of comprehensive energy data, and OT Security are prerequisites for innovative sustainable approaches in shared production environments. Specific contributions include recording the live product carbon footprint via Energy Consumption Optimization, federated Trust & ID solutions for data spaces, and monitoring the production modules to improve cybersecurity.

More information at

www.fujitsu.com/de/



GERMAN EDGE CLOUD GMBH & CO. KG

Brief description

German Edge Cloud (GEC) is part of the Friedhelm Loh Group and specializes in innovative edge and cloud solutions for manufacturing companies that enable optimal networking of shop floor infrastructures, fast and secure data access, and perfect process optimization in manufacturing. As a founding member of Catena-X, the company places a special emphasis on data sovereignty and scalability from the edge to the cloud. The ONCITE Digital Production System (DPS) is a combination of industrial software applications, coordinated and based on a cloud or edge infrastructure. ONCITE DPS digitalizes manufacturing processes and creates a manufacturing digital twin. The system is precisely designed to meet the challenges and new goals of intelligent production environments. GEC's DPS is being used at the Rittal smart factory, a sister company located in Haiger, where it is a blueprint and a display model for the topic of „Edge/Cloud-based, real time capable, and data sovereign Industrie 4.0 application scenarios.“

Contribution to the demonstrator

ONCITE DPS is a central component of the industrial edge cloud for the *SmartFactory*^{KL} demonstrator ecosystem. It represents the digital twin of the various *SmartFactory*^{KL} production islands, as it does for productive use in customer environments. It ensures secure data transmission and low latency times throughout the entire ecosystem value chain, which favors fast data processing on the shopfloor. The normed ONCITE DPS data model is the basis for the easy reuse of data for visualization, analytics, and AI scenarios. In addition, the system enables the standardization and consolidation of the shop floor infrastructure.

More information at

www.gec.io



GREENABLE GMBH

Brief description

Greenable, a Kaiserslautern based start-up, has developed software to balance the carbon footprint of products. In particular, small and medium-sized manufacturing companies are able to balance, disclose, and reduce the carbon footprint of their products. We stand for trustworthy, user-friendly and efficient emission management of products. With our software, our customers can easily balance the carbon footprint of their products in accordance with standards, initiate measures to reduce emissions and, at the same time, meet customer needs. Our customers gain transparency about their own processes and supply chain. This enables them to reduce emissions through their choice of machines, materials and suppliers. They are also in position to act sustainably and improve the public image of their company and products. We create transparency across industries and products for a sustainable future!

Contribution to the demonstrator

Our joint use case focuses on the digital product passport, product carbon footprint (PCF), and the circular economy. These are implemented on the innovative production island _SKYE with the re-use concept. We use our software to calculate the product's carbon footprint and obtain a valid and accurate result. The main goal is to show how the carbon footprint of the reused product components compares to that of new products. Is re-use worthwhile or is a new component more efficient, for example, in terms of sustainability KPI such as PCF. We feed the results back into the "Carbon Footprint" sub-model of the digital product pass in the AAS, where users can view the certificates and detailed values.

More information at

www.greenable.tech



Pushing Performance
Since 1945

HARTING STIFTUNG & CO. KG

Brief description

The HARTING Technology Group is a leading global supplier of industrial connection systems. Approximately 6,200 employees work in 44 sales companies, 15 production sites, and six development centers worldwide. HARTING Connectivity solutions are used in many industries: transportation, electric mobility, energy generation and distribution, automation, and equipment manufacturing. The family-owned company generated sales of 1.036 billion euros in 2022/23.

Contribution to the demonstrator

Anchored in the company vision is the desire to shape the future using technologies designed for people. *Production Level 4* clearly aligns with this forward looking vision of manufacturing. Given such agreement, it is easy for us to lend our full support to the demonstrator. Together with *SmartFactory*^{KL}, HARTING designed one of the demonstrator modules. The main aspect for HARTING is connectivity. Connectivity assumes a new role in highly flexible and adaptable production systems that demand connectors that are easy and safe to plug and unplug. Such connectors are the key to flexibility and should be implemented depending on state. Plug connectors with smart optional features can perform this task. HARTING implements connectivity concepts and tests them for utility in the *Production Level 4* demonstrator.

