

Driving the Transition to Industry 4.0/5.0

Advanced Technologies for Low-Carbon, Digital, and Energy-Efficient Production

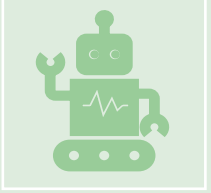
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Faculty of Mechanical Engineering

Introduction



What is Industry 4.0?

- Automation and Robotics (I3.0)
- IoT, Edge Computing and Cyber-physical systems
- Digital Twins, AI and data-driven decision-making, Cyber security...



What is Industry 5.0?

- Human-centric
- Sustainable & resilient manufacturing & Circular Economy
- Reducing waste & Emissions



Why is this transition important?

- Digitalization,
- Economic competitiveness and
- Climate change

Draghi Report – Key Insights

◆ Challenges:

- Europe lags behind in digital innovation and depends on external suppliers
- Needs strategic autonomy in key sectors

◆ Recommendations:

1. Invest in AI & Green Tech
2. Strengthen Supply Chains
3. Boost R&D Funding
4. Reskill Workforce
5. Foster Innovation

◆ Slovenia's Opportunity:

- ✓ Attract high-tech investments
- ✓ Support AI, green tech & digital transformation



Situation in Slovenia

- Strong research institutions
- Many initiatives, activities and events in Slovenia
 - ❑ at the governmental level (events, public calls - MGRT, MIZŠ, SVRK)
 - ❑ at the level of associations (Slovenian Chamber of Commerce – GZS, SRIP ToP and other SRIPs, DIH Slovenia, KCSTV...)
 - ❑ at the research institution's level (Faculties and Laboratories of the Slovenian Universities, JSI, TECOS...)
 - ❑ at the level of companies (Kolektor/Qlector, Yaskawa, TPV, Adria Dom, Telekom and many others, ...)
- A lot of ideas ...

BUT

- The impact is expected to be higher/bigger/faster
- Probably not enough financial means
- **Or is there SOMETHING ELSE ?**

Challenges in Slovenia

- SMEs adoption gap
- Most of the companies DO NOT really understand the essence of I4.0 and Smart factory concepts – connectivity and transparency
- Workforce upskilling needed - The lack of human potential and I4.0 competent experts – better situation in bigger companies, not so good in smaller companies
- A lot of initiatives, different events for spreading the idea of digitalization and I4.0 technologies – **MORE EFFICIENT REALIZATION is MISSING!**

Industry 4.0 and 5.0 needs more than just new technologies – it demands a cultural shift

SRIP FoF: Smart Factories - Goals and Action plans until 2030

Development & Implementation of Advanced Technologies

Expand the use of **AI, IoT, and digital twins** to optimize production.

Introduce **automated and (self)adaptive production systems** for increased efficiency.

Enhance **predictive maintenance** using advanced sensors and machine learning.

Transition to Low-Carbon and Energy-Efficient Production

Implement **energy management systems** and integrate **renewable energy sources**.

Optimize processes to **reduce waste and emissions**.

Develop and adopt **circular economy principles** in production.

Digitalization and Smart Connectivity

Strengthen **process automation and digital monitoring** through AI-driven solutions.

Improve **cybersecurity measures** for industrial networks.

Foster the **integration of smart factories into global supply chains**.

Human Resources & Competence Development

Invest in **education and training** for employees to develop Industry 4.0/5.0 skills.

Encourage cooperation between **universities and industries** to transfer knowledge.

Promote **interdisciplinary research and innovation** in smart manufacturing.

Funding & Policy Support

Secure funding from **EU and national programs** (Horizon, Interreg, etc.).

Establish a **National Demonstration Center for Smart Factories**.