More information at

www.harting.de



HUAWEI TECHNOLOGIES DUESSELDORF GMBH

Brief description

Huawei Technologies is one of the world's leading suppliers of information systems and telecommunications platforms. More than a third of the world's population and more than half of Germany's population use Huawei technology. Headquartered in Shenzhen, China, the company has over 197,000 employees worldwide and operates in 170 countries through its three business units: Carrier Network, Enterprise Business, and Consumer Business. Huawei has 107,000 employees in the area of research and development and operates 16 R&D clusters worldwide as well as 28 innovation centers together with partners. Huawei has been operating in Germany since 2001 and employs over 2,000 people at 18 locations. The headquarters of Huawei's European Research Center is located in Munich, Germany.

Contribution to the demonstrator

We use the aspect of quality assurance in a shared production environment networked with our production cell in Munich as an example of federated AI, a kind of data-sovereign machine learning method. A mobile camera sends data via 5G to a local edge device that monitors manufacturing quality. The common AI model built in the cloud receives from all manufacturing partners, where it is stored maintaining data sovereignty and optimized for local use at the partners. In the „smartMA-X“ project, we are partnered with GAIA-X and demonstrate how our production equipment and services are integrated on a customer-specific basis into a virtual *SmartFactory*^{KL}.

More information at

www.huawei.com



IBM DEUTSCHLAND GMBH

Brief description

IBM supports companies in the transformation to Industry 4.0 – from the idea to continuous value creation. Our customers' success is based on vertical and horizontal integration, data-based optimization of manufacturing, services, and products as well as more efficient business processes in all areas of operation. IBM offers consulting, design, and implementation as well as the necessary system modules. Analysts attest to IBM's leading position in the provision of complete IoT software platforms with integrated functionalities such as cognitive applications, augmented reality, blockchain, natural language processing or edge computing. The scalability and open interfaces of IBM solutions make Industrie 4.0 a realistically exploitable opportunity for every company.

Contribution to the demonstrator

The basis of the **SmartFactory^{KL}** demonstrator is the IBM App "Connect for Manufacturing." It demonstrates IBM's approach to the future of Industrie 4.0 by bridging the OT/IT gap in a scalable, actionable, and secure way and paving the way to a hybrid cloud. We demonstrate a managed, semantic representation of all OT data in the IBM IoT platform using IBM App Connect. Paired with the latest version of the **Smart-Factory^{KL}** Dashboard, we provide a complete representation of the entire factory floor live and in real time. This accelerates our development of anomaly detection at the infrastructure nodes, which supports the demonstrator as a whole and opens up more opportunities for innovation in the cloud. In addition, we demonstrate the first steps in implementing a shared production scenario across multiple factories based on GAIA-X. Mettler Toledo's quality inspection module is physically located in the Watson Center Munich, where we demonstrate vibration and acoustic analysis at both edge and cloud levels.

More information at

www.ibm.com



MAKINO EUROPE GMBH

Brief description

Makino Milling Machine Co., Ltd. is one of the leading technology and service provider in machine tool industry. The company is listed on the Tokyo Stock Exchange and employs more than 4,400 people in America, Europe, and Asia. Sales for the fiscal year ended March 31, 2022 were nearly 1.5 billion USD. MAKINO's wide range of world-class production solutions includes machining centers for parts manufacturing and tool and die making, with a variety of applications for aerospace, automotive, construction and agricultural machinery, industrial components, and microtechnology. MAKINO Europe employs around 200 people in technology centers and offices in Germany, Italy, France, Spain, Slovakia, Poland, and Russia, with a focus on marketing, sales, application engineering and service.

More information at

www.makino.eu



MINITEC GMBH & CO. KG

Brief description

MiniTec – from modular systems to custom, fully automated integrated systems. The MiniTec system is a modular design – consisting of profile as well as linear systems. Our designers and engineers passionately follow the principles that characterize all MiniTec products: maximum simplicity, no machining, unlimited range of applications with few components and universal compatibility.

We always aim to avoid senseless product diversity. The shortest assembly time and avoidance of machining have top priority – true to our slogan "The Art of Simplicity."

More information at

www.minitec.de



PERINET GMBH

Brief description

Perinet develops innovative electronic, electro-mechanical, and software components to enable a seamless connection of sensors and actuators to IT systems via a hybrid single-pair ethernet. Direct, fully encrypted communication with every sensor and actuator in the field enables operational access to relevant process data in a wide range of IoT, Industrial IoT, and Industrie 4.0 use cases. Our components can be implemented in new and – through retrofitting – in existing plants, enabling fast, efficient and economical digitalization. The modular design of our requirements-based edge computer completes our product portfolio in the vertical. In addition, we advise customers on digitalization and Sensor2Cloud.

Contribution to the demonstrator

Perinet provides intelligent sensor and actuator technology, so called smart peripherals, for the implementation of **Production Level 4**. within the framework of Industry 4.0. These smart peripherals are networked via future-proof hybrid single pair Ethernet (SPE). Perinets products are easy to integrate (Self-X) and communicate via established Internet Technology (IT). In contrast to conventional PLC solutions, our IPv6-based Sensor-2-IT approach offers real end-to-end communication by implementing established security technology.

More information at

www.perinet.io



PFALZKOM GMBH

Brief description

Digital – but secure! PFALZKOM is a reliable ICT partner that makes your IT infrastructure efficient and affordable. We provide highly reliable data centers, high performance fiber optic network, and managed services. Use colocation and operate your IT hardware in our regional data centers. Improve your energy efficiency, benefit from high reliability and save costs in the process. Unburden your IT team by outsourcing recurring, standardized IT services – managed services – to us. You too will benefit from fast transfer rates and excellent availability when you connect through our own fiber optic network.

Contribution to the demonstrator

PFALZKOM provides the Industrial Edge Cloud for the demonstrator environment. Specifically, the Regional Edge Cloud is provided in the regional PFALZKOM data centers. Building and operating data platforms such as Gaia-X requires secure private cloud architectures with dedicated access. These foundations make autonomous production possible and enable the advantages of federated services.

More information at

www.pfalzkom.de



PILZ GMBH & CO. KG

Brief description

The Pilz Group is a global supplier of products, systems, and services for industrial automation systems. This family business has 42 subsidiaries and branches worldwide working to ensure the safety of people, machines and the environment. The technology leader supplies integrated automation solutions comprising sensors, control and drive technology – to include systems for industrial communication, diagnostics and visualization.

Contribution to the demonstrator

The safety solutions from Pilz protect both physical and digital access to machines and processes. Our machine security components, a selectable operating mode, and the access authorization system plus firewall combine to cover both machine security and the industrial security of the plant. Safety and Security are critical success factors in the context of **Production Level 4**.

WG 2 “Connect & Control” is developing a dynamic safety architecture. Together with TÜV SÜD and B&R Automation, we are implementing a dynamic safety concept in the **SmartFactory^{KL}** production setting. Production is being adapted to human behavior under the heading “Operational Safety Intelligence.” What if sensors with the appropriate control systems could master safety risks with the help of AI? The result would be a safe and productive work environment with zero downtime. The basis for this is additional sensor technology for functionally safer components such as the radar sensor from Pilz, which can not only detect the position of objects, but also the speed and direction of movement.

More information at

www.pilz.com



PROALPHA BUSINESS SOLUTIONS GMBH

Brief description

proALPHA, with 56 locations around the globe, has been the digital sparring partner for small and medium-sized businesses for almost three decades. The powerful ERP core and add-on solutions from proALPHA and its partners form the digital backbone of the entire value chain for more than 8,200 customers – from the manufacturing industry, wholesale, and other sectors. proALPHA software ensures intelligent interconnection and efficient control of all business-critical systems and core processes. In increasingly competitive markets, an optimal integration of up and downstream processes is a crucial factor. The diverse software solutions from the proALPHA Group and its 262 partners provide support to every customer precisely in the areas that are most important to their businesses. The motivation of the more than 2,000 employees at proALPHA is as simple as it is focused – whether in data analysis and artificial intelligence, procurement, financial performance, security, quality, energy, production, or time management: contribute every day to a digital software platform that gives SMEs the necessary competitive edge in the ongoing transformation process.