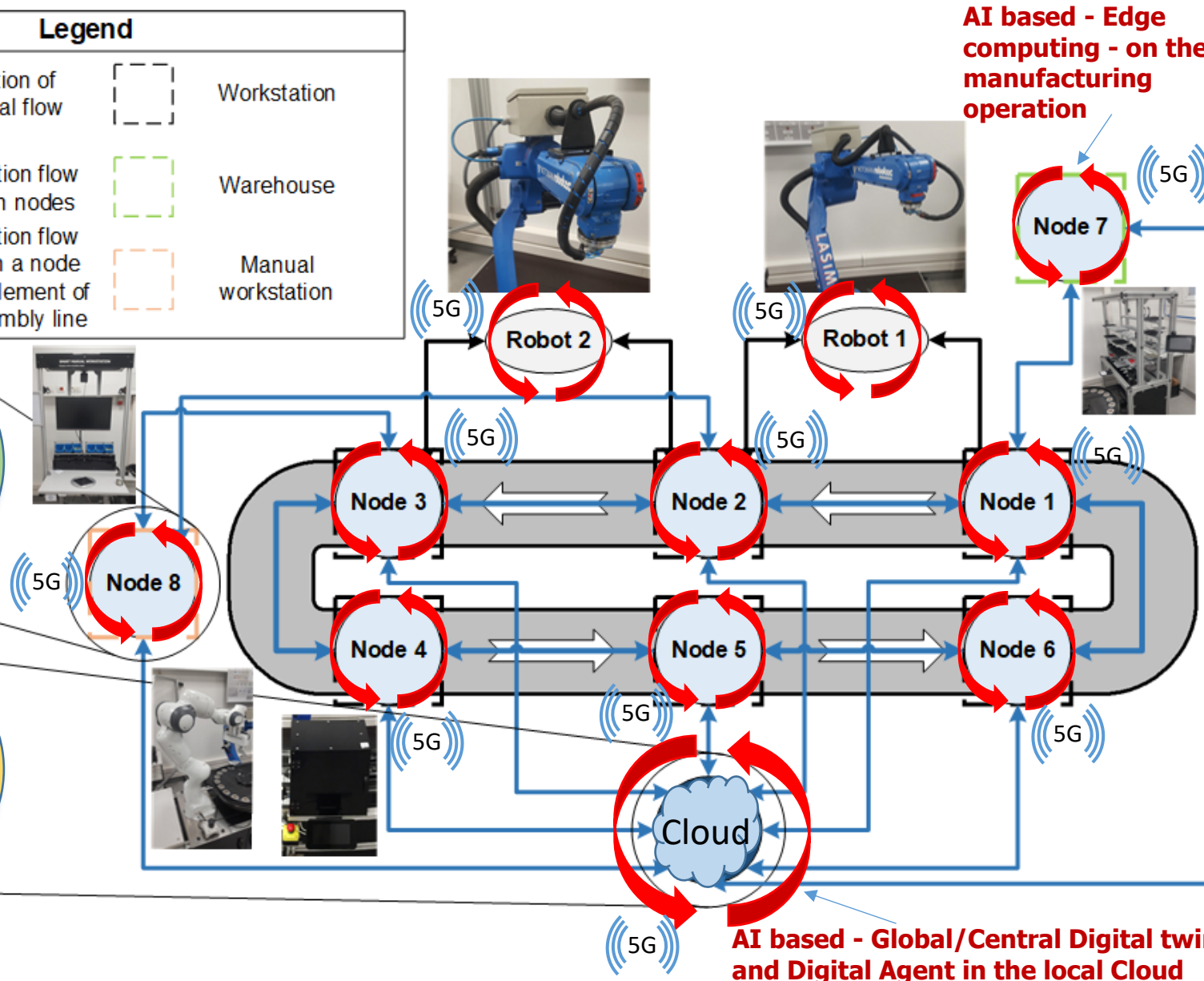
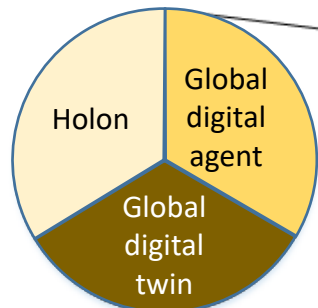
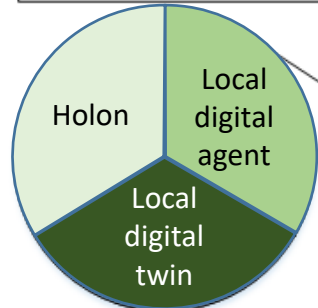
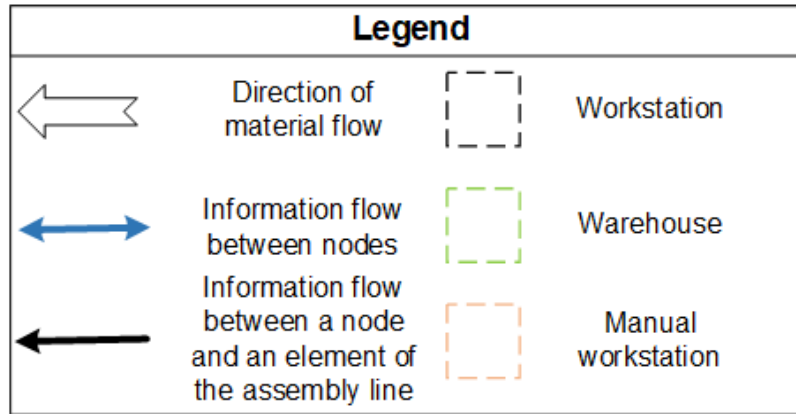
Foster **public-private partnerships** to accelerate technology adoption.

AI-based Edge Computing Concept in the R&D, Experimental, Testing and Demonstration Facility (RDTEF) at the University of Ljubljana, Faculty of Mechanical Engineering (UL FME)



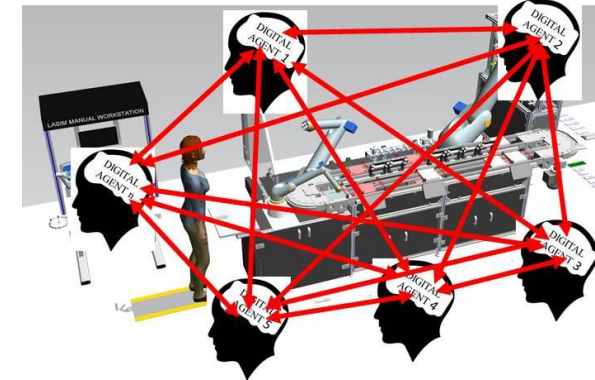
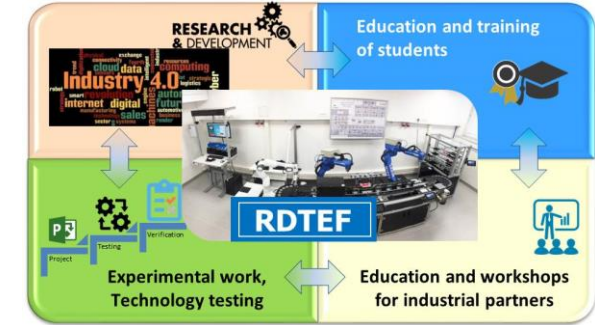
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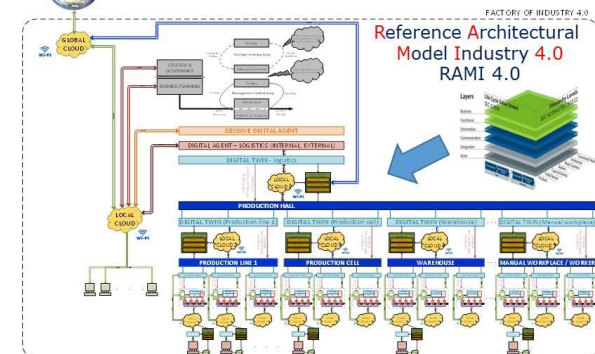