Contribution to the demonstrator

proALPHA provides the interface between the business management and the manufacturing levels: Using the integrated product configurator, it is easy to design the model truck – it is even browser-based with an interactive 3D previewer. The communications interface is based on technologies such as REST and MQTT and ensures the synchronization of order data and feedback to and from the ERP system.

More information at

www.proalpha.com



RADIFLOW

Brief description

Radiflow develops OT-specific security solutions that enable critical infrastructure and ICS organizations to assess and monitor all ICS traffic for attack attempts, provide full network visibility, and minimize cyber risk – all with the aim of ensuring operational resiliency and optimizing OT security expenditures. Radiflow operates a global network of certified local channel partners and maintains a world-class technology partner ecosystem that enables it to complement existing platforms with Radiflow’s threat detection, asset management and risk assessment data. All of Radiflow’s solutions are developed for local or centralized deployment in the enterprise SOC or an MSSP. Founded in 2009, Radiflow protects more than 7,000 locations worldwide in many different sectors.

More information at

www.radiflow.com



RAUSCH & PAUSCH SE (RAPA)

Brief description

The medium-sized RAPA group of companies is an internationally recognized research and development partner as well as a system supplier for application-specific valves and fluid-mechatronic system solutions in the automotive industry, medical technology, and the manufacturing industries – and has been for over 100 years. The operational business is organized in the subsidiaries RAPA Automotive, RAPA Healthcare, and RAPA Industry. Dr. Roman Pausch heads the family business with co-CEO Karin Wolf. In addition to its headquarters in Selb, Bavaria, RAPA is represented by subsidiaries in North America and China. RAPA currently employs around 1000 people worldwide.

More information at

www.rapa.com



RHEINLAND-PFÄLZISCHE UNIVERSITÄT KAISERSLAUTERN-LANDAU (RPTU)

Brief description

Rhineland-Palatinate's Technical University of Kaiserslautern-Landau was created on January 1, 2023 by the merger of the Kaiserslautern University of Technology and the University of Landau. With approximately 19,000 students and more than 300 professors, the university is the second largest academic institution in the state. As a center of international research and an academic talent factory for business and science, RPTU offers an excellent, open-minded environment for study and research. RPTU is an important innovation and transfer partner for government, business, and society. Those who study, learn, research, or work at RPTU are part of a vibrant university community that is shaping the world of tomorrow.

Contribution to the demonstrator

The University of Kaiserslautern-Landau (RPTU) maintains a close cooperation with **SmartFactory^{KL}** and contributes the hardware and software it has developed to the demonstrator ecosystem. One current priority of interest is Federated Learning: Federated learning benefits from the advantages of data diversity in a shared production network without jeopardizing data security and data protection. The locally learned models are exchanged in aggregated form, resulting in a shared, improved model without sensitive production data having to leave the location. The quality assurance of the truck trailers illustrates the advantages over machine learning models trained in isolation.

More information at

www.mv.rptu.de/fgs/wskl/



SICK AG

Brief description

SICK is one of the world's leading producers of sensors and sensor solutions for industrial automation applications. Founded in 1946 by Erwin Sick and headquartered in Waldkirch in Breisgau near Freiburg, the company is now a technology and market leader and is present around the globe with more than 50 subsidiaries and holdings as well as numerous agencies. Sick employs approximately 12,000 people worldwide and reported sales of 2.2 billion euros in FY 2022.

More information at

www.sick.com



SIEMENS AG

Brief description

Siemens (Berlin and Munich) is a technology company focused on industry, infrastructure, mobility, and healthcare. Resource-efficient factories, resilient supply chains, and smarter buildings and power grids, cleaner and more comfortable rail transportation as well as advanced healthcare – we create technology with a purpose, adding real value for customers. By connecting the real and the digital world, Siemens enables its customers to transform their industries and markets, helping them to improve the everyday lives of billions of people. Siemens is the majority owner of the publicly traded company Siemens Healthineers – a global leader in medical technology that is shaping the future of healthcare. Siemens also holds a minority stake in the publicly traded Siemens Energy, one of the world's leading companies in power transmission and generation. In fiscal year 2022, which ended on September 30, 2022, the Siemens Group generated revenue of 72.0 billion euros and net income of 4.4 billion euros. As of September 30, 2022, the company had around 311,000 employees worldwide.

More information at

www.siemens.de



STÄUBLI INTERNATIONAL AG

Brief description

Stäubli Electrical Connectors develops advanced connector systems and solutions on the basis of reliable MULTILAM contact technology. In the field of photovoltaics, Stäubli is a pioneer and global market leader with its MC4 connector system. Stäubli provides connections for life in industries such as renewable energies, industrial and automation applications, power transmission and distribution, railroad technology, welding automation, test and measurement technology, medical devices, and e-mobility.

More information at

www.staubli.com/ch/en/electrical-connectors.html



T-SYSTEMS INTERNATIONAL GMBH

Brief description

With locations in more than 20 countries and over 26,000 employees (December 31, 2023), as well as annual revenues of around EUR 4.0 billion (2023), T-Systems is one of the leading providers of digital services in Europe. T-Systems offers end-to-end IT solutions, driving the digital transformation of companies in all industries and public institutions. T-Systems' focus industries are automotive, the public sector, healthcare, and public transport. In these selected industries, T-Systems develops industry-specific solutions, so-called vertical applications. These include, for example, services for Catena-X, the open data ecosystem for the automotive industry, digital identities in the healthcare sector, administrative digitalization and an AI-based forecasting machine for public transport.

More information at

www.t-systems.com



TE CONNECTIVITY GERMANY GMBH

Brief description

TE Connectivity is a global technology leader working to ensure a safer, sustainable, productive, and connected future. Our broad range of connectivity and sensor products has proven itself in demanding environments while enabling advances in transportation, industrial applications, medical technology, energy technology, data communications, and in home use.

With more than 85,000 employees, including more than 8,000 engineers, we work with customers in nearly 140 countries. Our commitment is reflected in our motto: EVERY CONNECTION COUNTS.

More information at

www.te.com

and on LinkedIn, Facebook, WeChat and Twitter



TIKI GMBH

Brief description

The Technical Institute for Applied Artificial Intelligence (TI.KI), was founded in 2017 and is based in Weiden (near Bayreuth). The company develops and distributes productive AI solutions for the 3 partners from the fields of electrical engineering, plant engineering and service, as well as for customers. The focus is on the standardized integration of AI in everyday business. Based on a specially developed AI ecosystem (more than 50 man-years and an investment of 20 million euros, it is possible for the company to promise its customers "from an idea to useful AI in 90 days." TIKI is also a Gold Partner of Dremio and supports consulting and implementation of Lakehouse systems. This new architecture enables engines to access to different data sources as one data product. In collaboration with **SmartFactory^{KL}**, we develop processes that deliver on the new promise "From a completed AI model to the factory floor in 90 minutes."

More information at

www.tiki-institut.com



TÜV SÜD AG

Brief description

TÜV SÜD: Add Value. Inspire Trust. Approximately 25,000 employees at more than 1,000 locations worldwide ensure the optimization of engineering, systems, and know-how. They make a major contribution to shaping the safe and successful digital transformation of companies.

We support companies in achieving maximum quality, efficiency and safety for their products, systems and services – both for traditional systems and in the area of Industrie 4.0 and IIoT. As a partner with broad industry experience and internationally recognized expertise, we work with our customers to develop digital solutions for the complex requirements of networked factories and to enable seamless human-machine collaboration.

Contribution to the demonstrator

Productivity, flexibility, and safety are at odds with each other in flexible I4.0 manufacturing, especially, in terms of human-machine collaboration. Our TÜV SÜD contribution is to solve this contradiction by using a new safety concept called „Operational Safety Intelligence.“

We implement this concept using information models that incorporate safety and security and take into account the current manufacturing situation.

This context sensitive concept follows an agent-based approach in connection with semantic networks. TÜV SÜD experts are significantly involved in this development.

More information at

www.tuvsud.com/de



WEIDMÜLLER INTERFACE GMBH & CO. KG

Brief description

From automotive manufacturing to power generation to water management – few industries today can do without electronics and electrical connectivity. As new markets emerge in this globalized, technologically changing world, the complexity of the requirements is rapidly increasing. New and more diverse challenges must be overcome. Connectivity is the key, whether for power, signals and data, or for requirements and solutions, or between theory and practice. Industrial connectivity requires connectors and Weidmüller's 6,000 employees worldwide provide them!