AI based - Edge computing - on the manufacturing operation

AI based - Global/Central Digital twin and Digital Agent in the local Cloud



LASFA – Smart Factory Architectural model



Three main Use Cases & References

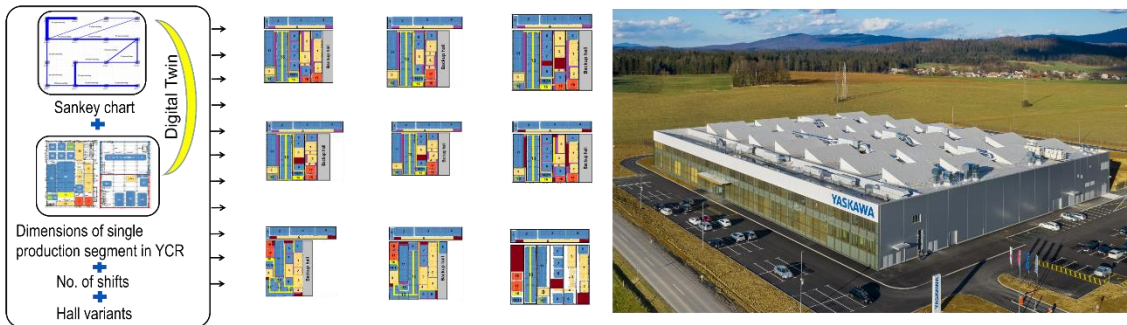
Use Case 1: Digital TWIN of the new YASKAWA robot factory



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DIGITEH
DIGITALIZATION OF PRODUCTION PROCESSES

- Detailed global digital twin of the entire factory (overall production and logistics processes, single production processes, internal logistics, supply chain, warehouses, ordering process etc.)
- Decisions for building and planning the factory are based on the global digital twin of the factory



Use Case 2: Real-time guidance of workers



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DIGITEH
DIGITALIZATION OF PRODUCTION PROCESSES



Our major references



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DIGITEH
DIGITALIZATION OF PRODUCTION PROCESSES



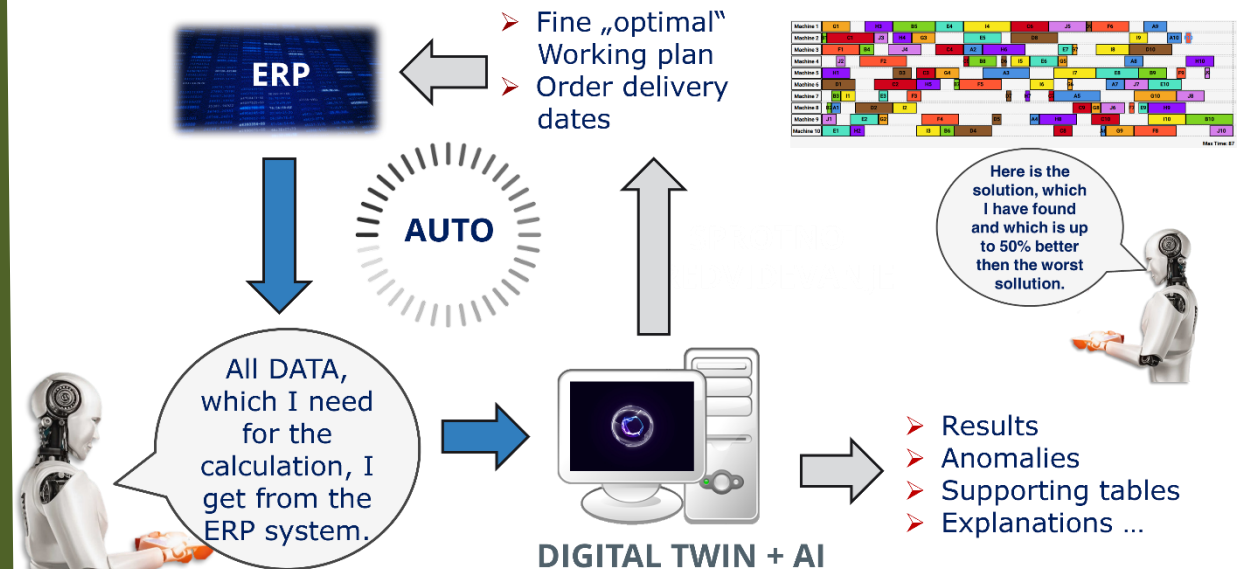
For the achievements and industrial applications in the field of Smart Factory technologies – AI and Digital Twins our TEAM received different prestigious awards