Contribution to the demonstrator

For more than 10 years, Weidmüller has played a key role in shaping the infrastructure concept of *SmartFactory^{KL}*. We enable more automation of the infrastructure by introducing energy measuring devices, providing interoperable consumption data for different media, and, finally, by integrating intelligent connectors. Industrial controls at the infrastructure nodes and the use of intelligent connectors serve to support the flexibility and modularity of the *Production Level 4* demonstrator by enabling automatic commissioning and decommissioning of the various production modules. Plugging and unplugging of the connector is only possible when there is no voltage flow, regardless of whether the power supply is AC or DC, which means our smart plug connector provides increased safety.

More information at

www.weidmueller.de



YASKAWA EUROPE GMBH

Brief description

Founded in 1915 in Japan, Yaskawa today is a leading global technology supplier in the fields of robotics, motion and control systems, and visualization. Yaskawa is one of the few companies in the world that can supply components, systems and solutions for almost all industries from a single source. The Motoman robot model is used in a wide variety of industrial applications, for example, in robotic welding in the automotive and metalworking industries, in CNC assembly and injection molding machines, in semiconductor manufacturing or other handling and assembly tasks, as well as in packaging lines in food and pharmaceutical production, but also in laboratory automation and automated painting operations. Yaskawa has also been planning and implementing complete turnkey robot welding systems in Allershausen near Munich for around four decades. The strategic importance of systems engineering is to be further expanded in the coming years: The goal is to become the European market leader in this area. Yaskawa also relies heavily on Europe as a production location for robots: around 80 percent of European demand for Motoman robots is now covered by the plant in Kočevje, Slovenia. This commitment on the part of the manufacturer of robots and welding systems currently results in unparalleled delivery performance in the EMEA market in this sector. Based in Hattersheim near Frankfurt, Yaskawa Europe offers mechatronics and robotics solutions for companies throughout Europe, the Middle East and Africa.