Use case 3: Integration of Digital Twin & AI with ERP system in different companies for REAL TIME PLANNING



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DIGITEH
DIGITALIZATION OF PRODUCTION PROCESSES

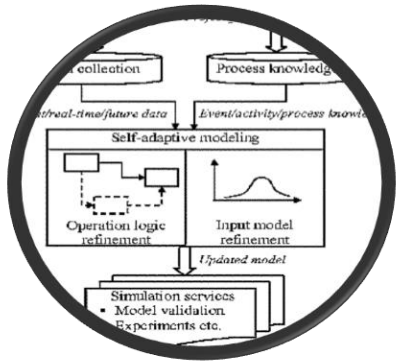


What can we offer?

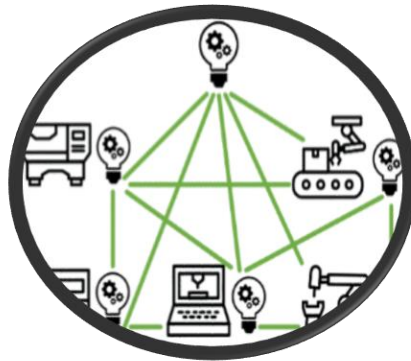


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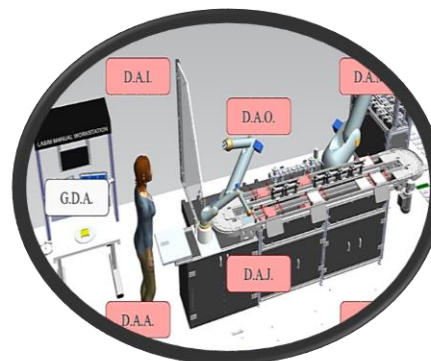
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Artificial
Intelligence
and Smart
Algorithms



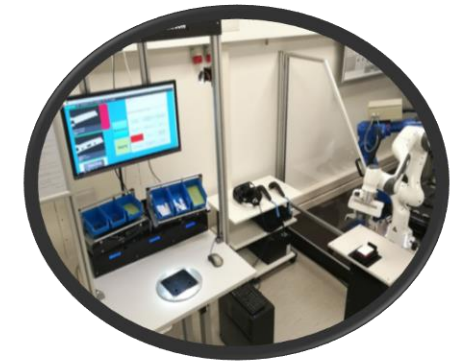
Distributed
Systems and
Edge Computing



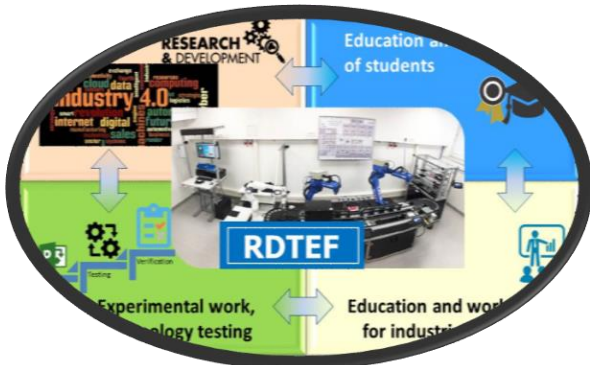
AI based Digital
Twins and Agents
for autonomous
decision making