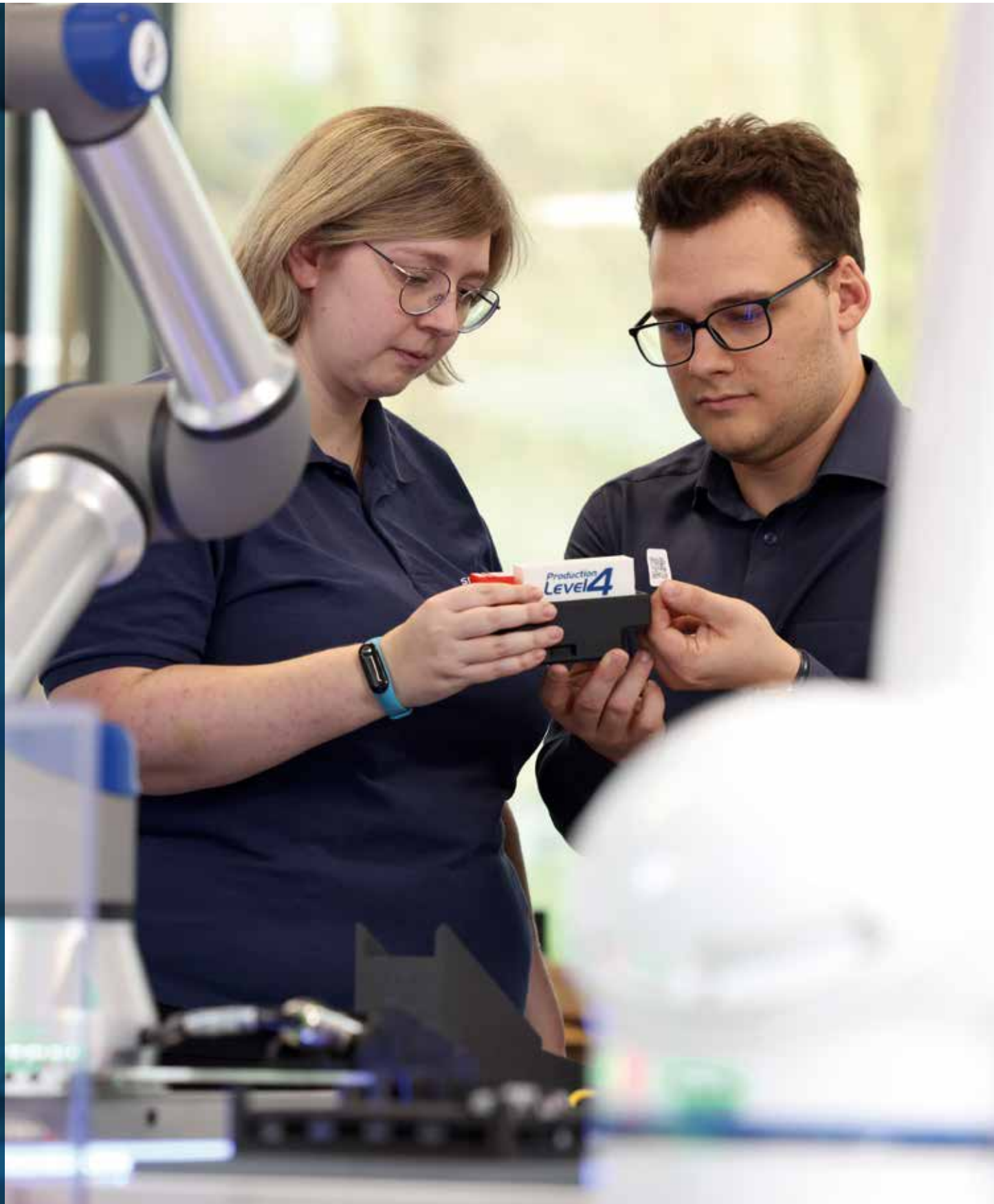
Contribution to the demonstrator

In the *SmartFactory^{KL}*, smart robots from Yaskawa – such as the Motoman GP4 and MotoMINI handling robots and the Cobot HC10 – play a key role because, to a large extent, their intelligence already enables the flexibility required in production. Mobile robots implement autonomous and efficient applications using intelligent navigation algorithms and networked systems in the factory of the future.

More information at

www.yaskawa.de

SELECTED RESEARCH PROJECTS



SMARTMA-X

The smartMA-X project began as an ambitious idea: Shared Production, in which companies work together in data spaces to manufacture efficiently, sustainably, and protected against external influences. A major hurdle first had to be overcome: The secure sharing of data with each other in a networked system as a prerequisite for value-adding collaboration. To turn this vision into reality, the smartMA-X ecosystem relies on three fundamental pillars: (1) a manufacturer-independent, standardized structure of information models for the exchange of machine-readable and interpretable data, (2) standard communication for automated negotiations and data exchange, and (3) a federated and secure data infrastructure in compliance with European regulations. SmartMA-X combines the concepts of the administration shell, Gaia-X, and skill-based manufacturing to achieve vertical networking within a company and horizontal networking between companies.



MAS4AI

In Multi-Agent Systems (MAS), several elements, e.g., software agents, act collectively to solve a problem. The goal of the MAS4AI project is to facilitate the development of software agents (production Bots). Each agent or system of agents can be programmed separately and placed in a docker-container for later access. A common information model based on the asset administration shell (AAS) is used for the description, configuration, and parameterization of the MAS4AI agents. All components of the MAS4AI framework can be exchanged, as long as they follow the general architecture and common interfaces. Different agents interact and synchronize with each other through messages and protocols based on the Industrie 4.0 language and the AAS. MAS4AI provides the templates for the most common agents and their standard description. The MAS4AI project provides the foundation for the further development of the multi-agent system for Shared Production Kaiserslautern.



DIMOFAC

The Dimofac project brings together various European partners from research and industry to jointly develop and test the technologies that enable the adaptable and flexible production of tomorrow. Dimofac has designed a series of plug-and-produce production modules to implement modular and reconfigurable production systems. The Common Information Model (CIM), jointly developed and based on the asset administration shell (AAS), promotes interoperability and supports the plug-and-produce capability of modular production lines. Dimofac project designed the CIM for use in the Shared Production Kaiserslautern and is to be further developed and expanded in the future. The _SYLT production island was built as part of the _KUBA production Island to demonstrate skill-based production and is used for research into the concept of reconfigurable cyber-physical production modules.





GREEN AI - HUB MITTELSTAND

The Federal Environment Ministry's Green-AI Hub Mittelstand project is helping small and medium-sized enterprises to improve resource efficiency through the use of modern AI systems. The aim is to highlight the potential of AI to improve process efficiency and to develop prototype solutions in collaboration with the companies themselves. A mobile consulting and demonstration service provides SMEs with practical, solution-oriented support directly on site. The mobile production island _SKYE was built as part of this project.

Green-AI Hub is an initiative within the framework of the Five Point Program „Artificial Intelligence for Environment and Climate“ of the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety, and Consumer Protection (BMUV).

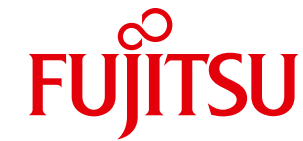
TWIN4TRUCKS



The acronym TWIN4TRUCKS stands for the composite grouping of names „Digital twins and artificial intelligence in a networked factory for integrated commercial vehicle production, logistics, and quality assurance. The aim is to provide end-to-end digitalization solutions for the commercial vehicle industry. This is achieved through a digital twin and by the linking and integrated use of the data in software services for manufacturing, intralogistics and quality assurance. In addition to artificial intelligence methods, concepts like the administration shell, 5G, and UWB are also used. These technologies are used to implement application-oriented solutions that can locate operating resources, route vehicles and load carriers, provide smart support for employees and ensure production quality. We see a growing need to share data across companies in order to ensure transparency about products and processes, as well as to fulfill the required legal obligations to provide traceability. TWIN4TRUCKS is also investigating secure communication of business data via data spaces. A Gaia-X conform data space is being created in which the project partners are testing the exchange of data and services.

TWIN4TRUCKS is part of the German government's economic stimulus package (KoPa) 35c. It is funded by the Ministry for Economics and Climate Action and the European Union.

CO-EXHIBITORS AT HANNOVER MESSE 2024



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THE ASSOCIATION AND ITS MEMBERSHIP



The Technology Initiative **SmartFactory^{KL}** is an association that focuses on the research and development of intelligent production systems and Industrie 4.0 technologies. The association works on the integration of information technology, the Internet of Things (IoT), artificial intelligence, and other innovative approaches to improve the efficiency, flexibility, and competitiveness in the manufacturing industry. **SmartFactory^{KL}** is one of the world's leading organizations in this field and works closely with industry partners, research institutions, and industry associations to drive technological advances in manufacturing.

The **SmartFactory^{KL}** network includes about 40 companies and research institutes. All work together as equals on various research and development projects related to Industrie 4.0 and the production of the future. Together with **SmartFactory^{KL}**-staff, experts from the member companies participate in joint working groups on specific topics. The focus is on implementing the concepts and applying the technologies and software solutions. In the future, we will also focus on business cases and the transfer of developed solutions.

Membership benefits:

- Access to leading research results and innovations in the field of intelligent manufacturing systems and Industrie 4.0.
- Networking opportunities with partners in industry and research institutes.
- Opportunity to participate in and use Shared Production Kaiserslautern to test and introduce new technologies.
- Participation in joint research projects and consortia.
- Access to workshops and conferences on current topics in the manufacturing industry.
- Support for the implementation and adaptation of Industrie 4.0 systems in your own company.

MEMBERS



OUR OFFER TO YOU



The **SmartFactory^{KL}** network includes companies from the field of classic automation, component manufacturers, software providers, telecommunications and users.

Today, the challenge is in getting the manufacturing companies to use the developed Industrie 4.0 applications and systems. It presents an environment that equipment manufacturers and integrators find especially challenging. We are striving to expand our association's network in this subject area.

www.smartfactory.de

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The Technologie-Initiative SmartFactory KL e.V. (**SmartFactory^{KL}**) is a non-profit association registered in the register of associations for Kaiserslautern.

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smartFactory^{KL}