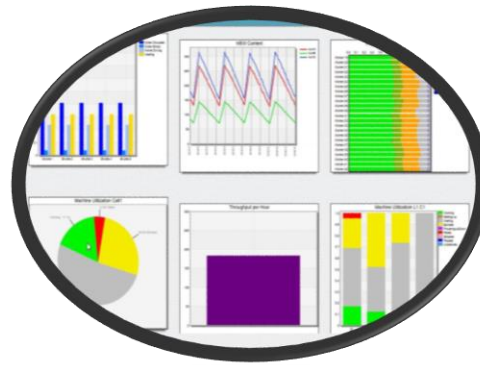
Flexible, Agile,
Reconfigurable
Robotic and
Cobotic Cells



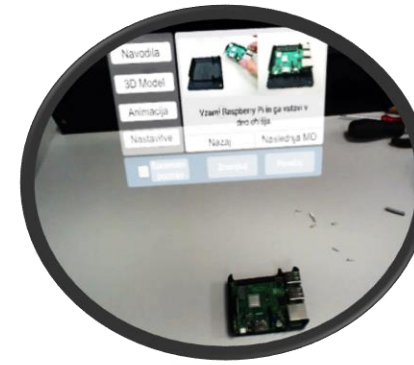
Smart Production,
Manufacturing (ERP-
MES-Digital twin
interconnectivity)



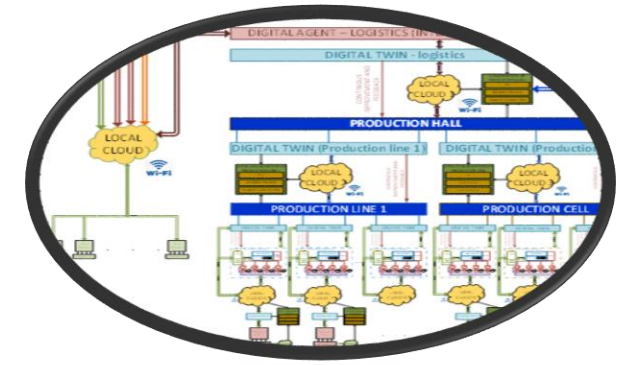
Experimental and
Testing facilities



Modelling,
Simulation, Data
Analytics



AR and VR



Architectural Models, Smart
Factories, Communication
Protocols and 5G)

Thank you for your attention!

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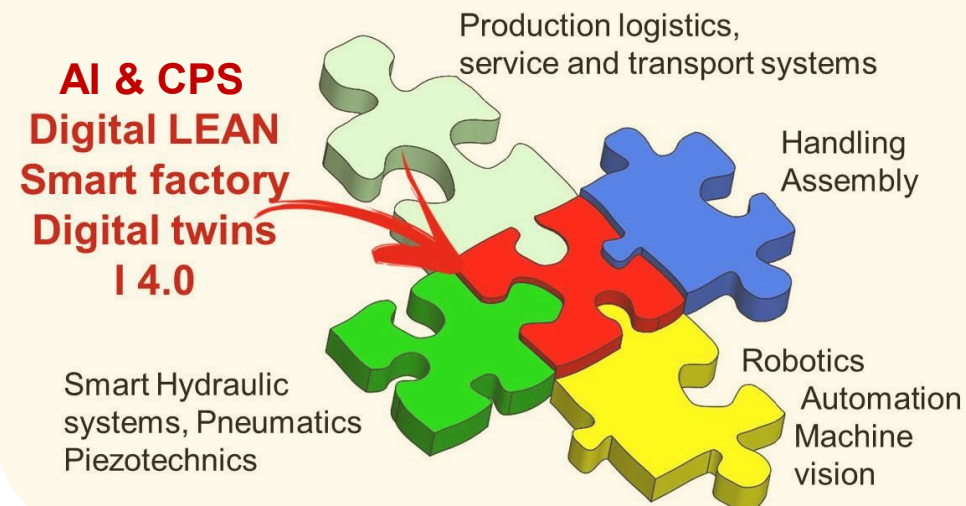
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<https://web.fs.uni-lj.si/lasim/>

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R&D fields



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